NHS
West Midlands
Clinical Networks

A Strategic Framework for Advancing Stroke Services in the West Midlands

NHS England and NHS Improvement

Contents

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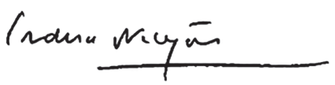
1 Foreword

As Clinical Director for the West Midlands Stroke Clinical Network, it has been an honour to collaborate with colleagues from across the region to harness the collective vision, drive and expertise of clinicians, managers, patients and the third sector to produce this visionary strategy.

The Stroke STP Programme Board has been forward-looking and creative in aspiring to meet the challenges of delivering high quality stroke services, especially in the context of significant economic and workforce challenges. The result is a Stroke Strategy which spans the entire pathway – from prevention through to treatment and rehabilitation.

If we are able to deliver this strategy together, stroke services in the West Midlands will deservedly be amongst the best in England, if not worldwide. I thank all board members who have contributed to developing this strategy, and commend them for having that ambition.

Regards



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2 Executive summary

2.1 Context

Over the last 20 years, there has been a continuous improvement in adult stroke care, which was accelerated by the development of a National Stroke Strategy in England. Today, most areas in the UK have specialised and dedicated stroke units which vastly improve people's outcomes, however, only 58% of patients are admitted directly to a stroke unit within four hours[1].

The NHS Long Term Plan set ambitious plans for improving the quality of health services and outlined key milestones to specifically improve stroke care across England to ensure we have stroke outcomes in line with the rest of Europe.

With thousands more people recovering from their stroke, people are achieving levels of independence and a quality of life that would have been unthinkable two decades ago – specialist units and rehabilitation teams have improved the recovery time and reduced levels of disability. However, there is a need to improve stroke services in the West Midlands; regional reviews, guidelines from the National Institute for Health and Clinical Excellence (NICE) and the Royal College of Physicians (RCP), clinical seven-day service standards and data from the latest Stroke Sentinel National Audit Programme (SSNAP) highlight the significant variation in existing services in the region.

Residents in rural West Midlands have a higher prevalence and incidence of stroke as the population is older, but also have the most limited access to specialist stroke services. In contrast, residents in urban areas of the region have the lowest prevalence and incidence of stroke as the population is young – Birmingham is the youngest city in Europe, with under 25s making up 40% of the population[2]. However, with increasing demand and an ageing population, investment and action needs to be taken now to increase prevention strategies and increase the regional workforce to provide the best stroke care by 2023.

1. *Stroke Association Strategy 2015 - 2018*
2. *https://www.greaterbirminghamchambers.com/our-group/birmingham/*

The overarching vision for stroke services across the area is to ensure that all patients who experience a stroke have access to high-quality acute care 24/7 and high-quality life after stroke rehabilitation. This is part of a stroke pathway focused on providing patient and carer centric care, empowerment and facilitation of self-management, leading to meaningful participation in daily life.

2.2 Prevention

Stroke, often a preventable disease, is the fourth leading single cause of death in the UK and the single largest cause of complex disability[3]. Naturally, prevention plays a key role in mitigating the demand for stroke services in the future. The NHS Long Term Plan highlights that cardiovascular disease is largely preventable through lifestyle change. It is supported by legislation and regulation, by Public Health initiatives, and by NHS staff making every contact count[4].

Public Health England and NHS England released Health Matters: 'Preventing cardiovascular disease – saving hearts and minds together' in February 2019[5], with a 10-year ambition link to the NHS Long Term Plan. The ambitions include recommendations for decision-makers and frontline professionals on ensuring more people at risk receive appropriate lifestyle advice and those already affected are detected and treated appropriately.

It should also be remembered that cardiovascular disease, including stroke, is one of the conditions most strongly associated with health inequalities. Those in the most deprived communities are 30% more likely to have hypertension – the biggest single known risk factor for heart attack and stroke[6]. Therefore, more focused action in the most deprived communities is required.

With appropriate prevention measures, individuals can significantly reduce their risk of cardiovascular mortality and morbidity; supporting people to live a healthy lifestyle and raising awareness of key risk conditions such as atrial fibrillation (AF), hypertension and high cholesterol as well as stroke symptoms will help reduce the number of strokes in the West Midlands.

2.3 Acute care

Hyper acute services provide expert specialist clinical assessment, rapid imaging, and the ability to deliver 24/7 intravenous 'clot-busting' thrombolysis and 'clot retrieval' thrombectomy treatments. This strategy aims to ensure that the West Midlands population has equal and timely access to world-class stroke care.

Services in the West Midlands continue to deliver high standards of hyper acute and acute stroke care. However, there are large variations across the region in incidence, mortality and metrics within stroke care pathways. The current quality and geographical spread of hyper acute services in the West Midlands is variable with further work required to ensure equity of services – it is clear that not all stroke services are meeting expectations. In developing this strategy, potential stroke reconfigurations (including comprehensive stroke centres, neuroscience centres and hyper acute centres) are outlined to ensure all of the West Midlands population has equal access to high quality specialist units that meet national and regional standards for care – now and in the future.

3. *Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/resources/state-nation-stroke-statistics*
4. *NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/*
5. *Ambitions set to address major causes of cardiovascular disease, Public Health England (2019) https://www.gov.uk/government/news/ambitions-set-to-address-major-causes-of-cardiovascular-disease*
6. *https://www.gov.uk/government/publications/health-matters-preventing-cardiovascular-disease/health-matters-preventing-cardiovascular-disease*

2.4 Rehabilitation

Every year, approximately 6,000 stroke patients in the West Midlands are discharged from stroke services with nearly 4,000 patients entering Early Supported Discharge (ESD) or Community Stroke Rehabilitation Services (CRS)[7]. Research has shown that developing an ESD team to support more complex patients in their own environment could reduce the hospital length of stay by 2-8 days and help survivors to be 1.5 times more independent[8]. Effective rehabilitation can reduce the impact of a disability for the stroke survivor, their family, carer and friends.

There are large disparities in ESD and CRS provisions across the region with services being unavailable in some areas, emphasising the differences in how services are commissioned, and the associated variances and outcomes for stroke patients. Regional standards and recommendations have been developed by experts in their respective rehabilitation roles to provide commissioners with a guide for service provision that meets patient and carer needs; coordinating community services would allow for seamless transfers of care and a better patient experience.

2.5 Implementation

West Midlands stroke services are continuously improving – with reviews being undertaken by the West Midlands Cardiovascular (WM CVD) Clinical Network in 2018/19 and the Getting It Right First Time (GIRFT) team in 2019. These reviews play crucial roles in driving change and improvement in regional stroke services. The West Midlands CVD Clinical Network will liaise with key organisations to ensure improvements in the stroke care pathway are made to deliver new and improved seven-day stroke services. An increase in workforce numbers and stroke-specific training will be required.

Clinical Commissioning Groups (CCGs), Local Authorities, acute and primary care providers, NHS England and NHS Improvement, Public Health England (PHE), Health Education England (HEE), West Midlands Ambulance Service NHS Foundation Trust (WMAS), Getting It Right First Time (GIRFT), the Stroke Association, The West Midlands CVD Clinical Network and third sector organisations all have leading roles to ensure the success of the West Midlands Stroke Strategy. Working together, these organisations will help to improve the stroke care pathway for our patients.

2.6 Key conclusions

- The NHS Long Term Plan set ambitious plans for improving the quality of health services and outlined key milestones to specifically improve stroke care
- Residents in rural West Midlands have a higher prevalence and incidence of stroke, as the population is older
- Birmingham is the youngest city in Europe, with under 25s making up 40% of the population – action needs to be taken now to increase prevention strategies and awareness of stroke symptoms
- There are significant areas of deprivation within the West Midlands and it has been demonstrated that those living in the most deprived areas are almost four times more likely to die prematurely than someone in the least deprived
- The region needs to increase the regional workforce to provide the best stroke care
- There are large variations across the region within acute stroke care pathways
- There are large disparities in ESD and CRS provisions
- Collaborative and cross-organisational working will enable the West Midlands to achieve the recommendations set out in this strategy and provide the best specialist care to our population.

7. *Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/resources/state-nation-stroke-statistics*
8. *https://journals.sagepub.com/doi/abs/10.1191/0269215504cr773oa; https://www.sciencedirect.com/science/article/pii/S0140673605178684 https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD000443.pub3/abstract*

3 Generating the West Midlands Stroke Strategy and Case for Change

3.1 Introduction

"The NHS Long Term Plan[9] states that "Stroke, a preventable disease, is the fourth single leading cause of death in the UK and the single largest cause of complex disability."

The West Midlands has higher than the national average of strokes and it is widely accepted that improvements are needed in the care that is currently delivered to our patients and their families. Our West Midlands Strategy is intended to guide those who commission and deliver our stroke services, thus enabling them to deliver world-class stroke care that we can be collectively proud of.

This strategy outlines the West Midlands response to the NHS Long Term Plan and describes our collective vison for the delivery of the entire stroke pathway from prevention, urgent and emergency care through to rehabilitation and long-term care.

3.2 Background

Stroke is the fourth most common cause of death in the UK and almost two-thirds of stroke survivors leave the hospital with a disability. Whilst a reducing prevalence of smoking and high blood pressure has seen the incidence of stroke decline, the Stroke Association reports that around 100,000 people each year have a stroke in the UK[10]. It estimates that, by 2025, this number will have risen to around 150,000.

Devastatingly, one in five strokes are fatal, even though the mortality rate has halved nationally since 1993. The overall prevalence of stroke is expected to rise not only due to demographic change but also as a result of underlying risk factors rising in our population with cardiovascular disease.

3.3 Context of the strategy

3.3.1 What is a stroke?

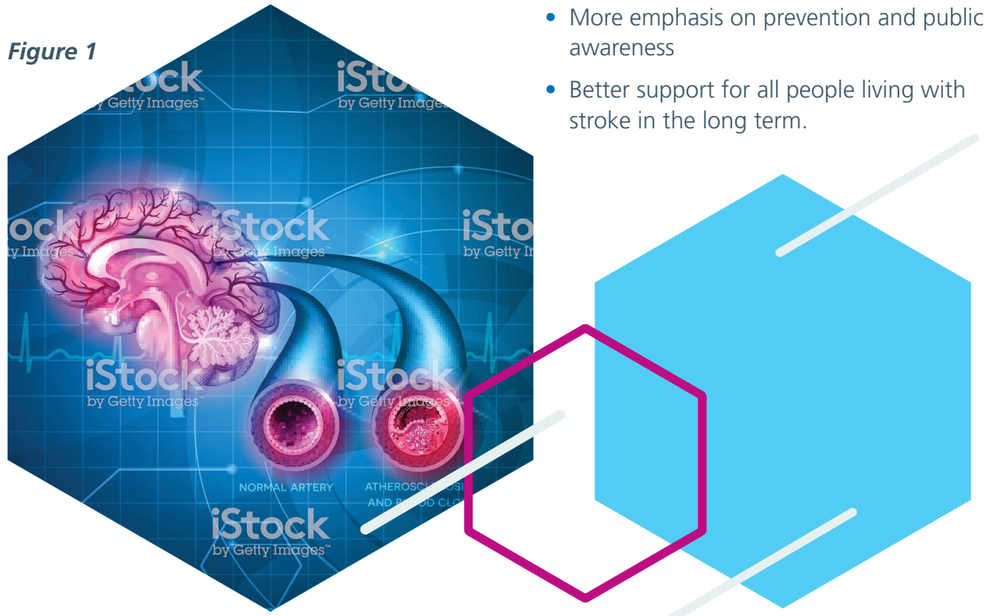
A stroke is a serious, life-threatening medical condition that occurs when the blood supply to part of the brain is restricted or stopped; brain cells begin to die. This can lead to brain injury, disability and possibly death.

There are two main causes of strokes: ischaemic (where the blood supply is stopped because of a blood clot; ***figure 1***), accounting for 85% of all cases, and haemorrhagic (where a weakened blood vessel supplying the brain bursts)[11].

The sooner a person receives treatment for a stroke, the less damage is likely to happen.

Transient ischaemic attack (TIA), where the blood supply to the brain is temporarily interrupted, is known as a 'mini-stroke'. TIAs should be treated urgently, as they're often a warning sign that patients are at risk of having a full stroke in the near future.

Figure 1



3.3.2 National stroke policies, guidance and evidence

A regional service specification for stroke Early Supported Discharge was developed by The West Midlands CVD Clinical Network in 2018, using this and the NHS Midlands and East Stroke Services Specification[12]; the provision of West Midlands stroke services is informed by the following key documents:

National Stroke Strategy (2007) – Department of Health[13]

This strategy established a consensus around:

- Specialist stroke units
- Regarding acute stroke as an emergency
- Rapid access to services for people who have had a TIA
- Immediate access to diagnostic scans and to thrombolysis for patients whose stroke was caused by a clot
- Early Supported Discharge for people with moderate disability as a result of stroke
- More emphasis on prevention and public awareness
- Better support for all people living with stroke in the long term.

9. *NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk*
10. *Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/resources/state-nation-stroke-statistics*
11. *https://www.nhs.uk/conditions/Stroke/*
12. *NHS Midlands and East Stroke Services Specification, 2012: https://www.england.nhs.uk/mids-east/wp-content/uploads/sites/7/2018/03/final-stroke-spec.pdf*
13. *https://webarchive.nationalarchives.gov.uk/20130105121530/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyandguidance/dh_081062*

National Clinical Guidelines for Stroke (2016) – Royal College of Physicians[14]

This updated guidance introduced:

- Mechanical thrombectomy for acute ischaemic stroke
- Urgent brain imaging within one hour of hospital arrival for suspected acute stroke
- Acute blood pressure management in intracerebral haemorrhage
- Urgent management of suspected minor stroke and TIA irrespective of risk stratification
- Incorporation of clinical psychology or clinical neuropsychology, dietetics and orthoptics expertise into the multidisciplinary stroke rehabilitation team
- Changes in the practice of early mobilisation after acute stroke
- Pragmatic management of swallowing difficulties in end-of-life stroke care
- Mechanically-assisted methods for gait training in people unable to walk after a stroke
- Lower blood pressure targets for secondary stroke prevention compared with previous NICE guidelines.

The guidance also outlines a set of key clinical co-dependencies (***table 1***) and workforce requirements (***table 2***). These workforce requirements are used in this strategy to assist with regional workforce calculations per bed base (***section 6.7***).

Table 1 - HASU-ASU clinical co-dependencies

The table below outlines key clinical co-dependencies and differences between a hyper acute stroke unit (HASU) and acute stroke unit (ASU).

Source: the National Clinical Guidelines for Stroke (2016) Royal College of Physicians.

Hyper acute stroke unit (HASU)	Acute stroke unit (ASU)
Immediate access to: • Specialist medical staff trained in the hyper acute and acute management of people with stroke, including the diagnostic and administrative procedures needed for the safe and timely delivery of emergency stroke treatments • Specialist nursing staff trained in the hyper acute and acute management of people with stroke, covering neurological, general medical and rehabilitation aspects • Stroke specialist rehabilitation staff • Diagnostic, imaging and cardiology services • Tertiary services for endovascular therapy, neurosurgery and vascular surgery • Continuous access to a consultant with expertise in stroke medicine, with consultant review 24/7.	Should provide: • Specialist medical staff trained in the acute management of people with stroke • Specialist nursing staff trained in the acute management of people with stroke, covering neurological, general medical and rehabilitation aspects • Stroke specialist rehabilitation staff • Access to diagnostic, imaging and cardiology services • Access to tertiary services for neurosurgery and vascular surgery • Continuous access to a consultant with expertise in stroke medicine, with consultant review five days per week.

14. *https://www.rcplondon.ac.uk/guidelines-policy/stroke-guideliness*

Table 2 - National workforce recommendations

The set of key clinical workforce requirements based on whole-time equivalent per five beds in HASUs and ASUs.

Source: The RCP National Clinical Guidelines for Stroke (2016).

	Physio-therapist	Occupational therapist	Speech and language therapist	Clinical neuro-psychologist/ clinical - psychologist	Dietitian	Nurse	Consultant stroke physician
	Whole-time equivalent (WTE) per five beds					WTE per bed	
Hyper acute stroke unit	0.73	0.68	0.34	0.20	0.15	2.9 (80:20 registered: unregistered)	24/7 availability; minimum six thrombolysis trained physicians on rota
Acute stroke unit	0.84	0.81	0.40	0.20	0.15	1.35 (65:35 registered: unregistered)	Consultant -led ward round five days/week

NICE Guideline [NG128]: Stroke and transient ischaemic attack in over 16s: diagnosis and initial management (May 2019) – NICE[15]

NICE guidance published in May 2019 updates and replaces NICE guideline CG68 (July 2008) and covers interventions in the acute stage of a stroke or TIA. It offers the best clinical advice on the diagnosis and acute management of stroke and TIA in the 48 hours after onset of symptoms, although some interventions of up to two weeks are covered as well.

The guidance made new recommendations on:

- Initial management of suspected and confirmed TIA
- Imaging for people with suspected TIA
- Thrombectomy for people with acute ischaemic stroke
- Blood pressure control for people with acute intracerebral haemorrhage
- Optimal positioning and early mobilisation for people with acute stroke
- Decompressive hemicraniectomy for people with acute stroke.

15. *https://www.nice.org.uk/guidance/ng128*

Clinical Guideline [CG162]: Stroke rehabilitation in adults (June 2013) – NICE[16] [Update due 2019]

This guideline includes recommendations on:

- Organising health and social care for people who need stroke rehabilitation
- Planning and delivering stroke rehabilitation
- Providing support and information
- Self-care and long-term health and social care support
- Assessments and interventions to help with cognitive and emotional functioning, vision, swallowing, communication and movement.

NICE Quality Standards for stroke and other related standards are available ***online***.

The 2019 updated guideline is in development at the time of publication of this strategy; NICE is engaging with the Royal College of Physicians Intercollegiate Stroke Working Party in the update of the guideline. Further information can be found ***here***.

Seven-Day Services Clinical Standards (February 2017) – NHS England[17]

The four priority clinical standards in ***table 3*** are a national measure for delivery of stroke services and should be met by all stroke centres providing stroke care.

Table 3 - Seven-day services clinical standards

Standard 2	**Time to first consultant review***	All emergency admissions must be seen and have a thorough clinical assessment by a suitable consultant as soon as possible but at the latest within 14 hours from the time of admission to hospital. The clinical standard update in 2018 now includes that low-risk patients can be reviewed by a consultant via telemedicine.
Standard 5	**Access to diagnostic tests**	Hospital inpatients must have scheduled seven-day access to consultant-directed diagnostic tests and completed reporting within one hour for critical patients; within 12 hours for urgent patients; and within 24 hours for non-urgent patients.
Standard 6	**Access to consultant-directed interventions**	Hospital inpatients must have timely, 24/7 access to key consultant-directed interventions, either on-site or through formally agreed networked arrangements with clear written protocols, including critical care, interventional radiology, and stroke thrombolysis.
Standard 8	**Ongoing review by consultant: twice daily if high dependency patients, daily for others**	All patients with high dependency needs should be seen and reviewed by a consultant twice daily (including all acutely ill patients directly transferred and others who deteriorate). Once a clear pathway of care has been established, patients should be reviewed by a consultant at least once every 24 hours, seven days a week, unless it has been determined that this would not affect the patient's care pathway.

** The West Midlands Stroke Expert Advisory Group have agreed on a consensus view that a suitable consultant should be defined as a stroke physician or suitably trained physician in stroke care so that patients receive the best quality care by the most suitably skilled personnel. Regional standards can be found online **here**.*

Developments in stroke services around the country have also been informed by the evidence of changes made in specific health economies, as referenced in the NHS Long Term Plan. NHS England and NHS Improvement recognise the evidence that centralising stroke treatment at a much smaller number of hospitals has considerable benefits, achieving faster access to key time metrics (seven-day standards), achieving a shorter length of stay and reduction in mortality and morbidly rates – when compared to more localised provision.

16. *https://www.nice.org.uk/guidance/cg162*
17. *https://www.england.nhs.uk/publication/seven-day-services-clinical-standards-updated-february-2017/*

3.3.3 National stroke developments

London

Acute stroke care has been centralised in eight hyper acute stroke units (HASUs) operating 24/7, with patients being assessed immediately by specialised stroke medical teams with the capacity for immediate brain imaging and thrombolysis when appropriate. A total of 24 stroke units provide acute rehabilitation services. Plans were based on a maximum travel time of 30 minutes to a HASU.

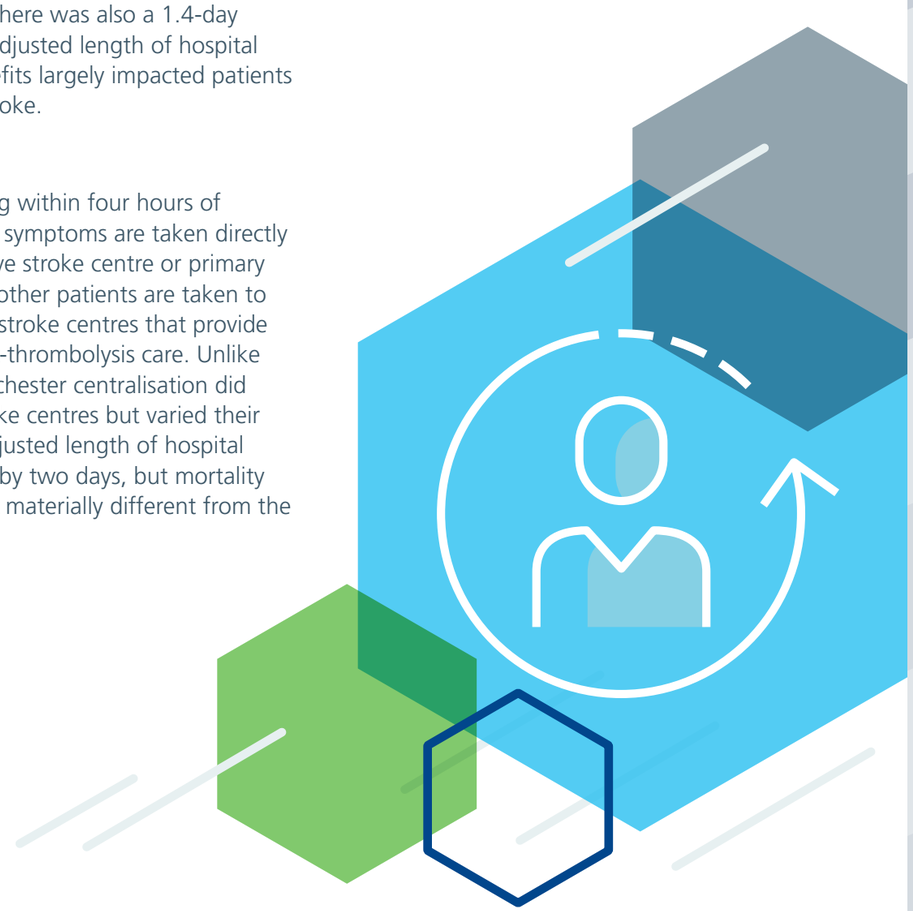
In London, reconfiguration led a significant decline in risk adjusted mortality at three, 30, and 90 days after admission. At 90 days, the absolute reduction was 1.1%, indicating 168 fewer deaths in the 21-month period after reconfiguration. There was also a 1.4-day reduction in risk adjusted length of hospital stay[18]. These benefits largely impacted patients with ischaemic stroke.

Manchester

Patients presenting within four hours of developing stroke symptoms are taken directly to a comprehensive stroke centre or primary stroke centre. All other patients are taken to one of 10 district stroke centres that provide all aspects of post-thrombolysis care. Unlike London, the Manchester centralisation did not close any stroke centres but varied their functions. Risk-adjusted length of hospital stay was reduced by two days, but mortality changes were not materially different from the rest of England.

North East

Recent research examined the impact of the 2015 centralisation of three acute stroke units into a single HASU within a mixed urban / rural area[19]. The total length of inpatient stay was reduced by 4.9 days; time from admission to thrombolysis was shortened by 26.0 minutes, and time from admission to brain imaging for thrombolysed patients improved by 16.2 minutes. There were no observed changes in time from stroke onset to hospital admission, mortality or dependency; however, the research recognised that including longer-term outcomes could have strengthened the study, but this data was not available.



18. *Impact of centralising acute stroke services in English metropolitan areas on mortality and length of hospital stay: difference-in-differences analysis, BMJ 2014; 349: https://doi.org/10.1136/bmj.g4757*
19. *The impact of acute stroke service centralisation: a time series evaluation, Future Healthcare Journal 2018 Vol 5, No 3: 181–7: http://futurehospital.rcpjournal.org/content/5/3/181.full.pdf+html*

3.3.4 Addressing health inequalities

In developing the NHS Long Term Plan, the Equality and Health Inequalities Impact Assessment (EHIA) explains how NHS England has considered and addressed 'equality duties'[20].

To reduce health inequalities, there was a duty placed on NHS England's Board by the National Health Service Act 2006 (***section 13 G***) which states that NHS England's Board must, in the exercise of its functions, have regard to the need to:

a. Reduce inequalities between patients with respect to their ability to access health services

b. Reduce inequalities between patients with respect to the outcomes achieved for them by the provision of health services.

There is a higher stroke incidence and mortality rate in lower socioeconomic groups and the Office of National Statistics reviewed the index of multiple deprivation and distribution of deprivation in towns and cities compared to England where West Bromwich, Walsall and Birmingham were all found in the bottom 20% of the country for health and deprivation indicators[21] (most deprived). A study using data from England, Wales and Northern Ireland found that people with the greatest levels of social deprivation experienced strokes approximately five years earlier in their lives, compared to the least deprived[22].

To reduce inequalities and avoid negative impacts on groups already disadvantaged, NHS England and The West Midlands CVD Clinical Network has undertaken work at a regional level to support acute stroke services and stroke rehabilitation including clinical review visits to assess the current state of stroke services in the West Midlands.

For acute stroke services, all regional trusts have been offered support with seven-day service clinical standards for stroke and centralisation of services (where required). For rehabilitation services, regional clinical service standards have been developed to encourage commissioners to reduce inequalities and prioritise gold standard stroke care in the West Midlands.

3.3.5 The scale of the problem

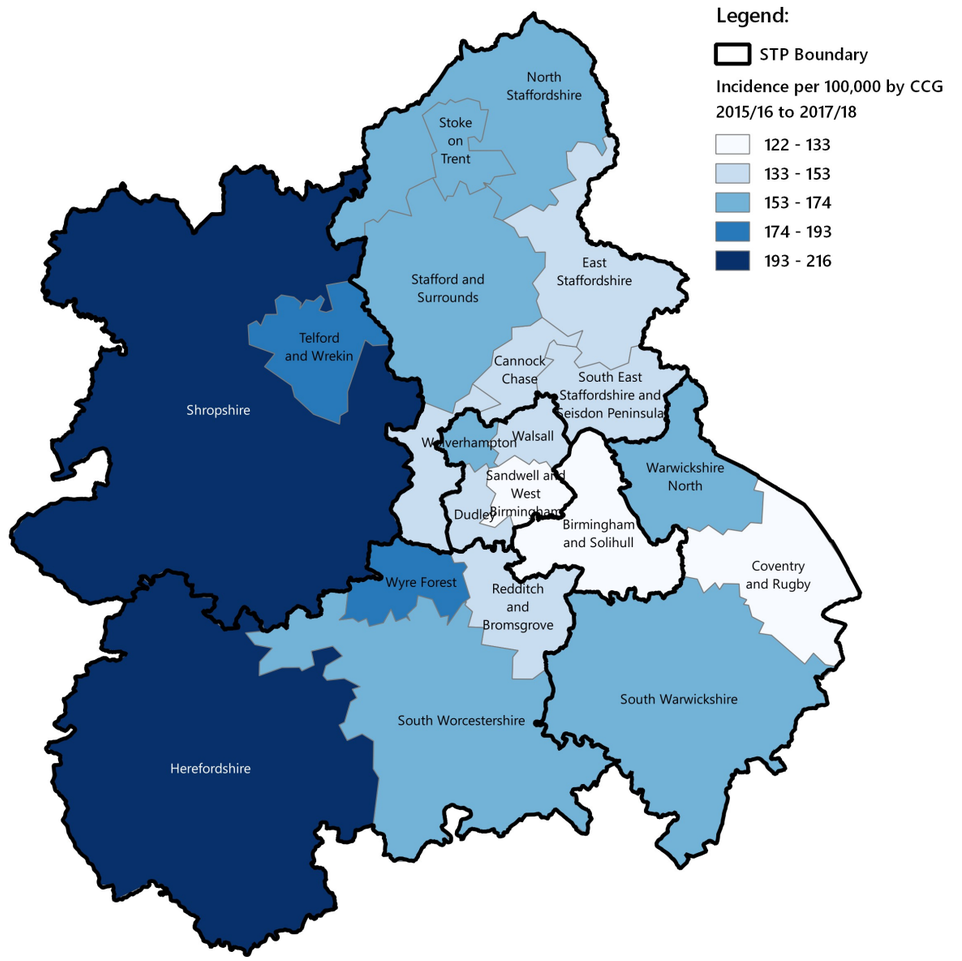
In 2016/17, the Stroke Association reported there were[23] 32,627 deaths from stroke in England and Wales. In the same year, there were 1,726 inpatient deaths from stroke recorded in the West Midlands. The average mortality rate over 75 years for the West Midlands in 2017/18 was 559.4 per 100,000; this is slight higher than the national mortality rate of 540.5 per 100,000[24].

During 2017/18, there were around 12,000 stroke / Transient Ischemic Attack patients in the West Midlands, with a total stroke incidence of 8,483[25]. Stroke incidence for the region is shown in ***figure 2***. Approximately 0.1% of the West Midlands' 5.8 million population has suffered a stroke.

Figure 2 – Stroke incidence in the West Midlands

The map below shows the stroke incidence in the region with updated CCG boundaries.

Source: Secondary Uses Service (SUS) inpatient spells based on date of discharge to ensure completeness of data over time. Diagnosis using ICD-10 codes I61, I63 and I64. The numerator is the count of distinct patients with a (primary) stroke diagnosis in each year and then pooled over 2015/16 to 2017/18. Population denominators all ages and genders for CCG resident estimates 2015 to 2017 pooled (ONS).



20. https://www.england.nhs.uk/publication/the-nhs-long-term-plan-equality-and-health-inequalities-impact-assessment/
21. Office of National Statistics - Towns and cities analysis, England and Wales, March 2016
22. Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/system/files/sotn_2018.pdf
23. Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/system/files/sotn_2018.pdf
24. https://fingertips.phe.org.uk/profile-group/cardiovascular-disease-diabetes-kidney-disease/profile/cardiovascular
25. SSNAP Annual Portfolio for April 2017-March 2018

Currently, only 47.8% of West Midlands stroke patients are directly admitted to a stroke unit within four hours of clock start which is lower than the national average (57.1%). In the region, 48% of stroke patients are scanned within one hour of clock start (52.5%), again lower than the national average. We are slightly under performing for straight to scanner times achieving 93.7% against the national average of 94.4%[26].

Strokes are potentially preventable through risk factor management. Modifiable risk factors (aspects of a person's lifestyle that can be managed or improved through their own behaviour) such as hypertension, high cholesterol, smoking, alcohol consumption, being overweight and inactive, and type 2 diabetes can be managed and controlled through lifestyle choices and management programmes such as the National Diabetes Prevention Programme (NDPP)[27], to help reduce the risk of having a stroke.

Non-modifiable risk factors include age, ethnicity, gender, atrial fibrillation, genetic factors, socioeconomic status and type 1 diabetes[28].

The management of risk factors are just as important for patients who have never had a stroke (primary prevention) as it is for existing stroke patients (to reduce recurrent strokes, i.e. secondary prevention). Local prevention strategies, information and education, and improvements to all aspects of service delivery are vital to reduce inequalities across the region.

In addition, those patients who have had a TIA are at a higher risk of having a stroke, with one in 12 people progressing to a stroke within aweek of a TIA. Investigating high risk TIA[28] patients within 24 hours could potentially reduce the number of strokes by 80%. All high-risk TIA patients should be assessed urgently by a neurological specialist or on an acute stroke unit[29].

In 2017/18, only 56.3% of all TIAs in the region were referred by their GP (with 23% presenting at A&E) – TIA referral pathways need to be improved, and GPs require further education on TIAs.

3.3.6 The cost of stroke in England and the West Midlands

Together with social care costs, the cost of all stroke care in the UK for those aged 45 and above has been estimated at £26 billion a year; with overall costs of stroke rising to £43 billion in 2025 and £75 billion in 2035 – an increase of 194% over 20 years.

Based on average costings, it is estimated that the total cost of all stroke care is £77 million in the West Midlands. Moreover, at the start of the last decade, the quality of stroke care in England was found to be lagging behind other advanced economies. In recent decades, clinical evidence has established that patients treated in specialist acute units have better outcomes. Morbidity and mortality rates could be substantially improved with rapid thrombolysis (the use of "clot-busting" drugs), whilst specialist teams and integrated rehabilitation services enable better quality care and faster recovery and the introduction of thrombectomy services will also greatly improve outcomes for patients.

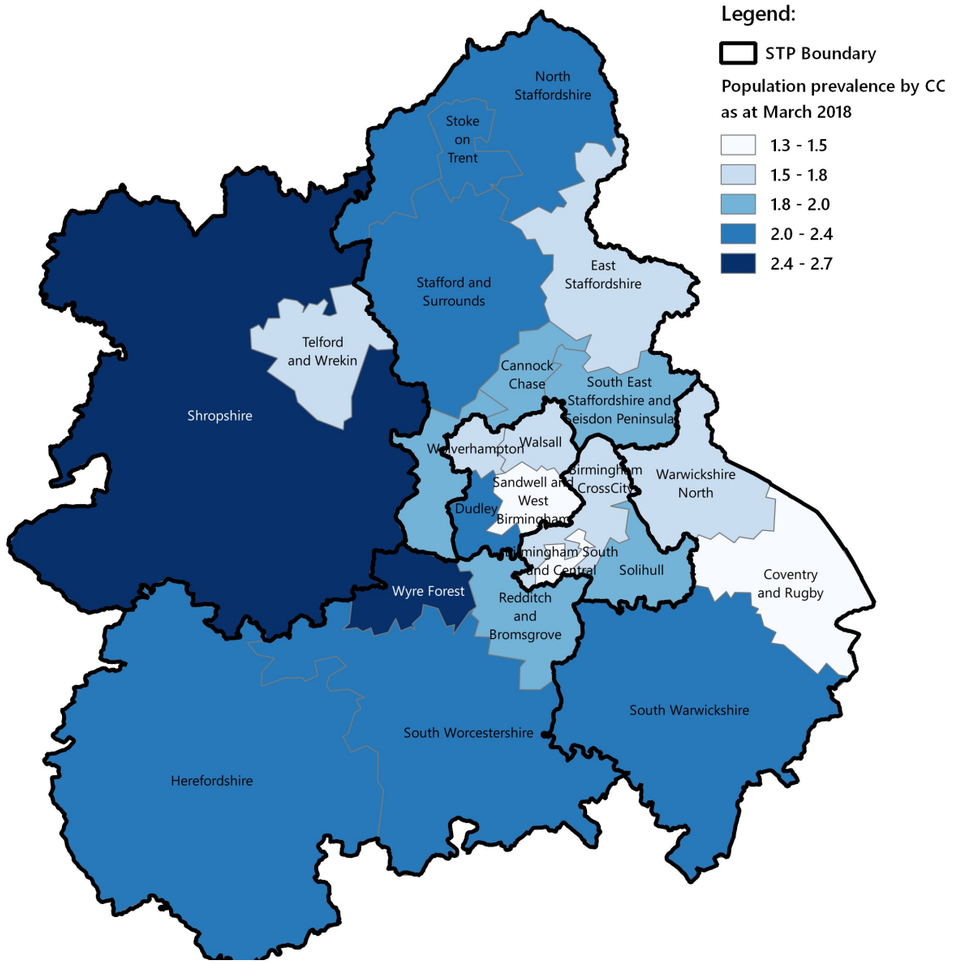
3.3.7 Prevalence of stroke in the West Midlands

The West Midlands (Staffordshire and Stoke-on-Trent, Shropshire, Telford and Wrekin, Coventry, Warwickshire, Birmingham, The Black Country, Herefordshire and Worcestershire) has a Quality and Outcomes Framework (QOF) prevalence range of 1.6% to 2.3% against the national prevalence of stroke at 1.8%. Stroke prevalence (***figure 3***) and mortality rates (***table 4***) are summarised below.

Figure 3 – Stroke prevalence in the West Midlands

Stroke prevalence for the region is shown in the map below per CCG.

Source: Fingertips, Public Health England (2017/18).



26. SSNAP Annual Portfolio for April 2017-March 2018

27. https://www.england.nhs.uk/diabetes/diabetes-prevention/

28. Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/resources/state-nation-stroke-statistics

29. https://www.rcplondon.ac.uk/guidelines-policy/stroke-guidelines

Table 4 – West Midlands key facts for stroke

Prevalence, mortality, admissions and the total number of stroke patients in the region are summarised below per CCG and Sustainability and Transformation Partnership (STP).

Source: Public Health England Fingertips (Cardiovascular Profiles 2017/18).

	Key Facts (2017/18, Public Health England)					
Region	**Number of people previously diagnosed with a stroke**	**Stroke QOF (Quality and Outcomes Framework) prevalence (%)**	**Stroke admissions with history of AF not prescribed anticoagulation prior to stroke (%)**	**Stroke patients assessed at six months (%)**	**Stroke mortality rates, under 75 years (rate per 100,000)**	**Stroke mortality rates, over 75 years (rate per 100,000)**
England	**-**	**1.8**	**47.5**	**29.5**	**13.1**	**540.5**
Herefordshire and Worcestershire STP	**17,656**	**2.2**	**-**	**-**	**12.2**	**605.2**
Herefordshire CCG	4,369	2.3	45.1	3.4	12.3	612.3
Redditch and Bromsgrove CCG	3,604	2	48.6	29.1	11	540.3
South Worcestershire CCG	6,540	2.1	52.5	18.3	11.7	620
Wyre Forest CCG	3,143	2.7	66.7	8.8	16	654.3
Birmingham and Solihull STP	**20,323**	**1.6**	**-**	**-**	**13.6**	**557.3**
Birmingham CrossCity CCG	11,448	1.6	48.4	9.6	14.3	553.3
Birmingham South Central CCG	4,134	1.3	55	23.9	16.6	560.3
Solihull CCG	4,741	1.9	41.9	1.9	9.8	563
Coventry and Warwickshire STP	**17,053**	**1.7**	**-**	**-**	**12.4**	**527.2**
Coventry and Rugby CCG	7,637	1.5	48.1	23.6	13.9	522.5
Warwickshire North CCG	3,485	1.8	55.7	13.6	11.3	581.6
South Warwickshire CCG	5,931	2.1	43.1	0.9	11.3	503.8
Shropshire, Telford and Wrekin STP	**11,217**	**2.3**	**-**	**-**	**13.2**	**595.7**
Shropshire CCG	7,866	2.6	57.6	3.3	11.2	618.9
Telford and Wrekin CCG	3,351	1.8	51.9	0	18	522.9
Staffordshire and Stoke-on-Trent STP	**24,052**	**2.1**	**-**	**-**	**11.7**	**537.6**
Cannock Chase CCG	2,677	2	48.1	30.7	13.7	626.7
East Staffordshire CCG	2,418	1.7	40	21.8	13.4	564.6
North Staffordshire CCG	5,316	2.4	31.3	80.8	9.7	480.4
Stafford and Surrounds CCG	3,302	2.2	29.5	30.6	9.4	531.5
Stoke-on-Trent CCG	6,057	2.1	35.6	81.1	13.7	491.2
South East Staffordshire and Seisdon Peninsula CCG	4,282	2	46.2	28.6	11.1	580
The Black Country STP	**24,459**	**1.7**	**-**	**-**	**16.4**	**533.2**
Dudley CCG	6,561	2.1	46.9	54.3	13	552.8
Sandwell and West Birmingham CCG	7,891	1.4	52.2	17.8	16.3	486
Walsall CCG	5,116	1.8	50.8	46.3	18.6	538.1
Wolverhampton CCG	4,891	1.7	57.1	58	19.1	571.1

3.3.8 Increasing demand

Stroke mortality in the UK has almost halved in the last two decades due to improvements in acute care, with 30-day mortality rates from a stroke now 13.0-13.5%[30]. Nevertheless, the NHS Long Term Plan highlights that without further action to offset changing demographics, by 2035:

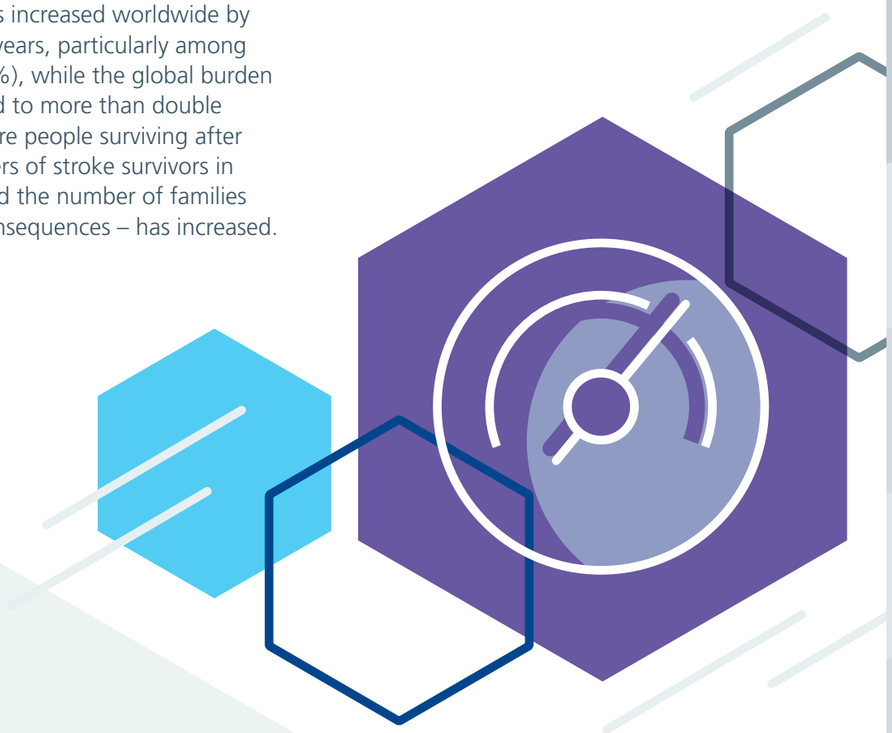
- The number of people in England having a stroke will increase by almost half
- The number of stroke survivors living in England with a disability will increase by a third[31].

Estimates of the potential growth in stroke incidence in the West Midlands are shown in ***table 5***, where the region is estimated to see an additional 830 strokes by 2023. These estimates reflect expected demographic change, but factors other than the ageing population may cause these rates to be higher or lower in reality (***see section 9***).

Stroke incidence has increased worldwide by 68% in the last 25 years, particularly among younger adults (25%), while the global burden of stroke is expected to more than double by 2030[32]. With more people surviving after a stroke, the numbers of stroke survivors in the population – and the number of families dealing with the consequences – has increased.

In the West Midlands, stroke incidence is predicted to increase by an average of 7% by 2023, with significant variation between Sustainability and Transformation Partnership (STP) areas; Herefordshire and Worcestershire have the highest predicted stroke incidence with 12%, compared to the lowest of 3% in Birmingham and Solihull. Closely followed by The Black Country at 4%; Shropshire, Telford and Wrekin at 7%; Staffordshire and Stoke-on-Trent at 9% and Coventry and Warwickshire also at 9%.

The rise in stroke incidence is linked to a rise in CVD; in the UK, the number of people with a higher than 20% risk of CVD could rise from 3.5 million in 2010 to 4.2 million by 2022[33].



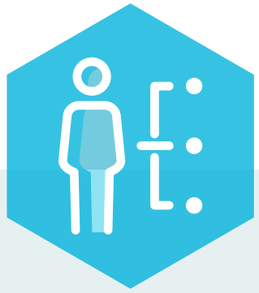
30. *https://www.stroke.org.uk/sites/default/files/stroke_association_strategy_2015-2018.pdf*
31. *NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/*
32. *https://www.stroke.org.uk/sites/default/files/stroke_association_strategy_2015-2018.pdf*
33. *Public Health England 2016: Action on cardiovascular disease: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/556135/Action_on_cardiovascular_disease-getting_serious_about_prevention.pdf*

Table 5 – Estimates of future stroke incidence in the West Midlands

STP	CCG	Baseline 2017/18 (n)	Future 2023 (n)	Estimated change (n)	Estimated change (%)
Birmingham and Solihull STP	Birmingham CrossCity	1,389	1,436	47	**3%**
	Birmingham South Central	359	345	-14	**-4%**
	Solihull	431	461	30	**7%**
Coventry and Warwickshire STP	Coventry and Rugby	893	960	67	**7%**
	South Warwickshire	568	632	64	**11%**
	Warwickshire North	421	454	33	**8%**
Herefordshire and Worcestershire STP	Herefordshire	573	634	61	**11%**
	Redditch and Bromsgrove	393	436	43	**11%**
	South Worcestershire	685	768	83	**12%**
	Wyre Forest	223	256	33	**15%**
Shropshire, Telford and Wrekin STP	Shropshire	861	965	104	**12%**
	Telford and Wrekin	459	446	-13	**-3%**
Staffordshire and Stoke-on-Trent STP	Cannock Chase	240	267	27	**11%**
	East Staffordshire	275	299	24	**9%**
	North Staffordshire	461	499	38	**8%**
	South East Staffordshire and Seisdon Peninsula	467	527	60	**13%**
	Stafford and Surrounds	286	318	32	**11%**
	Stoke-on-Trent	565	589	24	**4%**
The Black Country and West Birmingham STP	Dudley	579	606	27	**5%**
	Sandwell and West Birmingham	792	817	25	**3%**
	Walsall	514	533	19	**4%**
	Wolverhampton	506	522	16	**3%**
West Midlands	**Grand Total**	**11,940**	**12,770**	**830**	**7%**

The table above shows the estimates of future stroke incidence per CCG in 2023 accounting for demographic change with no intervention or prevention models.

Source: The Strategy Unit, NHS Midlands and Lancashire Commissioning Support Unit; with reference to providers and STPs, the data is based on patients registered with a GP practice in the six STPs.



3.4 Key benefits

The key measurable benefits for patients and the NHS that are expected on the adoption of the West Midlands Stroke Strategy might include:

- Offset increasing demand through prevention strategies (Public Health England campaigns, AF management, hypertension management)
- Improving awareness of stroke symptoms across the region
- Improving access to stroke-specific care for all patient populations
- Increasing patient outcomes and reducing the length of stay by providing ESD and CST services across the region, reducing inequality and variation
- Improving all domains of quality including equity of access and sustainability i.e. seven-day services, stroke unit care, service re-configuration and community provision
- Improving education and training for stroke-specific staff through workforce development
- Improving patient satisfaction with continuity of their care through the stroke pathway – so that all services are linked up with no delays.

3.5 Key conclusions

- 0.1% of the West Midlands population has suffered a stroke
- The impact on hospital services is significant with more than 12,000 people in the region being admitted to stroke services following a stroke or TIA each year
- Only 47.8% of West Midlands stroke patients are directly admitted to a stroke unit within four hours of clock start
- Only 48% of stroke patients are scanned within an hour
- Strokes are potentially preventable and improving prevention will require increased investment
- Stroke incidence and CVD are on the increase
- Patients and the public are happy to support centralisation processes and travel to specialised centres for stroke care[34]
- There is room for improvement and therefore this strategy is a welcome step in the right direction to making the West Midlands an exemplar in the prevention, treatment and rehabilitation of stroke – patients should have the same experience across the whole West Midlands region.

34. https://www.stroke.org.uk/sites/default/files/jn_2640e_-psp_reorganising_acutestrokeservices.pdf

4 World-class stroke care in the West Midlands

4.1 Stroke strategy objectives

This Stroke Strategy aims to share the vision of the future of stroke services across the West Midlands to ensure the provision of high quality care for the population it serves. The West Midlands CVD Clinical Network formed a regional Stroke Sustainability and Transformation Partnership Programme Board (SSPB) to act as an expert advisory body for local systems on enhancing and improving stroke and TIA care across the region.

The SSPB consisted senior leaders within stroke services from across the region, including, but not limited to: clinical directors, commissioners, Public Health, West Midlands Ambulance Service NHS Foundation Trust and patient representatives. The Board aspires to define and guide quality improvement along the entire stroke pathway, from primary prevention, through to acute treatment and into rehabilitation.

This strategy addresses the stroke pathway up to and including the initial rehabilitation phase. It seeks to:

- Review the current performance of hyper acute stroke units (HASU) and acute stroke units (ASU) in the West Midlands
- Map likely changes in service demand over the next five years
- Review current plans for service change
- Define best-practice clinical pathways across the whole patient journey
- Support cross-speciality workforce development
- Provide a framework for commissioning and implementation.

The long-term care of stroke patients in the community by local authority commissioned teams is beyond the initial rehabilitation phase and is outside the scope of this current strategy. As Integrated Care Systems (ICSs) develop and mature in the future, there will be a natural opportunity to examine existing commissioning models and service provision to ensure it is fit for purpose to provide a high standard of care for the local population.

The milestones within the NHS Long Term Plan set out ambitions to improve stroke care across the NHS in England to ensure we have stroke outcomes in line with European performance. The vision of the West Midlands Stroke Strategy is in line with the NHS Long Term Plan ambitions, with clear assertions on regional plans to address stroke workforce issues, the provision of a robust and sustainable thrombectomy service and improved rehabilitation models. These objectives will form the basis of future evaluations of this Stroke Strategy, to assess the impact of programmes of work on service provision and patient outcomes.

Table 6 below identifies the required actions in order to achieve the four stroke milestones from the NHS Long Term plan which relate the improvements across the stroke pathway that will reduce mortality and morbidity. With the publication of the Clinical Standards Review, the plan establishes four milestones for stroke care, with a particular focus on the delivery of a robust and sustainable thrombectomy service as well as stroke rehabilitation models.

Table 6 - Stroke improvement milestones in the NHS Long Term Plan

The table below outlines the milestones for stroke care within the NHS Long Term Plan; it identifies the actions required and sets out ambitions to improve stroke care.

Milestone	Action required
In 2019 we will, working with the Royal Colleges, pilot a new credentialing programme for hospital consultants to be trained to offer mechanical thrombectomy.	• Working with Health Education England (HEE) to modernise the stroke workforce with a focus on cross-specialty and in some cases cross-profession accreditation of particular 'competencies' • Establishing Integrated Stroke Delivery Networks (ISDNs) to ensure that all stroke units will meet the NHS seven-day standards for stroke care and the National Clinical Guidelines for Stroke • Supporting local systems to reconfigure stroke services into specialist centres in line with the evidence base (improving the use of thrombolysis and further rolling out mechanical thrombectomy) • Extending higher intensity care models for stroke rehabilitation • Scaling technology that will assist the expansion of life-changing treatments to more patients.
By 2020, we will begin improved post-hospital stroke rehabilitation models, with a full rollout over the period of this Long-Term Plan.	
By 2022, we will deliver a tenfold increase in the proportion of patients who receive a thrombectomy after a stroke so that each year 1,600 more people will be independent after their stroke.	
By 2025, we will be amongst the best performers in Europe for delivering thrombectomy to all patients who could benefit.	

4.2 Patient engagement and expectations

4.2.1 Patient and public views

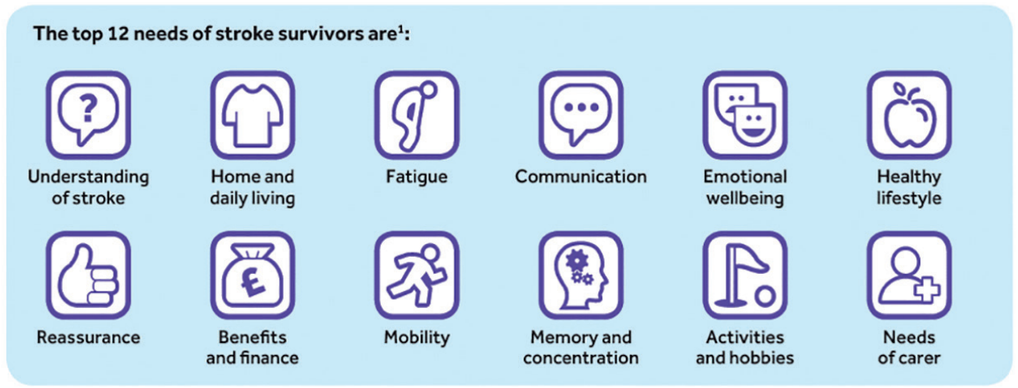
Stroke can have a devastating effect on the lives of stroke patients, as well as on their families and carers, often turning worlds around in unimaginable ways. Independent, active and dynamic people can be suddenly left with life-debilitating deficits and become reliant on carers and health care professionals for the most basic of tasks. These effects – both physical and emotional – can impact lives and relationships for many years[35].

The quality of the service accessed during the acute and hyper acute phases is paramount to the patient and carer experience. Ensuring that the right care is provided at the right place in with the right time can not only have a profound impact on the patients' outcomes but also their experience.

Reflecting on their experience of stroke care, stroke survivors highlighted their top 12 needs in ***figure 4***[36].

Figure 4 - Top 12 needs of stroke survivors

Source: The Stroke Association.



The needs of stroke survivors naturally reflect the long-term issues faced by those affected by stroke and the ongoing support and services likely to be required which need to be considered in the modelling of support services. Most of them have significant impacts on the community rehabilitation and long-term care elements of the stroke pathway as well as the wider socio-economic impact, particularly in the younger cohort of stroke patients.

Public and patient views relating to the acute phase of stroke care are most commonly gathered in engagement and consultation processes linked to the proposed reconfiguration of stroke services (***figure 5***).

In recent years, such processes have been undertaken across the West Midlands and a number of themes emerge suggesting that there is evidence that the public prioritises the quality of care over access when time-critical emergency care is required. Conversely, after the initial acute phase, consideration of travel times and costs for family and friends take on greater significance, and closer to home provision is preferred. The quality case for reconfiguring services is broadly accepted, but such proposals do also raise concerns concerning the ability of specialist units to manage additional flows from other units and the potential for further services to be lost from lower acuity sites.

35. *https://www.stroke.org.uk/publication-type/health-information*
36. *Our services impact (Stroke Association, 2016)*

These themes and reflections are considered throughout this strategy with regards to the configuration of services to ensure the provision of quality diagnostics, treatment and rehabilitation to improve not only patient outcomes but patient and carer experience.

Figure 5 – Stroke survivors and reorganisation of services

When reorganising acute stroke services, it is vital to engage patients and carers as key stakeholders.

Source:The Stroke Association.

Stroke survivors support reorganisation

A big effort needs to be made to explain HASUs to patients and carers if they are to be successful and understood. A combination of bottom-up and top-down leadership has proven to be effective in service reorganisation and so it is essential that health leaders engage with the relevant stakeholders, including patients and carers. Again, in Greater Manchester and London, this is working, although Greater Manchester has been through two sets of reconfiguration in 2010 and 2015. Despite stroke patients often having to travel further to be admitted to HASU and family and friends having having to do the same when they visit, studies have shown that stroke survivors and their families have been happy with their experience of HASUs.

These locally-recorded views echo what is reported nationally, that stroke survivors and their carers report having positive experiences being treated in HASUs, even if they were unsure at first what treatment in these units would mean and worried about any extra travel[37]. This is reinforced by research which found that a centralised comprehensive stroke service, which has been associated with high thrombolysis levels, resulted in high levels of patient and carer satisfaction, despite many patients and families being seen in a regional centralised service rather than their local hospital[38]. Ultimately, with clear and proper communication with patients and their families, we can overcome the concerns and misconceptions of conveying patients to a comprehensive stroke unit as opposed to a local hospital.

Finally, an analysis of the views of West Midlands stroke patients submitted via the **Care Opinion** website illustrates a wide variety of experience and suggests there is an opportunity to enhance patient and carer experience. The vision of this strategy will remedy the gaps within the existing service across the region to support the realisation of opportunities to deliver high quality service by:

- Improving 24-hour access to diagnostic services
- Prioritising providing a 24-hour workforce
- Improving communication between staff in different departments and between hospitals
- Offering staff training focused on the importance of effective communication with patients.

37. *https://www.stroke.org.uk/sites/default/files/jn_2640e_-psp_reorganising_acutestrokeservices.pdf*
38. *https://www.ahajournals.org/doi/pdf/10.1161/STROKEAHA.113.001675*

4.2.2 Patient outcomes and expectations

From a patient perspective, world-class services should be provided throughout the entire stroke care pathway, from public health interventions to acute treatment and long-term care[39]. Some expectations from stroke patients are outlined in ***table 7 below*** which must be considered in the reconfiguration of services, future business planning and improvement to existing pathways to ensure patients' needs are at the centre of decision making[40]:

Table 7 – Expectations from stroke patients

Public Health intervention	Providing education and understanding about risk factors and life choices, and how these impact on the likelihood of having a stroke
	Raising awareness of the signs and symptoms of a stroke to the public and all healthcare professionals to increase reaction times and 'Act FAST'
Initial assessment	Rapid assessment of stroke symptoms through education and training for all ambulance crews, so that patients are conveyed to their nearest specialist HASU as quickly as possible
	Rapid access to experts in stroke medicine, alongside imaging and a diagnosis of the type of stroke to allow for timely access to the best treatment options
Ongoing management	A point of contact for patients, their family, friends and carers throughout the stroke care pathway
	Clear communication and easy to understand information to enable patients to make informed decisions
	Patient-centred care with the best treatment available by respectful, skilled staff, in the most appropriate location and, where possible, close to home
	Help to understand what is happening now, in the future and what has happened with professional services available if required. For example, emotional and psychological support for stroke patients – 21% of survivors said that the emotional impact of stroke was the hardest to deal with[28]
	Services, information and support to be continuously improved and shaped around stroke patients' and carers' experiences and feedback
	Practical guidance and help from stroke-skilled staff, whether they are from the third sector or part of the standard NHS stroke care pathway
	Information and guidance about how to reduce the chances of having another stroke
Transfer of care	Ensuring that patients, carers and families are prepared, supported and informed about the discharge process and feeling confident that patients will not 'fall through any gaps' – 45% of all stroke survivors stated that they felt abandoned when they left the hospital[41]
	Similarly, patients did not want to feel 'stuck' in the system due to capacity issues or not be able to leave hospital when they are ready to go home – patients should be going home as soon as they are able too with the right support, equipment, care plans or rehabilitation plans if required and follow up information
	Continuity of care and communication so patients wouldn't have to repeat the same or similar information to different people in every care setting they enter
	Assessment of the needs of carers following transfers of care to reduce the need for crisis interventions
Ongoing care	Long-term support for and access to rehabilitation as required, as recovery time varies from patient to patient
	Support and recognition from professionals that patients are, and become, experts in their stroke journey
	Support and guidance for implementing secondary prevention measures and assessments for all patients who have had a stroke or TIA
	Healthcare professionals and the public to have more information and heightened awareness about the long-term impact of stroke, the consequences and significant effect it has on a stroke survivor
	Awareness of the possible consequences for patients living with life after a stroke, including the possibility of living with a disability (communication or physical)
	Recognition that stroke survivors are able to return to living active and fulfilling lives, with a range of support services available to them (statuary and voluntary) tailored to meet their individual needs

39. *https://www.stroke.org.uk/sites/default/files/anefs_report_web.pdf*
40. *The London Stroke Strategy (2007)*
41. *https://www.stroke.org.uk/sites/default/files/anefs_report_web.pdf*

4.2.3 The Stroke Association

The Stroke Association has over 30 years' experience working with stroke survivors and carers, giving them a good understanding of an individual's needs and what a good quality of life means for them. They support stroke survivors and carers to identify their needs and the outcomes that matter to them, and they tell them that recovery after stroke becomes less overwhelming with their support.

Trained and skilled coordinators support people through the ups and downs of their individual recovery journey to help them rebuild their lives. Their services are based on a holistic model of wellbeing and quality of life in the stroke recovery context, and an outcomes framework co-produced with stroke survivors and carers. Individuals tell the Stroke Association that they value their holistic approach – the way they listen, the accessible way they explain things, the continuity of their support, the way they proactively encourage and support progress, and the way they draw on experience to help people better understand their situation and manage their recovery.

The Stroke Association has a range of packages that can be funded in a specific area to support the long-term needs of stroke survivors and their families, including:

- Stroke Recovery Service
- Emotional support
- Communication support
- Post-stroke reviews (including six-month reviews).

In the West Midlands, Stroke Recovery Services (SRS), post-stroke reviews, emotional and communication support is provided across multiple CCGs within the West Midlands however there is not a unified approach to the commissioning and delivery of these services.

A full breakdown of the services provided by the Stroke Association in the West Midlands can be found in ***Appendix 12.3***.

Further information, resources and support for patients and carers can be found on the Stroke Association website: **https://www.stroke.org.uk**.

4.3 Key conclusions

- Stroke can have a devastating effect on the lives of stroke patients, as well as on their families and carers
- The top 12 needs of stroke survivors are:
  1. Understanding of stroke
  2. Home and daily living
  3. Fatigue
  4. Communication
  5. Emotional wellbeing
  6. Healthy lifestyle
  7. Reassurance
  8. Benefits and finance
  9. Mobility
  10. Memory and concentration
  11. Activities and hobbies
  12. Needs of carers.
- Nationally, stroke survivors and their carers report having positive experiences being treated in HASUs[42]
- Stroke survivors support reconfiguration of services,
- From a patient perspective, world class services should be provided throughout the entire stroke care pathway, from public health interventions to acute treatment and long-term care[43]
- The Stroke Association services are based on a holistic model of wellbeing and quality of life in the stroke recovery context, and an outcomes framework co-produced with stroke survivors and carers[44]
- The vision and objectives of this strategy will remedy the gaps within the existing service across the region to support the realisation of opportunities to deliver a high-quality service that is equitable to all.

42. *https://www.stroke.org.uk/sites/default/files/jn_2640e_-psp_reorganising_acutestrokeservices.pdf*
43. *https://www.stroke.org.uk/sites/default/files/anefs_report_web.pdf*
44. *https://www.stroke.org.uk/*

5 An assessment of stroke services in the West Midlands

5.1 Prevention

According to the NHS Long Term Plan, the UK mortality rate from heart and circulatory diseases has declined by more than three quarters in the last 40 years. However, CVD remains the biggest cause of premature mortality, particularly in the most deprived areas. The rate of increase in life expectancy has slowed for both sexes as improvements in heart disease mortality have plateaued[45]. This highlights the need for a renewed drive to prevent CVD deaths and reduce health inequalities.

Public Health England and NHS England released Health Matters: 'Preventing cardiovascular disease – saving hearts and minds together' in February 2019 with a 10-year ambition linking to the NHS Long Term Plan. The publication sets out the first ever national ambitions to improve the detection and treatment of atrial fibrillation, high blood pressure and high cholesterol ('A-B-C') – the major causes of CVD[46]. Further information about the publication can be found ***here***.

The ambitions include recommendations for decision-makers and frontline professionals on getting more people checked and best practice for identifying and treating those already at risk. The A-B-C conditions can be detected through routine health checks such as the free NHS Health Check (offered to eligible people aged between 40 and 74). The checks help patients understand their CVD risk and provide support to access lifestyle modification and treatment to lower the risk.

45. NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/

46. Ambitions set to address major causes of cardiovascular disease, Public Health England (2019)

This is complemented by the Heart Age online tool aimed at those aged 30 or over which can be used to find out how old the person's heart is and to know their CVD risk. The older a person's heart age, the higher their risk of a cardiovascular event, such as a stroke or heart attack.

Everyone can find out about the different ways to maintain good cardiovascular health, such as stopping smoking, eating well, staying active and cutting back on alcohol. Free advice is available through Public Health England's OneYou campaign[47].

Lack of awareness of stroke and TIA – its lifestyle causes, risk factors, prevention and symptoms – can also be a significant challenge to the realisation of successful outcomes. A proactive approach by all healthcare professionals (as advocated in the NHS Long Term Plan) is needed to recognise patients at risk of stroke or TIA and to help them mitigate those risks.

With appropriate prevention measures, individuals can significantly reduce their risk of cardiovascular mortality and morbidity. It is estimated that cardiovascular disease costs the NHS £8.96 billion per year, and 26% of all deaths are caused by CVD[48].

Atrial fibrillation (AF) is the most common form of heart rhythm disorder, affecting approximately 900,000 people in England (1.74% of the population), and national data suggests that it is the cause of 20% of strokes. CVD prevention data released from Public Health England in 2015/16 demonstrated the anticoagulation treatment gap in the West Midlands; with an AF registered GP population of 104,600, an estimated population with undiagnosed AF of 47,400 and 19,700 GP-registered, high-risk AF patients (***appendix 12.5***) are not anticoagulated; of which approximately 949 people suffered a stroke. In the West Midlands in 2015/16, there were 1,594 strokes in patients with known AF[49].

The cornerstone of AF-related stroke prevention is anticoagulation; reducing the incidence of clot formation and therefore contributing to the prevention of AF-related strokes. The primary focus for preventing AF-related strokes is to increase the detection of AF with the adoption and integration of the West Midlands Regional AF pathway (***appendix 12.5***). The secondary focus is to improve thse rates of anticoagulation in high-risk AF patients.

5.2 Pre-hospital

A rapid response to stroke reduces the risk of mortality and disability – 'Time is Brain'; there are 1.2 billion neurons lost per acute ischaemic stroke and 1.9 million neurons per minute[50]. The early identification of potential stroke or TIA and timely admission to an appropriate stroke centre is a critical stage of the care pathway; the West Midlands CVD Clinical Network and West Midlands Ambulance Service NHS Foundation Trust (WMAS) highlight the importance of time critical transfer and the pre-alert of stroke teams from paramedics across the region. Promotion amongst healthcare professionals, the public and carers of stroke symptom awareness that prompt emergency treatment (e.g. 'Act FAST' campaign – Face, Arms, Speech, Time) improves health outcomes through timely access to stroke care and specialist treatments.

Living alone, primary school education, non-European origin, previous stroke, diabetes, smoking, and dependency in activities of daily living (ADL) are associated with a lower probability of receiving stroke pre-alerts[51]. There are opportunities to make pre-alert systems more efficient by introducing the concept of registering patient details with the hospital and booking Computed Tomography (CT) scans whilst patients are en-route. Stroke teams will also need to work on developing a pre-hospital triage system, where they can help in directing patients to the most suitable stroke centres.

47. https://www.nhs.uk/oneyou/

48. The Stroke Association [online]: https://www.stroke.org.uk/sites/default/files/costs_of_stroke_in_the_uk_report_-executive_summary_part_2.pdf

49. Public Health England: Size of the Prize (2015/16)

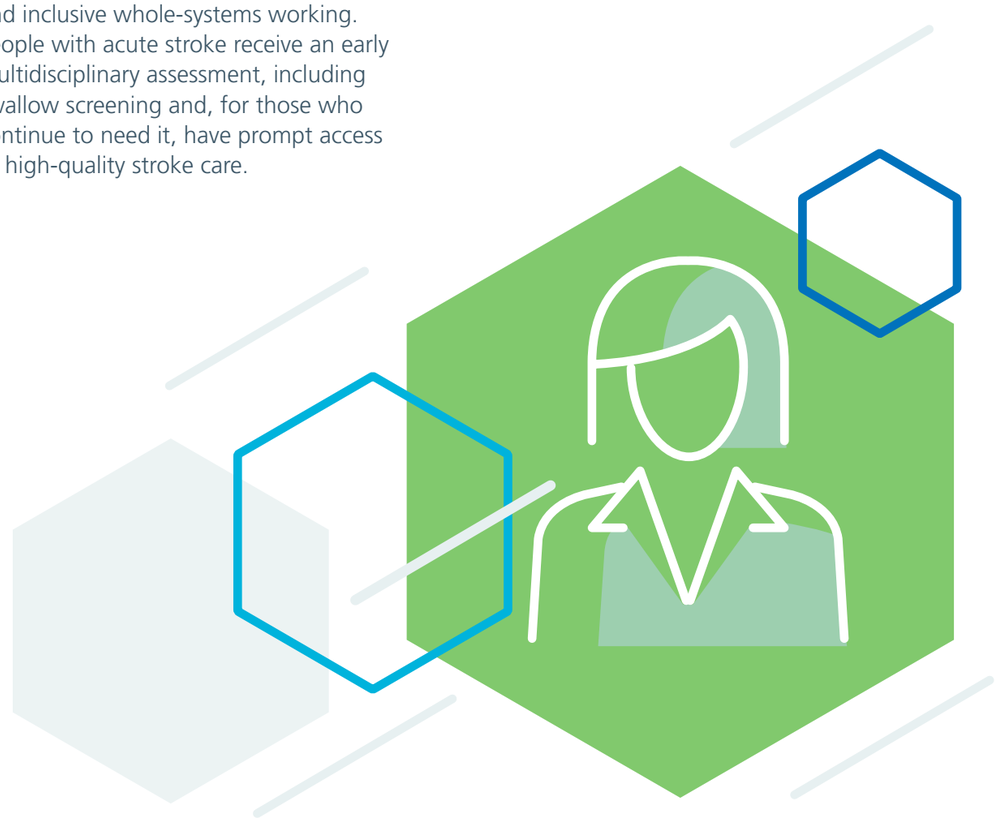
50. Saver J L, 2006, 'Time is Brain – Quantified', Stroke (37), 263-266

51. Eriksson M, Glader EL, Norrving B, Stegmayr B, Asplund K. Acute stroke alert activation, emergency service use, and reperfusion therapy in Sweden. Brain Behav. 2017;7(4):e00654. Published 2017 Mar 15. doi:10.1002/brb3.654

5.3 Acute care

Hyper acute services provide expert specialist clinical assessment, rapid imaging and the ability to deliver 24/7 intravenous thrombolysis (a clot-busting drug to try to disperse the clot and return the blood supply to the brain), which must be administered within 4.5 hours of the onset of stroke symptoms[52]. At least 600 stroke cases per year are typically required to provide sufficient patient volumes to make a hyper acute stroke service clinically sustainable, to maintain expertise and to ensure good clinical outcomes. This standard is only one factor, and must be seen within the context of other crucial variables such as travel times, clinical and financial sustainability, workforce and inclusive whole-systems working. People with acute stroke receive an early multidisciplinary assessment, including swallow screening and, for those who continue to need it, have prompt access to high-quality stroke care.

The acute stroke care phase immediately follows the hyper acute phase, with acute stroke services continuing to provide specialist day and night care, with daily multidisciplinary care, continued access to stroke-trained consultant, nurse and allied health professional care, access to physiological monitoring and access to urgent imaging as required. In-hospital rehabilitation should begin immediately after a person has had a stroke, and patients should be discharged from the stroke unit to Early Supported Discharge (ESD) services or Community Stroke Teams (CST) where no ESD exists.



52. *https://www.nice.org.uk/guidance/ng128*

5.4 Rehabilitation and community care

Early Supported Discharge is an intervention for adults after a stroke that allows their care to be transferred from an inpatient environment to a community setting (NICE 2016). It enables stroke survivors to leave the hospital as soon as is clinically appropriate and allows them to continue their rehabilitation therapy at home with the same intensity and expertise that they would receive in the hospital. There is a large body of evidence to support ESD after stroke, suggesting that this approach can deliver positive clinical outcomes whilst improving quality of life, without adverse effects[53].

ESD can expedite discharge from hospital:

"ESD in a multidisciplinary setting is beneficial for patients with mild to moderate stroke and is a likely cause of the significant reduction in length of stay in stroke units in these patients"[54].

The expectation is that 40% of patients with stroke can be managed through such a service and have their admission length reduced by an ESD service; in the West Midlands, approximately 38% of patients currently receive ESD services[55].

An ESD team of nurses, therapists, doctors and social care staff work collaboratively as a team with patients and families, providing intensive rehabilitation at home for up to six weeks, thereby reducing the risk of re-admission into hospital for stroke-related problems and increasing independence and quality of life with support for the carer and family. These services enable stroke survivors to experience a better quality of life and greater independence following stroke than would otherwise be the case. Community stroke rehabilitation services / community stroke teams (CST) provide stroke care and rehabilitation including the transfer of care from hospital to home (where no ESD is available) and time at home. This is provided through collaboration with health and social services, the independent and third sectors. Rehabilitation services should continue for as long as required, to ensure the best recovery, improvement in disability and maximise independence. Rehabilitation goals are agreed between the multidisciplinary team, stroke patients and carers during a patient's acute stay, and are re-assessed regularly throughout their rehabilitation.

The current range of ESD and community stroke / rehabilitation services in the West Midlands are summarised in ***table 8*** which highlights the variation across the region; in some STP areas there are no ESD teams available and in others, there is no CST or CRT. This emphasises the commissioning difference and service gaps across STPs and the West Midlands region but also highlights the potentially high variance in outcomes for stroke patients. In general, there has been an increase in ESD over five years and steady reduction of CST discharges over the same period. In the region, patients discharged with a stroke or neurology-specific ESD has increased from 22.3% in 2013/14 to 37.2% in 2017/18, and patients discharged with a stroke or neurology-specific CST or CRT has decreased from 28.2% in 2013/14 to 20.5% in 2017/18[56].

53. *Langhorne and Baylan 2017, Fisher et al. 2016 and 2011*
54. *Action on Stroke, 2018*
55. *SSNAP Annual Report 2017/18*
56. *https://www.strokeaudit.org/results/Clinical-audit/Regional-Results.aspx*

Table 8 – ESD and rehabilitation teams in the West Midlands

The table below outlines the Early Supported Discharge and rehabilitation teams in each STP in the West Midlands.

Source: The West Midlands ESD and Rehabilitation Working Group (2018).

STP	ESD or Outreach Teams	Community Teams
Birmingham and Solihull	Birmingham Heartlands Hospital ESD Team (Heartlands, Good Hope and Solihull (HGS)) Birmingham Community Healthcare NHS Trust (BCHC) ESD (South, Central and Cross City Birmingham ESD Team)	Birmingham Community Stroke Team (North, East, West and Central Birmingham) Birmingham Neuro Rehabilitation Team (South Birmingham) Community Neuro Physio (South, Central and North Birmingham) Solihull Neuro Team (South Birmingham)
The Black Country and West Birmingham	Russells Hall ESD Team Sandwell and West Birmingham NHS Trust ESD Royal Wolverhampton NHS Trust ESD (Wolverhampton and Seisdon Peninsula ESD Team) Walsall ESD Team Cannock ESD Team [Provided by Walsall Healthcare NHS Trust] Stafford ESD Team [Provided by Walsall Healthcare NHS Trust]	Dudley Community Stroke Rehabilitation Team Outpatient Community Occupational Therapy Walsall Community Stroke Rehab Team Cannock Community Stroke Team [Provided by Walsall Healthcare NHS Trust] Stafford Community Stroke Team [Provided by Walsall Healthcare NHS Trust; NOT Seisdon Peninsula] Community Stroke Services (Stafford/Seisdon Peninsula)
Coventry and Warwickshire	Stroke Outreach Rehabilitation Team (North) [Provided by George Eliot Hospital] Rugby ESD Team [Provided by South Warwickshire and funded by Coventry] Coventry and Warwickshire Partnership Trust ESD Team South Warwickshire Stroke Outreach Team	Community Speech and Language Team / Dietetics Generic Community Team Coventry Community Neuro Rehab Team Community Speech and Language Team / Dietitian / Physiotherapist Community Dietitian
Herefordshire and Worcestershire	Hereford ESD Team Community Stroke Service: North Worcestershire ESD Team and South Worcestershire ESD Team	Herefordshire Community Stroke Rehab Team Community Stroke Service (Worcestershire) Neuro Rehabilitation Team
Shropshire, Telford and Wrekin	Shrewsbury and Telford Hospitals NHS Trust ESD (Shrewsbury and Telford ESD Team)	Community Neuro Rehabilitation Team (based in Shrewsbury)
Staffordshire and Stoke-on-Trent	University Hospitals of North Midlands NHS Trust Enhanced ESD (Cheshire, Stoke, Stafford) ESD (Cheshire East) Cannock ESD Team [Provided by Walsall Healthcare NHS Trust] Stafford ESD Team [Provided by Walsall Healthcare NHS Trust]	Community Stroke Team (Cheshire) Neuro Community Team (Macclesfield) East Staffordshire Community Stroke Rehab Team Cannock Community Stroke Team [Provided by Walsall Healthcare NHS Trust] Stafford Community Stroke Team [Provided by Walsall Healthcare NHS Trust] South East Staffordshire Community Neuro Rehab Team

5.5 Current service provision

5.5.1 Configuration

Hyper acute stroke services for the region's six million population are currently provided at 10 hospital sites across the West Midlands and acute stroke services at 13 hospital sites (see ***figure 6 overleaf***; including Burton-on-Trent, there are 14 ASU sites). Since the release of the National Stroke Strategy and National Clinical Standards, the regional response to achieving the seven-day standards and meeting national requirements was to centralise stroke care across the West Midlands.

The West Midlands has undergone several centralisation processes. These are summarised below:

- Sandwell and West Birmingham NHS Trust successfully reconfigured their stroke services from City Hospital to the Sandwell Hospital site in March 2013[57]
- In July 2013, stroke services across Worcestershire were centralised at Worcestershire Royal Hospital, with stroke beds at the Alexandra Hospital in Redditch closing. High-risk TIA clinics continue to be held in Worcester, Kidderminster and Redditch
- Hyper acute and acute stroke services were temporarily transferred to the Princess Royal Hospital (PRH), Telford in July 2013. During 2014, services were centralised at PRH – this was planned as a short-term measure. However, Healthwatch Shropshire and other stakeholders were told that clinical outcomes for acute stroke improved so much that it was decided to keep the centralised acute service at PRH for the longer term[58]
- In Birmingham, part of the trust-wide reconfiguration of stroke services included the opening of a new, state-of-the-art specialist stroke unit at Heartlands Hospital in October 2014, benefiting patients from across the Heartlands, Good Hope and Solihull Hospital catchment areas[59]
- In April 2018, a successful service change resulted in the direction of all acute strokes in Walsall to New Cross Hospital in Wolverhampton for hyper acute and acute stroke care.

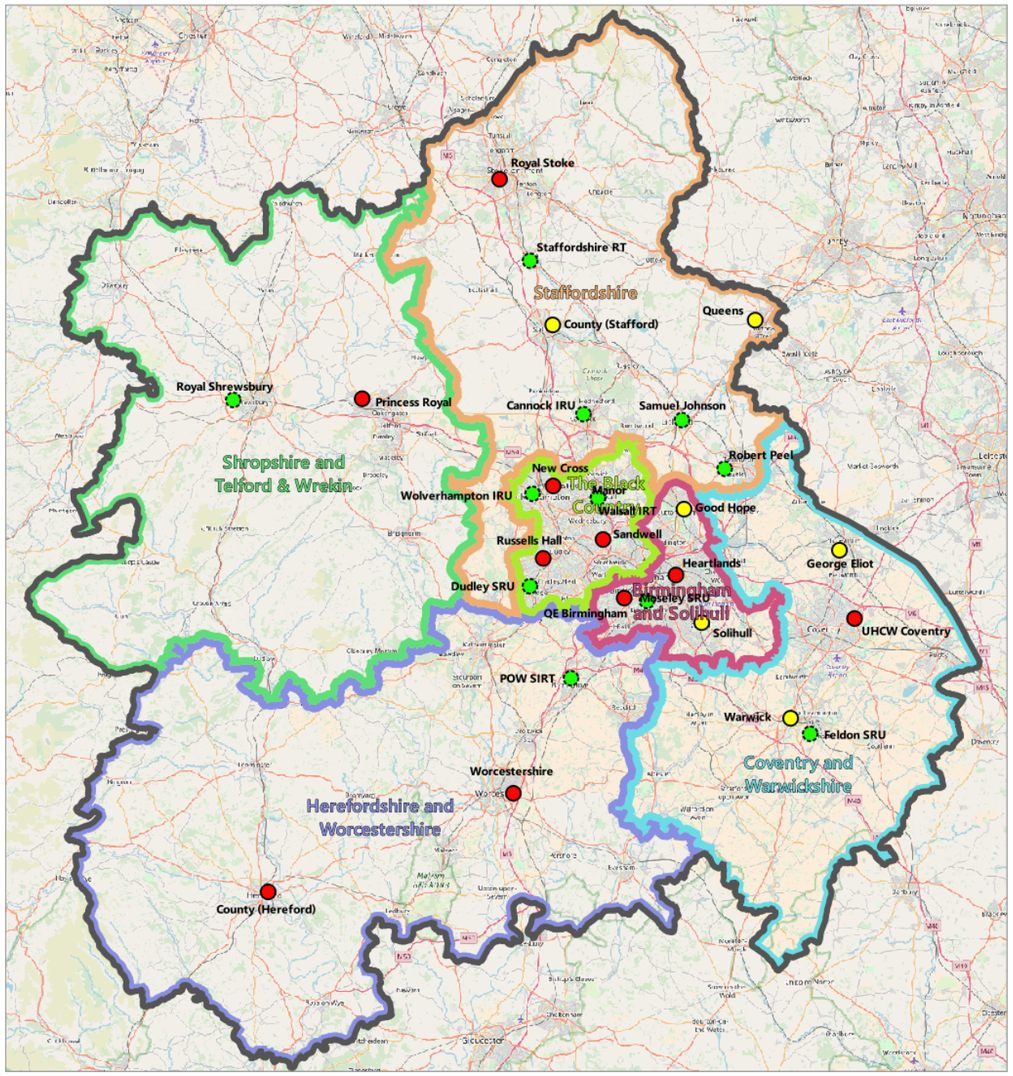
The region has still not achieved the optimum delivery of care and further work is needed; future provision and potential centralisation outcomes are outlined in service reconfiguration; ***section 8.3.2***.

57. *http://www.wmscnsenate.nhs.uk/home/publications*
58. *https://www.healthwatch.co.uk/sites/healthwatch.co.uk/files/reports-library/20170131_Shropshire_Ward_15_and_16_Stroke_Service_Royal_Shrewsbury_Hospital._Enter_and_View.pdf*
59. *https://hgs.uhb.nhs.uk/stroke-prevention/*

Figure 6 – Current service provision for stroke care in the West Midlands (2019)

The West Midlands has a population of 5.8 million, with a total stroke incidence of 8,483 in 2017/18. The estimated stroke incidence for the region is 9,057 in 2022/23.

Stroke Services in the West Midlands as at April 2018



Legend:

West Midlands Region

STP boundary

- Birmingham and Solihull
- Coventry and Warwickshire
- Herefordshire and Worcestershire
- Shropshire and Telford and Wrekin
- Staffordshire
- The Black Country

Stroke Service:

- Hyper Acute Stroke Unit (HASU)
- Acute Stroke Unit (ASU)
- Rehabilitation service

The Strategy Unit

The services provided at each site are set out below (***see table 9***).

Table 9 – West Midlands stroke services by site

The table below details which services are available at each of the individual hospital sites per STP in the West Midlands. ***Note: Queens Hospital Burton will no longer have an ASU and has merged with Derby Hospitals, therefore, it is out of scope for the West Midlands activity modelling. However, there are still some patients from the North East of the region who may present with a stroke at Derby Hospital and potentially attend Queens Hospital or the community hospitals as an option for rehabilitation; these sites physically remain within the West Midlands (Staffordshire).***

STP Area	Site	HASU	ASU	Throm-bectomy	Inpatient Rehab	Community Rehab	TIA Clinic	ESD Team
The Black Country	New Cross Hospital	X	X		X	X	X	X
	Russells Hall Hospital	X	X		X		X	X
	Sandwell Hospital	X	X		X		X	X
	Dudley Stroke Rehabilitation				X	X		X
	Walsall Stroke Rehabilitation Unit				X	X		
	Cannock Hospital Rehabilitation Unit				X			
	West Park Hospital Stroke Rehabilitation Unit				X	X		
Birmingham and Solihull	Good Hope Hospital		X			X	X	X
	Queen Elizabeth Hospital (ESD provided by BCHC)	X	X	X			X	
	Solihull Hospital		X			X	X	X
	Birmingham Heartlands Hospital	X	X			X	X	X
	Birmingham Community Healthcare (BCHC)					X		X
	Moseley Hall Stroke Rehabilitation Unit (Part of BCHC)				X	X		
Coventry and Warwickshire	George Eliot Hospital		X		X		X	
	South Warwickshire Hospital		X		X		X	
	University Hospital Coventry	X	X		X	X	X	X
	Feldon Stroke Rehabilitation Unit				X	X		
Hereford and Worcestershire	Hereford County Hospital	X	X		X		X	X
	Worcestershire Royal Hospital	X	X			X	X	
	Evesham Community Hospital Stroke Rehabilitation Unit				X	X		
Shropshire, Telford and Wrekin	Royal Shrewsbury Hospital				X	X		X
	Princess Royal Hospital	X	X		X		X	X
Staffordshire	County Hospital				X		X	X
	Royal Stoke University Hospital	X	X	X	X	X	X	X
	Cannock Hospital Rehabilitation Unit				X	X		
	Haywood Hospital Stroke Rehabilitation Team				X	X		
	Queens Hospital Burton		X		X		X	
	Sir Robert Peel Community Hospital				X	X		
	Samuel Johnson Community Hospital				X	X		

5.6 Current performance

The Sentinel Stroke National Audit Programme (SSNAP) is the key source of stroke data for the UK and is collected from each stroke unit (HASU, ASU and rehabilitation) to assess delivery against national clinical guidelines. Services are expected to achieve an A or B score indicating excellent or good service provision, respectively.

According to SSNAP data, from October to December 2018, six out of 13 centres in the West Midlands who routinely admit stroke patients, met the expected standards for overall performance (***table 9***). SSNAP data highlights the variation within the region in terms of the 10 key indicator domains:

- The majority of centres achieved a 'good' performance rating, meeting the expected timeliness of MRI / CT scanning; the provision of occupational therapy and physiotherapy; and preparing patients for discharge (nutrition, continence and mood / cognition)
- Weaker performance is observed in relation to two domains – the timeliness of multidisciplinary assessments and the effectiveness of hospital discharge processes. These include provision of a joint health and social care plan, treatment by a stroke skilled Early Supported Discharge team, anticoagulation for patients with AF, and information on the named person to contact after discharge
- The four remaining domains reported in SSNAP show where great improvements are required across the region to meet national expectations. Three relate to the critical initial phase of acute stroke care: caring for patients in a specialist stroke unit, the timely administration of thrombolysis, and assessment by specialist doctors and nurses within 24 hours. The fourth domain is the extent of speech and language therapy provided. This is critical to the recovery phase where clinically required.

Regarding thrombolysis, it must be noted that George Eliot Hospital and Warwick Hospital are not hyper acute centres and therefore do not provide thrombolysis services to patients; in Coventry and Warwickshire, only University Hospital Coventry and Warwickshire (UHCW) provides hyper acute care and thrombolysis. SSNAP highlights the variation across the region with a range reported between A and E for thrombolysis; this relates to a range of 80% to 30% of patients being thrombolysed within an hour, and median clock start to thrombolysis time less than 40 minutes to less than 90 minutes. There are no descriptors reported for E ratings.

Detailed SSNAP scores by site and domain are summarised in ***table 9***. SSNAP does not report data for clinical psychology and dietetic input in the SSNAP overall performance score, which are integral parts of the stroke care pathway.

In addition to national data, local clinical reviews were undertaken in January to March 2018 and October 2018 to March 2019 to understand the extent of compliance with seven-day standards across the region. Of the 10 sites reviewed, seven were found to have over 50% of patients seen by a stroke consultant and to provide a very strong seven-day service. Three hospitals were identified as requiring improvement to achieve the seven-day standard.

Table 10: SSNAP performance – West Midlands

The table below indicates the patient-centred performance of routinely admitting stroke teams in the West Midlands from SSNAP (October – December 2018). *Note: Queens Hospital Burton is physically within the geography of the West Midlands; the trust has merged with Derby and sits outside of the West Midlands modelling activity.*

Routinely admitting teams	Number of patients		Overall performance				Patient-centred data										
Team name	Admit	Disch	SSNAP level	CA	AC	Com-bined KI level	D1 Scan	D2 SU	D3 Throm	D4 Spec Asst	D5 OT	D6 PT	D7 SALT	D8 MDT	D9 Std Disch	D10 Disch Proc	PC KI Level
Russells Hall Hospital	169	160	B↓	A	A↑	B↓	B↓	C↓	C↓	A	B	B	C↓	A	B	A↑	B↓
George Eliot Hospital	69	65	C	A	C	B	C↓	E	D↑	B	A	A↑	C↓	A	A	C	B
New Cross Hospital	206	215	C↑	B↓	B↑	B↑↑	B	C	C↑	B↑↑	A	B	D↓	D	B↑↑↑	A↑↑↑	B↑↑
Sandwell District Hospital	146	149	B↑	A	B	B	A	C	C	B↓	C	B↑	C↑↑	B	B	A↑	B
Princess Royal Hospital, Telford	227	225	D↓	A	B	D↓↓	C↓	E↓↓	D↓	D↓	C↓↓	D↓↓	E	D↓	B	A	D↓↓
Warwick Hospital	88	90	C	A	A	C	C↑	D↑	C↑↑	D	B↓	B↓	C	B	B↓	C↑	C
Birmingham Heartlands Hospital	205	214	B↓	A	A	B↓	B↓	D↓	B	B↓	A	B	D	B	B	A	B↓
Queen Elizabeth Hospital, Edgbaston	177	174	B↑	A↑	A	B↑	B	D	D↓	C	A↑↑	B↑	C	C↑	B	A↑	B↑
University Hospital Coventry	218	223	A↑	A	A	A↑	A	D	A↑	C	A↑	B	B↑	B	B	A	A↑
Queens Hospital, Burton-on-Trent	87	88	D	B↑	C	D↓	B↓	D↓	D	D	C↓↓	D↓↓	D↓	B	D	B↑↑	D↓
Royal Stoke University Hospital	387	378	A	A	A	A	A	C	B	B	A	A	D	A	A↑	A	A
Worcestershire Royal Hospital	232	226	D	A	B↑	D	C	E	D	D	A	A	C↑↑	D↑	B	C	C
Hereford County Hospital	146	161	C↑	A↑	A	C↑	C	E	E	C	B↑	A↑	C↑	B↑	B↓	C	C

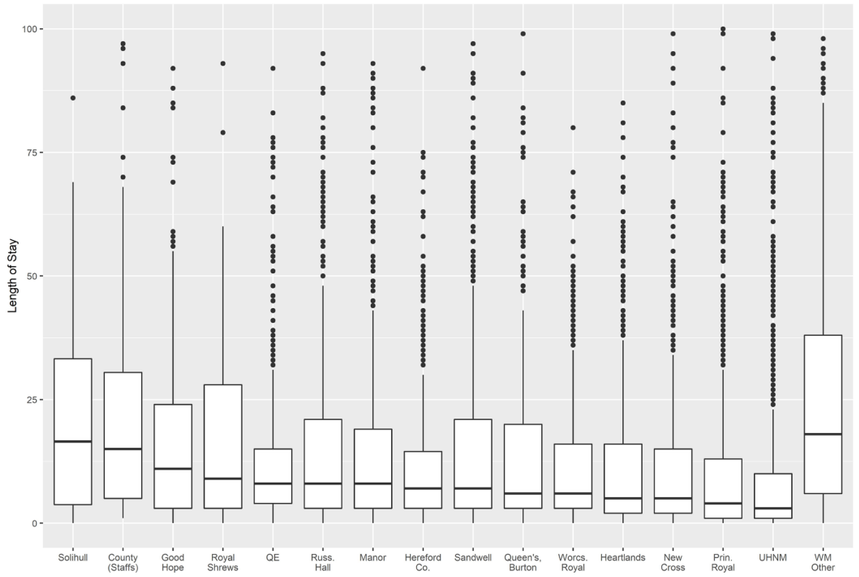
5.6.1 Average length of stay

The length of stay experienced by stroke patients also varies significantly by hospital site (***figure 7***) due to the services provided at the sites. For example, HASU sites will have a lower average length of stay when compared to ASU or rehab units only, with HASU length of stays ranging between 0.6 and 5 days and ASU / rehab ranging from 2.8 to 24.9 days.

Other areas of variation that are likely to impact either quality and/or efficiency of care and thus affect a patient's length of stay are evident from the analysis of current service provision from SSNAP, which highlights a weaker performance on the timeliness of multidisciplinary assessments and the effectiveness of hospital discharge processes in the region.

Figure 7 – Average length of stay by site in the West Midlands

Length of stay is calculated based on continuous inpatient spells and assigned to the site in which the stroke was first diagnosed (i.e. includes any stroke-specific transfer and rehabilitation episodes as well as the primary acute episodes of care).



5.6.2 Access

The overarching vision for stroke services across the area is to ensure that all patients who experience a stroke have access to high-quality acute care 24/7 and high-quality life after stroke rehabilitation. This should be as part of a stroke pathway focused on providing patient and carer centric care, empowerment and facilitation of self-management, leading to meaningful participation in daily life[60].

The regional ambition for emergency stroke care is for 100% of the population to have access to their local HASU or Comprehensive Stroke Unit ideally within 30 minutes and no longer than 60 minutes[61]. The maps below (***figures 8A and 8B***) illustrate the travel time by road to the nearest HASU and demonstrate the challenge of conveying patients by ambulance travel in rural communities. The West Midlands Air Ambulance can be utilised in rural communities – if there are agreed sites available and pre-lit agreed sites at night time.

60. *NHS Midlands and East Stroke Services Specification, 2012: https://www.england.nhs.uk/mids-east/wp-content/uploads/sites/7/2018/04/7-stroke-specification.pdf*
61. *Allen M, Pearn K, Villeneuve E, et al. Feasibility of a hyper acute stroke unit model of care across England: a modelling analysis. BMJ Open 2017;7:e018143. doi:10.1136/ bmjopen-2017-018143*

5.6.3 West Midlands activity

During 2017/18, there were 11,945 strokes and TIAs recorded in the West Midlands. The highest stroke and TIA activity is in The Black Country, closely followed by Birmingham and Solihull and Staffordshire and Stoke-on-Trent. The lowest activity is seen in Shropshire, Telford and Wrekin.

This activity is outlined in ***table 11***, using; information based on the area of registration or residence and trust-level information supplied to the editorial team. This table enables a simple, high-level comparison of those key features of local service provision. It identifies significant variation in the workforce across the region – the majority of the stroke consultant workforce is shown to be localised to Birmingham and Solihull STP and The Black Country STP (24.9% and 28.3% respectively) when compared to areas such as Coventry and Warwickshire STP and Shropshire, Telford and Wrekin STP who both have 9.1% of the stroke consultant workforce.

Current workforce rotas match with the stroke activity flow with a full complement of stroke, radiology, A&E and haematology (where required) multidisciplinary colleagues being available on site during the peak hours of stroke activity. Activity admitted via A&E reaches a peak towards the middle of daytime hours (09:00 - 13:00 hours), with the lowest levels occurring in the early hours of the morning (01:00 - 06:00 hours). Tables showing this data can be found in the ***Appe ndices***. Low overnight activity is supported by lower staff levels – teams have access to stroke-skilled consultants on-call overnight. The majority of hyper acute services have stroke clinical nurse specialists available from 08:00 to 20:00 hours.

Figure 8A – HASU access times – self-conveyed

Travel time to the nearest HASU is from the patient's home for self-conveyance.

Source: West Midlands Ambulance Service NHS Foundation Trust.

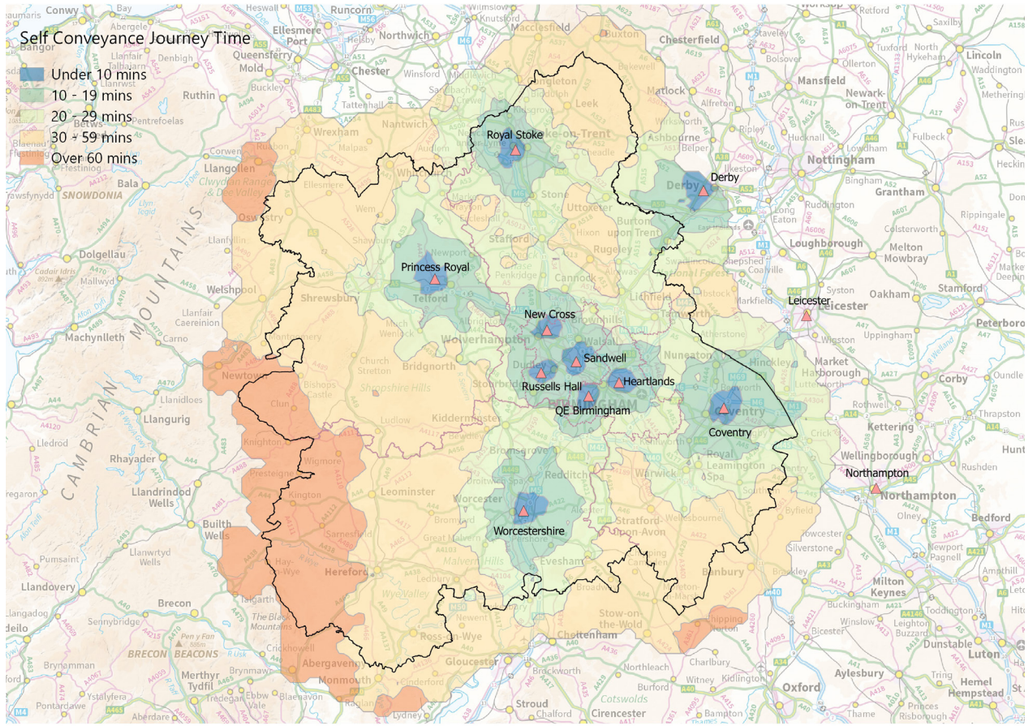


Figure 8B – HASU access times – ambulance conveyed

Travel time to the nearest HASU is from the incident location for ambulance conveyance.

Source: West Midlands Ambulance Service NHS Foundation Trust.

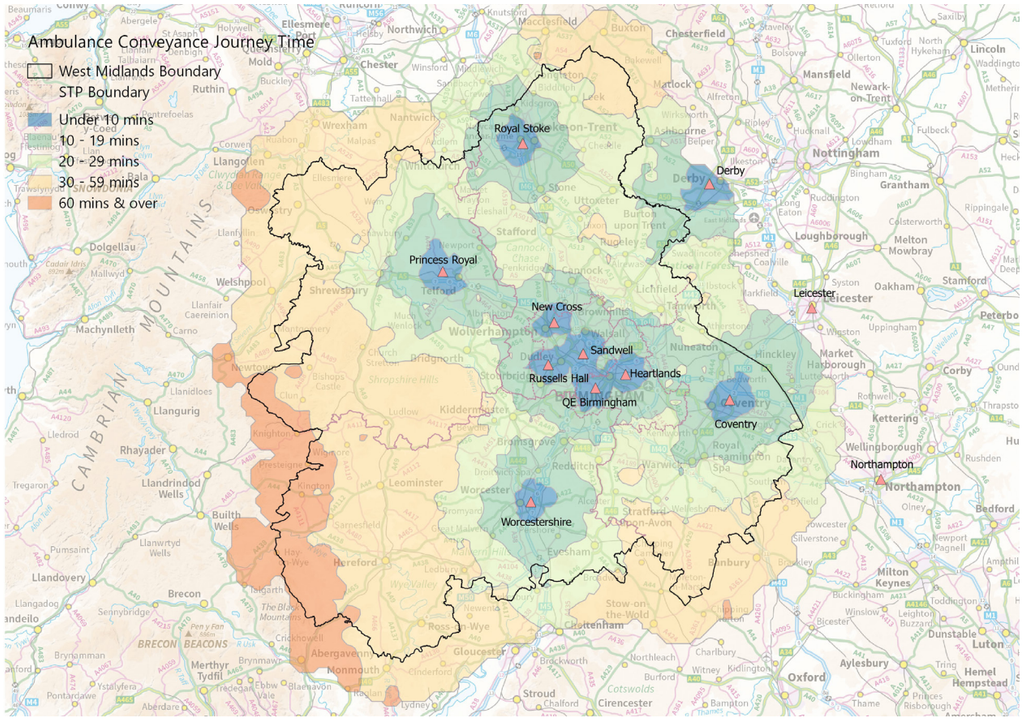


Table 11 – 2017/18 West Midlands stroke activity, capacity and workforce

The table summarises the activity seen in 2017/18 (11,945 strokes and TIAs) by STP and accompanied by key population, capacity and workforce data. Information is based on the area of registration or residence and trust-level information. Count of deaths refers to inpatient deaths only. Nursing whole-time equivalent (WTE) accounts for all bands of staff (ward, front line and supernumerary).

STP/ICS	2016/17 CCG Weighted Population (m)	Stroke/ TIA Activity	Average Length of Stay	Brain Scans	Throm-bolysis	Thromb-ectomies	Count of Deaths	Cons-sultant WTE	Medical WTE	Nursing WTE	AHP WTE	HASU Beds	ASU Beds	Total Beds
Birmingham and Solihull	1.30	2,269	13.67	951	91	21	303	11	29	162.25	37.51	28	28	**56**
Coventry and Warwickshire	0.98	1,907	14.19	768	122	5	244	4	5	11	12.6	6	30	**36**
Herefordshire and Worcestershire	0.75	1,833	14.79	910	59	6	270	5.6	14.6	93.09	18.9	14	29	**43**
Shropshire and Telford and Wrekin	0.49	1,298	9.90	1,032	87	9	143	4	9	72.16	19.65	6	36	**42**
Staffordshire and Stoke-on-Trent	1.20	2,262	15.56	917	156	67	359	7	14	63	9	6	26	**32**
The Black Country and West Birmingham	1.50	2,376	17.30	1,338	182	10	407	12.5	23.5	160.68	36.6	22	66	**88**
TOTALS	6.22	11,945	14.68	5,916	697	118	1,726	44.1	95.1	562.18	134.26	82	215	297

STP/ICS	2016/17 CCG Weighted Pop-ulation (m)	Stroke/ TIA Activity	Aver-age Length of Stay	Brain Scans	Throm-bolysis	Thromb-ectomies	Count of Deaths	Cons-sultant	Medical	Nursing	AHP	HASU Beds	ASU Beds	Total Beds
Birmingham and Solihull	20.9%	19.0%		16.1%	13.1%	17.8%	17.6%	24.9%	30.5%	28.9%	27.9%	34.1%	13.0%	**18.9%**
Coventry and Warwickshire	15.8%	16.0%		13.0%	17.5%	4.2%	14.1%	9.1%	5.3%	2.0%	9.4%	7.3%	14.0%	**12.1%**
Herefordshire and Worcestershire	12.1%	15.3%		15.4%	8.5%	5.1%	15.6%	12.7%	15.4%	16.6%	14.1%	17.1%	13.5%	**14.5%**
Shropshire and Telford and Wrekin	7.9%	10.9%		17.4%	12.5%	7.6%	8.3%	9.1%	9.5%	12.8%	14.6%	7.3%	16.7%	**14.1%**
Staffordshire and Stoke-on-Trent	19.3%	18.9%		15.5%	22.4%	56.8%	20.8%	15.9%	14.7%	11.2%	6.7%	7.3%	12.1%	**10.8%**
The Black Country and West Birmingham	24.1%	19.9%		22.6%	26.1%	8.5%	23.6%	28.3%	24.7%	28.6%	27.3%	26.8%	30.7%	**29.6%**
TOTALS	100%	100%		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

5.7 Current workforce and future requirements

The variation in the scale and skill-sets of the stroke workforce has a material impact on the delivery of effective stroke care, as has been recognised in the NHS Long Term Plan[62]. The plan commits to working with Health Education England (HEE) to modernise the stroke workforce, focusing on cross-specialty and, in some cases, cross-profession accreditation of defined competencies. There is also a commitment in 2019 to work with the medical Royal Colleges and specialty societies to develop a mechanical thrombectomy credentialing programme for hospital consultants from a variety of relevant disciplines.

A set of workforce standards covering the entire stroke pathway was developed as part of the NHS Midlands and East Stroke services specification[63]. According to workforce data collated during site visits: workforce composition and numbers, bed bases and stroke numbers per year varied widely across the West Midlands in 2018. This reveals significant, potentially unwarranted, variation in the scale and balance of staffing provision across West Midlands units. According to the data (see tables ***12A below*** and ***12B overleaf***), there are deficiencies across all hospitals in the stroke workforce; the gaps are highlighted in ***table 12C*** where the current stroke workforce of the West Midlands is measured against the requirements outlined in the RCP guidelines (***table 2; section 4.3.2***).

Table 12A – The stroke medical workforce, bed base and number of strokes per year by STP and site (Data collected 2018/19)

STP area	Hospital site	Stroke Consultant	Neurology Consultant	Acute Medical Consultant	Speciality Registrar	Junior Doctor	HASU beds	ASU beds	Approx. stroke numbers per year
The Black Country and West Birmingham	New Cross (Royal Wolverhampton)	7	0	0	1	5	6	33	**950-1,000**
	Russells Hall (Dudley Group)	4	0	0	1	4	12	12	**600-650**
	Sandwell	4	2	1	1	2	10	15	**600**
Birmingham and Solihull	Heartlands (Good Hope and Solihull ASU combined)	6	0	0	1	5	16	14	**1,200-1,300**
	QE Birmingham (UHBFT)	5	0	0	1	8	12	14	**750 (100 for thrombectomy)**
Coventry and Warwickshire	University Hospital Coventry and Warwickshire	4	7	0	3	4	6	30	**900**
Herefordshire and Worcestershire	Hereford County (Wye Valley)	2	0	1	1	0	6	6	**500**
	Worcestershire Royal	3.6	0	0	1	0	8	23	**900**
Shropshire, Telford and Wrekin	Princess Royal (Telford)	4	0	0	TBC	TBC	6	18	**1,000**
Staffordshire and Stoke-on-Trent	Royal Stoke	7	0	0	2	5	6	26	**1,250**

62. *NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/*
63. *https://www.england.nhs.uk/mids-east/wp-content/uploads/sites/7/2018/03/final-stroke-spec.pdf*

Table 12B – The stroke workforce data for stroke nurses, bed base and number of strokes per year by STP and site in the West Midlands

(Data collected 2018/19)

STP area	Hospital site	Stroke Nurse Practitioners	Stroke CNS	Stroke Alert Nurse	HASU beds	ASU beds	Approx. stroke numbers per year
The Black Country and West Birmingham	New Cross (Royal Wolverhampton)	2	1	0	6	33	**950-1,000**
	Russells Hall (Dudley Group)	0	2	0	12	12	**600-650**
	Sandwell	0	1	6	10	15	**600**
Birmingham and Solihull	Heartlands (Good Hope and Solihull ASU combined)	5	0	0	16	14	**1,200-1,300**
	QE Birmingham (UHBFT)	4	0	0	12	14	**750 (100 for thrombectomy)**
Coventry and Warwickshire	University Hospital Coventry and Warwickshire	0	2.16	0	6	30	**900**
Herefordshire and Worcestershire	Hereford County (Wye Valley)	0	3	0	6	6	**500**
	Worcestershire Royal	0	3	0	8	23	**900**
Shropshire, Telford and Wrekin	Princess Royal (Telford)	0	2	0	6	18	**1,000**
Staffordshire and Stoke-on-Trent	Royal Stoke	10	0	0	6	26	**1,250**

Table 12C – West Midlands workforce audit against RCP workforce standards (per bed base/STP)

Based on the RCP National Clinical Guidelines for Stroke (2016) which outline the set of key clinical workforce requirements in HASUs and ASUs, the table below highlights the required stroke workforce per bed base per type of unit.

STP	Unit	Hospital	Bed base	PT	OT	SLT	C.Psy	Dietitian	Nurse	Stroke Consultant
Birmingham and Solihull	HASU	Birmingham Heartlands	16	2.34	2.18	1.09	0.64	0.48	46.40	Six thrombolysis trained consultants per HASU to provide 24/7 cover ASU Cconsultant-led ward round five days a week
	HASU	Queen Elizabeth	12	1.75	1.63	0.82	0.48	0.36	34.80	
	ASU	Queen Elizabeth	14	2.35	2.27	1.12	0.56	0.42	18.90	
	ASU	Solihull	24	4.03	3.89	1.92	0.96	0.72	32.40	
	ASU	Good Hope	28	4.70	4.54	2.24	1.12	0.84	37.80	
Coventry and Warwickshire	HASU	Coventry Hospital	6	0.88	0.82	0.41	0.24	0.18	17.40	
	ASU	Coventry Hospital	30	5.04	4.86	2.40	1.20	0.90	40.50	
	ASU	Warwick	12	2.02	1.94	0.96	0.48	0.36	16.20	
	ASU	George Eliot	19	3.19	3.08	1.52	0.76	0.57	25.65	
The Black Country and West Birmingham	HASU	Russells Hall	12	1.75	1.63	0.82	0.48	0.36	34.80	
	HASU	Sandwell General	10	1.46	1.36	0.68	0.40	0.30	29.00	
	HASU	New Cross	6	1.01	0.97	0.48	0.24	0.18	8.10	
	ASU	Russells Hall	12	2.02	1.94	0.96	0.48	0.36	16.20	
	ASU	Sandwell General	15	2.52	2.43	1.20	0.60	0.45	20.25	
	ASU	New Cross	33	5.54	5.35	2.64	1.32	0.99	44.55	
Herefordshire and Worcestershire	HASU	Worcestershire Royal	8	1.17	1.09	0.54	0.32	0.24	23.20	
	HASU	Hereford County	6	0.88	0.82	0.41	0.24	0.18	17.40	
	ASU	Worcestershire Royal	23	3.86	3.73	1.84	0.92	0.69	31.05	
	ASU	Hereford County	6	1.01	0.97	0.48	0.24	0.18	8.10	
Shropshire, Telford and Wrekin	HASU	Princess Royal	6	0.88	0.82	0.41	0.24	0.18	17.40	
	ASU	Princess Royal	18	3.02	2.92	1.44	0.72	0.54	24.30	
Staffordshire and Stoke-on-Trent	HASU	Royal Stoke	6	0.88	0.82	0.41	0.24	0.18	17.40	
	ASU	Royal Stoke	26	4.37	4.21	2.08	1.04	0.78	35.10	

The data highlights some commonalities in workforce issues, including deficiencies in numbers of stroke consultants and fully qualified stroke nurse practitioners. Across the West Midlands, data also highlights shortages with interventional neuro-radiologists, neuro-anaesthetists and speech and language therapists; these workforce issues are not limited to the West Midlands and can be seen nationally.

5.8 Workforce pressures and potential solutions

5.8.1 National perspective

Service, workforce and financial planning are essential to develop sustainable stroke services that meet the needs of the population both now and in the future. Within all elements of the stroke pathway, recruitment and retention is a key and this will be explored from a national perspective.

5.8.2 Recruitment

Table 13 - Roles relevant in stroke services

Within the Migratory Advisory Committee Shortage of Occupation list (2016, updated 23 April 2019)[64], the following staff groups are listed which will have implications for stroke services:

Staff group	Roles relevant in stroke services
Medical Practitioners	Consultants in the following specialities: • Clinical radiology • Emergency medicine • Trainees in emergency medicine (certain grades). Non-consultant, non-training, medical staff posts in the following specialities: • Emergency medicine (including specialist doctors working in accident and emergency).
Medical Radiographers	• HPC registered Diagnostic Radiographer • Nuclear Medicine Practitioner • Sonographer.
Healthcare professions not elsewhere classified	• Neurophysiology Healthcare Scientist • Neurophysiology Practitioner • Nuclear Medicine Scientist • Orthotist.
Nurses	• All jobs in this occupational code.
Paramedics	• All jobs in this occupational code.

There is also a 40% stroke consultant vacancy rate across the UK which will provide a challenge to the current HASU format in the West Midlands. Where appropriate, the use of strategic and efficient Consultant Stroke Physician and stroke specialist resource should be employed so that sustainable high standard care is uniformly provided for the future 10 years. This should encompass the utilisation of high specialisation of care with the use of advanced imaging modalities and treatments that will become available. The Sentinel Stroke National Audit Programme (SSNAP) has modelled that a HASU will be more clinically effective if it admits between 600 and 1,500 stroke patients per year. Larger services are also more likely to be financially viable than smaller services. Financial modelling suggests that the breakeven point if all patients were eligible for the best practice tariff is about 900 admissions per year[65]. This has implications for where services are delivered as well as recruitment to posts.

64. https://www.gov.uk/guidance/immigration-rules/immigration-rules-appendix-k-shortage-occupation-list

65. Guidance for STPs on recommended standards for Acute Stroke Services: https://www.strokeaudit.org/SupportFiles/Documents/miscellaneous/Stroke-Services-Guidance-for-STPs-on-recommended-s.aspx

Regarding stroke nurses, the Royal College of Nursing has noted a shortage of nurses with specialist neuro and stroke qualifications due to a reduction in validated specialist courses, closure of courses and cuts in education funding by many trusts. An ambitious year-long project has been established to create a new career framework for stroke nurses. To encourage nurses into the profession, the framework will involve promoting 'Stroke Facts', an online course aimed at undergraduate nursing students that clearly sets out the requirements that are fundamental to understanding stroke care[66].

A two-year study was conducted in Britain to find out why 600 to 2,000 AHPs (including occupational therapists, physiotherapists, radiographers and speech and language therapists) stayed in their profession. At the end of the first and second year, popular reasons were having job security, a good pension and having interesting work and job satisfaction. Fewer people ranked the flexibility of hours or fitting work in with family responsibilities in the first year, and promotion / progression opportunities in the second year as being reasons to stay[67].

Student bursaries can also drive down numbers of individuals applying for health-related degrees, which may have contributed to an increase in vacancies for AHPs, including physiotherapists and occupational therapists, to their highest level in three years in 2017/18[68].

Recruitment of staff groups within the shortage occupation lists as well as within existing vacancies has the potential to negatively impact on the implementation of the Stroke Strategy. Initiatives to attract staff to work in stroke services would be required such as:

- Maximising opportunities for apprenticeships, including attractive routes into training such as "earn as you learn" schemes[69]
- Promoting opportunities for developing new skills through extended and specialist roles with progression to advanced clinical practice level[70]
- Building on existing resources such as those of 'Health Careers'[71], to develop an integrated attraction strategy promoting the range of the multi-professional roles in stroke services rather than a single professional focus
- Learning from social media campaigns and TV programmes such as 'Ambulance' and '999 On the Frontline' which increased interest in ambulance staff training in the West Midlands in July 2018, with almost 20,000 people responding to a paramedic recruitment campaign[72].

66. *Exclusive: Work to start on new career framework for stroke nurses: https://www.nursingtimes.net/news/education/exclusive-work-to-start-on-new-career-framework-for-stroke-nurses/7026441.article; Stroke nursing: career framework will attempt to bolster specialist workforce: https://rcni.com/nursing-standard/newsroom/news/stroke-nursing-career-framework-will-attempt-to-bolster-specialist-workforce-135566*
67. *Retention, turnover and return – a longitudinal study of allied health professionals in Britain: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1748-8583.2010.00140.x*
68. *NHS in England facing deepening staffing crisis, figures show: https://www.theguardian.com/society/2018/jul/26/nhs-in-england-facing-deepening-staffing-crisis-figures-show*
69. *Paramedic campaign at West Midlands Ambulance attracts more than 21,000: https://www.shropshirestar.com/news/health/2017/11/09/paramedic-jobs-campaign-at-west-midlands-ambulance-attracts-more-than-21000/*
70. *https://www.hee.nhs.uk/our-work/advanced-clinical-practice/multi-professional-framework*
71. *Working life (stroke monitored): https://www.healthcareers.nhs.uk/explore-roles/doctors/roles-doctors/medicine/stroke-medicine/working-life*
72. *Almost 20,000 register interest in West Midlands Ambulance Service student paramedic job: https://www.birminghammail.co.uk/news/midlands-news/almost-20000-register-interest-west-14949418*

5.8.3 Retention

tepping up recruitment is not the only way to ensure the NHS has an adequate supply of staff, and efforts to increase recruitment will be undermined if these staff are not joining a supportive environment that they want to stay in. In 2017/18, one in nine staff left the NHS, highlighting the scope to increase the workforce by improving retention.

The challenge of having areas of densely populated urban areas and low populated rural areas for service provision also has workforce implications for both recruitment and retention. Professional groups may be leaving their roles to work elsewhere in the NHS and whilst this is not as significant a concern that people leaving the NHS, churn is an issue for health care providers. In addition, rural areas may be more difficult to recruit to[73]. There are also profession specific issues – the Migratory Advisory Committee highlighted that paramedics may be lost to other, more attractive areas (e.g. 111 service / GPs) due to better working hours and less strenuous work[74].

Within stroke medicine, individuals in the field have noted several advantages to their job, including taking part in varied work, having wide-ranging research opportunities and growing both specific neurological and rehabilitation knowledge as well as general medical acumen. However, disadvantages that may drive people to leave the profession include feeling busy and emotionally drained, being constantly assessed throughout training and resources not being equally distributed, meaning real-world care may lag behind new treatment advances[75].

For stroke nurses, an audit of stroke care in 2016 by the Royal College of Physicians, found that only 51% of hospitals in England, Wales and Northern Ireland had enough senior nurses on their stroke units[76]. To combat retention, the new career framework for stroke nurses will set out four career pathways that newly trained and established specialist stroke nurses can follow (clinical, leadership, research, or education-based) to give power back to nurses and allow their expertise to be fully recognised and used. Any gaps that are identified will be used to develop areas where careers can be enhanced.

A further study explored why AHPs left their profession[77]. At the end of the first and second year, popular reasons for leaving were the excessive workload, pressure and stress, a need to look after children, more flexible hours outside of the NHS, a lack of career opportunities and not being able to give good patient care. Better pay offered outside of the NHS was mentioned in the first year whilst poor management and feeling personally undervalued were highlighted in the second year[78].

73. *https://www.kingsfund.org.uk/sites/default/files/2019-03/closing-the-gap-health-care-workforce-full-report.pdf*
74. *Paramedics are proposed to be added to the UK shortage occupation list: https://bic-immigration.com/paramedics-are-proposed-to-be-added-to-the-uk-shortage-occupation-list/*
75. *A career in stroke medicine: https://www.bmj.com/content/340/bmj.c2823*
76. *SSNAP Acute organisational audit report: https://www.strokeaudit.org/Documents/National/AcuteOrg/2016/2016-AOANationalReport.aspx*
77. *Let's shine a light on the opportunities in allied health professions: https://www.officeforstudents.org.uk/news-blog-and-events/our-news-and-blog/let-s-shine-a-light-on-the-opportunities-in-allied-health-professions/*
78. *Retention, turnover and return – a longitudinal study of allied health professionals in Britain: https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1748-8583.2010.00140.x*

Increasing retention is key to achieving a sustainable workforce. Emerging themes from NHS Improvement's retention programme which can be applied to stroke services include[79]:

- Understanding workforce data and building a plan based on the insights, including those gleaned from staff focus groups and exit interviews
- Supporting new starters and the newly qualified, expanding preceptorship programmes and offering pastoral support for more experienced staff
- Offering a range of flexible working options
- Mapping out career pathways in stroke services.

79. *NHS Improvement (2018c) Staff retention support programme: one year on: https://improvement.nhs.uk/resources/staff-retention-support-programme-one-year/*

5.8.4 West Midlands perspective

The following table provides a summary of system challenges and potential solutions for the West Midlands workforce.

Table 14 – Summary of system challenges and potential solutions

Enabling theme (HEE Star)	System challenges	Potential solutions
Supply	Deficiencies in the stroke workforce across medical (Junior Doctors, Consultants and Interventional Neuro Radiologists), nursing, therapists (specifically speech and language therapists). Lack of weekend and 24/7 stroke services, including a lack of seven-day services of sonographers and carotid dopplers procedures. No stroke consultant TIA triage.	Develop system-based workforce plans for stroke services across the West Midlands, identify the future vision for stroke services, understand the gap and identify how the gap can be minimised or removed. This will include: • A review of the whole stroke workforce to ensure 24/7 cover • recognise the contribution of voluntary organisations • Exploring options for accessible and sustainable TIA services • Exploring options to develop a sustainable thrombectomy service which includes the training of other speciality consultants to undertake the procedure. Potential workforce solutions may include: • A specific recruitment and attraction campaign across all staff groups for stroke services • Exploring how cross system network arrangements can minimise any gap • Considering joint posts across organisations • Exploring potential for new roles, which may include nursing associates, integrated support worker roles, advanced clinical practitioners, physician associates Considering joint posts where units carry consultant vacanciesConsidering multi-professional fellowship schemes.
Upskilling	A lack of training and education for the stroke workforce, including community staff. A lack of stroke-specific training for emergency department staff. Lack of support for stroke-specific junior doctors.	Develop an education and training plan specific to the stroke pathway for all elements of the pathway, including: • Emergency department medical and nursing staff • Clinical skills to meet the needs of stroke patientsTraining of all staff in the stroke pathway so that there is understanding across the whole pathway to enable a smooth transition from acute to community servicesIdentifying the support needs of junior doctors in stroke and implement appropriate solutions to meet the gap.
New ways of working	Inconsistency in communication between West Midlands Ambulance Service, Emergency Departments and stroke teams across sites.	Adopt a standardised approach across West Midlands for communication between West Midlands Ambulance Service, Emergency Departments and stroke teams. Implement pre-alerts from West Midlands Ambulance Service to stroke teams. Develop protocols for repatriation within West Midlands.

5.9 Workforce recommendations

There is a clear need for developing system-wide workforce recommendations and workforce improvement which include:

- Developing system-based workforce plans to meet the needs of the future service configuration across the West Midlands
- Having a recruitment and attraction strategy specific to stroke services across the West Midlands
- Considering joint consultant posts wherever possible (which could include the thrombectomy regional rota)
- Considering networked service provision across Sustainability and Transformation Partnerships (STP) and Integrated Care Systems (ICS)
- Upskilling the multidisciplinary workforce to ensure that care can be delivered by the right person, at the right time and in the right place, including training focused on the importance of effective communication with patients
- Prioritising the commissioning of Early Supported Discharge (ESD) and community rehabilitation.

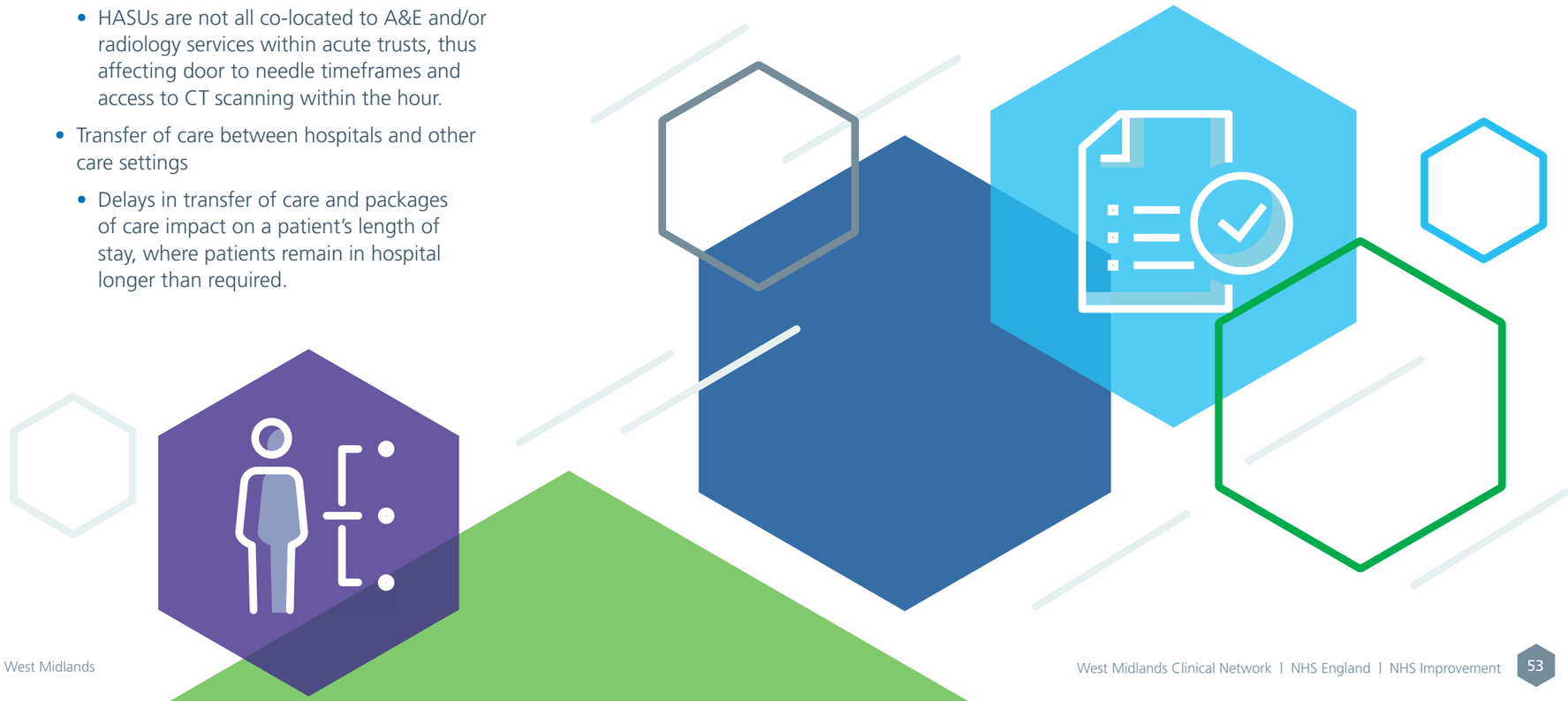
5.10 Key challenges for delivering stroke care

The key challenges for delivering stroke care in the West Midlands are:

- Workforce and skills
  - Increased workforce supply, new ways of working, including the adoption of clinical and technological advancements, upskilling and new roles are all required to deliver evidence-based stroke care to meet the needs of the West Midlands population. This also includes the need for providing seven-day services across the care pathway
  - Education and training are varied across the region; there is a need for multidisciplinary teams who are trained in stroke medicine.
- Information, technology and IT infrastructure
  - Information cannot be shared between different services on the stroke care pathway due to various IT systems; there is a lack of integration
  - IT infrastructure is lacking across the West Midlands.
- Infrastructure of services
  - HASUs are not all co-located to A&E and/or radiology services within acute trusts, thus affecting door to needle timeframes and access to CT scanning within the hour.
- Transfer of care between hospitals and other care settings
  - Delays in transfer of care and packages of care impact on a patient's length of stay, where patients remain in hospital longer than required.
- Rural and urban geography
  - The West Midlands services span across areas of densely populated urban areas and low populated rural areas – the challenge is to be able to provide equal services and 24/7 access to these services regardless of where patients live.
- Communication and linkages between providers of stroke care
  - The stroke care pathways in the West Midlands are very complex and co-ordination of these services can be limited – teams should be fully integrated across the stroke care pathway.

5.11 Key conclusions

- The West Midlands has four trusts out of 10 that are indicative of excellent or good service provision
- There are various commissioning pathways in the West Midlands which all provide different services; tracking the true cost for stroke care is complex
- The current quality and geographical spread of hyper acute services in the West Midlands is variable with further work required to ensure equity of services
- There are large disparities in Early Supported Discharge and Community Rehabilitation Services provisions across the region with services being unavailable in some areas
- There is a need for an integrated service, workforce and financial planning to move the Stroke Strategy forward. Workforce planning will require time, effort and accuracy to ensure that the key recommended staffing guidelines are met to provide cover for seven-day services now, alongside future planning to meet increasing demand in the next five years.



6 Mechanical thrombectomy services

6.1 Mechanical thrombectomy

Mechanical thrombectomy is an invasive procedure involving the removal of a blood clot from the blood vessel which has prevented blood supplying oxygen to the brain, ultimately causing the presenting ischemic stroke symptoms. It is a time-sensitive procedure with eligibility criteria to ensure the appropriate patients are receiving the treatment option; this decision can be reached following a CT or MRI scan. The procedure involves inserting a small catheter into the patient's groin and accessing the section of the brain where the clot is lodged, under the guidance of radiology.

6.2 Background

In April 2017, NHS England announced in the Five Year Forward View that they would routinely commission mechanical thrombectomy services. NHS England now commissions mechanical thrombectomy for acute ischaemic stroke in accordance with the criteria outlined in the full NHS England Clinical Commissioning Policy and accompanying service specification 'Mechanical thrombectomy for acute ischaemic stroke (all ages)'[80].

It is anticipated that within the current criteria approximately 8,000 people per year in England may benefit from this intervention. Rollout nationally will be via an incremental implementation programme managed on a regional basis.

Thrombectomy services are being established in commissioned neuroscience centres with established interventional radiology services, sufficient expertise in the procedure and a co-located hyper acute stroke service. There are 24 adult neuroscience centres in England (5-8 in each region). Each regional team is developing services to ultimately have sufficient capacity to offer comprehensive patient access 24/7.

The responsible commissioner for the thrombectomy service is NHS England Specialised Commissioners, as part of interventional neuroradiology provision. Clinical Commissioning Groups (CCGs) commission the vast majority of inpatient stroke care, stroke rehabilitation, and ongoing health care. Local authorities may provide social care services for those disabled by stroke.

Rollout nationally is dependent on there being sufficient numbers of specialists to perform the intervention. In England, there is currently a national shortfall of around 50 of these staff in post. To run a 24/7 thrombectomy service, consultant operator numbers would need to be similar to those currently running 24/7 in primary percutaneous coronary intervention (PCi) for ST-segment-elevation myocardial infarction (STEMI) services; as a 1:6 minimum (and ideally 1:8) sustainable rota.

In the West Midlands, this would involve 18 consultant operators as a minimum with up to three centres; currently there is a shortfall of 11 operators in the West Midlands.

New training programs are being agreed with the colleges, Health Education England (HEE) and the General Medical Council (GMC). HEE have a plan in development to enable deanery training of non-neuro-interventional radiologists – both cardiologists and interventional radiologists, to deliver stroke thrombectomy, thus improving the size and sustainability of the workforce. The concept of stroke intervention centres that perform thrombectomy, but no other neuro-intervention is also recognised and becoming more common. This model may need to be explored to provide services in a geographical location nearer to those regions with long transfer times to one of the regional neuroscience centres.

NHS England anticipates there being 700-800 thrombectomies undertaken in England by the end of the 2017/18 financial year, with approximately 1,500 anticipated for 2018/19. These numbers are expected to increase annually over the next four years as services develop further and key staff are trained and recruited.

The intention is to commission three mechanical thrombectomy services in the West Midlands at the commissioned neuroscience centres located at Royal Stoke University Hospital (University Hospital North Midlands NHS Trust), Queen Elizabeth Hospital (University Hospitals Birmingham NHS Foundation Trust) and University Hospital Coventry (University Hospitals Coventry and Warwickshire NHS Trust).

The NHS Long Term Plan has made a commitment to improve stroke services through a combination of specialist stroke care, improving access to thrombolysis and thrombectomy which would lead to the NHS having amongst the best performance in Europe for people who have a stroke.

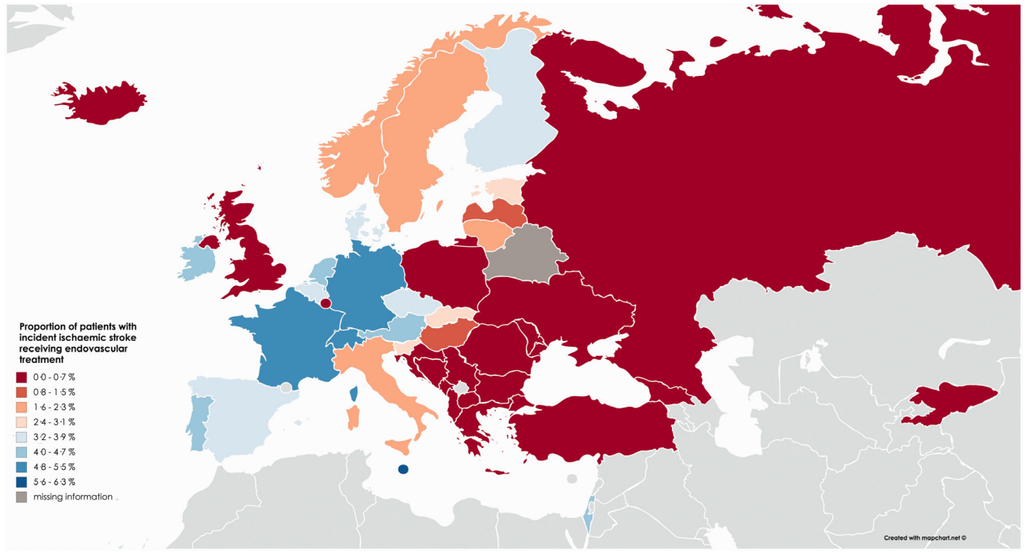
Milestones identified in the NHS Long Term Plan set out the ambition to deliver a tenfold increase of mechanical thrombectomy – from 1% up to 10% – by 2022, more people each year will remain independent after their stroke avoiding life debilitating deficits. This can be achieved by the modernisation of the stroke workforce with cross-speciality training and credentialing programmes, ensuring care is being delivered in specialised centres and the scaling of technology to support the pathway. The effective delivery of thrombectomy services can impact the outcomes of patients suffering a stroke by significantly reducing the severity of the disability that stroke causes.

The UK is failing to deliver 24/7 mechanical thrombectomy in comparison to countries in Europe, with countries with much smaller economies having better access than the UK. In ***figure 9***, the UK is highlighted red for providing 0-0.7% of thrombectomy treatment, compared to other countries in Europe such as France for example, who are highlighted blue and provide 5.6-6.9%.

80. *(accessed on 2 May 2019)*

Figure 9 – Thrombectomy treatment in Europe

Choropleth map showing contemporary annual estimates of the proportion of patients with incident ischaemic stroke receiving thrombectomy in 42 European countries (mean 1.9%; 95% CI 1.3–2.5). Source: ***https://doi.org/10.1177/2396987318786023***



6.3 Access to thrombectomy across the West Midlands

Patients eligible for mechanical thrombectomy are transferred from their local hospital units (HASUs) to access specialist provision at tertiary neuroscience centres, also named Comprehensive Stroke Units (CSU) in Europe; neuroscience centres are specialist units commissioned to provide hyper acute stroke care including mechanical thrombectomy with on-site neurosurgical support. In the West Midlands, there are two such comprehensive stroke units currently – Royal Stoke University Hospital (University Hospital North Midlands NHS Trust) and Queen Elizabeth Hospital (University Hospitals Birmingham NHS Foundation Trust) – **illustrated in *figure 10* overleaf**.

There are ambitions to support the establishment of a third comprehensive stroke unit at University Hospital Coventry to meet the needs of the local population in ensuring timely access to the life-sustaining treatment, but this is dependent upon the trust being able to recruit to the required posts to deliver the service. This will take place through a phased approach linked to the availability of specialist workforce, especially Interventional Neuro-Radiologists.

As well as improving patient access to thrombectomy, this third unit will enable the region to manage increasing demand. ***Table 15*** shows what demand could be like if 100% of eligible patients received a thrombectomy and all sites were active as at 2022/23. This would see the number of thrombectomy procedures increasing from 118 in 2017/18 to 832 in 2022/23.

It is expected that around 10% of all ischaemic stroke patients would benefit from this specialist procedure with a current optimum time limit of six hours from onset of symptoms to procedure. Evidence suggests that the window of opportunity to perform a thrombectomy and reap the benefits could sit beyond six hours and it is anticipated that any amendments to the existing guidelines would include the expansion of the time limit up to 24 hours; therefore, there will be an increase in the number of eligible patients and an increase in access to the neuroscience centres / CSUs.

Figure 10 – Regional thrombectomy services and transfer pathways

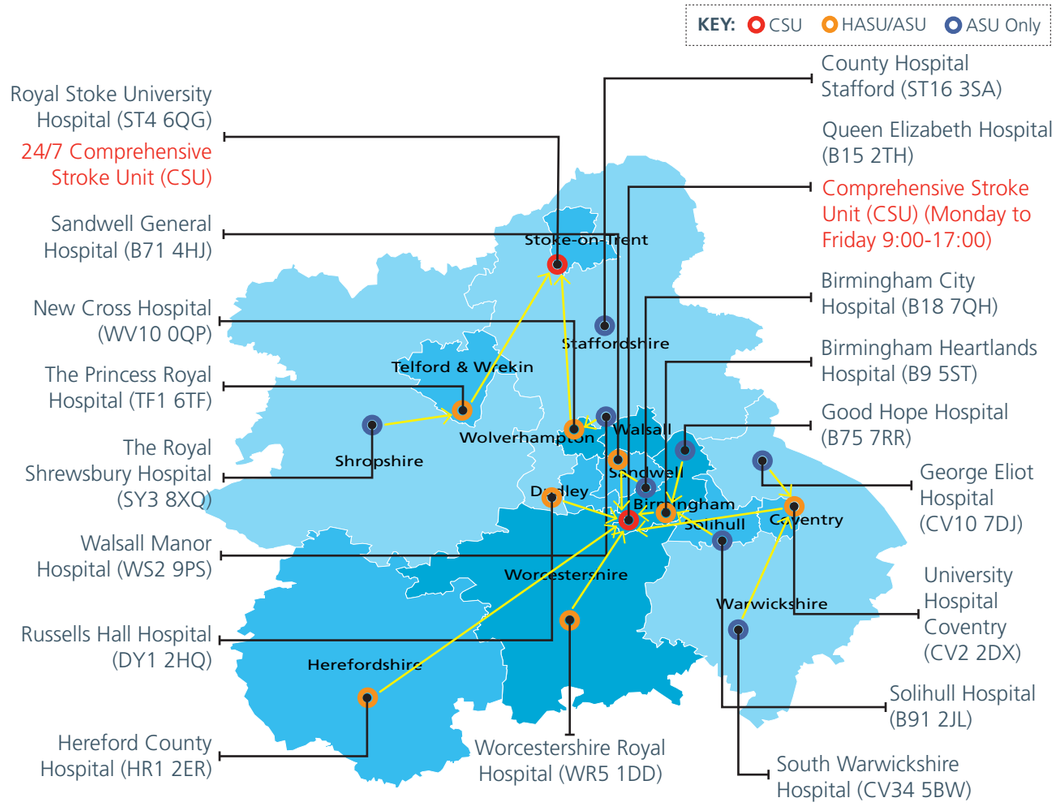


Table 15 – Projected thrombectomy activity in the West Midlands

The table below shows what demand could be like by site if 100% of eligible patients received a thrombectomy and all sites were active as at 2022/23.

Source: The Strategy Unit, NHS Midlands and Lancashire Commissioning Support Unit.

STP Name	2017-18 Baseline			2022-23 Projection				
	UHNM	QEH	**Grand total**	UHNM	QEH	UHCW	**Grand total**	*Change*
Birmingham and Solihull	0	21	**21**	0	117	14	**111**	*110*
Coventry and Warwickshire	0	5	**5**	0	5	117	**122**	*117*
Herefordshire and Worcestershire	0	6	**6**	0	130	3	**133**	*127*
Shropshire and Telford and Wrekin	9	0	**9**	48	42	0	**90**	*81*
Staffordshire and Stoke-on-Trent	63	4	**67**	133	23	11	**167**	*100*
The Black Country and West Birmingham	2	8	**10**	23	165	1	**189**	*179*
Grand Total	**74**	**44**	**118**	**204**	**482**	**146**	**832**	***714***

6.4 Thrombectomy guidelines and pathways

At the request of the Stroke STP Programme Board, a West Midlands Thrombectomy Working Group was established to develop a set of regional guidelines[81] to include a unified thrombectomy pathway (***figure 11 overleaf***) and a protocol for clinicians. These guidelines have been developed on the basis on national and international evidence with input from each of the regional centres and the Regional Medical Director. Regional guidelines and referral forms can be found ***here*** and in ***Appendix 12.5***.

The aim of these regional guidelines is to provide a single source of truth and guidance for clinicians, managers and the ambulance service to reference in the acute management of ischemic stroke patients eligible for thrombectomy. With 10 local HASUs and the ambition to have three neuroscience centres, clear guidance on the pathway is essential to support time-critical and complex decision making.

The regional transfer flows are illustrated in ***figure 10***. Eligible patients for thrombectomy will be conveyed to their nearest neuroscience centre either by road or air ambulance by the West Midlands Ambulance Service NHS Foundation Trust (WMAS) who are fundamental in this time critical transfer process; WMAS has confirmed thrombectomy transfers are category 2 (18 minutes). Transfer travel times provided by WMAS show significant variation across the West Midlands, reflecting the urban and rural geographic configuration of the region (***table 16***).

A critical element of the regional pathway development and included in the regional thrombectomy guidelines is the need to develop a robust regional repatriation agreement to ensure that the neuroscience centres do not become burdened with the ongoing management of the patient beyond the hyper acute phase; bed capacity could pose a potential risk to the thrombectomy service and the bed capacity of the neuroscience centre.

Table 16 – Transfer times to thrombectomy centres in the West Midlands

The table below demonstrates the variance in conveyance times between West Midland HASUs and the thrombectomy centres: Queen Elizabeth Hospital, University Hospitals Birmingham NHS Foundation Trust (UHB) and Royal Stoke University Hospital, University Hospital North Midlands NHS Trust (UHNM). These transfer times have been produced to indicate travel times for the thrombectomy centres closest to the referring stroke unit. In some circumstances, both clinically and operationally patients may be conveyed to a an alternative thromebctomy centre or out of region.

Source: West Midlands Ambulance Service NHS Foundation Trust. Times shown are not blue light transfer but average times with no road blockages.

Hospital	Ambulance conveyance time to UHB (minutes)	Ambulance conveyance time to UHNM (minutes)	Air ambulance conveyance times to a thrombectomy centre (minutes)
Birmingham Heartlands Hospital	25	69	N/A due to proximity to QE
Princess Royal Hospital, Telford	56	51	10-15 to UHNM
New Cross Hospital, Wolverhampton	42	52	10-15 to UHNM
Hereford County Hospital	100	124	20-25 to UHB
Worcestershire Royal Hospital	55	86	10-15 to UHB
University Hospital, Coventry	53	79	10-15 to UHB
Russells Hall Hospital, Dudley	34	67	N/A due to proximity to UHB
Sandwell General Hospital	24	55	N/A due to proximity to UHB

81. *Clinical Guidelines for Accessing Thrombectomy Services in the West Midlands (West Midlands Clinical Network, 2018)*

The flows of patients through thrombectomy centres, HASUs and ASUs are represented in the diagram below (***figure 11***). Patients who have received thrombectomy at a neuroscience centre should be repatriated back to their local referring HASU within 24 hours of the decision to transfer.

Figure 11 – Outline of the regional thrombectomy pathway

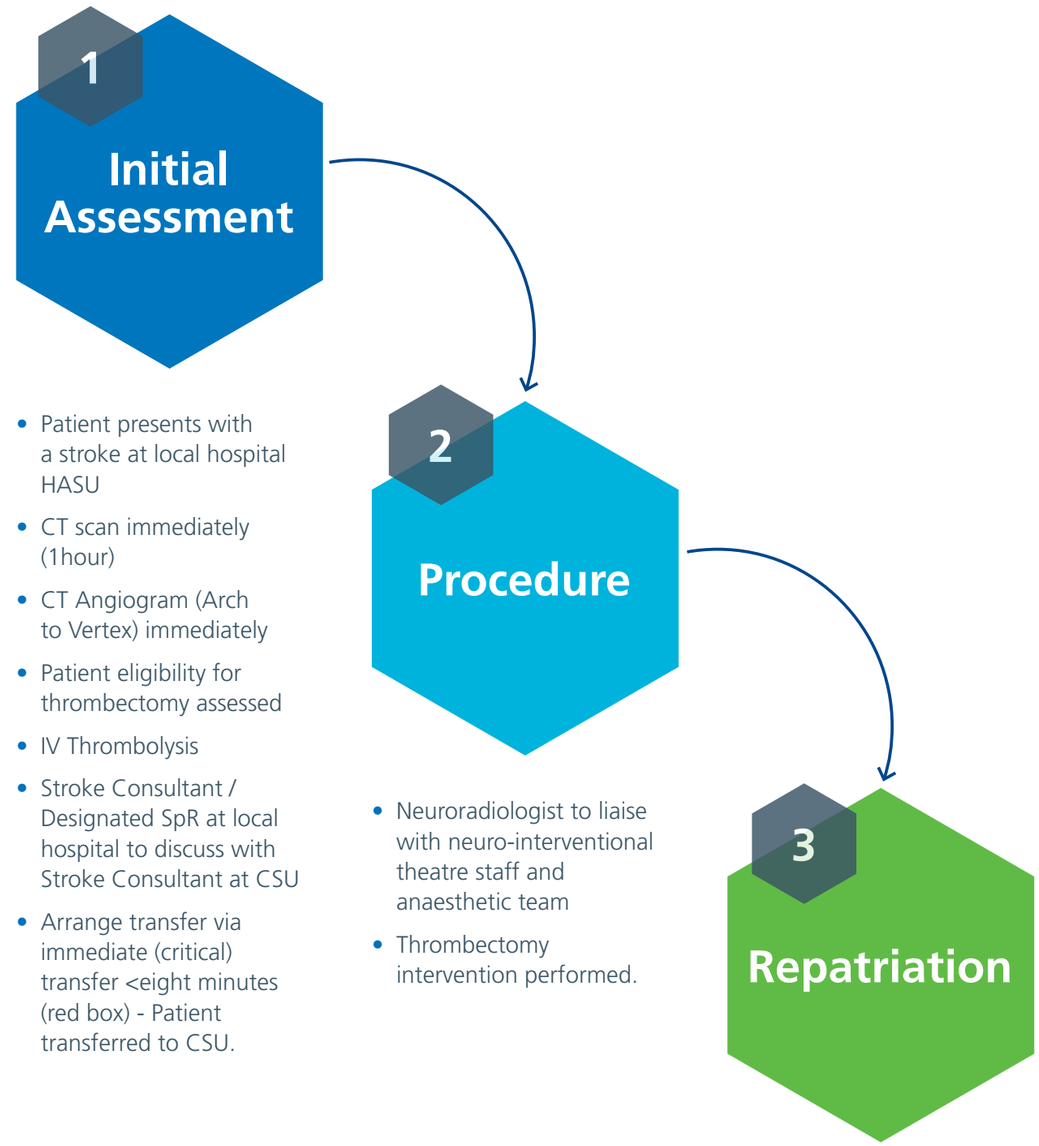
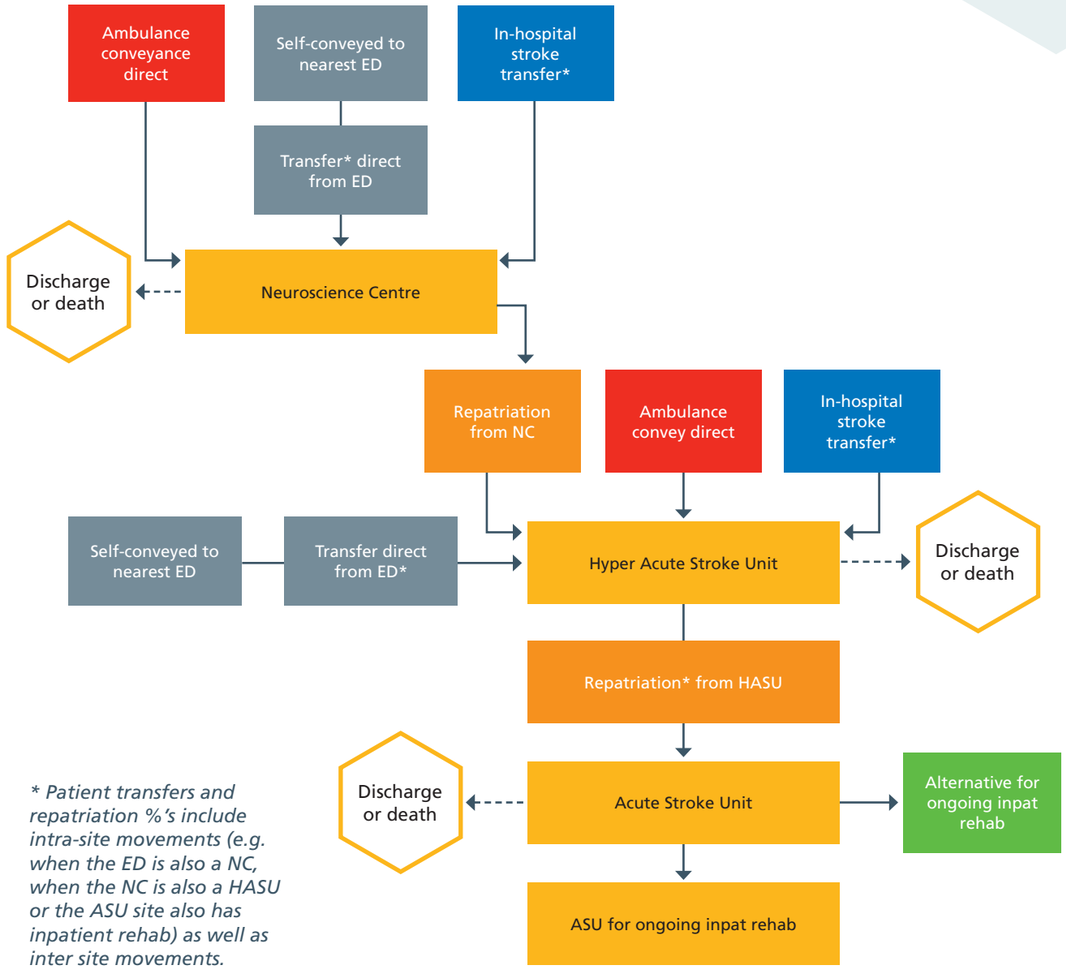


Figure 12 – Simplified patient flow model

The figure below indicates the potential patient flows between a thrombectomy centre (TC), hyper acute stroke unit (HASU) and acute stroke unit (ASU).



** Patient transfers and repatriation %'s include intra-site movements (e.g. when the ED is also a NC, when the NC is also a HASU or the ASU site also has inpatient rehab) as well as inter site movements.*

6.5 Key conclusions

- Mechanical thrombectomy is an invasive procedure involving the removal of a blood clot from the blood vessel which has prevented blood supplying oxygen to the brain
- Mechanical thrombectomy is a time-sensitive procedure with eligibility criteria
- It is expected that around 10% of all ischaemic stroke patients would benefit from this specialist procedure with a current optimum time limit of six hours from onset of symptoms to the procedure
- Regional guidelines provide a single source of truth and guidance for clinicians, managers and the ambulance service to reference in the acute management of ischemic stroke patients eligible for thrombectomy.

7 The future of stroke services

In this section, the evidence-based improvements to stroke care that the strategy wishes to see advanced across the West Midlands are described; to deliver the benefits for our patients set out in our case for change, each of the first four stages of the stroke pathway are addressed in turn.

7.1 Primary prevention

Stroke, often a preventable disease, is the fourth single leading cause of death in the UK and the single largest cause of complex disability[82]. Naturally, prevention plays a key role in mitigating the demand for stroke services in future. The NHS Long Term Plan outlines an ambition to prevent up to 150,000 heart attacks, strokes and dementia cases over the next 10 years[83]. It highlights that cardiovascular disease is largely preventable through lifestyle change and is supported by legislation and regulation; by Public Health initiatives; and through the work of Local Authorities in tackling health inequalities in their communities by providing high quality smoking cessation services and tobacco control (from legal and illicit sources); as well as by NHS staff making every contact count.

> *"Eating too much salt remains a leading cause of raised blood pressure, leading to thousands of heart attacks, strokes and early deaths. Reducing salt in foods by 1 gram/ day could prevent 1,500 premature deaths each year and save the NHS over £140 million annually.".*

82. *Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/resources/state-nation-stroke-statistics*
83. *NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/*

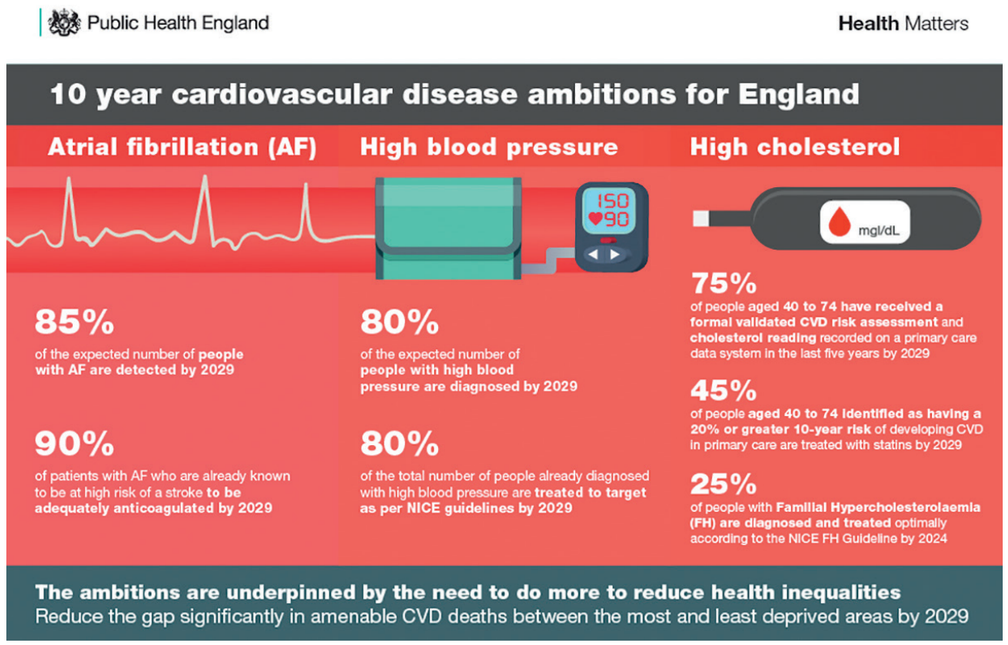
The National Cardiovascular Disease Prevention System Leadership Forum has agreed to a set of ambitions related to reducing CVD induced mortality and morbidity. While it is estimated that 20% of cerebral infarctions (non-haemorrhagic strokes) are caused by ineffective management of atrial fibrillation, CVD risk factors can also be contributors.

The ambitions include[84]:

- Reducing the gap in amenable CVD deaths between the most and least deprived areas by 2023
- Ensuring that by working with local health economies the expectations contained within the 10-year CVD ambitions are brought forward to achieve the following:
  - 80% of the expected number of people with hypertension are diagnosed
  - 80% of the total number of people diagnosed with hypertension are treated to target as per NICE guidelines
  - 85% of the expected number of people with AF are diagnosed
  - 90% of patients with AF who are known to be at high risk of a stroke to be adequately anticoagulated
  - 75% of people aged 40-74, without established CVD such as a previous myocardial infarction (MI) or stroke, have received a formal validated CVD risk assessment and cholesterol recorded on a primary care data system in the last five years
  - 45% of people aged 40 to 74 identified as having a 20% or greater 10-year risk of developing CVD in primary care are treated with statins
  - 25% of people with familial hypercholesterolaemia (FH) are diagnosed and treated optimally according to the NICE FH Guideline.

Figure 13 – Ten year cardiovascular disease ambitions for England

Source: Health Matters: Public Health England



84. *National Cardiovascular Disease Prevention System Leadership Forum: https://www.healthcheck.nhs.uk/commissioners-and-providers/governance/national-cvd-prevention-system-leadership-forum/*

With an estimated 20% of ischemic strokes being caused by ineffective management of atrial fibrillation (AF), there is an opportunity to realise improvements to this area of the pathway. AF is the most common form of heart rhythm disorder, affecting approximately 900,000 people in England (1.74% of the population), and national data suggests that it is the cause of 20% of strokes.

The cornerstone of AF-related stroke prevention is anticoagulation. Treating AF with an anticoagulant thins the blood, reducing the incidence of clot formation. As anticoagulation itself carries some risk, however, there are a variety of risk stratification tools and techniques available to assess the level of risk to individual patients should they be initiated on anticoagulation.

Following use of the Public Health England 'Size of the Prize' analysis[85], key prevention activities have been identified to drive a reduction in stroke incidence across the West Midlands. These are:

- An extension of health check population coverage by ensuring an increase in uptake; working with the Public Health commissioning function of the Local Authority
- Meeting the ambitions agreed by Public Health England and the NHS with the optimal management of hypertension and AF patients in primary care; the level of potential impact has been reduced to avoid double counting across hypertension and AF. CCGs will have to build this into their Local Improvement Schemes and work with Primary Care Networks.

The potential impact of these key prevention activities on the population of West Midlands CCGs has been modelled in ***figures 14A and 14B***; the figures present the end point of the five-year period 2017/18 to 2022/23 and show the extent to which the two key prevention activities could offset demographic growth. This indicates that between 2.5-4% of potential future strokes and TIAs in West Midlands STPs could be offset through improvements to prevention in these two specific areas alone. If each local system prioritised additional prevention activities, e.g. smoking cessation, there would be a more significant impact in each STP which would, in turn, impact on the region overall.

Health commissioners can use the Public Health England's return on investment (ROI) tool[86] to help decide the best approach to preventing cardiovascular disease within their populations[87].

85. *https://www.healthcheck.nhs.uk/commissioners_and_providers/data/size_of_the_prize_and_nhs_health_check_factsheet/*
86. *https://cvd-prevention.shef.ac.uk/*
87. *https://www.gov.uk/government/news/new-roi-tool-shows-best-ways-to-prevent-cardiovascular-disease*

Figure 14A – Impact of demography and prevention on stroke and TIA incidence in the West Midlands

Increasing the coverage of health checks amongst the population with the management of AF and hypertension could prevent 426 strokes and TIA s by 2023.

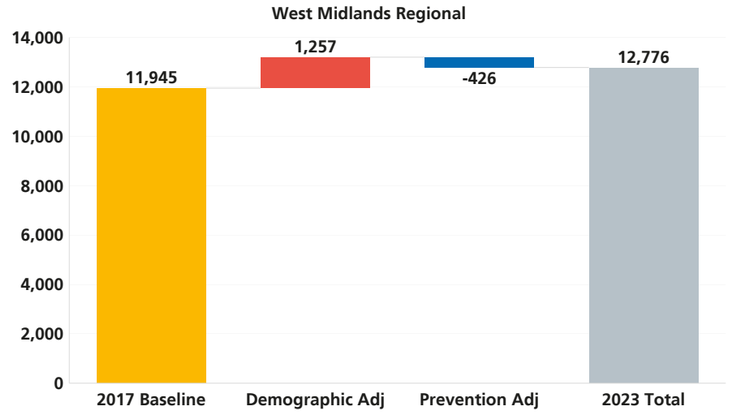
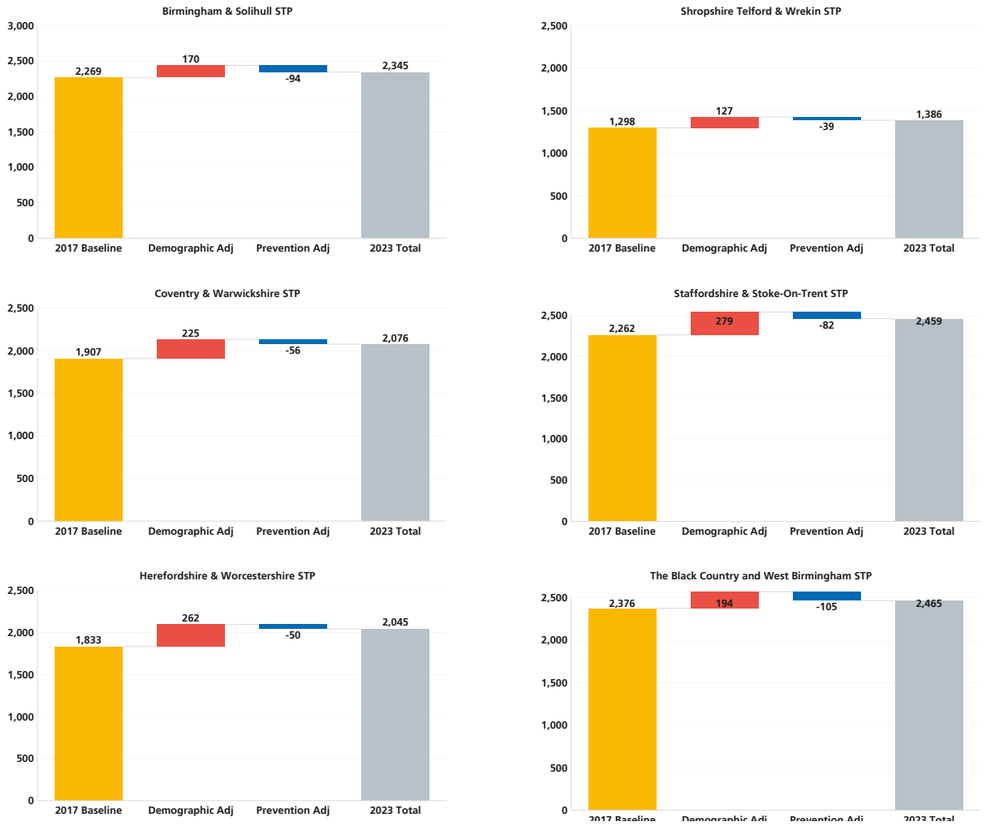


Figure 14B – Impact of demography and prevention on stroke incidence per STP

Increasing prevention could prevent 426 strokes and TIAs by 2023 in the region: 94 in Birmingham and Solihull, 56 in Coventry and Warwickshire, 50 in Herefordshire and Worcestershire, 39 in Shropshire, Telford and Wrekin, 82 in Staffordshire and Stoke-on-Trent, and 105 in The Black Country and West Birmingham.



7.1.1 Prevention recommendations

- Increase the effectiveness of the NHS health check programme in the West Midlands by ensuring: an increase in uptake and that high-quality management intervention are delivered to people identified at risk through the programme
- Focus on the most deprived areas and local inequalities as these populations are most at risk of CVD and related complications
- Maintain focus on upstream lifestyle services that can tackle health inequalities including smoking cessation, physical activity, healthy diet and obesity reduction, including the National Diabetes Prevention Programme (***NDPP***)[88]
- STPs to develop a local plan together with NHS RightCare to achieve the Public Health England / NHS joint ambitions for the detection and management of AF, hypertension and high cholesterol (A-B-C)[89] so that these can be achieved across their Primary Care Networks (PCNs) and unwarranted variation reduced. CCGs will have to build this into their Local Improvement Schemes (LISs) and adopt the West Midlands AF Algorithm Pathway (***appendix 12.5***).

7.2 Pre-hospital

Patient outcomes are influenced by the transfer of patients from a pre-hospital environment to a HASU or Emergency Department (ED), the speed and accuracy of diagnosis and the administration of pre-luminary treatment. Ensuring a solid partnership with the ambulance trusts to allow for the bi-directional sharing of information, where there are iterations of pathways, processes and educational needs, such as the pre-alert process undertaken by the ambulance crews'; information is provided to the acute stroke team upon imminent arrival of a stroke patient.

The regional ambition for emergency stroke care is for 100% of the population to have access to their local HASU or Comprehensive Stroke Unit ideally within 30-minutes and no longer than 60 minutes[90] for ambulance transfers by road (***see figures 8A and 8B; section 5.6.3***). It is evident that there are challenges in providing emergency care for rural populations across the UK. Therefore, it is acknowledged that as a region, it is not feasible for 100% of the West Midlands population to be able to access a HASU or CSU within the national standards timeframe due to the largely rural geographies within the region, but, the strategy aspires to ensure patients are received at the right place – their local HASU or CSU, to receive the best care, and achieve the best outcomes.

The West Midlands CVD Clinical Network and West Midlands Ambulance Service NHS Foundation Trust are trying to overcome the geographical challenges by utilising air conveyance where appropriate and able. This also has the additional benefits of advanced professionals supporting the pre-hospital treatment options which aren't provided by standard paramedic crews.

Some local systems are considering proposals for change to the configuration of HASU and ASU provision, and these are set out in the **service reconfiguration section overleaf *(7.3.2)***. The proposed centralisation of acute stroke services in Herefordshire and Worcestershire, and in Coventry and Warwickshire, whilst theoretically increasing travel times to the nearest ASU, would not affect current journey times to the nearest HASU to which patients should be admitted in the first instance.

88. *https://www.england.nhs.uk/diabetes/diabetes-prevention/*
89. *https://www.gov.uk/government/news/ambitions-set-to-address-major-causes-of-cardiovascular-disease*
90. *Allen M, Pearn K, Villeneuve E, et al. Feasibility of a hyper acute stroke unit model of care across England: a modelling analysis. BMJ Open 2017;7:e018143. doi:10.1136/ bmjopen-2017-018143*

Proposed structures and configuration opportunities

Nationally agreed guidance of patient numbers for a sustainable stroke service is 1,200 strokes per year. This give further opportunities in the West Midlands to review current services that are provided within STP geographical boundaries.

Where majority of sites have centralised, there are further opportunities within the Black Country STP and Hereford and Worcestershire STP where further work should be considered to develop services on a centralised footprint. The table below details opportunities for these sites.

Table 17 Configuration of service modelling for West Midlands Stroke provision; (taken from the CSU modelling Andy Hoods team – should you need access to the original info).

STP area	Site	HASU	ASU	Thromb-ectomies	Inpatient rehab	Community rehab	TIA clinic	ESD team
Black Country	Walsall Manor				X			
	New Cross	X	X	Not locally provided but part of network solution			X	
	Russells Hall	X	X	Not locally provided but part of network solution			X	
	Sandwell	Opportunity to centralise further merging with Russell's hall. *Site to be agreed (Sandwell or Russells Hall site)	X			X		
	Dudley SRU				X	X		
	Walsall IRT				X	X		
	Wolverhampton IRU				X	X		
Birmingham and Solihull	Good Hope		X				X	
	QE Birmingham	X	X	X			X	
	Solihull		X				X	
	Heartlands	X	X				X	
	Moseley SRU				X	X		
Coventry and Warwickshire	George Eliot					X	X	
	Warwick						X	
	Coventry	X	X	X			X	
	Leamington, Feldon SRU					X	X	
Hereford and Worcestershire	County (Hereford)		X				X	
	Worcestershire	X	X	Not locally provided but as part of network solution	Care and community trust provision	Care and community trust provision	X	Care and community trust provision planned
	Princess Of Wales SIRT					X	X	
Shropshire and Telford	Royal Shrewsbury	X	X				X	
	Princess Royal		X				X	
Staffordshire	County (Stafford)		X				X	
	Queens		X				X	
	Royal Stoke	X	X	X			X	
	Cannock IRU					X	X	
	Robert Peel					X	X	
	Samuel Johnson					X	X	
	Staffordshire RT					X	X	

7.3 Acute stroke care

7.3.1 Thrombolysis

> *"Stroke; the most common cause of disability in the world among adults, remains the only neurological disorder for which physicians are potentially able to completely reverse disabling deficits.[91]"*

> *"Time is brain – each **hour** in which treatment fails to occur, the brain loses as many neurons as it does in almost **3.6 years of normal ageing.**[92]"*

> *'Every minute matters during a stroke'*

Thrombolysis is the process of delivering medicine to a patient for the dissolution of a blood clot, typically involving the infusion of a tissue plasminogen activator (tPA) such as alteplase into the blood. Thrombolysis via treatment with alteplase has been shown to produce neurological and functional improvement in stroke patients who were given the drug within three hours of stroke onset[93]; the effective delivery of thrombolysis to stroke patients has a significant impact on patient outcomes and survival, as the clot-busting treatment can significantly reduce the severity of disability caused by a stroke. Currently thrombolysis is available at each of the 10 HASUs in the West Midlands.

The NHS Long Term Plan states that Integrated Stroke Delivery Networks (ISDNs) will support local systems to reconfigure stroke services into specialist centres to ensure that 90% of stroke patients receive care on a specialist stroke unit, allowing all patients who could benefit from thrombolysis (about 20%) to receive it, up from just over half of eligible patients now. The plan has committed that, by 2025, England will have amongst the best performance in Europe for delivering thrombolysis to all patients who could benefit. The plan also notes the strong evidence that hyper acute interventions such as thrombolysis are best delivered as part of a networked 24/7 service[94].

91. *Thrombolytic Therapy for Acute Stroke – Not a Moment to Lose [editorial]; Lynden 2008; 359 (13); 1393-1394; The New England Journal of Medicine*
92. *Saver J L, 2006, 'Time is Brain – Quantified', Stroke (37), 263-266*
93. *Strategies to Extend Thrombolytic Time Window for Ischemic Stroke Treatment: An Unmet Clinical Need; 2017 Jan; 19(1): 50–60; Journal of Stroke*
94. *NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/*

7.3.2 Service reconfiguration

The NHS Long Term Plan looks to ISDNs to support local systems in reconfiguring stroke services into specialist centres to ensure that 90% of stroke patients receive care on a specialist stroke unit.

In the West Midlands, a significant amount of reconfiguration has already taken place (most recent in The Black Country) and there are several further planned changes currently being advanced within local systems:

- Herefordshire and Worcestershire STP are developing proposals for centralising HASU / ASU at Worcestershire Royal Hospital
- In The Black Country and West Birmingham STP, following the centralisation of HASU / ASU for Walsall and Wolverhampton at New Cross Hospital, Sandwell Hospital HASU / ASU will move to the new Midland Metropolitan Hospital when it opens in 2022
- Shropshire and Telford and Wrekin STP have recently consulted on a proposal to consolidate emergency services at the Royal Shrewsbury Hospital. This proposal would involve the transfer of the current centralised HASU / ASU provision from Princess Royal Hospital, Telford
- Coventry and Warwickshire STP are exploring the transfer of the ASUs at Warwick and George Eliot Hospitals to the HASU / ASU at University Hospital, Coventry
- In both the Staffordshire and Stoke-on-Trent and Birmingham and Solihull STPs there are currently no stroke service configuration changes under consideration.

Table 18 overleaf shows the projected 2022/23 impact of these proposed changes on activity in the West Midlands, reflecting expected demographic change and the impact of defined prevention programmes. The 2022/23 projections also assume that all stroke activity initially occurs at a HASU.

In line with the evidence-base and the recommendations of the NHS Long Term Plan, the impact of some further potential changes to the configuration of stroke services have additionally been explored, to assist local systems in their planning:

- Moving from three to two HASUs across The Black Country and West Birmingham, with the units being located at New Cross and Russells Hall or Sandwell General / Midland Metropolitan Hospitals
- Moving from four to three ASUs across Birmingham and Solihull, with the units being located at the Queen Elizabeth, Heartlands and Good Hope or Solihull Hospitals.

NHS England, the West Midlands Cardiovascular Clinical Network and the West Midlands Clinical Senate will work closely with acute providers and commissioners alongside involvement from the patient and public representatives to ensure the required steps are undertaken for any stroke reconfigurations in the region. Improvement and reconfiguration plans will be supported and closely monitored by the network to ensure that the region meets the national standards for seven-day stroke care.

Table 18 – Projected future activity by site

The table below shows the projected 2022/23 impact of proposed reconfiguration changes on stroke activity in the West Midlands assuming that all activity initially occurs at a HASU, reflecting the expected demographic change and the impact of defined prevention programmes.

Source: The Strategy Unit, NHS Midlands and Lancashire Commissioning Support Unit. Data is presented by CCG and patient residing in the CCG area.

STP	Hospital	2017/18 activity	2022/23 activity	Difference in activity (n)	Difference in activity (%)
Birmingham and Solihull STP	Birmingham Heartlands Hospital	1,101	1,706	605	55%
	Good Hope Hospital, Sutton Coldfield	266	0	-266	-100%
	Solihull Hospital	108	0	-108	-100%
	Queen Elizabeth Hospital, Birmingham	803	901	98	12%
Coventry and Warwickshire STP	University Hospital Coventry	1,178	1,836	658	56%
	George Eliot Hospital, Nuneaton	256	0	-256	-100%
	Warwick Hospital	369	0	-369	-100%
Herefordshire and Worcestershire STP	Hereford County Hospital	659	0	-659	-100%
	Alexandra Hospital, Redditch	81	0	-81	-100%
	Worcestershire Royal Hospital	1,061	1,399	338	32%
Shropshire and Telford and Wrekin STP	Princess Royal Hospital, Telford	1,195	0	-1,195	-100%
	Royal Shrewsbury Hospital	89	1,095	1,006	1,130%
Staffordshire and Stoke-on-Trent STP	Queens Hospital, Burton-on-Trent	569	0	-569	-100%
	Royal Stoke University Hospital	1,562	1,601	39	2%
The Black Country and West Birmingham STP	Manor Hospital, Walsall	425	0	-425	-100%
	Midland Metropolitan Hospital	0	981	981	-
	New Cross Hospital, Wolverhampton	726	1,335	609	84%
	Russells Hall Hospital, Dudley	684	852	168	25%
	Sandwell General Hospital	636	0	-636	-100%
	Grand Total	**11,768**	**11,706**	**-62**	**-1%**
	Out of Area	0	910	910	

7.3.3 Acute stroke care recommendations in line with national guidelines and NHS Long Term Plan

In summary, the following key recommendations have been made to improve acute stroke care in the West Midlands:

- Improving communication between stroke teams and WMAS by standardising regionally agreed on pre-alert protocols to enhance patient journey and reduce assessment times
- Increase the rate of thrombolysis to 15-20% and aim for reducing the door to needle time to 30 minutes
- Ensure admission to stroke unit with four hours of arrival into a hospital, 24/7
- Increase the percentage of patients able to access thrombectomy using regional clinical guidelines to 10%, supported by CT-Angiogram access 24/7, training of all stroke consultants to identify large vessel occlusions, and reporting 24/7
- Investment in workforce and training to facilitate seven-day services across the region
- Improving the access to and sharing of imaging using the Regional Image sharing platform created by Queen Elizabeth Hospital Birmingham or alternatively source software solutions to assist in the identification of large vessel occlusions and salvageable brain for reperfusion
- Improve repatriation following HASU / ASU stay; the ***agreed referral time*** point at both acute facilities sets a receipt time at a maximum of 48 hours[95]
- Improve patient follow-up after acute episodes – the ambition is for post-discharge follow-ups to be performed in secondary care or in community services within 4-6 weeks; optimal secondary prevention, improved stroke rehabilitation and personalised care are key pillars of the stroke service improvement landscape and are commitments in the NHS Long Term Plan[96]. A six-month assessment has been highlighted as a fundamental part of this work and it is the strongest ask from stroke survivors.

7.4 Early Supported Discharge and Community Rehabilitation

Early Supported Discharge (ESD), rehabilitation and community care are essential to ensuring the greatest degree of recovery for stroke survivors. The NHS Long Term Plan has committed to the improvement of post-hospital stroke rehabilitation models over the period of the plan. **The benefits of higher intensity care models for stroke rehabilitation include improved patient outcomes and shorter length of stay. The national expectation is that 40% of patients with stroke can be managed through such a service**.

ESD involves rapid access to intense rehabilitation and community-based assessment by a specialist multidisciplinary team. This enables patients with stroke to leave hospital sooner whilst receiving the same quality and quantity of rehabilitation that would be provided in a hospital. Research has shown that developing an ESD team to support more complex patients in their own environment could reduce the length of stay by 2-8 days and help survivors to be 1.5 times more independent[97].

The key aims of ESD are to:

- Provide rehabilitation in the patient's home environment at an intensity equivalent to national standards (45 minutes of each required therapy per day where the patient can tolerate this)
- Reduce the risk of re-admission into hospital for stroke-related problems
- Increase patient independence
- Improve quality of life for the patient
- Support the patient, carers and family.

Although ESD is an accepted and widely implemented approach to stroke rehabilitation, not all patients can be cared for on an ESD pathway. NICE Quality Standards for Stroke were updated in 2016 to include the recommendation that ESD is offered to patients where the multidisciplinary team (MDT) agree if it is suitable and can be delivered safely[98]. The decision to offer ESD should be made by a collaborative discussion between the patient and family, and core members of the MDT.

SSNAP reports, anecdotal evidence and clinical opinion suggest that the percentage of patients who could be safely discharged with ESD might be increased through accepting a more dependent cohort of patients who have moderate to severe stroke symptoms in enhanced ESD (EESD). The potential benefits of enhanced ESD are:

95. *West Midlands Inter Hospital Transfer Concordat (2018), NHS England*
96. *NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/*
97. *https://journals.sagepub.com/doi/abs/10.1191/0269215504cr773oa; https://www.sciencedirect.com/science/article/pii/S0140673605178684; https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD000443.pub3/abstract*
98. *https://www.nice.org.uk/guidance/qs2*

- Patients with higher levels of dependency could be enabled to leave hospital sooner, avoiding the complications of a long hospital stay
- Patients and families could receive high-intensity rehabilitation programs at an intensity equivalent to that provided in a hospital
- Patients would not necessarily achieve a discharge as early as those on an ESD pathway, but would potentially achieve a shorter length of stay than in current practice
- Pressure on inpatient rehabilitation beds would reduce, improving patient flow
- Performance against key ESD SSNAP measures would improve
- Clinical outcomes could be equal to or better than hospital-based care due to the provision of rehabilitation in the patient's familiar environment.

Commitment from commissioners is required to ensure equitable access to ESD and community rehabilitation is achieved across the region for suitable patients. In order to increase the percentage of stroke patient cohorts able to be discharged earlier, there is a need for a whole pathway view of stroke in local systems. We recommend that ESD and EESD are not commissioned in isolation from HASU, ASU, CSU, Rehabilitation Stroke Unit (RSU), CST and long-term follow-up services. Local considerations may include:

- Where re-allocation of in-patient rehabilitation resources will compromise the safety and function of small community hospitals
- Where existing services provide rehabilitation to stroke but are part of a wider team providing treatment to other patient groups
- Location of EESD / ESD teams may be important in terms of provision of acute medical support
- Where existing contracts will be negatively impacted by the development of EESD.

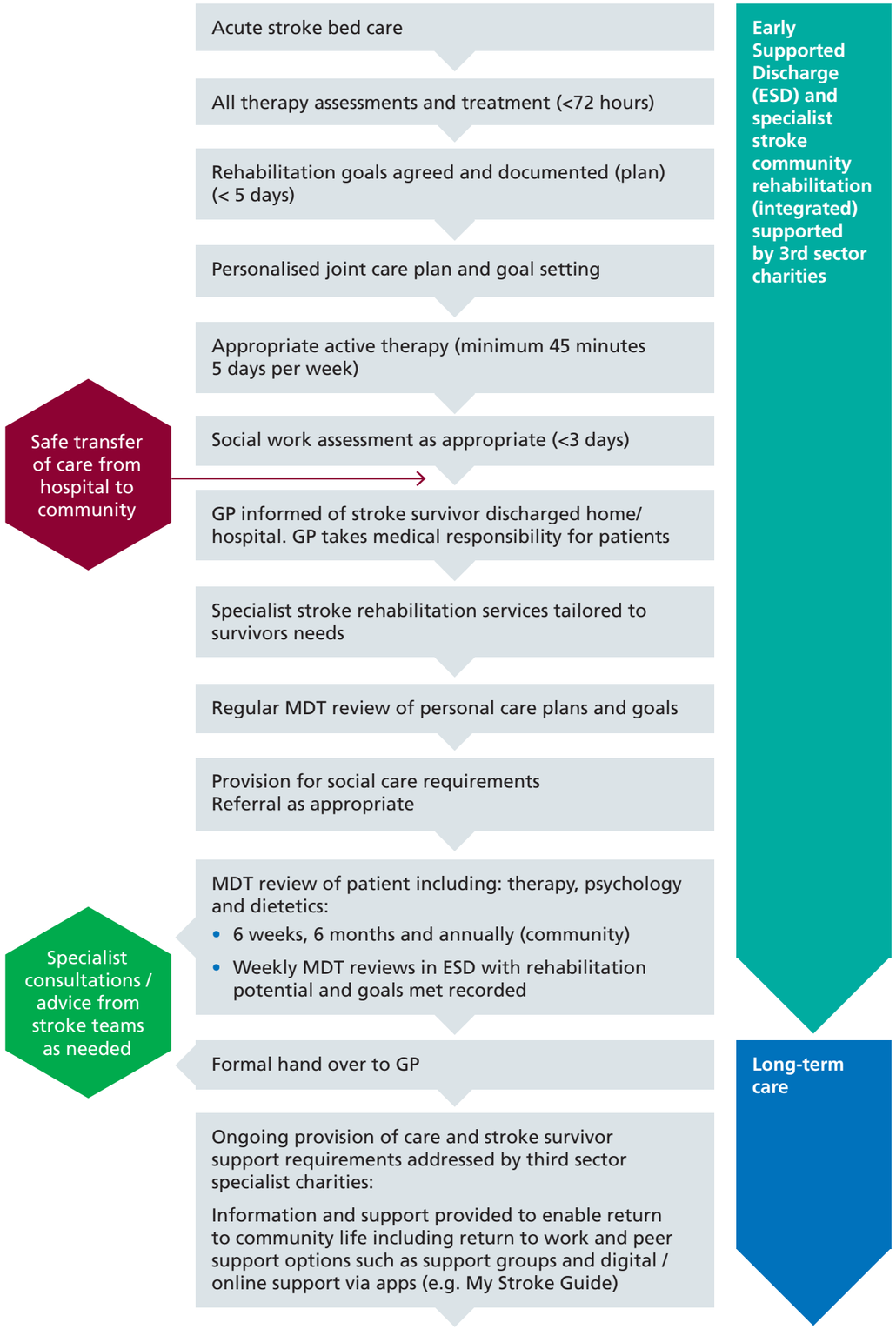
The West Midlands Cardiovascular Clinical Network has set up and worked collaboratively with the West Midlands ESD and Rehabilitation Working Group to outline and define the gold standard of stroke care in the West Midlands based on the National Stroke Care Pathway, NICE guidance and RCP guidelines, whilst allowing flexibility for individual patients' clinical needs. As a result, a regional pathway for ESD has been produced (***figure 15 overleaf***) and regional standards for both ESD and Enhanced ESD have been developed; these can be found in ***appendix 12.6*** and ***12.7*** with the full report ***online***[99].

After six weeks of ESD or EESD, patients requiring on-going stroke support should be discharged into Community Stroke Teams (CST) with no delay. Those patients who have not accessed ESD or EESD should have immediate access to a specialist CST. CST is a co-located interdisciplinary team that co-produces goals with patients and carers, building on work done within a bedded unit and embedding rehabilitation into life at home. The input should be:

- Patient-centred
- Provide therapy for those showing gains and achievement of goals as a result of this intervention
- Continue for as long as a patient is benefitting
- Focus on living life after stroke in line with each patient's roles, priorities and quality of life
- Empower patients to self-manage wherever possible, including seeking tertiary peer and community support, as and when required.

99. *Stroke Care in the West Midlands: Early Supported Discharge and Rehabilitation (West Midlands Clinical Networks, 2019)*

Figure 15 – Regional Early Supported Discharge and rehabilitation pathway



There may be a lack of availability of appropriately trained and skilled staff to support ESD, so local recruitment drives should be optimised, regional training development should be reviewed, local issues should be logged on risk registers and flagged to senior managers within their respective trusts / organisations and posts could be incentivised to help retention (training programme/ training posts).

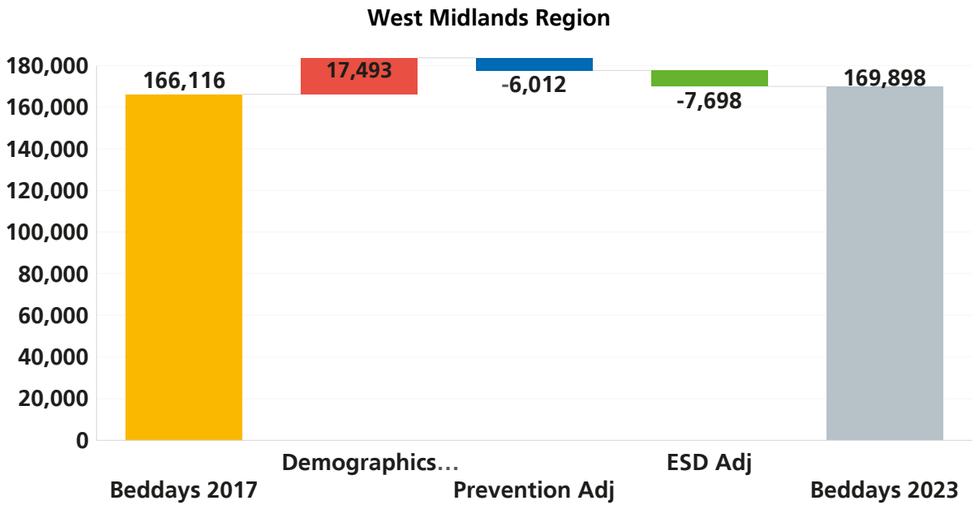
Discharging higher dependency patients earlier could lead some patients having to pay for domiciliary care earlier than if they had remained in the hospital for longer, so local agreements should be in place to ensure equity of provision. Patients and families may also find it difficult to manage high intensity rehabilitation in the home environment. Therefore, education on the stroke pathway and inclusion of patient and carers in care planning is vital. Support from appropriate agencies such as the Stroke Association could be sought.

Finally, patients may decline ESD service input and leave hospital but later decide they need specialist input. So, the acute team responsible for the patient should notify their GP of a high-risk discharge and inform of routes to refer to the service.

Recent evidence suggests that ESD versus no ESD after mild to moderate stroke can reduce acute length of stay for eligible stroke patients by around two days[100]. Analysis below shows the projected change to overall bed days for different types of stroke in the West Midlands and per STP after adjusting for demographic pressures, prevention initiatives and the extension of access to ESD (***figure 16A and 16B***). Currently, there are 200,000 occupied inpatient bed days for stroke patients across the West Midlands in a year – the equivalent of 612 beds at 90% occupancy. The net effects on demand after demographic changes and increased prevention would require a further 53 beds. Moreover, increasing the provision of ESD in areas that have low access could free up more than 7,000 bed days – around 23 beds a year.

Figure 16A – Projected changes to overall bed days in the West Midlands

The graph below shows modelled stroke and TIA bed days on the population of the West Midlands. The calculations take into consideration demographic changes and prevention projects alongside the impact of a fully resourced ESD team. The final bed day calculation saving is equivalent to an additional 23 bed days.



100. https://journals.sagepub.com/doi/abs/10.1177/0269215515578697

Figure 16B – Projected changes to overall bed days per STP

The graphs indicate the impact of a fully resourced ESD team per STP alongside prevention and demographic adjustments in 2022/23. There could be 2 bed days saved in Birmingham and Solihull, 4 bed days in Coventry and Warwickshire, 7 in Herefordshire and Worcestershire, 2 in Shropshire, Telford and Wrekin, 2 in Staffordshire and Stoke-on-Trent, and 5 in The Black Country and West Birmingham.

7.4.1 Early Supported Discharge and Rehabilitation recommendations

In summary, there are five key recommendations for the further development of ESD services across the region:

1. Equitable funding of standard ESD and CST

All standard ESD and community stroke rehabilitation teams should be staffed to enable seven-day service provision; commissioning bodies should ensure standard ESD is available to all patients who meet the criteria. Patient and public involvement should be included as part of any review or development of services

2. Community follow-up

Stroke patients must be re-assessed in the community on a regular basis as per their clinical need, have therapeutic care plans and access to therapists

3. Step down services

Six weeks before patients leave the ESD service, and where there is a clinical need, patients should then enter Community Stroke Team (CST) / Step down services without any delay

4. Discharge to assess (D2A)

The D2A pathway or other similar pathways are not appropriate for stroke patients. The pathway for ESD should not run alongside D2A or other similar pathways

5. Primary care and community support

Telemedicine or direct access for GPs and rehabilitation teams to a designated stroke physician (for example, a rehabilitation consultant) should be provided.

7.5 Key conclusions

- The West Midlands needs to increase the effectiveness of the NHS health check programme, focusing on the most deprived areas as these populations are most at risk of CVD and related complications
- Prevention activities must maintain focus on upstream lifestyle services including smoking cessation, physical activity, healthy diet and obesity reduction
- A whole pathway view must be undertaken; ESD and EESD should not be commissioned in isolation from HASU, ASU, CSU, RSU, CST and long-term follow up services. This is supported by the National Stroke Programme and National Director for Stroke, which/who takes a whole pathway approach.
- Further centralisation across the West Midlands should be considered as per the opportunities highlighted in the modelling.

8 Horizon scanning

In this section, the work was undertaken to explore the wider contextual factors that could affect the demand for, and supply of stroke care over the coming five to 10 years is summarised. The longer-term workforce implications have previously been discussed in *chapter 6.7.*

It must be recognised that the environment is continuously evolving and that the plans described elsewhere in this document will, at some point, encounter challenges and opportunities that they are not designed to address.

The purpose of this section, therefore, is to identify some of the key trends and uncertainties that may affect stroke services over the longer-term and to use these factors to begin consideration of future actions and mitigations that may need to be defined.

This current analysis is a snapshot of a range of potential factors influencing stroke care. If local systems are to be best prepared for the challenges and opportunities on the horizon, this static analysis needs to be converted into a dynamic conversation that enables the network to identify and monitor 'early warning signals' of approaching change and to start developing appropriate plans and mitigations in response.

> *"I recommend that the Department of Health and Social Care, and the health system, invest in capabilities for "futures thinking" in health…*
>
> *Future thinking is vital to planning effective and efficient health environments and services going forward. Strategic leaders in healthcare and public health organisations need to embed futures thinking (and specifically scenario planning) in the development process of long-term plans."*
>
> ***Annual Report of the Chief Medical Officer***
> *2018 Health 2040 – Better Health Within Reach*

The analysis here is organised around incidence, medicine and technological advancements

8.1 Incidence

Public Health England (PHE) data shows that the West Midlands has on average, the same stroke prevalence and cardiovascular-induced mortality rates as the England average, but that its under-75 mortality rates due to cardiovascular disease are worse than England overall[101].

When considering the factors that influence the incidence of stroke, it is useful to consider six key elements:

1. Age
2. Ethnicity
3. Lifestyle
4. Treating pre-cursor conditions
5. Environment
6. Public awareness.

8.1.1 Age

Older individuals are more likely to experience stroke however, **no age is immune from a stroke**. In England, Wales and Northern Ireland the average age for stroke is 72 for men and 78 for women; and people are most likely to have a stroke after the age of 55. However, it should be noted that around 25% of strokes occur in people of working age[102].

According to Public Health England's health profile, the West Midlands region shows a broadly similar age profile to England's with the largest proportions of the total population being aged 20-29 and 45-54. However, the West Midlands population is ageing, as according to the Office for National Statistics in 2016, the average age has increased by 1.1 years to 39.8 years between 2002 and 2016[103].

In 2017, 36% of the West Midlands population were aged 50+ and 18.4% were 65+. The Office for National Statistics noted a 0.4% increase in the proportion of individuals aged 65+ between 2014 and 2017, and they predict that numbers of 65+ individuals will increase by a further 1.6% between 2017 and 2024[104]. This will likely increase demand for stroke services in the West Midlands.

101. Public Health England Health Profiles: https://fingertips.phe.org.uk/profile/health-profiles

102. Stroke Association (2018) State of the nation: Stroke statistics: https://www.stroke.org.uk/resources/state-nation-stroke-statistics

103. West Midlands population statistics: http://www.plumplot.co.uk/West-Midlands-population.html

104. ONS Statistics, How the population of England is projected to age: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/compendium/subnationalpopulationprojectionssupplementaryanalysis/2014basedprojections/howthepopulationofenglandisprojectedtoage

8.1.2 Ethnicity

People of African or South Asian origin are twice as likely to have a stroke than those of European origin. Research has also shown that black individuals or those of South Asian origin have strokes earlier on in their lives[105].

According to the most recent 2011 census, the West Midlands region has 10.8% Asian (including 3.9% Indian, 4.1% Pakistani and 0.9% Bangladeshi), 3.3% Black (including 1.1% African), and 2.4% mixed individuals. The West Midlands had displayed significant changes across the ethnic groups between 2001 and 2011, for example, Caribbean groups increased by 1.3%[106].

Between 2009 and 2051, projections indicate an increase in individuals of Indian, Pakistani, Bangladeshi and other Asian origins, an increase in black African individuals and little change for black Caribbean and other black individuals. Future increases in these ethnic groups may increase stroke incidence in the West Midlands in the future, although by what percentage remains uncertain[107].

Any material change in migration patterns could also affect expected incidence. Changes in the relative economic status of the UK and other nations, as well as the UK's post-Brexit immigration policy, are significant uncertainties: a more prosperous UK is likely to attract greater immigration to sustain growth, increasing political instability, conflict in other countries or climate change could cause a rise in refugee numbers, and there may be an increase in Commonwealth relative to European immigration.

105. South Asian strokes: lessons from the St Mary's stroke database: https://www.telegraph.co.uk/travel/maps-and-graphics/world-according-to-tobacco-consumption/; Differences in stroke subtypes between black and white patients with stroke: the South London Ethnicity and Stroke study: https://www.telegraph.co.uk/travel/maps-and-graphics/world-according-to-tobacco-consumption/

106. ONS regional ethnic diversity: https://www.ethnicity-facts-figures.service.gov.uk/british-population/national-and-regional-populations/regional-ethnic-diversity/latest; Ethnicity and National Identity in England and Wales: 2011: https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/articles/ethnicityandnationalidentityinenglandandwales/2012-12-11#changing-picture-of-ethnicity-over-time; West Midlands Ethnic Minorities Factsheet: https://race.bitc.org.uk/sites/default/files/kcfinder/files/RaceforOpportunity/WEST_MIDLANDS%20Factsheet.pdf

107. Ethnic population projections for the UK and local areas, 2001-2051: https://www.ethpop.org/Publications/wp_eth_pop_projections.pdf

108. Health Matters: obesity and the food environment: https://www.gov.uk/government/publications/health-matters-obesity-and-the-food-environment/health-matters-obesity-and-the-food-environment--2

109. Alcohol: minimum pricing: http://researchbriefings.files.parliament.uk/documents/SN05021/SN05021.pdf

110. First ads banned under new junk food rules: https://www.bbc.co.uk/news/uk-44706755; https://news.sky.com/story/junk-food-ads-banned-from-london-transport-network-to-reduce-child-obesity-11560530 Junk food ads banned from London transport network to reduce child obesity:

111. Cancer Research Obesity Campaign backlash: https://www.contemporaryhealth.co.uk/cancer-research-uks-obesity-campaign-causes-online-backlash/

112. Mapped: The countries that smoke the most: https://www.telegraph.co.uk/travel/maps-and-graphics/world-according-to-tobacco-consumption/

113. Four million UK children too poor to have a healthy diet, study finds: https://www.telegraph.co.uk/travel/maps-and-graphics/world-according-to-tobacco-consumption/

114. Relationship between smoking and obesity: a cross-sectional study of 499,504 middle-aged adults in the UK general population: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0123579 The alcohol harm paradox: using a national survey to explore how alcohol may disproportionately impact health in deprived individuals: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-2766-x Adolescent socioeconomic and school-based social status, smoking and drinking: https://www.sciencedirect.com/science/article/pii/S1054139X15001275

115. UK tipped to fall to bottom of European growth league next year – as it happened: https://www.theguardian.com/business/live/2018/nov/08/german-exports-slide-trade-war-markets-fed-business-live

116. Economists predict the UK economy's trajectory in 2019: https://www.ft.com/content/4b566c36-0521-11e9-9d01-cd4d49afbbe3

117. "Prevent a Stroke: Feel the Pulse" – Irish Heart Foundation urges Kilkenny people to do a simple daily check to prevent stroke: https://www.kilkennypeople.ie/news/kilkenny-news/347706/prevent-a-stroke-feel-the-pulse-irish-heart-foundation-urges-kilkenny-people-to-do-a-simple-daily-check-to-prevent-stroke.html

8.1.3 Lifestyle

There are several lifestyle factors that influence stroke incidence: poor diet, a lack of physical activity, smoking and alcohol consumption. Public Health England data shows a variety of trends across the West Midlands but overall, the region has higher excess weight, diabetes diagnoses, and alcohol-related hospital stays; and fewer physically active adults than the England average. Although the average smoking prevalence was similar for the West Midlands and England's average, hotspot areas of high prevalence exist in Redditch and Stoke-on-Trent. Overall, an increased risk of stroke could materialise in the West Midlands in the coming years.

Lifestyle factors are themselves subject to several subsidiary drivers:

- **Prevention measures:** What resources will be available to support prevention activities and how effectively will those resources be used? To what extent will central and local government employ legislative and regulatory measures in support of prevention activities (e.g. planning restrictions on takeaway food shop density[108]; minimum alcohol unit pricing[109]; restrictions on advertising[110])?
- **Social attitudes:** The success of prevention measures also depends on public acceptance – there was resistance, for example, to the first reports linking smoking with lung cancer. Distrust of official messages can inhibit behavioural change. To what extent will citizens[111] willingly embrace health and wellbeing initiatives and opportunities (including screening opportunities) and what level of support will there be for legislative constraints such as tax, pricing and planning measures designed to reduce harmful choices? Cancer Research UK's obesity campaign ("OB_S__Y" is a cause of cancer) attracted criticism. There is a workforce dimension here, too, affecting the extent to which all healthcare workers (and others, such as teachers and carers) feel able to "make every contact count"
- **Cultural norms:** As well as the direct impact of ethnicity on stroke incidence there is a linked, indirect impact from lifestyle behaviours of discrete cultural groups – for example, Eastern Europeans typically have high alcohol and cigarette consumption rates[112]. In five to 10 years' time – and post-Brexit – to what extent might cultural practices have changed? Changing immigration patterns could relieve or increase the lifestyle challenges related to specific cultural backgrounds
- **Deprivation:** Ultimately driven by the state of the economy and associated policy, deprivation can mean that individuals cannot afford to make changes to have a healthier lifestyle (for example through not being able to afford a gym membership or enough fruit, vegetables and fish to meet official nutritional guidelines[113]). Moreover, some studies have suggested that deprivation is associated with worse lifestyle factors such as increased obesity, smoking rates and alcohol consumption[114]. Gross Domestic Product (GDP) is expected to remain relatively low over the coming years in the vast majority of projections[115] and inflation is expected to increase[116]. Certain areas of the country may be more affected than others depending on their underlying economic characteristics and the success of interventions such as local industrial strategies.

8.1.4 Treating pre-cursor conditions

Another important factor regarding stroke prevalence is treating potential pre-cursor conditions, including diabetes for all types and atrial fibrillation for TIAs and ischaemic strokes predominantly. Individuals' awareness of the need to treat these conditions is important, as well as the technological advancements in this area to manage or treat these precursors. Regarding awareness, could the government invest in future campaigns, such as following the example of the Irish Heart Foundation's "Prevent a Stroke: Feel the Pulse" campaign to identify atrial fibrillation[117]?

The technology includes, for example for diabetes, smart therapeutics in the form of anti-diabetics and insulin analogues, artificial intelligence-driven precision medicine including non-finger pricking monitoring devices or artificial pancreas and technology convergence methods including 3D tissue printing or micro / nanotechnology glucose monitoring and cell therapies[118].

For atrial fibrillation, for example, the ***KardiaBand*** Apple watch straps that take ECG measurements are now available for AF detection[119]. It is of utmost importance that individuals are trained appropriately to interpret the data from patient-controlled devices and that they are relatively simple to use, to avoid problems that may result in unnecessary hospital admissions. In patients with identified AF, developments in cardiology include a new 'One Shot' cryoablation catheter aimed at simplifying ablation treatment[120] and the possibility to offer left atrial appendage (LAA) closure devices to patients who cannot take anticoagulants, or who have a stroke despite anticoagulation management.

In secondary prevention of cryptogenic stroke in those under 60 years of age, procedures to insert a closure device percutaneously for those who have a patent foramen ovale (PFO closure) are now to be commissioned following a complete evaluation of safety and efficacy by NICE and NHS England and NHS Improvement.

There is also upcoming 4D flow MRI technology to identify high-risk clot suffers[121].

8.1.5 Environment

Although evidence can be conflicting, studies have shown that environmental risk factors including pollution[122] and extreme weather conditions (cold conditions, humid conditions or large daily temperature fluctuations[123]) can impact stroke incidence. The need to address air pollution, for example, was recently highlighted in government guidance[124].

1Although the numbers of cold days are expected to decline in the UK at a steady pace between 2020 and 2080 due to global warming[125], studies find that episodes of cold months will continue to occur with the potential for cold Januaries to manifest themselves as cold anomalies by 2100[126]. Although humidity projections show little increase up until 2100[127], pollution projections are less positive, as Birmingham is set to exceed EU pollution limits for nitrogen dioxide until 2030, which began in 2010[128] and ozone pollutants are expected to increase across England by 2020, 2050 and 2080[129].

118. Diabetes monitoring and drug delivery innovation fields: the scenario for big technology synergy: https://www.openaccessgovernment.org/diabetes-monitoring-and-drug-delivery-innovation/53701/; Abbot gets CE mark for Freestyle Libre 2, adds Bluetooth for real-time alerts: https://www.mobihealthnews.com/content/abbott-gets-ce-mark-freestyle-libre-2-adds-bluetooth-real-time-alerts

119. Diagnosing atrial fibrillation in 30 seconds: https://www.news-medical.net/news/20181011/Diagnosing-Atrial-Fibrillation-in-30-Seconds.aspx

120. Smartwatch algorithm highly effective for detection of atrial fibrillation: https://www.medicalbag.com/tech-talk/kardiaband-apple-watch-afib-detection/article/809722/

121. Adagio Medical treats first atrial fibrillation patients using new One Shot+ Cryoablation catheter: https://www.prnewswire.com/news-releases/adagio-medical-treats-first-atrial-fibrillation-patients-using-new-one-shot-cryoablation-catheter-300722079.html

122. Treating AFIB: 4D Blood Flow MRI: https://www.ksat.com/health/treating-afib-4d-blood-flow-mri Air pollution is now a leading stroke risk factor: https://www.medicalnewstoday.com/articles/310887.php

123. Cold weather, temperature changes tied to stroke risk: https://www.livescience.com/43313-cold-weather-stroke-risk.html Strokes "may be linked to temperature", study finds: https://www.nhs.uk/news/neurology/strokes-may-be-linked-to-temperature-study-finds/

124. https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution

125. Climate change effects on human health: projections of temperature-related mortality for the UK during the 2020s, 2050s and 2080s: https://jech.bmj.com/content/68/7/641

126. Artic sea ice reduction and European cold winters in CMIP5 climate change experiments: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2012GL053338

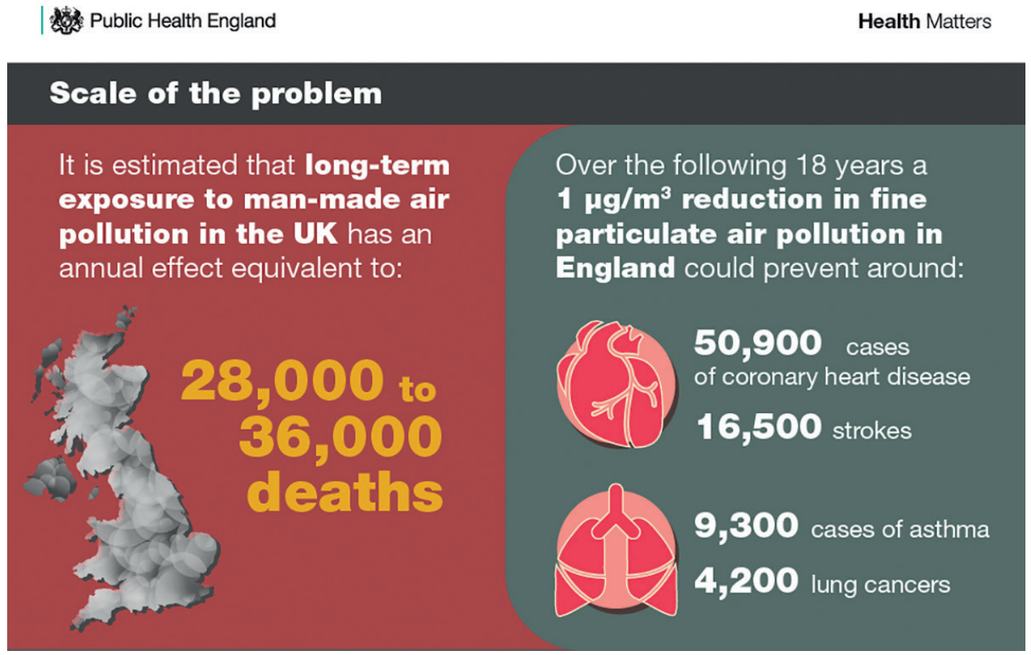
127. Seasonal changes in solar radiation and relative humidity in Europe in response to global warming: https://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-12-00007.1

128. UK cities will exceed EU pollution limit by 2030: https://journals.ametsoc.org/doi/pdf/10.1175/JCLI-D-12-00007.1

129. Climate change, tropospheric ozone and particulate matter, and health impacts: http://re.indiaenvironmentportal.org.in/files/Climate%20Change,%20Tropospheric%20Ozone.pdf

Figure 17 – Public Health England Environmental Impact

Source: Health Matters: Public Health England.



The trends for extreme cold events and pollutants suggest that stroke incidence may increase in future, although the implementation and success of initiatives could alter the environmental impact on stroke incidence. Government plans include tackling air pollution by supporting authorities including Dudley, Wolverhampton, Sandwell and Stoke-on-Trent to reduce public transport emissions, employ traffic management and run behavioural change campaigns[130]; enforcing a "clean air zone" on Birmingham[131]; prohibiting the sale of new diesel and petrol cars by 2040[132], could help to alleviate climate warming and improve pollution in the West Midlands, subsequently lowering stroke incidence rates.

130. Government to fund local authority plans to tackle air pollution: https://www.gov.uk/government/news/government-to-fund-local-authority-plans-to-tackle-air-pollution

131. A Birmingham city centre congestion charge is coming – what we know so far: https://www.birminghammail.co.uk/news/midlands-news/birmingham-city-centre-congestion-charge-14785035

132. New diesel and petrol vehicles to be banned from 2040 in UK: https://www.bbc.co.uk/news/uk-40723581

8.1.6 Public awareness

The ability to identify stroke depends on personal awareness, the policy and the campaign initiatives in place to increase this awareness. For example, the 'Act FAST' TV campaign was released in 2014 as stroke continued to be the third leading cause of death in England and the largest cause of adult disability[133]. Will central and local government create further legislation or invest resources into new campaigns to increase identification rates (e.g. as part of the new national plan for stroke care[134])?

> ***The Secretary of State has stated that:***
>
> *"For past generations, it made sense to focus on things like heart disease and stroke. As a result of these efforts…strokes are down. The focus of the system has to move…to care for multiple chronic conditions and promoting the health of the whole individual.[135]"*

There could well be more "wellness not illness" initiatives in the future. Non-governmental bodies may still invest in raising public awareness – "First Aberdeen" is working with NHS Grampian and a stroke charity to incorporate the 'Act FAST' message into its driver training scheme, on bus tickets and on notice boards, to further raise awareness in drivers and passengers[136]. Should the West Midlands follow suit? Could better promotion of identification techniques in local community buildings or newsletters and GP surgeries be beneficial for the less able bodied / technology proficient?

This leads onto individuals' personal awareness, which may be influenced by the exposure to, and/or education they receive about identifying strokes. Factors such as deprivation could impact this, for example, if they cannot afford a TV licence or an internet connection to view campaigns, or if their local community poorly promotes stroke identification. Moreover, individuals could be unaware of their own risks (e.g. from their age, ethnicity, diet) or believe that "this would not happen to me". Awareness may also be driven by an individual's general health consciousness, as more health-conscious individuals may become more aware of stroke risk factors or precursors (diabetes / atrial fibrillation) through their own research or using fitness trackers. Health consciousness may be driven by exposure to widely available stroke information, or by the environment or culture individuals were raised in. To what extent will individuals engage with campaigns in future? Will people become more health conscious with the increasing availability of information in the public domain?

133. Act FAST campaign: https://www.gov.uk/government/news/act-fast-campaign

134. Stroke national plan questioned: https://www.bbc.co.uk/news/live/uk-politics-parliaments-46183710

135. Primary care is crucial to preventing ill health: https://www.gov.uk/government/speeches/primary-care-is-crucial-to-preventing-ill-health

136. Aberdeen bus drivers to be taught how to recognise stroke symptoms: https://www.pressandjournal.co.uk/fp/news/aberdeen/1594900/aberdeen-bus-drivers-to-be-taught-how-to-recognise-stroke-symptoms/

8.1.7 Medicines

Research and advancements in the discovery of new medicines to treat strokes show high promise, and some recent developments for treatment will be discussed here.

Table 18 – Research summary of new stroke medicines

Area of practice	Year	Where	Research summary
Ischaemic stroke treatment	2018	Texas	Discovery of a protein in the brain called neurolysin, which functions to protect the brain from stroke injury. Future research will focus on finding molecules that will enhance its function to help treat strokes[137].
Ischaemic stroke treatment	Human trials commencing in 2019	Georgia	New treatment called AB126, involving using extracellular vesicles (EV) generated from human neural stem cells, which could be packaged with therapeutics, to reduce brain damage and accelerate brain repair processes after stroke onset. Results are promising in rodents and human trials are due to commence in 2019[138].
Ischaemic stroke treatment	2018	California	New drug called 3K3A-APC, an engineered variant of activated protein C which humans normally produce. It has been linked to blood clotting regulation and aspects of inflammatory response. Preclinical studies have shown that the drug decreased stroke damage and produced less complications than the common drug tPA[139].
Ischaemic stroke treatment	2018	Melbourne	Use of tenecteplase, originally used to treat heart attacks. Clinical trials in Melbourne in 2018 found that it was life-changing in treatment of ischemic strokes, allowing earlier restoration of blood flow before clot removal surgery[140].
Ischaemic stroke treatment	2018	California	Studies of TIA medicines have been carried out, including the use of intensive therapies (using two or three antiplatelets in combination rather than smaller combinations). Although studies have shown that combination can reduce the frequency of subsequent ischaemic events, likelihoods of major haemorrhages increased, meaning these options should be approached with caution[141] [142].
Ischaemic and haemorrhagic stroke	2019	Phase 2 trial in 2019	Research is being carried out on Trans Sodium Crocetinate (TSC), a molecule that can improve brain tissue oxygenation. Pre-clinical models have shown a great success, a Phase 2 trial with stroke patients is being planned for 2019[143].

137. Amarillo researchers work to develop new stroke treatment: https://www.newschannel10.com/2018/11/23/amarillo-researchers-work-develop-new-stroke-treatment/

138. Stem-cell based stroke treatment repairs brain tissue: https://news.uga.edu/new-stem-cell-based-stroke-treatment-repairs-damaged-brain-tissue/

139. Experimental stroke drug succeeds in preliminary trial: https://www.medicalnewstoday.com/articles/320989.php

140. New stroke drug melts brain clots faster, costs less and improves recovery: http://newsroom.melbourne.edu/news/new-stroke-drug-melts-brain-clots-faster-costs-less-and-improves-recovery

141. Platelet-oriented inhibition in new TIA and minor ischemic stroke – POINT: https://www.acc.org/latest-in-cardiology/clinical-trials/2018/05/17/13/52/point

142. Intensive antiplatelet therapy reduces risk for recurrent events in TIA: https://www.healio.com/cardiology/stroke/news/online/%7B4708b9f2-c6bb-4e69-b1cf-8b0cf8b313cc%7D/intensive-antiplatelet-therapy-reduces-risk-for-recurrent-events-in-tia

143. DFFN: Phase 2 clinical trial of TSC in acute stroke to commence in 2019…: https://finance.yahoo.com/news/dffn-phase-2-clinical-trial-151500752.html

8.1.8 Technology, stroke identification and the success of medical advancements

Technological advancements have huge positive impacts on stroke identification, which has been highlighted in the NHS Long Term Plan. It highlights that offering national support for the scaling of technology will assist the expansion of life-changing identification and subsequent treatment to more patients. This includes the use of CT perfusion scans to assess the reversibility of brain damage, improved access to MRI scanning and the potential use of artificial intelligence interpretation of CT and MRI scans to support clinical decisions regarding suitability for thrombolysis and thrombectomy[144].

The following summary highlights the current state of technological advancements. The technologies listed below are not an exclusive or exhaustive list of companies offering these options:

- Infervision is working on a head CT AI-augmented screening technology to assist doctors in determining which type of stroke a patient has suffered[145]
- POCKiT Diagnostics is working to identify the type of strokes people suffer, by developing a portable and affordable device that uses immune-based detection of stroke-specific biomarkers[146]
- A portable, visor-like device has been developed by Cerebrotech that uses volumetric impedance phase-shift spectroscopy (VIPS) (low energy radio waves) to detect emergent large-vessel occlusion ischaemic strokes and large haemorrhagic strokes in patients within seconds, enabling earlier intervention to prevent further brain damage[147]
- Angiosuite-based cone beam imaging has also been presented at the Society of Neuro Interventional Surgery's 15th Annual Meeting, which could decrease delays in patient care by up to an hour through creating a "one-stop shop" imaging and treatment angiosuite rather than waiting for CT imaging before transfer to the suite[148]
- Use of the automated image analysis platforms, which creates high-quality and easily interpretable images for faster visualisation and subsequent treatment of strokes[149]
- Utilising the power of computer-aided diagnosis to facilitate image interpretation, then transfers data to physicians via smartphones for rapid patient triage[150]
- Utilising technology that allows ambulances to reach patients more quickly to identify strokes. This could include using transport analysis technology and live streams from GPS tracking devices to find the route with less traffic
- Ambulance staff could be given more power to diagnose strokes on-call, as for example, mobile stroke units are deployed in the US that contains mobile CT scanners and other equipment for stroke diagnosis and treatment[151]. Also, in New York, paramedics use iPads to communicate with doctors in real time about a patient's needs and how to prepare them for hospital staff
- Driverless ambulances could increase response rates and allow more medical professionals to be diagnosing and treating patients at the rear[152].

The success of medical advancements is dependent on a range of factors, including:

- The amount of funding received
- Potential safety regulations and restrictions on their usage
- Access to treatments, inequality could be felt if different medicines are unequally available in the West Midlands
- The impact that Brexit will have on the availability and supply of certain drugs and other vital healthcare products remains uncertain[153]. The long-term impact of Brexit on the supply of medicines and medical equipment cannot be known with any certainty.

144. NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk

145. Infervision launches AI platform to help radiologists diagnose stroke faster: https://www.wired.com/story/using-ai-to-help-stroke-victims-when-time-is-brain/

146. POCKiT full of potential miracles for stroke victims: https://www.businessweekly.co.uk/news/startups/pockit-full-potential-miracles-stroke-victims

8.1.9 Technological advancement – acute care and rehabilitation

Technological advancements in treatment can have a large impact on improving patient outcomes and the potential to use technology to improve treatment delivery has been highlighted in the NHS Long Term Plan, whereby the use of interoperable information systems supported by telehealth will aid more timely transfer of information between providers, enabling more effective hyper acute pathways. Some of the most recent advancements in stroke treatment are highlighted in ***table 19***.

Table 19 – Technological advancements and links to types of strokes

Type of stroke	Summary of technological advancement
All stroke types	24-hour TeleStroke networks (incorporating the use of video, internet and other technology), could improve the quality of treatment by virtually linking stroke specialists with emergency medical personnel who require stroke expertise as they treat patients in hospitals[155].
For severe ischaemic strokes	Announcement that NHS England would commission mechanical thrombectomy, the clot removal procedure in 2017, which can significantly improve disability-free survival, was welcomed[156]. Research from summer 2018 has shown that thrombectomy can be performed up to 16-24 hours after stroke onset compared to the six hours previously thought, which should vastly improve stroke outcomes over the coming years[157]. Research to improve thrombectomy techniques is also ongoing, for example, a new aspiration device platform that can offer cyclical vacuum aspiration (varying the vacuum suction intensity) to improve clot ingestion into aspiration catheters and reduce the release of dangerous debris that could cause a secondary stroke is being explored[158].
For haemorrhagic strokes	Research is ongoing into the use of flow diverters for ruptured aneurysms, more minimally invasive surgical approaches (e.g. the stereotactic placement of catheters) used in combination with intermittent dosing of thrombolytic drugs for blood removal which has formed part of the international MISTIE III trial[159] [160] and 3D printing ceramic skull implants that dissolve over time, allowing bone to grow in their place which will be useful after partial skull removal via hemi-craniectomy to relieve brain swelling[161].
For TIAs	Research into a new technique called Transcarotid Artery Revascularisation (TCAR) is showing promise, which involves making a small incision in the neck to access the carotid artery, temporarily reversing blood flow to keep dangerous debris away from the brain and implanting a stent to clear plaque. Some have suggested that compared to the conventional carotid endartectomy technique, TCAR is believed to reduce nerve damage and scarring and speed up patient recovery, although further research would be beneficial[162].

147. Wearable device detects stroke in seconds: https://aabme.asme.org/posts/wearable-device-detects-stroke-in-seconds

148. New stroke imaging technology could reduce potential for patient brain damage: http://www.snisonline.org/newspressrelease/exec/New%20stroke%20imaging%20technology%20could%20reduce%20potential%20for%20patient%20brain%20damage

149. RAPID stroke technology is helping save lives in real time: https://www.wndu.com/content/news/RAPID-stroke-technology-is-helping-save-lives-in-real-time-500163132.html; RAPID worldwide imaging platform: http://www.i-rapid.com/

150. A.I. powered stroke triage: https://www.wired.com/story/using-ai-to-help-stroke-victims-when-time-is-brain/

151. Mobile stroke unit reduces time to treatment: https://www.itnonline.com/article/mobile-stroke-unit-reduces-time-treatment

152. he next generation of ambulance technology hits the road: https://healthtechmagazine.net/article/2017/04/next-generation-ambulance-technology-hits-road

153. BREXIT LIVE: "Support Brexit deal or RESIGN" Varadkar's warning – May's agreement on BRINK: https://www.express.co.uk/news/politics/1050821/Brexit-latest-Theresa-May-Article-50-Brexit-deal-Donald-Trump

154. NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/

Several existing and upcoming technologies have the potential to vastly improve stroke rehabilitation and the potential to use technology to improve rehabilitation provision has been highlighted in the NHS Long Term Plan[163]. Some of the most recent rehabilitation innovations, particularly in assistive devices, are being presented here (***table 20***).

Table 20 – Summary of technological advancements in development

Developing technological advancements	Where
1. Development of a limb-strengthening device, whereby the patient grips a clear plastic cone attached to a robot arm that applies assistive or resistive force, then patients use the cone to control a player's movements in a video game 2. Use of a ceiling-mounted machine which can call for help if a stroke survivor falls in the home 3. Development of a prototype robotic glove named "Hero Glove" which can collect data that can be relayed to patients in the form of feedback to improve patient treatment plans and to help patients to clench and unclench their fingers, so they can perform everyday tasks such as gripping a toothbrush 4. Testing an adolescent-sized robot named Casper which can assist adults to carry out daily tasks[164].	Toronto
A stroke rehabilitation device to be launched next year includes a smart glove paired with a companion app that can track hand motions and convert them to speech. The devices use artificial intelligence and a translation application programming interface, allowing individuals to make up their own signs for translation via machine learning software[165].	Brightsign
Researchers have been working on a prototype pair of robotic assistive trousers that combine soft artificial muscles with electric stimulation to aid walking. However, it may take around five years to obtain a working product and questions have been raised about how it will be powered, if it will be too bulky to wear and if it will function in complex environments, although utilising brain-computer interfaces that can interpret brain signs should tackle the last concern[166].	University of Bristol
Research into 3D printing customised fingerboards for limb rehabilitation is being conducted, with initial experiments finding that patients felt comfortable wearing the device and that their grip, strength, range of motion and hand function improved to different extents[167]. As the cost of the software, printers and materials decreases in future, the opportunity to utilise 3D printing for rehabilitation will become more feasible.	University of Bristol

155. New ways to save your brain during stroke: https://www.premierhealth.com/Women-Wisdom-Wellness/Content/New-Ways-to-Save-Your-Brain-During-Stroke/

156. Stroke patients in England set to receive revolutionary new treatment: https://www.england.nhs.uk/2017/04/stroke-patients-in-england-set-to-receive-revolutionary-new-treatment/

157. New studies quadruple the window for stroke treatment: https://www.sciencemag.org/news/2018/01/new-studies-quadruple-window-stroke-treatment

158. World Stroke Day – SVIN latest clinical trials and breaking science news: https://www.eurekalert.org/pub_releases/2018-10/sova-wsd102918.php

159. Flow diversion in ruptured intracranial aneurysms: a meta analysis: http://www.ajnr.org/content/38/3/590

160. Making strides in the treatment of haemorrhagic stroke: https://www.nyp.org/amazingadvances/clinical-innovations/making-strides-in-the-treatment-of-hemorrhagic-stroke

161. 3D-printed ceramic implants help regrow bone: https://www.medgadget.com/2018/08/3d-printed-ceramic-implants-help-regrow-bone.html

162. Minimally invasive treatment for carotid artery disease reduces stroke risk: https://blog.virginiamason.org/2017/02/23/minimally-invasive-treatment-for-carotid-artery-disease-reduces-stroke-risk/; Transcarotid artery revascularization suggests reduced risk of major adverse events compared to standard carotid stenting in real-world outcomes: https://vascularnews.com/transcarotid-artery-revascularisation-half-risk-major-adverse-events-compared-to-carotid-stenting/
Transcarotid artery revascularization offers similar in-hospital outcomes to surgery: Schermerhorn ML, et al. Abstract VESS05. Presented at: Society for Vascular Surgery Vascular Annual Meeting; June 20-23, 2018; Boston

01. https://www.wired.com/story/using-ai-to-help-stroke-victims-when-time-is-brain

8.1.10 Implementation of technological advancements

It is evident that the introduction of technological advancements can have a positive impact on improving patient outcomes. The successful deployment and usage of these technological advancements is dependent upon:

- The availability of funding
- How well the availability of new technologies has been communicated to healthcare providers and staff, their ease of use and the quality of training undertaken by staff
- Access to the technology – inequality will occur if the availabilities of different technologies are not evenly distributed around the country or within the West Midlands, meaning individuals may be able to access one type of device, but not another that may be more beneficial to them
- Patient education and engagement – patients may be apprehensive to try out new experimental devices or to substitute seeing a rehabilitation specialist for a robot.

8.2 Key conclusions

- **No age is immune from stroke**
- People of African or South Asian origin are twice as likely to have a stroke than those of European origin
- Poor diet, a lack of physical activity, smoking and alcohol consumption are lifestyle factors that influence stroke incidence
- Important factors regarding stroke prevalence include individuals' awareness of treating potential pre-cursor conditions such as diabetes and atrial fibrillation, as well as the technological advancements in this area to support management or treatment of these precursors
- Environmental risk factors including pollution, air pollution and extreme weather conditions can impact stroke incidence
- The public and personal ability to identify stroke depends on public awareness – awareness is key to help improve the time taken to get to a stroke unit
- Research and advancements in the discovery of new medicines to treat strokes show high promise
- Technological advancements have huge positive impacts on stroke identification, this includes:
  - The use of CT perfusion scans to assess the reversibility of brain damage
  - Improved access to MRI scanning
  - Use of artificial intelligence interpretation of CT and MRI scans to support clinical decisions regarding suitability for thrombolysis and thrombectomy
- Technological advancements in treatment can have a large impact on improving patient outcomes and improving treatment delivery
- The introduction of technological advancements can have a positive impact on improving patient outcomes, e.g. Left atrial appendage occlusion, diagnostic aids such as loop recorders and self monitporing tools (iWatches, Fitbits, iPhones etc.)

163. NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/

164. Technologies that can help end "hallway medicine": U of T health-care researchers to meet with Ontario legislators: https://www.utoronto.ca/news/technologies-can-help-end-hallway-medicine-u-t-health-care-researchers-meet-ontario-legislators

165. Assistive technology start-up BrightSign gives voice to those who cannot speak: https://fashnerd.com/2018/11/brightsign-assistive-wearables-technology-sign-language/

166. These robotic pants could help some disabled people walk again: https://www.smithsonianmag.com/innovation/these-robotic-pants-could-help-some-disabled-people-walk-again-180970289/

167. The research on 3D printing fingerboard and the initial application on cerebral stroke patient's hand spasm: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6019708/

9 Making it happen

9.1 Overall implementation

Sustainability and Transformation Partnerships and the emerging Integrated Care Systems will be the primary conduits for the delivery of this West Midlands Stroke Strategy while working together with the following organisations: Clinical Commissioning Groups, specialised commissioning, Local Authorities, acute and primary care providers, NHS England, NHS Improvement, Public Health England, NHS RightCare, Health Education England , West Midlands Ambulance Service NHS Foundation Trust, Getting It Right First Time , the Stroke Association, The West Midlands CVD Clinical Network and other third sector organisations – all have leading roles to ensure the success of the West Midlands Stroke Strategy.

The role of The West Midlands CVD Clinical Network is crucial in driving improvements in stroke services in the next five years, including supporting all trusts to meet the seven-day standards for acute stroke care right through to supporting provider trusts and CCGs in the community.

Health Education England will work alongside providers and NHS England to ensure that the stroke workforce is able to deliver the improved service specifications – it is vitally important that our stroke specific staff members feel valued and are encouraged to train, enter further education and are supported to do so. Workforce planning will require time, effort and accuracy to ensure that the key recommended staffing guidelines are met to provide cover for seven-day services now, alongside future planning to meet increasing demand in the next five years.

9.2 Key roles in delivering new services

The following key organisations have been identified to be essential in moving the strategy forward:

- Sustainability and Transformation Partnerships (STPs) and emerging Integrated Care Systems (ICSs) – will be primary conduits for delivery of this strategy
- Public Health England – will focus on prevention measures and increasing the public's knowledge and education on prevention measures
- Commissioners (CCGs and specialised commissioning) – will prioritise investment into stroke services and work alongside provider trusts developing stroke services in STP areas where there is inequity of access to services
- Local authorities and Public Health teams – will focus on prevention interventions
- Provider trusts – will focus on developing and improving the pathways in and out of acute care services. Trusts will also develop performance monitoring systems to track improvements in acute care
- Health Education England – will focus on developing and improving the stroke workforce of the future
- Cardiovascular Clinical Network – will focus on supporting STP localities and work closely with providers to ensure the development and improvement of stroke services
- The Stroke Association – will continue to work closely with our patients, carers and families, with CCGs and the Clinical Network to provide support and help improve stroke care across the region
- West Midlands Ambulance Service NHS Foundation Trust – will focus on delivering the best care pre-hospital with education and training for all paramedic crews.

9.3 Consultation

The public consultation will cover any service reconfigurations for acute services in the region and will be supported by the Stroke Association and West Midlands Clinical Senate.

Rehabilitation and community service access is inequitable across the region and as a result of this, STPs and CCGs may propose to make changes to existing services; any changes will be subject to an appropriate level of consultation, which may or may not include formal public consultation – this is proposal dependant and the extent of any proposed changes.

9.4 Role of cardiovascular networks

The West Midlands CVD Clinical Network has a unique role to enable the inception and refinement of the integrated stroke delivery networks (ISDNs) and delivery of the West Midlands Stroke Strategy and will support key organisations to ensure improvements in the stroke care pathway work so far has provided STPs and CCGs with service provider reports for each acute centre in the region, will continue to provide service level information to support stroke units to improve stroke care. The West Midlands CVD Clinical Network has provided STPs and CCGs with a set of regional service standards and recommendations to improve stroke rehabilitation.

The West Midlands CVD Clinical Network will also address innovation, education, training, audit and quality alongside strong clinical leadership from the West Midlands Stroke Clinical Director and West Midlands Stroke Expert Advisory Group.

The work will be supported by NHS England and STPs to achieve improvements across the whole stroke care pathway in the West Midlands, ensuring equitable access and the best care is received by all patientsin the region.

From 2019 to 2023, the network will support and ensure :

- The development best practice pathways and regional standards for all aspects of the stroke care pathway including thrombectomy
- The STPs and ICSs to reconfigure stroke services into specialist centres
- Improvements needed to ensure the use of thrombolysis so that all patients who could benefit from thrombolysis (about 20%) receive it
- 90% of stroke patients receive care on a specialist stroke unit
- The expansion of mechanical thrombectomy – from 1% up to 10% of stroke patients; this combination of specialist stroke care, thrombolysis and thrombectomy would result in the NHS having the best performance in Europe for people with stroke[168]
- Teams from lesser performing centres to improve their services alongside enablers from high performing centres – peer support is pivotal
- The provision of regional educational events and training for the stroke workforce
- We collaborate Health Education England (HEE) with the development of new training programs for non-neuro-interventional radiologists to deliver stroke thrombectomy
- The pilot of CT-Angiogram reporting software platforms.

9.5 Key conclusions

- The collaboration of organisations both in acute and primary care settings are key to ensure the success of the West Midlands Stroke Strategy
- Proposed changes to services and the extent of any proposed changes will seek appropriate levels of consultation
- To deliver new and improved seven-day stroke services, an increase in workforce numbers and stroke specific training will be required
- The role of the West Midlands Cardiovascular Clinical Network for the next five years is crucial to driving changes and improvements in stroke services.

9.6 Recommendations and next steps

In line with the ambitions of the NHS Long Term Plan and the West Midlands Stroke Strategy, the region will ensure that all stroke units will, over the next five years, meet the NHS seven-day standards for stroke care and the National Clinical Guidelines for Stroke.

The NHS will work with Health Education England (HEE) to modernise the stroke workforce with a focus on cross-specialty and in some cases, cross-profession accreditation of particular 'competencies'; this includes working with the medical Royal Colleges and specialty societies to develop a new credentialing programme for hospital consultants from a variety of relevant disciplines who will be trained to offer mechanical thrombectomy – in the West Midlands HEE currently have a plan in development to enable deanery training of non-neuro-interventional radiologists to deliver stroke thrombectomy.

The NHS Long Term Plan states that "implementation and further development of higher intensity care models for stroke rehabilitation are expected to show significant savings that can be reinvested in improved patient care" – the West Midlands has developed gold standard regional standard ESD and enhanced ESD guidelines that can be implemented with investment into workforce and training.

168. NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/

The West Midlands Stroke Strategy, therefore, has the following recommendations summarised in ***table 21 overleaf***; these recommendations will allow the West Midlands to fulfil the milestones for stroke care outlined in the NHS Long Term Plan[169]:

In 2019, we will, working with the Royal Colleges, pilot a new credentialing programme for hospital consultants to be trained to offer mechanical thrombectomy

- By 2020, we will begin improved post-hospital stroke rehabilitation models, with a full rollout over the period of this long-term plan
- By 2022, we will deliver a ten-fold increase in the proportion of patients who receive a thrombectomy after a stroke so that each year, 1,600 more people will be independent after their stroke
- By 2025, we will have amongst the best performance in Europe for delivering thrombolysis to all patients who could benefit.

169. NHS Long Term Plan (2019): https://www.longtermplan.nhs.uk/

Table 21 – West Midlands Stroke Strategy recommendations

Workforce			
Recommendations and next steps		Responsibility	Timeline
Collaborative working between NHS England and NHS Improvement, commissioners (CCGs), and Health Education England to facilitate a system-wide stroke workforce review in the region – education, training, and cross-speciality workforce development will be supported.	Develop system-based workforce plans to meet the needs of the future service configuration across the West Midlands.	HEE , NHS England and NHS Improvement	2019-2022
	Having a recruitment and attraction strategy specific to stroke services across the West Midlands.	HEE	2019-2021
	Considering joint consultant posts wherever possible (which could include the thrombectomy regional rota).	Acute service providers	2019-2020
	Upskilling the multidisciplinary workforce to ensure that care can be delivered by the right person, at the right time and in the right place, including training focused on the importance of effective communication with patients.	Acute service providers and CCGs	2019-2022
	Prioritising the commissioning of Early Supported Discharge (ESD) and community rehabilitation.	CCGs	2020-2021
Prevention			
Recommendations and next steps		Responsibility	Timeline
Ensure that local prevention plans take advantage of the opportunities to reduce stroke incidence by increasing the proportion of the eligible population receiving age-related health checks and through improving the management of hypertension and AF in primary care. TIA referral pathways need to be improved and GPs require further education on TIAs.	Increase the effectiveness of the NHS health check programme in the West Midlands by ensuring: an increase in uptake, and that high-quality management intervention are delivered to people identified at risk through the programme.	Local authorities with CCGs	2019-2025
	Focus on the most deprived areas and local inequalities as these populations are most at risk of CVD and related complications.	CCGs	2019-2025
	Maintain focus on upstream lifestyle services that can tackle health inequalities including smoking cessation, physical activity, healthy diet and obesity reduction, including the National Diabetes Prevention Programme (NDPP)[170].	Local authorities with CCGs and Public Health England	2019-2025
	STPs to develop a local plan together with NHS RightCare to achieve the PHE/NHS joint ambitions for the detection and management of AF, hypertension and high cholesterol (A-B-C) so that these can be achieved across their Primary Care Networks (PCNs) and unwarranted variation reduced; CCGs will have to build this into their Local Improvement Schemes (LISs) and adopt the West Midlands AF Algorithm Pathway (***appendix 12.5***). Clinical Networks and Public Health England will support STPs with CVD Prevention Programme Boards.	STPs, primary care and NHS RightCare	2019-2025

170. https://www.england.nhs.uk/diabetes/diabetes-prevention/

Acute			
Recommendations and next steps		Responsibility	Timeline
Review all HASU and ASU STP configurations to ensure the most appropriate service reconfigurations for the best care, that meet demand over the next five years, incorporating the current performance of all units and plans for service change.	Improving communication between stroke teams and WMAS by standardising regionally agreed with pre-alert protocols to enhance patient journey and reduce assessment times.	WMAS and clinical networks	2019-2021
	Increase the rate of thrombolysis to 15-20% and aim for reducing the 'door to needle' time to 30 minutes.	Acute service providers	2019-2025
	Ensure admission to stroke unit with four hours of arrival into a hospital, 24/7.	Acute service providers	2019-2021
	Increase the percentage of patients able to access thrombectomy using regional clinical guidelines to 10%, supported by CT-Angiogram access 24/7, training of all stroke consultants to identify large vessel occlusions, and reporting 24/7.	Acute service providers , NHS England and NHS Improvement	2019-2022
	Investment in workforce and training to facilitate seven-day acute services across the region.	Acute service providers	2019-2025
	Improving the access to and sharing of imaging using the Regional Image sharing platform created by Queen Elizabeth Hospital Birmingham or alternatively source software solutions to assist in the identification of large vessel occlusions and salvageable brain for reperfusion.	Acute service providers	2019-2022
	Improve repatriation following HASU / ASU stay; the agreed referral time point at both acute facilities sets a receipt time at a maximum of 48 hours.[171]	Acute service providers	2019-2022
	Improve patient follow-up after acute episodes – the ambition is for post-discharge follow-ups to be performed in secondary care or in community services within 4-6 weeks. Practical guidance has been developed to support the delivery of the 2019/20 'Six-month post-stroke review' ***CQUIN***.	Acute service providers and community service providers	2019-2020
Early Supported Discharge and Rehabilitation			
Recommendations and next steps		Responsibility	Timeline
Investment into ESD (including enhanced ESD) and Community Stroke Services models across the region to ensure patients have equitable access to seven-day services – workforce and training is required.	Equitable funding of standard ESD and CST: All standard ESD and community stroke rehabilitation teams/services should be staffed to enable seven-day service provision; Commissioning bodies should ensure standard ESD is available to all patients.	CCGs	2020-2021
	Community follow-up: Stroke patients must be re-assessed in the community on a regular basis as per their clinical need, have therapeutic care plans and access to therapists.	Community service providers	2019-2021
	Step down services: Six weeks before patients leave the ESD service, and where there is a clinical need, patients should then enter Community Stroke Team (CST) / Step down services without any delay.	Community service providers	2019-2021
	Discharge to assess (D2A): The D2A pathway or other similar pathways are not appropriate for stroke patients. The pathway for ESD should not run alongside D2A or other similar pathways.	Acute service providers and CCGs	2019-2021
	Primary care and community support: Telemedicine or direct access for GPs and rehabilitation teams to a designated stroke physician (for example, a rehabilitation consultant) should be provided.	Acute and community service providers	2020-2022
Whole stroke pathway			
Recommendations and next steps		Responsibility	Timeline
Working collaboratively, primary care, secondary care (acute services providers), community service providers and third sector charities such as the Stroke Association will help, support and define best-practice clinical pathways for stroke across the whole patient journey – ensuring seamless transitions between services and the best experiences for our stroke patients. Frameworks for commissioning and implementation will be provided.		Primary care, acute service providers, community service providers and clinical networks	2019-2025
Interoperative working of IT and software platforms; systems must be able to communicate between acute and community sectors with clear user pathways and clinical governance.		Primary care, acute service providers, and community service providers	2019-2025
Clinical governance and clear pathways are required to ensure clear transfers of care and identified responsible clinicians throughout the stroke care pathway, from all acute care services through to community care services.		Acute service providers and community service providers	2019-2025

171. West Midlands Inter Hospital Concordat (2018), NHS England

10 Glossary

Summary of acronyms:

Acronymn	Description
A-B-C	Atrial fibrillation, high blood pressure and high cholesterol
ADL	Activities of daily living
AEDS	A&E Delivery Boardss
AF	Atrial fibrillation
AHP	Allied Health Professional
ASU	Acute Stroke Unit
BCHC	Birmingham Community Healthcare NHS Foundation Trust
CCG	Clinical Commissioning Group
CRS	Community Rehabilitation Service
CRT	Community Rehabilitation Team
CSU	Comprehensive Stroke Unit
CVD	Cardiovascular disease
D2A	Discharge to Assess
ED	Emergency Department
EESD	Enhanced Early Supported Discharge
EHIA	quality and Health Inequalities Impact Assessment
ESD	Early Supported Discharge
FAST	Face, Arms, Speech, Time
FH	Familial hypercholesterolaemia
GIRFT	Getting It Right First Time
GMC	General Medical Council
HASU	Hyper Acute Stroke Unit
HEE	Health Education England
ICS	Integrated Care System
ISDNs	Integrated Stroke Delivery Networks
LAA	Left Atrial Appendage
LISs	Local Improvement Schemes
MDT	Multidisciplinary team
NC	Neuroscience Centre
NDPP	National Diabetes Prevention Programme
NICE	National Institute for Health and Clinical Excellence
ONS	Office National Statistics
PCi	Primary Percutaneous Coronary Intervention
PCN	Primary Care Network
PHE	Public Health England
PRH	Princess Royal Hospital
QOF	Quality and Outcomes Framework
RCP	Royal College of Physicians
RSU	Rehabilitation Stroke Unit
SRS	Stroke Recovery Services
SSNAP	Stroke Sentinel National Audit Programme
SSPB	Stroke STP Programme Board
StEIS	Strategic Executive Information System
STEMI	ST-Segment-Elevation Myocardial Infarction
STP	Sustainability and Transformation Partnership
SUS	Secondary Uses Service ***[NHS Digital]***
TIA	Transient ischaemic attack
tPA	Tissue plasminogen activator
UHB	University Hospitals Birmingham NHS Foundation Trust
UHCW	University Hospital Coventry and Warwickshire
UHNM	University Hospital North Midlands NHS Trust
WMAS	West Midlands Ambulance Service NHS Foundation Trust
WM CVD	West Midlands Cardiovascular

11 Appendices

11.1 Stroke Association services provided in the West Midlands

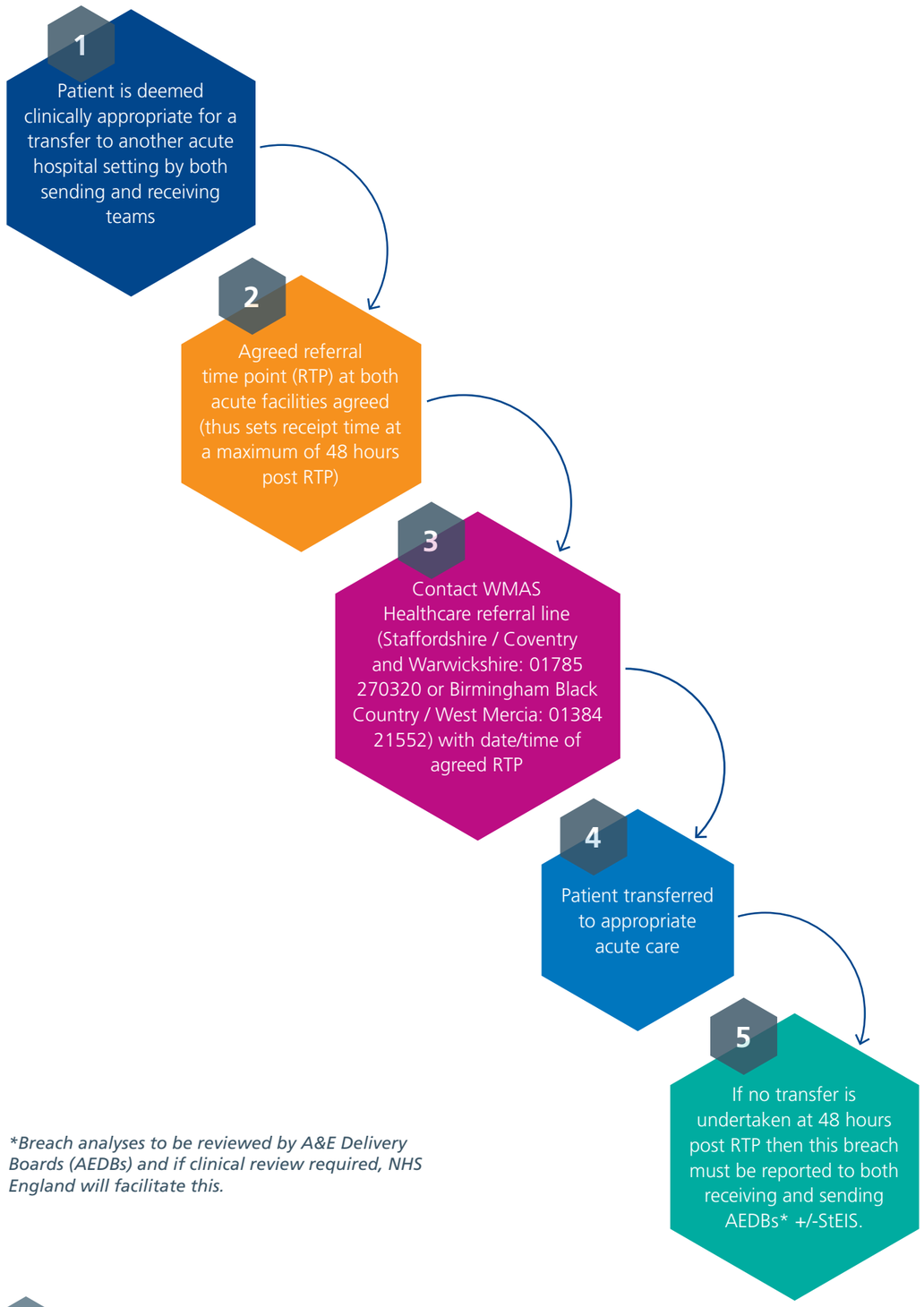
Table 1 overleaf shows the services that are currently provided in each STP area in the West Midlands. The Stroke Association has a range of packages that can be funded in a specific area to support the long-term needs of stroke survivors.

Table 1 'Stroke Association support services available across the West Midlands as of 2019

STP	Area	Stroke Association services			
		Stroke Recovery Service (SRS)	Post Stroke Review including six month reviews	Emotional support	Communication support
Birmingham and Solihull	North Birmingham	Yes	Yes (For approx. 300-400 strokes; Not QE as they complete them)	No	Yes (included in SRS model)
	South Birmingham	Yes (combined with above)	No	No	Yes (included in SRS model)
The Black Country and West Birmingham	Dudley	No	No	No	No
	Wolverhampton and Seisdon Peninsula	No	No	No	No
	Sandwell and West Birmingham	Yes	Yes	No	No
Coventry and Warwickshire	Coventry and Rugby	Yes (not Rugby)	Yes (not Rugby)	No	No
	North Warwickshire	Yes	No	No	No
	South Warwickshire	No	No	No	No
Herefordshire and Worcestershire	Herefordshire	No	No	No	No
	Worcestershire	Yes	No	No	Yes (included in SRS model)
Shropshire, Telford and Wrekin	Telford and Wrekin	No	Yes	No	No
	Shropshire	Yes	No	No	No
Staffordshire and Stoke-on-Trent	Stoke-on-Trent	Yes	No	No	No
	North Staffordshire	Yes	No	No	No
	South Staffordshire	No	No	No	No

11.2 West Midlands inter hospital concordat flow chart (2018)

The West Midlands inter hospital transfer concordat is an established set of principles and guidelines to enable patient transfer between NHS providers when clinically appropriate. The inter hospital transfer flow chart is highlighted below for reference:



**Breach analyses to be reviewed by A&E Delivery Boards (AEDBs) and if clinical review required, NHS England will facilitate this.*

11.3 Time of stroke and TIA admissions to A&E

The number of strokes and TIAs that patients are admitted to A&E over seven days (2017/2018).

Stroke

Day of Week \ Hour of day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Monday	19	10	8	11	7	14	21	32	48	79	101	104	83	92	73	61	57	61	42	48	36	34	17	37
Tuesday	17	11	11	9	15	14	12	26	35	78	78	89	72	68	45	49	57	49	51	43	31	29	21	21
Wednesday	26	9	9	7	8	10	17	23	35	61	92	98	84	78	53	60	66	47	49	43	24	34	25	21
Thursday	17	12	12	15	16	12	16	17	33	68	93	78	76	74	55	58	43	32	55	41	31	38	32	37
Friday	18	16	8	8	12	5	13	28	37	77	85	93	90	81	63	68	62	53	69	35	37	40	25	25
Saturday	9	23	6	10	11	6	5	20	32	56	78	59	76	56	64	58	36	48	42	52	30	27	32	25
Sunday	18	6	11	6	8	15	17	16	23	48	61	51	70	67	57	65	42	61	33	33	30	40	23	22

TIA

Day of Week \ Hour of day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Monday	6	0	1	2	3	2	5	7	9	16	22	22	18	29	14	20	12	19	14	8	12	10	9	4
Tuesday	8	4	0	1	1	0	0	8	3	12	17	18	21	16	19	18	16	12	18	13	8	10	4	7
Wednesday	5	2	2	2	3	2	0	4	7	18	14	16	27	15	18	18	24	14	19	10	11	10	12	6
Thursday	0	1	3	0	6	0	4	3	8	26	31	24	11	37	18	15	14	19	15	14	13	11	6	7
Friday	4	5	2	2	1	0	3	5	5	14	30	24	18	18	17	16	22	20	19	19	10	10	8	10
Saturday	7	6	3	0	2	2	1	2	3	15	12	22	18	13	16	23	15	25	17	8	13	13	8	7
Sunday	5	2	6	3	1	0	0	2	4	8	16	25	17	22	20	20	18	18	16	16	11	6	8	8

11.4 West Midlands atrial fibrillation algorithm pathway fibrillation detection and management

west midlands ACADEMIC HEALTH SCIENCE NETWORK | Public Health England | NHS England

Primary Care Clinical Pathway for Atrial Fibrillation Detection & Management

Symptomatic Presentation
e.g. palpitations

Opportunistic Detection
e.g. flu, HTN, diabetes clinic

Targeted/Systematic Detection
e.g. GRASP-AF, case finding

Patient is unwell or haemodynamically unstable

Clinical Suspicion of AF
Confirmation of AF usually requires demonstration on either a 12 lead ECG or presence for >30 seconds on ECG monitoring. Mobile device suggestion of AF should be confirmed on a 12 lead ECG

Confirmed Diagnosis of AF

Consider an echocardiogram if there is suspicion of LVSD, valve disease or a new murmur is identified on auscultation

Organise investigations
e.g. FBC, TFTs, U&Es, LFTs

Assess thromboembolic risk
using CHA_2DS_2-VASc

Risk Factor	Score
Congestive heart failure	1
Hypertension	1
Age ≥ 75	2
Diabetes	1
Previous TIA/Stroke	2
Vascular Disease*	1
Age 65-74	1
Sex category (female)	1

*PAD, MI, complex aortic plaque disease

- 0 in males or 1 in females = No antithrombotic therapy
- 1 = Consider OAC (men only)
- ≥2 = Offer OAC

Assess bleeding risk
using HASBLED

Risk Factor	Score
Hypertension uncontrolled (SBP > 160mmHg)	1
Abnormal renal and/or liver function	1 or 2
Stroke	1
Bleeding history	1
Labile INR (TTR < 65%)	1
Elderly (age ≥ 65)	1
Drugs (NSAIDs/antiplatelet) or alcohol (> 8 drinks/week)	1 or 2

- Do not withhold OAC
- Address modifiable risk factors to reduce bleeding risk at every point of contact
- ≥ 3 are high risk and should be 'flagged up' for early review/ follow up

Determine OAC strategy
using SAMe-TT_2R_2

Risk Factor	Score
Sex (female)	1
Age (< 60)	1
Medical history	1
Treatment strategy (Interacting drugs)	1
Tobacco use (current)	2
Race (non - caucasian)	2

- 0 - 2 = likely to do well on a VKA with good TTR
- > 2 = if VKA used, will need more frequent INR checks to improve TTR; maybe more likely to do better on a NOAC

Don't wait to anti-coagulate ie. Avoid stroke with Anticoagulation ('A')
Oral anti-coagulation should be initiated as soon as a diagnosis of AF has been made and can be initiated safely in primary care. You should have an awareness of your local anti-coagulation pathways.

Better symptom management ('B')
Initiate rate control e.g. with a beta-blocker (aim for a target resting heart rate that renders the patient asymptomatic). If the patient remains symptomatic despite optimal rate control refer to secondary care for consideration of a rhythm control strategy

Optimise management of co-morbidities and reinforce lifestyle advice i.e. **Cardiovascular** and other **risk factor management ('C')** (e.g. manage HTN, diabetes, cardiovascular disease, weight loss, sleep apnoea, etc)

Undertake a regular/annual review
Review quality of OAC (For VKA, assess TTR and aim for TTR > 65%. For NOACs, assess renal function). Assess adherence, symptom control, general health and well-being. Ensure NOACs are prescribed in line with licensed indications and as per manufacturers recommendations regarding age, weight, renal function and drug interactions. Ensure patient &/or carer involvement in decision making regarding treatment options.

Specialist Cardiology Input/Secondary Care if:
Haemodynamic instability, breathlessness at rest, syncope, dizziness, chest pain, stroke, TIA, resting heart rate > 150bpm
Recent onset AF (<48hours) for consideration of electrical cardioversion
Still symptomatic, despite optimal rate control

Approved by the West Midlands Cardiovascular and Stroke Clinical Network NHS England
Date approved: October 2016
Date of Review: October 2022
M_AG79614_22.10.18_V_1

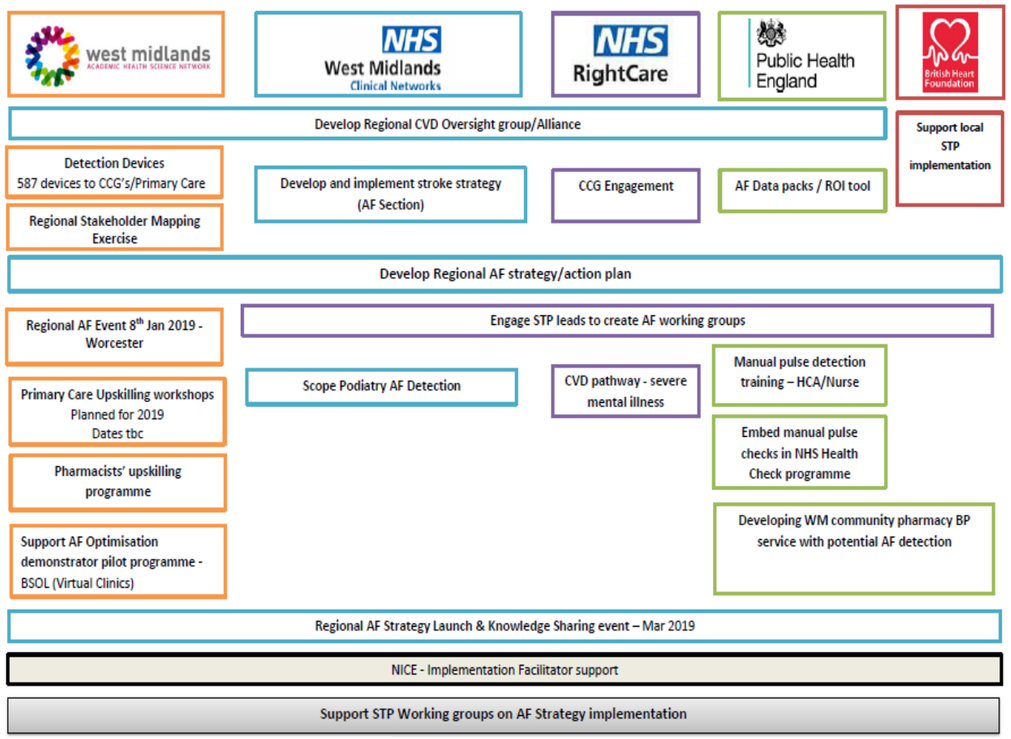
11.5 West Midlands thrombectomy clinical guidelines (2019)

Clinical guidelines for accessing thrombectomy services in West Midlands

Version number: 1.7

First published: TBC

Prepared by: Dr Indira Natarajan (Clinical Director for Stroke, West Midlands Cardiovascular Clinical Network), Dr Don Sims (Clinical Lead for Stroke, University Hospitals Birmingham NHS Foundation Trust), Dr Kurdow Nader (Consultant Neuroradiologist and Clinical Lead for Neuroradiology, University Hospitals Birmingham NHS Foundation Trust), Dr Anthony Kenton (Clinical Lead for Stroke and Neurology, University Hospital Coventry and Warwickshire NHS Trust), Sarah Mountford (Stroke Services Team Lead, University Hospital Coventry and Warwickshire NHS Trust), Victoria Millward (Head of West Midlands Cardiovascular Clinical Network), Jodie Powell (Senior Quality Improvement Manager, West Midlands Cardiovascular Clinical Network) and Sarah Rogers (Quality Improvement Officer, West Midlands Cardiovascular Clinical Network).



West Midlands Atrial Fibrillation plan on a page December 2018

Document management

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Directorate / programme	Medical	Project	Clinical Guidelines for Thrombectomy
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Author	West Midlands Thrombectomy Working Group		

Revision history

Version	Date	Summary of changes
1.0	08/08/2018	Initial draft for comment to West Midlands Thrombectomy Working Group
1.1	17/08/2018	Review by Kurdow Nader
1.2	03/09/2018	Guidelines reviewed and updated by the working group
1.3	13/09/2018	Guidelines approved for review and circulation by the working group
1.4	24/10/2018	Guidelines reviewed and amended by WM Stroke EAG and WM Clinical Leads
1.5	23/11/2018	Guidelines updated following final review from the working group
1.6	29/01/2019	Protocol updated by Indira Natarajan
1.7	23/04/2019	Guidelines updated by working group following WM Stroke STP Programme Board

Reviewers

This document must be reviewed by the following people:

Reviewer name	Title/responsibility	Date	Version
West Midlands Thrombectomy Working Group	Authors	Jan 2019	v.1.6
West Midlands Stroke Expert Advisory Group	Clinical Leads	April 2019	v.17
West Midlands Ambulance Service			
Specialised Commissioning - NHSE			

Approved by

This document must be approved by the following people:

Name	Signature	Title	Date	Version
Kiran Patel		Medical Director		
Prof. Adrian Williams				

Document control

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Contents

Circulation

This document should be read by all staff responsible for the management of patients undergoing mechanical thrombectomy.

This document applies equally to staff in a permanent, temporary, voluntary or contractor role acting for or on behalf of any Comprehensive Stroke Unit or local stroke unit.

Scope

This is a West Midlands Clinical Network guideline that covers any adult patient receiving a mechanical thrombectomy at a West Midlands Comprehensive Stroke Unit.

Definitions

Comprehensive Stroke Unit (CSU) or Neuroscience Centre: a specialist unit designed to provide hyper acute stroke care including mechanical thrombectomy/ neurosurgical support. These are interchangeable terms where internationally it can be referred to as a CSU and nationally as a neuroscience centre.

Hyper Acute Stroke Unit (HASU): a specialist unit designed to provide hyper-acute Stroke care for patients usually up to the first 72 hours following admission to hospital.

Acute Stroke Unit (ASU): specialist units that provide Stroke specialist care for patients who need to remain in hospital after the hyper-acute phase following a Stroke. Patients should be repatriated to the ASU at the hospital closest to the patient's resident address.

Decision To Transfer (DTT): the moment at which the Medical, Nursing and Therapy teams at the Comprehensive Stroke Unit agree the patient is suitable for transfer to their local hospital.

Repatriation: the transfer of a patient in accordance with this procedure to their local hospital.

Post Take: assessment and review by a Consultant within 14 hours of admission

Comprehensive Stroke Units (CSUs)

In the West Midlands there are currently **two Comprehensive Stroke Units**:

Queen Elizabeth Hospital
(Monday to Friday 09:00 – 17:00;
September 2019 for 24/7 services)
University Hospitals Birmingham NHS
Foundation Trust (UHBFT)
Edgbaston
Birmingham
B15 2TH
Clinical Lead: Dr Don Sims

Royal Stoke University Hospital
(Service available 24/7)
University Hospital of North Midlands NHS Trust (UHNM)
Newcastle Road
Stoke-on-Trent
ST4 6QG
Clinical Lead: Dr Indira Natarajan

In the rare scenario that the West Midlands centres are at full capacity and cannot take a patient eligible for thrombectomy, other centres providing thrombectomy which could be accessed, however, service provision may vary as services develop. Centres include but not limited to:

- North Bristol NHS Trust
- Nottingham University Hospitals NHS Trust
- Salford Royal Hospitals NHS Trust
- The Walton Centre NHS Foundation Trust
- Oxford University Hospitals NHS Trust.

Background

NHS England announced in April 2017 in the '***Five Year Forward View***' that NHSE will routinely commission mechanical thrombectomy services. NHS England now commissions mechanical thrombectomy for acute ischaemic stroke in accordance with the criteria outlined in the full Clinical Commissioning Policy, and accompanying service specification 'Mechanical thrombectomy for acute ischaemic stroke (all ages)' *NHS England Reference: 170033P published in March 2018*.

It is anticipated that within the current criteria approximately 8,000 people per year in England may benefit from this intervention. Rollout nationally will be via an incremental implementation programme managed on a regional basis.

Thrombectomy services are being established in Neuroscience Centres with established interventional radiology services, sufficient expertise in the procedure and a co-located hyper acute stroke service. There are 24 adult Neuroscience Centres in England (5-8 in each Region). Each regional team is developing services to ultimately have sufficient capacity to offer comprehensive patient access 24/7.

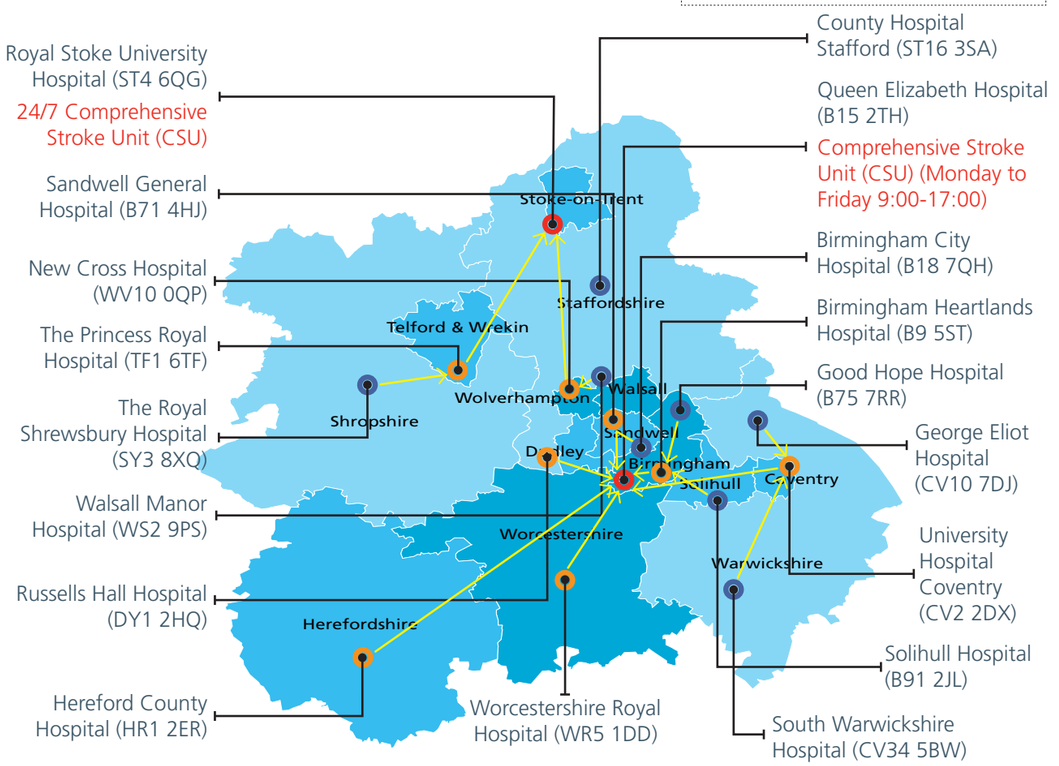
The responsible commissioner for the thrombectomy service is NHSE, as part of interventional neuroradiology provision. Clinical Commissioning Groups (CCGs) commission the vast majority of inpatient stroke care, stroke rehabilitation, and ongoing health care. Local authorities may provide social care services for those disabled by stroke.

Roll out nationally is dependent on there being sufficient numbers of specialists to perform the intervention. In England, there is currently a shortfall of circa 50 of these staff in post. New training programs are being agreed with the colleges, Health Education England and the GMC.

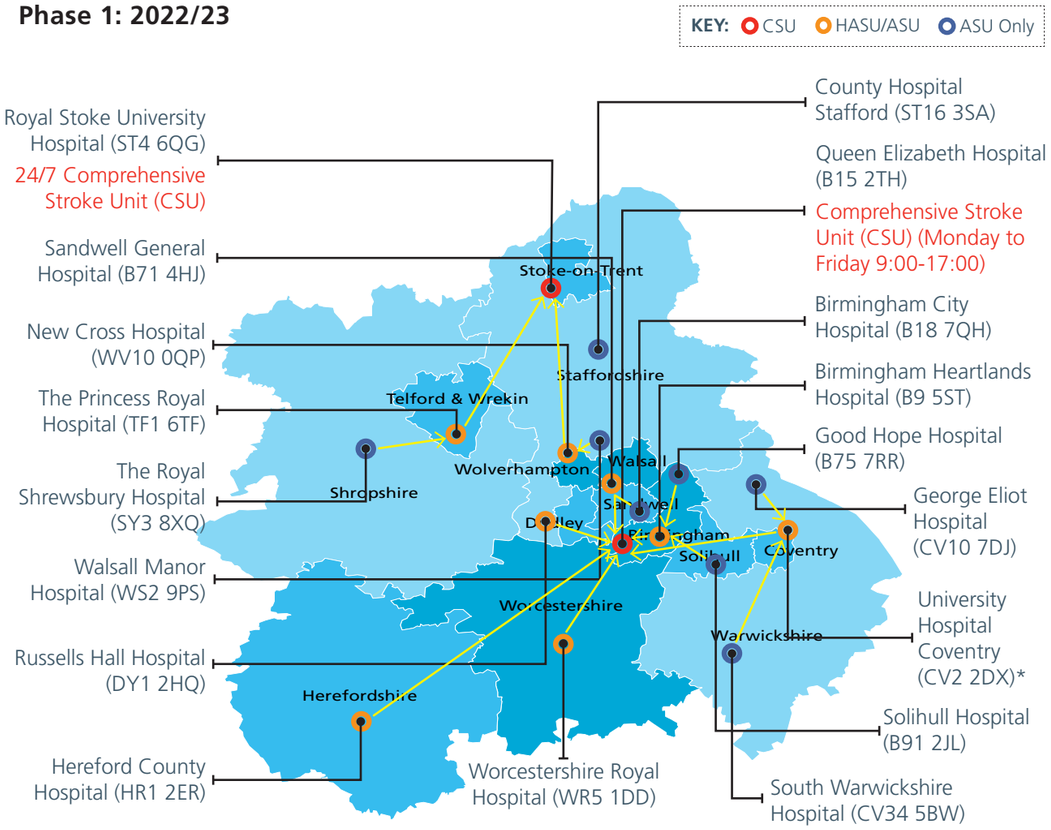
NHS England anticipates there being 700-800 thrombectomies undertaken in England by the end of the 2017/18 financial year with approximately 1,500 anticipated for 2018/19. These numbers are expected to increase annually over the next four years as services develop further and key staff are trained and recruited. A total of 240 procedures are planned in the West Midlands in 2018/19 which is around twice the number undertaken in 2017/18. The intention is to undertake a total of 400 cases per year in the West Midlands by 2021/22.

Thrombectomy Mapping: Current services

KEY: CSU HASU/ASU ASU Only



Phase 1: 2022/23

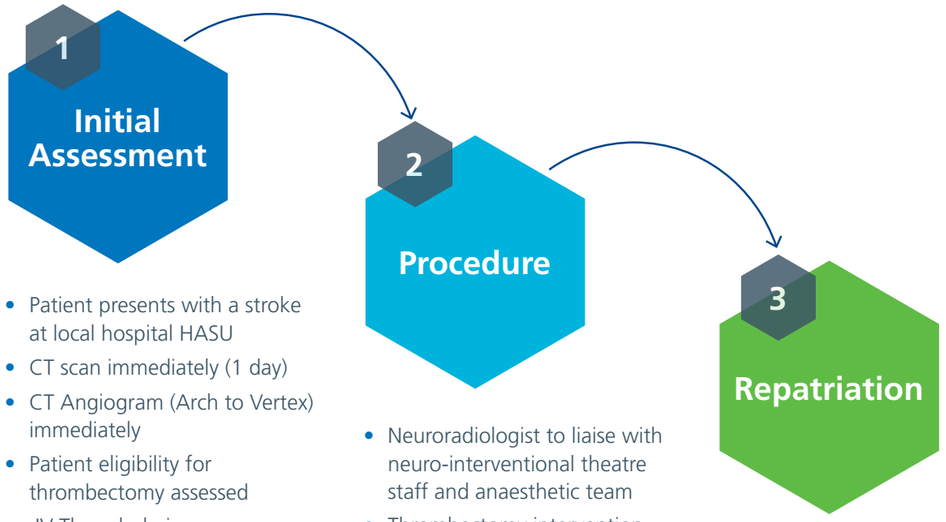


**There is a planned phased approach to open a CSU for UHCW*

Thrombectomy Pathway: Summary

High level pathway including specified timeframes for thrombectomy

Thrombectomy (clot retrieval) can be achieved within six hours of the onset of symptoms where there are no major new ischaemic changes on CT or MRI brain scan.



- Patient presents with a stroke at local hospital HASU
- CT scan immediately (1 day)
- CT Angiogram (Arch to Vertex) immediately
- Patient eligibility for thrombectomy assessed
- IV Thrombolysis
- Stroke Consultant / Designated SpR at local hospital to discuss with Stroke Consultant at CSU
- Arrange transfer via immediate (critical) transfer <eight minutes (red box) - Patient transferred to CSU

- Neuroradiologist to liaise with neuro-interventional theatre staff and anaesthetic team
- Thrombectomy intervention performed

- Patient assessed for safe transfer and repatriation back to local hospital or discharge home if appropriate
- Therapy goals to be established

Inclusion and Exclusion Criteria

Inclusion:

- Confirmed Acute Stroke
- Large Vessel Occlusion confirmed by CT-Angiogram
- Previously fit and well (Rankin Score 0-1)
- NIHSS >5
- Thrombectomy can sbe performed within 6 hours
- Paediatric cases (<18 years) must be discussed on a case-by-case basis by Stroke Consultant and Paediatric teams.

Exclusion:

- Patients outside these criteria (such as Rankin >1 or NIHSS <6 or thrombectomy cannot be performed within 6 hours) can be discussed on a case by case basis but currently fall outside NHS England guidelines.

Protocol for stroke patients who need mechanical thrombectomy

With regards to extracranial and intracranial stenting, individual centres must make local decisions on a case by case basis.

Confirmed Acute Stroke
Previously fit and well (Rankin Score 0-1) NIHSS >5

Do Immediate CT Angiogram (Arch to Vertex)

- **Anterior circulation stroke**
  - Severe disabling neurological deficit (NIHSS > 5)
  - Within six hours of onset of symptoms
- **Brain stem stroke**
  - Treatment can be delivered up to 24 hours of onset and occlusion of basilar artery
  - Potentially eligible even if consciousness impaired and/or patient ventilated

Discuss with Stroke Consultant on-call (at the local hospital)

CTA findings which suggests need for intervention

- Carotid T occlusion (internal carotid bifurcation occlusion)
- M1 (trunk of the MCA) or M2 (MCA branch in Sylvian fissure) occlusion
- Vertebro-basilar occlusion

Stroke Consultant / Designated SpR at local hospital to discuss with Stroke Consultant at the Comprehensive Stroke Unit

- Start standard dose IV thrombolysis if indicated if not already given
- **Arrange transfer via immediate (critical) transfer <eight minutes (red box)**
- Neuroradiologist to liaise with neuro-interventional theatre staff and anaesthetic team
- Patient should have venous access and urinary catheter prior to transfer
- If there is a delay in the patients arriving at the CSU, a repeat CT brain scan and CT-Perfusion is to be performed by the CSU to look for established infarct/haemorrhage and viable brain tissue for reperfusion.
- Do CT head immediately post procedure and again between 22 and 36 hours
- Ensure patients are monitored according to the thrombectomy care pathway (local policy)
- All cases should be discussed in the Stroke Neuroradiology MDT

Patients outside these criteria (such as Rankin >1 or NIHSS <6) can be discussed on a case by case basis but currently fall outside NHS England guidelines.

Mechanical thrombectomy should allow reperfusion within six hours of onset. Generally, this means the patient must arrive in the neuroscience centre within five hours at the latest. Patients with proven viable brain parenchyma on CTP or MRI may be suitable for treatment up to 12 hours. Please discuss if necessary.

Thrombectomy patients should be repatriated via the normal repatriation procedure. This should mean return to their local HASU **within 24 hours of decision to transfer and certainly by 72 hours**. Patients deemed unsuitable or whose symptoms have resolved on arrival for thrombectomy can be immediately returned to referring HASU by ambulance.

Imaging Protocol for Thrombectomy

CSU neuro-radiologists will not be reporting CT-Angiograms for the West Midlands. All stroke consultants at referring HASUs should be trained to review a CT-Angiogram and confirm a large vessel occlusion; it is the stroke consultant's responsibility. CT-Angiograms are accepted, and CT-Perfusion scanning is strongly recommended however not essential currently.

Regional Thrombectomy Referral Form

All referring sites are to use the Regional Thrombectomy Referral Form.

NHS England

Attach patient sticker

(Patient details)

WEST MIDLANDS THROMBECTOMY REFERAL FORM

Referring Hospital and consultant:	**Accepting consultant:**
Time of arrival at referring hospital:	**Date and time of referral to CSU:**
Form completed by:	

INDICATIONS FOR MECHANICAL THROMBECTOMY				
Proximal intracranial large vessel occlusion (LVO) on CT-A	☐	Yes	☐	No
Disabling acute stroke (NIHSS > 5)	☐	Yes	☐	No
Pre-morbid **modified Rankin score of 0 -1**	☐	Yes	☐	No
Procedure can restore perfusion **within 6 hours**; or	☐	Yes	☐	No
Unless proven salvageable brain tissue proven on imaging (up to 12 hours); or	☐	Yes	☐	No
Unless LVO is in the posterior circulation (up to 24 hours)	☐	Yes	☐	No

PERSONAL HEALTH HISTORY- RISK FACTORS	
☐ Hypertension	☐ Ischemic Heart Disease
☐ Diabetes	☐ Current smoker
☐ Atrial Fibrillation	☐ Previous smoker
☐ Hypercholesterolemia	☐ Alcohol excess
☐ Congestive cardiac failure	☐ Previous stroke/TIA
☐ Peripheral artery disease	☐ Malignancy
☐ Prosthetic heart valve	☐ Dementia

Stroke Symptoms:

☐ Right arm weakness ☐ Left arm weakness ☐ Dysphasia ☐ Visual symptoms

☐ Right leg weakness ☐ Right leg weakness ☐ Dysarthria ☐ Cerebellar symptoms

Allergies:

Is the patient on anticoagulation? Yes / No – If so, please specify which

DATE AND TIME OF ONSET:	
NIHSS SCORE:	

Pre-morbid mRS: If not 0, please explain why?

MANAGEMENT		
Was the patient Thrombolysed?	☐ Yes	☐ No
If yes, what total dose and what time?	**mg**	
Have the CTA images been transferred across to QEHB or UHNM?	☐ Yes	☐ No
What time has the blue-light ambulance been booked?		
Time patient leaving department:		
Next of kin aware?	☐ Yes	☐ No

OBSERVATIONS		
Airway: Self-Ventilating?	☐ Yes	☐ No
Intubated?	☐ Yes	☐ No
Breathing: SATs/RR?		
Aspirated?	☐ Yes	☐ No
Circulation: BP?		
Disability- GCS? E…. V…. M…. (If GCS <8 has the patient had an anesthetic review?)	☐ Yes	☐ No
Pyrexial?	☐ Yes	☐ No
Urinary Catheter?	☐ Yes	☐ No
Seizure?	☐ Yes	☐ No
Vomiting?	☐ Yes	☐ No

Referrals to be accepted by on-call stroke consultant – via switchboard
Queen Elizabeth Hospital: 0121 371 2000
Royal Stoke University Hospital: 01782 715444

Please request a blue light transport for life threatening conditions.
Always send this form together with the patient notes and retain a copy yourselves.

QEHB Stroke Nurse Practitioners: 07769 932 342 or 0121 371 5144 Please inform them of ETA	**UHNM Stroke Team:** 01782 715444 FAST Bleep 1910 or 1911 Please inform them of ETA
NAME:	**GRADE / PROFESSION:**
SIGNED:	**TIME / DATE:**

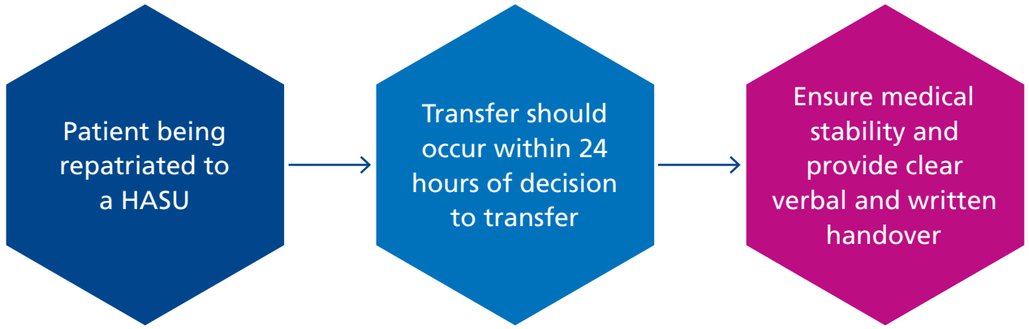
Exit pathway from Comprehensive Stroke Unit (CSU)

Repatriation from the CSU to local HASU

Overview

Patients who have received the thrombectomy at a CSU should be repatriated to their local referring HASU within 24 hours of decision to transfer.

- Patients should be accepted promptly by the receiving local stroke unit and the escalation policy should be followed if this does not occur
- There must be clinician-to-clinician communication to agree the transfer and confirm medical stability with clear written communication to back this up including a discharge summary and access to results of investigation and care undertaken. This can be at stroke nurse level given that all patients will be under the care of a stroke physician on both sites who will authorise the repatriation when clinically ready. The stroke nurses on individual sites will have easy access to the right consultant to accept the patient
- Patients should be transferred during 09:00 – 17:00 whenever possible
- Repatriation should take place seven days a week.



Criteria for medical stability for transfer of patient to HASU

- Clear diagnosis of stroke and secondary prevention plan (including referral for carotid intervention if indicated)
- Not dependent on inotropic or ventilator support
- Stable level of consciousness
- Reliable route of hydration and nutrition established (NG and IVI would suffice).

Transfer of patients to local unit pathway

Within first 24 hours post-intervention

- Stroke CNS/Stroke Nurse or Stroke coordinator to identify appropriate local stroke unit using **postcode lookup**
- Complete repatriation paperwork
- Clinical assessment for suitability for transfer
  - Medical assessment (confirm stability)
  - Nursing assessment (complete transfer form)
  - Therapy assessment (complete rehabilitation plan and goals).

Stroke coordinator or lead at CSU to send paperwork to local stroke unit (SU), call to confirm receipt, discusses clinical stability and date of planned transfer. CSU confirms arrangement in place to accept transfer and book transport.

See Escalation process for delayed transfers to SU if SU unable to accept patient (table 3)

Overseas visitors

Patients who live outside the UK requiring further stroke unit care after the intervention will be managed in the referring West Midland stroke units. The patient would usually stay in the HASU / ASU where they first presented unless pressing reasons why this should not be the case. Ensure referral to Overseas office has been made.

West Midland patients who stroke outside the region or abroad

Patients who have a stroke completely outside the region should be repatriated to their local stroke unit within the region using the agreed catchment areas for each trust. If the patient requires HASU / ASU / thrombectomy services which are not available locally they should be transferred to the nearest trust with these services on site.

Patients with no fixed abode

Patients with no fixed abode will be repatriated back to the referring HASU. Ensure referral to the homeless team has been made.

Mixed accommodation guidance

The NHS Operating Framework for 2011-2012 confirmed that all providers of NHS funded care are expected to eliminate mixed-sex accommodation, except where it is in the overall best interest of the patient. Information on mixed sex accommodation is available on the Department of Health ***website***.

Infection control guidance

No patient should knowingly be transferred with contagious infectious illness without clinician-to-clinician discussion and appropriate infection control measures. However, this should not prevent timely repatriation outside of the context of a patient being in a clinically unstable condition.

It is accepted that on occasion, in such circumstances patients may not be repatriated direct to a Stroke Unit or suitable medical ward in order to meet the infection control requirements and maintain patient safety.

As soon as the period of infectious illness has passed - provided stroke is the predominant medical problem – such patients should be transferred to complete their inpatient stay on a Stroke Unit.

General contracting rules for CSUs

Stroke units must accept a patient from a CSU. CSUs have the authority to repatriate patients to the relevant stroke unit and are expected to follow the agreed protocol when doing so. If a patient transfer is delayed in excess of 24 hours after the agreed transfer time by a stroke unit, a CSU can:

- Keep the patient in the HASU
- Transfer the patient to the stroke unit in the same trust as the HASU
- Seek an alternative stroke unit for the patient's post ongoing stay.

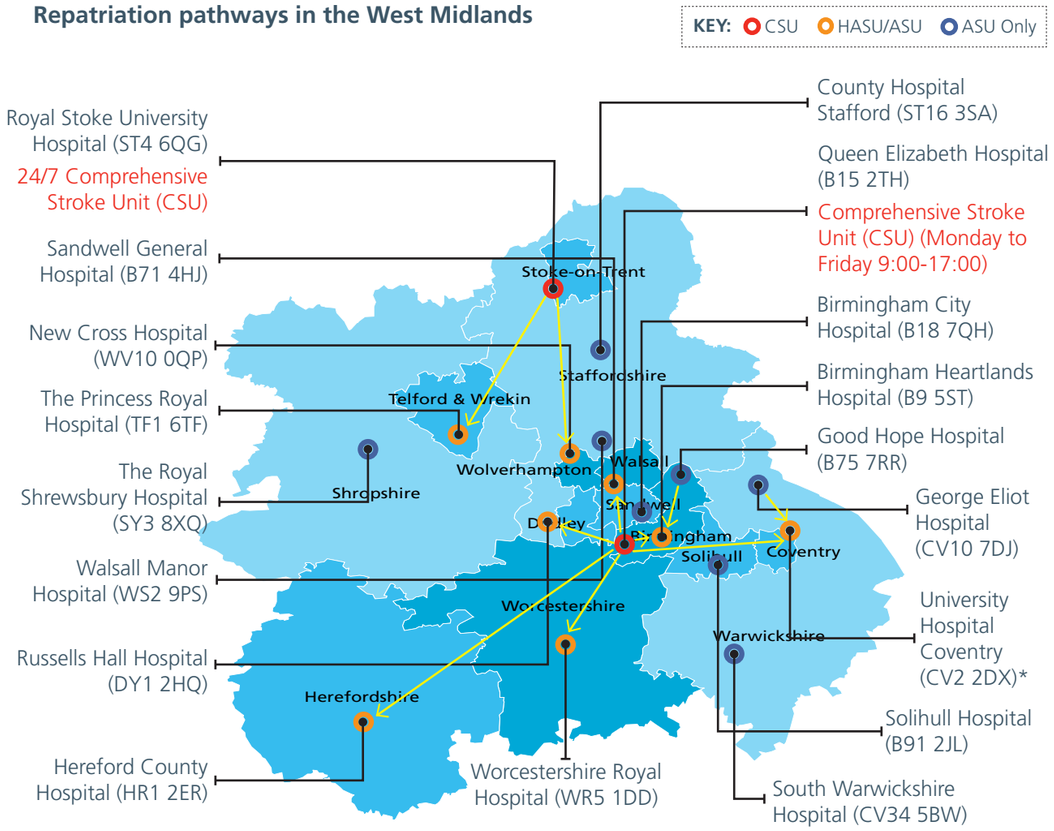
Table 2 – CSU to HASU: Contact details for repatriation

	Stroke Unit and Switchboard Contact	Lead Stroke Consultant	Stroke Nurse	Stroke Coordinator
CSU	Royal Stoke University Hospital 01782 715444	Dr Indira Natarajan Stroke Consultant of the Day contact on 01782 679987 or via switchboard	TBC	TBC
	Queen Elizabeth Hospital, Birmingham 0121 627 2000	Dr Don Sims	TBC	TBC
Local Stroke Units: West Midlands	Birmingham Heartlands Hospital 0121 424 2000	Dr Rajendra Yadava	0121 424 2000 pager 2499 07971717588	0121 424 2000 pager 2499 07971717588
	Sandwell General Hospital 0121 553 1831	Dr Sissi Ispoglou	TBC	TBC
	New Cross Hospital, Wolverhampton 01902 307999	Dr Simon McBride Switchboard (01902 307999) then 772611	TBC	TBC
	Russells Hall Hospital, Dudley 01384 456111	Dr Ashim Banerjee	Switchboard (01384 456111) and bleep stroke nurse on 7557	TBC
	University Hospital Coventry 024 7696 4000	Dr Antony Kenton 024 7696 8261	Switchboard (024 7696 4000) then Bleep 1910	Sarah Mountford 024 7696 8336
	Worcester Royal Hospital 01905 763333	Dr Neil Baldwin/ Stroke On-Call Consultant	TBC	TBC
	Hereford County Hospital 01432 355444	Dr Phil Sanmuganathan	TBC	TBC
	Princess Royal Hospital, Telford 01689 863000	Dr Meena Srinivasan	TBC	TBC
	Contact number for West Midlands Ambulance Service Inter-hospital transfer - 999 *(Request Category 2 blue light transfer)*			

Table 3 – Escalation process for thrombectomy repatriation

Within 24 hours of decision to transfer			48 hours	72 hours	96 hours
Patient ready to be repatriated from CSU to local referring hospital **Standard: Patient to be repatriated directly from CSU to referring HASU within 24 hours from decision to transfer**	1. Stroke CNS/ Stroke Nurse or Stroke coordinator to notify local referring hospital that their patient is ready to be repatriated and to request a transfer date within the specified timeframe. 2. Patient is clinically reviewed / confirmed safe to transfer 3.Transfer documentation completed	4. If transfer date is not available within 24 hours, Stroke CNS / Stroke Nurse or Stroke coordinator to escalate to Group Manager for Stroke and Group Support Manager for Stroke in referring local hospital via email.	5. Escalate to Head of Operations for Division Local level responsible for updating contacts	6. Escalate to Chief Operating Officer (COO) On Call	7. Escalate to Chief Executive

Repatriation pathways in the West Midlands



Discharge home from CSU

If appropriate, patients can be discharged directly from the CSU to their home address or their local ESD/CST. Patients will be discharged with:

- Discharge summary
- Therapy and rehabilitation plan
- Follow-up plan.

Discharge to hospice / palliative care from CSU

Patients requiring palliative care after a mechanical thrombectomy will be referred to the palliative care team to support the most appropriate destination and care planning for the patient and their carer/family. This can include transfer to their local hospice, or a hospice that is agreed with the patients' carer or family.

Thrombectomy follow-up

All patients who have received a mechanical thrombectomy must be followed up by a telephone call at threeand six months post intervention by a stroke consultant at the CSU.

The stroke consultant from the referring stroke unit should follow up their patient independently of the CSU, at six months as per the standard care pathway.

SSNAP data entry process

Every referring hospital is to be complete data entry on SSNAP as per the standard stroke care pathway including the six-month follow up as per SSNAP requirements (table 4).

Local CSUs will collate outcome data on thrombectomy in SSNAP as per table 5. The SSNAP record must be commenced by the Comprehensive Stroke Unit and on repatriation the SSNAP records must be transferred to the local stroke unit. In order to initiate the SSNAP data the stroke team will be able to enter the information directly form the referral form.

When a thrombectomy is performed, the CSU team performing the thrombectomy will start the record. This is the case even if the patient has been transferred from another hospital. Guidance on how to start a thrombectomy record can be found here: ***https://ssnap.zendesk.com/hc/en-us/articles/115003802165-Which-team-s-responsibility-is-it-to-start-the-SSNAP-record-***

Table 4 – SSNAP Data Entry at six-month follow-up

Number of patients	M1.1	Number of patients due for follow-up based on when the patient was admitted or when the follow-up was completed
	M2.1	Breakdown of six-month follow-up provision:
	M2.2	Yes
	M2.3	
	M2.4	Died whilst on the stroke care pathway (as reported on SSNAP)
	M2.5	
	M2.6	Died within six months of admission (as reported on SSNAP)
	M2.7	
	M2.8	No but
	M2.9	
	M2.10	No
	M2.11	
	M2.12	Blank (section 8 not completed)
	M2.13	
Applicability for record to be actively answered	M3.1	Patient record deemed appropriate to be actively answered (excludes died in care)
	M3.2	
	M3.3	
	M3.4	Section 8 has been actively answered, if record appropriate for completion
	M3.5	
	M3.6	
Applicability for follow-up	M4.1	Applicability for follow-up to be undertaken (excludes died in care, died within six months of admission, and "no but")
	M4.2	
	M4.3	
	M4.4	Six month follow-up has been completed, if patient applicable for follow-up
	M4.5	
	M4.6	
Six month follow-up timings	M5.1	Number of months from Clock Start to six-month assessment
	M5.2	
	M5.3	
	M5.4	Number of months from discharge from all care to six-month assessment
	M5.5	
	M5.6	
Follow-up characteristics	M6.1	Follow-up type:
	M6.2	In person
	M6.3	
	M6.4	Online
	M6.5	
	M6.6	By telephone
	M6.7	
	M6.8	By post
	M6.9	
	M6.10	Follow-up provider:
	M6.11	GP
	M6.12	
	M6.13	Stroke coordinator
	M6.14	
	M6.15	Therapist
	M6.16	
	M6.17	District / community nurse
	M6.18	
	M6.19	Voluntary services employee
	M6.20	
	M6.21	Secondary care clinician
	M6.22	
	M6.23	Other
	M6.24	
Mood, behaviour, and cognition	M7.1	Mood, behaviour, cognition screening:
	M7.2	Yes
	M7.3	
	M7.4	No
	M7.5	
	M7.6	No but
	M7.7	
	M7.8	If screened, support needed:
	M7.9	
	M7.10	
	M7.11	If support needed, psychological support received since discharge:
	M7.12	Yes
	M7.13	
	M7.14	No
	M7.15	
	M7.16	No but
	M7.17	

Discharge information	M8.1	Where the patient is living:
	M8.2	Home
	M8.3	
	M8.4	Care Home
	M8.5	
	M8.6	Other
	M8.7	
Rankin	M8.8.1	modified Rankin Scale is not known:
	M8.8.2	
	M8.8.3	
	M8.8	If known, modified Rankin Scale (mRS) score:
	M8.9	0
	M8.10	
	M8.11	1
	M8.12	
	M8.13	2
	M8.14	
	M8.15	3
	M8.16	
	M8.17	4
	M8.18	
	M8.19	5
	M8.20	
Atrial fibrillation	M9.0	Persistent, permanent or paroxysmal atrial fibrillation (AF) at the time of six-month follow-up assessment
	M9.1.1	Yes
	M9.1.2	
	M9.2.1	No
	M9.2.2	
	M9.3.1	Not known
	M9.3.1	
	M9.4	If patient is in AF at six-month follow-up assessment, was also in AF when first admitted to hospital
	M9.5	
	M9.6	
	M9.7	If patient is in AF at six-month follow-assessment, was also in AF when discharged from inpatient care
	M9.8	
	M9.9	
	M9.10	If patient is in AF at six-month follow-up assessment, then taking anticoagulant
	M9.11	
	M9.12	

Medication	M12.1	Taking antiplatelet
	M12.2	Yes
	M12.3	
	M12.4	No
	M12.5	
	M12.6	Not known
	M12.7	
	M13.1	Taking anticoagulant
	M13.2	Yes
	M13.3	
	M13.4	No
	M13.5	
	M13.6	Not known
	M13.7	
	M14.1	If patient was discharged on anticoagulant, still taking at six-month follow-up assessment
	M14.2	
	M14.3	
	M15.1	Taking lipid lowering
	M15.2	Yes
	M15.3	
	M15.4	No
	M15.5	
	M15.6	Not known
	M15.7	
	M16.1	Taking antihypertensive
	M16.2	Yes
	M16.3	
	M16.4	No
	M16.5	
	M16.6	Not known
	M16.7	
Since initial stroke	M17.1	Since stroke, another stroke
	M17.2	Yes
	M17.3	
	M17.4	No
	M17.5	
	M17.6	Not known
	M17.7	

	M18.1	Since stroke, myocardial infarction
	M18.2	Yes
	M18.3	
	M18.4	No
	M18.5	
	M18.6	Not known
	M18.7	
	M19.1	Since stroke, other illness requiring hospitalisation
	M19.2	Yes
	M19.3	
	M19.4	No
	M19.5	
	M19.6	Not known
	M19.7	

Table 5 – SSNAP data entry for Comprehensive Stroke Units

Thrombectomy*	G19.1	Thrombectomy (all stroke types)
	G19.2	
	G19.3	
	G19.4	Time from onset to puncture (hours:mins)
	G19.5	
	G19.6	
	G19.7	Time from onset to completion (hours:mins)
	G19.8	
	G19.9	
	G19.10	Time from clock start to puncture (hours:mins)
	G19.11	
	G19.12	
	G19.13	Time from puncture to deployment (hours:mins)
	G19.14	
	G19.15	
	G19.16	Time from puncture to end of procedure (hours:mins)
	G19.17	
	G19.18	
NIHSS after thrombectomy	G19.19	NIHSS 24 hours after thrombectomy is known
	G19.20	
	G19.21	

Accountability and governance

Local hospitals are to have access to the MDT at the CSU (discussions should be held between sites at a local level to decide on how this is managed, for example, via teleconferencing). It is up to each HASU and CSU to communicate regarding thrombectomy cases and feedback mechanisms are to be discussed locally.

11.6 West Midlands regional standard ESD service standards

The table below contains the regional standard ESD service standards recommended by the WM CVD Clinical Network and developed by the West Midlands ESD and Rehabilitation Core Working Group to achieve gold standard stroke care. Regional standards were based on NICE Quality Standard [QS2], The Royal College of Physicians (RCP) National Clinical Guidance for Stroke (5th Edition; 2016), the NHS England Midlands and East Stroke Service Specification (2012), alongside the experience and expertise of specialist clinicians in stroke care rehabilitation. The standards were subsequently reviewed by the West Midlands ESD and Rehabilitation Working Group.

Service standards for standard ESD[1,2]	
Definition	Early Supported Discharge (ESD): Rapid access to intense rehabilitation and community based assessment by a stroke specialist core MDT. It enables patients with stroke to leave hospital sooner, and receive the same quality and quantity of rehabilitation that would be provided in hospital. ESD should meet RCP guidelines[2] whilst allowing flexibility for individual patients' clinical needs.
Workforce* *WTEs are based on RCP guidelines plus regional clinical opinion from the West Midlands ESD and Rehabilitation Working Group. This includes face-to-face clinical and non-clinical time.	Core MDT to consist of (per 100 caseload per year/WTE3) with a designated clinical lead: • nurses (1.2) • physiotherapists (1) • occupational therapists (1-1.5) • speech and language therapists (0.4) • dietitians (0.2) • clinical psychologists/neuropsychologists (0.5) • rehabilitation assistants (2-2.5) • social workers (0.5) • dedicated administrative support (1) *This will need to be localised to meet geographical requirements such as widespread rural populations. Where a single member of a profession or less than 1 WTE is required the post will need to be embedded within a whole stroke pathway in order to maintain clinical competencies and governance (clinical supervision, training, peer support and case review for example).In regards to rehabilitation assistants the skill mix and competencies should be locally agreed. For example 1 WTE B4 and 1.5 WTE B2-3. Having a higher banded assistant could enhance patient access to rehabilitation.*
Patient cohort	ESD will accept confirmed stroke patients from any location, with identified rehabilitation goals that will benefit from therapy. Patients accessing ESD are mild to moderate in stroke severity and dependency: Teams need to use a stratification based on severity such as NIHSS, Bartel. Modified Rankin (MRS) or NEADL for example. Teams could consider using a scale to stratify patients locally or agree local clinical criteria. They may complete their rehabilitation programme within their time with an ESD team or require long-term support and follow up. Some patients will require ongoing rehabilitation at completion of ESD and will require referral onwards. Patients requiring only one core MDT should not be prevented from accessing ESD.

Service standards for standard ESD[1,2]	
Pathway and timelines	ESD will take confirmed stroke patients **from day 0 up to six weeks post-stroke**. Rapid access to packages of care or care home placement is required to achieve early safe discharge. ESD services should work towards an average LOS of six weeks within the ESD team, to prevent hand-over of care to CST for patients who are within days of completing their rehabilitation. After a period of six weeks, all patients should have equal and timely access to CST for continued rehabilitation where required to ensure an equity of intensity. All patients should have a clear plan for six-week stroke medical follow up, and six-month stroke follow up in place with flexibility to meet individual patient needs. A plan should be in place to hand over care to the patient's GP within a locally agreed timeframe.
Therapy	Patients **should be offered** 45 minutes per day, per therapy discipline, five days per week[2] for up to six weeks from the start of ESD input (or medically stable in exceptional circumstances) if clinically indicated. Therapy provision should meet professional standards therefore could be delivered by a supervised non-registered team member following assessment by a registered therapist.
Service provision	Seven days a week.
% Caseload	National guidance of 40%[2] with conditions: 1. Any start point (day 0), until six weeks post stroke 2. Accepting referrals from any part of the stroke pathway (HASU, ASU, RSU, community, ED, TIA clinic) 3. Accepting referrals from a thrombectomy pathway (from a Comprehensive Stroke Unit).
ESD criteria	1. Clinical or radiological diagnosis of stroke 2. Transfer independently or with assistance of 1 +/- equipment requiring one person to use 3. Clinically stable and fit for discharge, or needs can be met by GP and/ or advice from HASU/ ASU 4. Continence management plan (including overnight plan) 5. Medication management plan 6. Nutrition and hydration management plan to optimise rehabilitation potential managed by dietetics 7. Skin care management plan 8. Mental health screen/mood and emotion screen completed in order to plan safe discharge 9. Cognition and communication screen/ assessment in order to plan safe discharge 10. All patients should have access to ESD if they meet the criteria regardless of their permanent address 11. Social needs – patient and carer needs to be assessed, and care package in place prior to discharge to ESD 12. ESD pathway to be discussed with the patient and patients' family/ carer. Benefits and any disadvantages to be discussed prior to discharge 13. Discharge destination safe for provision of rehabilitation (space for equipment, safe for workforce to attend).
Clinical delivery model	A Qualified / registered ESD team member to assess and treat patients within 24 hours as per RCP guidelines[2]

Service standards for standard ESD[1,2]	
Ratio of staff (therapy)	Qualified / registered: 70% Un-qualified / non-registered: 30%
Estates	ESD to be able to provide: • equipment at home (Staff to have access to seven-day buffer stock for equipment) • gym or rehab facilities where required • access into the community • transport (volunteer drivers/contracts for example) where required • accommodation for ESD team to be based together for effective team working. In order to support the function of ESD, IT infrastructure needs to be reviewed.
Key performance indicators (KPIs)	1. Completion of SSNAP 2. Clinical impairment outcome measure 3. Patient satisfaction outcome measure 4. Quality of Life outcome measure 5. Carers support / experience.
Guidelines	NICE Quality Standard [QS2][1] Royal College of Physicians (RCP) 2016 National Clinical Guidance for Stroke (5th Edition)[2] NHS England Midlands and East Stroke Service Specification (2012)3

11.7 West Midlands regional enhanced ESD service standards

The table below contains the regional Enhanced ESD service standards recommended by the WM CVD Clinical Network and developed by the West Midlands ESD and Rehabilitation Core Working Group to achieve gold standard stroke care for stroke patients with a higher level of dependency. Regional standards were based on NICE Quality Standard [QS2], The Royal College of Physicians (RCP) National Clinical Guidance for Stroke (5th Edition; 2016), the NHS England Midlands and East Stroke Service Specification (2012), alongside the experience and expertise of specialist clinicians in stroke care rehabilitation including a clinical lead who has developed and initiated an enhanced ESD pilot in their local STP. The standards were subsequently reviewed by the West Midlands ESD and Rehabilitation Working Group.

Service standards for enhanced ESD[1,2]	
Definition	Enhanced Early Supported Discharge (EESD): Rapid access to **highly specialised** intense rehabilitation and community based assessment by a stroke specialist core MDT. It enables patients with stroke to leave hospital sooner, and receive the same quality and quantity of rehabilitation that would be provided in hospital. EESD should meet RCP guidelines[2] whilst allowing flexibility for individual patients' clinical needs.
Workforce* *WTEs are based on RCP guidelines plus regional clinical opinion from the West Midlands ESD and Rehabilitation Working Group. This includes face-to-face clinical and non-clinical time.	There are no national guidelines for staffing numbers required to provide EESD. The regional group recommend that EESD is provided as a bolt on service to standard ESD. As patients in EESD are more likely to require at least two therapists or staff members per visit, the regional group give the following recommendation for EESD: Core EESD MDT to consist of (per 100 caseload per year/WTE[3])* with a designated clinical lead: • consultant physicians (0.2) • nurses (0-2.4) • physiotherapists (2) • occupational therapists (2-2.5) • speech and language therapists (0.8) • Dietitians (0.4) • clinical psychologists (0-1) • rehabilitation assistants (2-4) • social workers (1) • dedicated administrative support (1) Workforce for EESD should have clear leadership for each profession and contain experienced staff. For clinical psychology this is usually a Band 8A or above. There needs to be at least one Band 7 nurse or AHP per EESD team. For speech and language therapy, dysphagia competence is essential; this is usually a Band 6 or above.*Teams need to agree their model for delivery locally to meet geographical requirements such as widespread rural populations; these numbers are a guide. Local teams may need to consider impact on existing neuro and community teams. Carers should be integrated with EESD. Where a single member of a profession or less than 1 WTE is required the post will need to be embedded within a whole stroke pathway in order to maintain clinical competencies and governance (clinical supervision, training, peer support and case review for example). In regards to rehabilitation assistants the skill mix and competencies should be locally agreed; having a higher banded assistant could enhance patient access to rehabilitation.

Service standards for enhanced ESD[1,2]	
Patient cohort	EESD will accept confirmed stroke patients from any location, with identified rehabilitation goals that will benefit from therapy. Patients suitable for EESD are likely to be more complex in nature compared to standard ESD: • Higher stroke severity • Higher dependency • Require two or more staff to rehabilitate or deliver care tasks • Require increased access to specialist equipment. Teams need to use a stratification based on severity such as NIHSS, Bartel. Modified Rankin (MRS) or NEADL for example – Teams could consider using a scale to stratify patients locally – (clinical picture) • May be at higher risk of complications and therefore require access to a range of specialist staff in addition to EESD. For eg district nurses, nutrition nurses, continence specialists • Are more likely to require ongoing rehabilitation at the end of the six-week EESD period • Are more likely to require referrals to specialist services to meet their complex needs.
Pathway timelines	EESD will take confirmed stroke patients f**rom day 0 up to six weeks post-stroke**. Rapid access to packages of care or care home placement is required to achieve early safe discharge. EESD services should work towards an average LOS of six weeks within the EESD team, to prevent hand-over of care to CST for patients who are within days of completing their rehabilitation. After a period of six weeks, all patients should have equal and timely access to CST for continued rehabilitation where required to ensure an equity of intensity. All patients should have a clear plan for six-week stroke medical follow up, and six-month stroke follow up in place with flexibility to meet individual patient needs. A plan should be in place to hand over care to the patient's GP within a locally agreed timeframe.
Therapy	Patients should be offered 45 minutes per day per therapy, five days per week discipline[2] for up to six weeks if clinically indicated.
Service provision	Seven days a week.
% caseload	National guidance of 40%2 with conditions: 1. Any start point (day 0), until six weeks post stroke 2. Accepting referrals from any part of the stroke pathway (HASU, ASU, RSU, community) 3. Accepting referrals from a thrombectomy pathway (from a Comprehensive Stroke Unit). PLUS 20% bolt on to ESD (to treat 10% of the caseload) however CST MUST be fully funded and supported to allow for 60%.

Service standards for enhanced ESD[1,2]	
EESD criteria	1. Clinical diagnosis of stroke 2. Transfer assistance of ≤ 2 +/- equipment, a trained carer may be the second person where appropriate 3. Clinically stable and fit for discharge, or needs can be met by GP and/ or advice from HASU / ASU 4. Continence management plan (including overnight plan) 5. Medication management plan 6. Nutrition and hydration management plan to optimise rehabilitation potential managed by dietetics including daily care and ongoing review of enteral feeding routes to be determined by locally agreed policies (PEG, RIG, NGT) 7. Skin care management plan 8. Mental health screen / mood and emotion screen assessment completed in order to plan safe discharge 9. Cognition and communication screen/ assessment in order to plan safe discharge 10. NH / EAB / D2A beds patients in D2A or EAB should have access to EESD if they meet the criteria regardless of their permanent address 11. Social needs – patient and carer needs to be assessed, and care package in place prior to discharge to EESD 12. EESD pathway to be discussed with the patient and patients' family / carer. Benefits and any disadvantages to be discussed prior to discharge 13. Discharge destination safe for provision of rehabilitation (space for equipment, safe for workforce to attend) 14. Night time management plan (Band 7 on call).
Clinical delivery model	A Qualified / registered team member to assess and treat patients within 24 hours as per RCP guidelines[2]
Ratio of staff (therapy)	Qualified / registered: 60% Un-qualified / non-registered: 40%
Estates	EESD to be able to provide: • equipment at home (Staff to have access to seven-day buffer stock for equipment) • gym or rehab facilities where required • access into the community, • transport (volunteer drivers/contracts for example) • accommodation for EESD team to be based together for effective team working. In order to support the function of EESD, IT infrastructure needs to be reviewed.
Key performance indicators (KPIs)	1. Completion of SSNAP mandatory 2. Clinical impairment outcome measure 3. Patient satisfaction outcome measure 4. Quality of Life outcome measure 5. Carers support/experience. EESD is a new relatively untested pathway. Relationships between teams, shared education, best practice, and experience need to be built in order to see the required outcomes. A lead in time of 9-12 months is recommended in order to see improvements in SSNAP reports.
Guidelines	NICE Quality Standard [QS2][1] Royal College of Physicians (RCP) 2016 National Clinical Guidance for Stroke (5th Edition)[2] NHS England Midlands and East Stroke Service Specification (2012)[3]

Notes