Kent Surrey Sussex Academic Health Science Network

NHS

Health Economic Analysis of a Co-ordinated Delivery Network for Post-Stroke Spasticity Care

Approach and Findings

March 2020

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1 Executive Summary

1.1 Purpose of the report

To evaluate the economic, health and social outcomes of a co-ordinated service model for post-stroke spasticity management services across Kent, Surrey and Sussex, a cost-benefit analysis was conducted to measure the potential impact of the proposed service model. The service model has been designed to reduce unwarranted clinical variation in practice and availability of spasticity management services. It is intended to enable staff to access the appropriate resources and expertise to get the patient the care they need at the first attempt, fulfilling the vision of the NHS Long Term Plan to implement an innovative, high-intensity rehabilitation service to help manage this long-term condition. This report sets out the methodology and findings of this analysis.

1.2 Key Findings

Results: The primary scenario analysed is based on a hypothetical 100% immediate implementation, measured over 5 years across Sussex Health & Care Partnership, Surrey Heartlands ICS, and Kent and Medway STP. Each area running a triage process through a central 'Hub' service is led by a Rehabilitation Medicine Consultant who supports qualified staff at 'Spoke' locations around the area. This is required in order to reach patients who could not previously access the specialist care and treatments offered under the existing service.

The primary scenario returned a strong return on investment, with a Net Present Value of £4.11 million across the five-year period. Purely in terms of benefits to the healthcare system (non-cash releasing), this represent a £1.46 return for every £1 spent. When social benefits are included, the return on investment rises to £4.66 for every £1 spent. Social benefits represent £3.60 million in total, £2.3 million of which relates to impact upon quality of life.

The secondary scenario assumes a phased rollout over the first two years of implementation, which reduces the benefits, but still returns a positive Net Present Value of £3.61 million. Healthcare benefits also dropped in line with the headline figure, to £1.35 for every £1 spent.

Insights: Overall, these results provide a strong summary of the potential benefits of increasing access to these specialised services.

The potential benefits of these services support clinical feedback and Stroke Association findings relating to the social cost of strokes.

However, inconsistent data availability has made it difficult to quantify the full extent of these benefits.

1.3 Limitations

Bundled rehabilitation costs have proven a challenge, making it difficult to establish the true cost of spasticity and attribute the complication to the condition. As the proposed service model has been under development during this project and is not currently active within the region, the outcomes are not based on direct data collection.

In order to unbundle the potential costs and benefits we have relied upon research and literature reviews to support assumptions used in the modelling. This has been mitigated with the use of optimism biases to ensure estimations of benefits are prudent and reflect the quality of data used.

1.4 Suggestions

Implementing a centralised and standardised approach to data collection may help understand the true scale of spasticity and its complicating factors. Similarly, strong data governance would enable the sharing of best practice and learning.

A network-based approach would help formalise training pathways, connecting staff in training with the experts within the region.

The proposed model would also provide a support structure to get the most out of existing rehabilitation therapy.

The model would provide a focal point for primary care systems, to encourage referral for patients in need.

2 Purpose of the report

The Kent Surrey Sussex Academic Health Science Network ("KSS AHSN") was commissioned to support South East (Kent Surrey Sussex) Clinical Networks ("SECN") in conducting a health economic analysis. This would assess, from the healthcare system's perspective, the economic impact of a proposed revised delivery model developed by the clinical network to treat and manage spasticity in post-stroke patients across the network, relative to the current state of services within the region.

A cost-benefit analysis has been conducted to measure the potential impact of a proposed Hub and Spoke service model in terms of savings to the healthcare system as well as broader social benefits.

In addition to building the cost-benefit model, this review sought to help develop the service proposition by gathering information and feedback from clinicians across the region to produce a full reflection of benefits, including qualitative outcomes which may not be monetised as part of a health economic evaluation.

KSS AHSN has reviewed existing data sources and research to produce a decision tree model as well as a cost-benefit analysis, highlighting data gaps and working to develop the proposal accordingly. The aim of this work has been to support discussion on the merits of the proposed delivery model with a view to potential implementation of the most appropriate model across the region.

A number of tools were used to support this evaluation, including:

DECISION TREE

The purpose of the decision tree model is to illustrate the various patients' journeys along the pathway, providing insight into how patients will receive treatment under the proposed model and the costs associated with each branching path.

DATA COLLECTION

Data collection is crucial to allow analysis to take place, with evidence acquired to clearly define the affected population, establish the baseline costs and outcomes as well as the impact upon these of the intervention, where delivered.

COST-BENEFIT ANALYSIS

The purpose of the cost-benefit analysis is to evaluate the value of the revised model by calculating the difference in anticipated benefits and costs between the baseline case of the existing treatment pathway vs. adopting the revised model over the course of 5 years, from the NHS perspective (incorporating health and social outcomes). The final output will return a cost-benefit ratio reflecting the potential saving against every £1 invested

3 Introduction

3.1 Project Overview

Stroke is one of the leading causes of mortality in England, estimated as the third biggest killer of women (7% of all deaths) and the fifth biggest killer of men (5.4%) as of 2016 (Public Health England, 2018). There are over 100,000 strokes in the United Kingdom each year and this number is expected to rise to over 180,000 by 2035 (Stroke Association, 2017). With reforms being made to acute care pathways across the country, mortality rates are estimated to have dropped by up to 28% between 1999 and 2008, with around two-thirds of patients now believed to survive their stroke (SECN, 2017). Half of these, however, are left with long-term disability and are dependent on the care of others.

The Stroke Association (2017) estimates that the number of stroke survivors will rise from around 950,000 in 2015, to over 2.1 million in 2035, with stroke-related costs to the NHS set to treble during this timeframe. This growing number of stroke survivors is expected to lead to a significant increase in social and unpaid care costs, from £18.2billion in 2015 to £54.4billion in 2035. With costs set to spiral, the NHS Long Term Plan calls for the development and

implementation of higher intensity rehabilitation models to prevent the onset of debilitating long-term conditions commonly associated with stroke (NHS, 2019).

3.2 Spasticity

A stroke can be summarised as a 'brain attack' where, as the result of a blood clot (known as an ischaemic stroke) or burst blood vessel (haemorrhagic stroke), part of the brain is starved of blood and oxygen, killing brain cells and impeding neurological function (Stroke Association, 2018). Long after the original event has been treated, patients may suffer from a combination of potentially disabling complications such as paresis, impaired motor control, dysphagia and spasticity. The variety of complications, and how they present in individual patients, creates a challenge for clinicians to effectively balance treatments without aggravating conflicting conditions.

According to clinical guidance from the Royal College of Physicians (RCP, 2018), the term 'spasticity' is used to refer to the physiological effects of damage to nerve cells that control muscle activity in the brain and spinal cord. Lesions resulting from the damage lead to involuntary muscle contraction that, if untreated, can restrict the patient's range of movement and ability to function. Over the long-term, this can lead to abnormal limb posture and soft tissue shortening.

Spasticity presents a challenge, as its symptoms can often directly impact other complications. For example, an overactive muscle directly conflicting with local muscle weakness resulting from hemiparesis, or limited range of movement inhibiting efforts to improve motor control. As a result, spasticity management is a complex process that requires expert consultancy to help manage the patient's needs, without inadvertently impeding their overall quality of life. The process should be tailored to the individual needs and goals of the patient.

A further challenge associated with spasticity is the variety of ways it can present in a patient. Spasticity can affect several muscles groups; some patients suffering mainly through the upper limbs, whilst others experience the effects mainly through the lower extremities, or a mixture of both. Whilst RCP have stated that spasticity is estimated to effect approximately one-third of stroke survivors, prevalence estimates also vary greatly, which may partially be explained by the variation in the emergence of spasticity following a stroke.

Wissel et al. (2013) claims that prevalence estimates range from 4 - 42.6%, with 'disabling spasticity' affecting 2-13% of survivors. The timing of assessment seems to have a major effect on results, with 4-27% prevalence being recorded one to four weeks post-stroke, compared to 19-26.7% in the first three months, or 17%-42.6% when the patient has been assessed over three months after their stroke. Spasticity management services must therefore be robust enough to support patients whether they have been referred during the inpatient phase of their stroke recovery, or long after they have been discharged back into the community.

Early discussions by a Spasticity Task and Finish group, facilitated by SECN, identified concerns that existing spasticity management services did not effectively meet the needs of the post-stroke population across the region. Inequality of access to clinical rehabilitation expertise meant that many patients faced a significant variation in terms of the treatment they were likely to receive. Without proper management, spasticity may develop into contracture and disability, requiring costly referrals to out of area services or even expensive surgical interventions.

3.3 Further complications

Whilst patients may be referred to spasticity management services at varying points in their post-stroke rehabilitation, they may also be referred with varying degrees of severity. As spasticity often starts as a relatively subtle condition, it can often depend on the expertise of the therapist or primary carer as to whether symptoms are recognised and appropriate treatment sought at the earliest opportunity. Furthermore, each patient's subjective tolerance of the symptom could delay referral and subsequent treatment.

The symptoms prompting referral can themselves be myriad in nature. Whilst some complications may be apparent to the patient immediately, such as pain or impeded range of movement, these can be conflated with the patient's general stroke recovery, or possibly even the ageing process. Initial treatments may then focus on relieving the symptom, rather than addressing the root cause.

If these symptoms are not successfully attributed to spasticity at an early stage, more advanced complications may emerge that can have long-term significance for the patient's

quality of life. Loss of function and range of movement can directly increase a patient's dependence on their carer for basic hygiene and mobility needs. With contracture affecting an individual's ability to care for themselves, or leading to issues of gait asymmetry, costly sequelae such as falls, or infection can lead to readmissions. These issues can also take their toll on the patient's mental health, affecting self-esteem and social participation, as well as putting pressure on personal relationships.

As the approach to treatment can vary greatly depending on the services and expertise available in the patient's area, referrals into specialised spasticity services vary greatly in terms of severity and complexity. Balancing the treatment of patients with severe complications, with the need to prevent deterioration in others, puts additional strain on services in place. Without formal stratification of patients, referrals usually flow through the same channels meaning that, in some areas, specialists may find themselves treating simple cases, whilst complex cases elsewhere are left to manage their condition without the best clinical guidance.

The following table indicates the range of complications patients may encounter, compiled through discussion with consultants, whilst drawing on RCP clinical guidance (2018):

Table 1: Potential complications of Spasticity and associated treatment options

Complication	Treatment
Pain	Medication ▪ Analgesics ▪ General Anti-Spasticity Drugs - Gabapentin - Pregabalin - Marcain
Long-term Impairment ▪ Muscle Shortening ▪ Abnormal Posture	Therapy and Physical Support ▪ Physical Therapy ▪ Occupational Therapy ▪ Orthotics ▪ Casting ▪ Seating Management

	Medication ▪ Botulinum Neurotoxin (BoNT) - Dysport - Botox - Xeomin ▪ Phenol ▪ Oral Anti-Spasticity Drugs - Baclofen - Tizanidine - Dantrolene - Diazepam - Gabapentin - Pregabalin ▪ Intrathecal Baclofen (ITB) Surgical Intervention
Loss of Function ▪ Impeded Personal Care ▪ Loss of Mobility	Additional Care to help maintain personal hygiene ▪ Inpatient care ▪ Outpatient care ▪ Informal Care Physical support ▪ Orthotics ▪ Wheelchairs Functional Electrical Stimulation (FES)
Psychological Impact ▪ Mental Health ▪ Low Mood ▪ Strain on Relationships ▪ Self-Esteem ▪ Independence ▪ Ability to Work	Therapy Additional Care and Support
Dependence on Care	Formal Care

▪ Hygiene ▪ Infection ▪ Pressure Ulcers	▪ Inpatient care ▪ Outpatient care ▪ Community Services Informal Care ▪ Increased burden on friends & family
Falls	Fracture Treatment ▪ Casting ▪ Splinting ▪ Additional pain management ▪ Mobility Support ▪ Home Hazard Assessments ▪ Adjusted care burden

The broad range of potential complications may present themselves in a multitude of combinations, often leading to or exacerbating one another. The wide range of potential treatment options require expert understanding of the symptoms to apply effectively without aggravating conflicting symptoms. Usually this cannot be covered by a single clinician, requiring a multi-disciplinary approach, as recommended by RCP (2018).

Similarly, different treatments, such as Botulinum Toxin (BoNT), require the appropriate level of expertise to administer. Linking qualified staff with patients across the region that would benefit from BoNT as part of their spasticity management (it is an adjunct and should not be delivered without an accompanying treatment plan – RCP 2018) has formed a focal point for the task and finish group, and for this report.

3.4 Local Context

Using Hospital Episode Statistics (HES) from 2017-2019, Figure 1 illustrates hospital admissions for cases of strokes by Clinical Commissioning Groups (CCG) across the Kent, Surrey and Sussex (KSS) region. The darker blue areas show a high stroke admission per 1,000 population in each CCG. The four units highlighted in the map do not represent the acute stroke units that have received these admissions, but are those currently commissioned

to offer a specialist spasticity service in the KSS region: Bradley Unit, Woking; Donald Wilson Neuro Rehab Centre; Sussex Rehabilitation Centre; and Kent and Canterbury hospital.

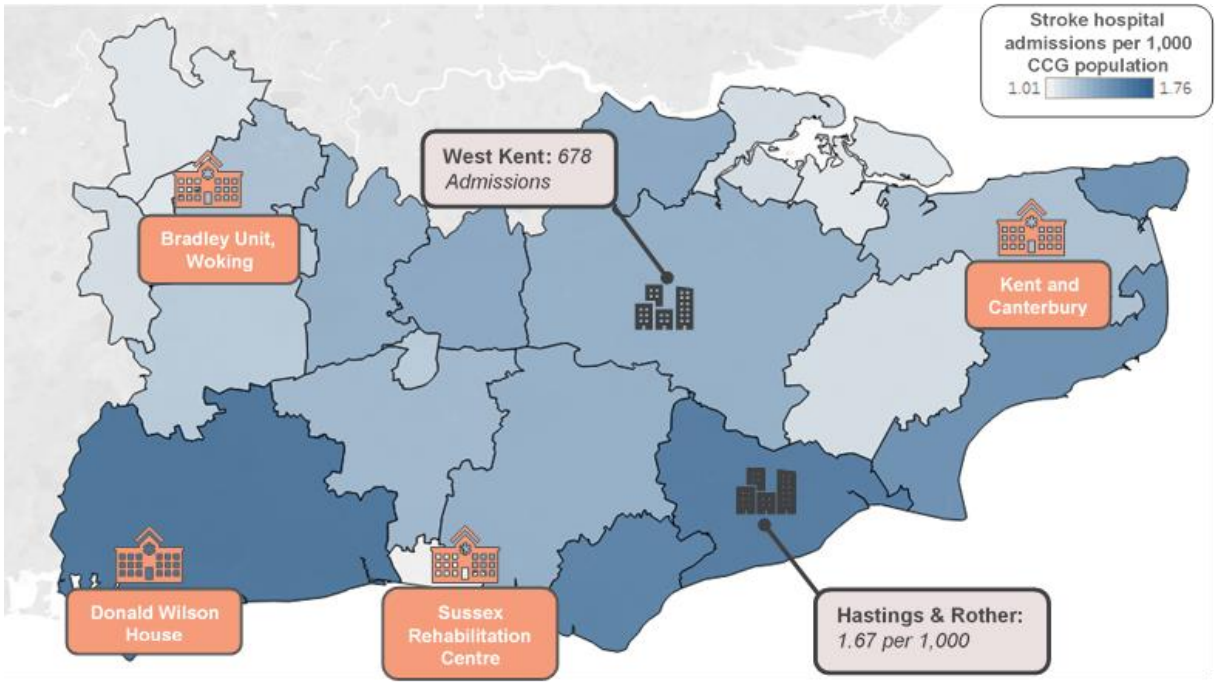


Figure 1: Heat map of stroke incidence across Kent, Surrey and Sussex

The highest areas of stroke admissions occur across the Kent and Sussex coastal areas, which is where there is a higher proportion of older people. Figure 1 highlights the large geographical gap between some CCGs with high proportions of stroke admissions and where specialist care is available. As an example, NHS Hastings and Rother CCG has one of the highest proportions of admissions at 1.67 patients per 1,000 population. It is, however, over 40 miles away from the closest specialist rehabilitation centre. A further example of the challenges faced across the region is that NHS West Kent CCG has the second largest total of stroke admissions for the period (678) but has no local commissioned spasticity service. This can lead to complex cases needing to be referred to external services, often into London, where patients are subject to lengthy waiting times during which their condition may deteriorate. This visual representation of the current situation reiterates the geographical inequality of access to clinical rehabilitation expertise.

It is important to note that the data used for Figure 1 is based on 2018/19 HES data for all CCGs, excluding NHS Eastbourne, Hailsham & Seaford CCG and NHS Hastings & Rother

CCG, for which, due to incomplete 2018/19 data, the 2017/18 HES data has been used. Total population figures have been calculated using the total GP list population per CCG.

Furthermore, it should also be noted that all economic modelling excludes Frimley Health and Care STP. As a bordering region with close ties to services in Surrey in particular, clinicians in the area were engaged to inform research into existing services, but the Health Economic modelling itself focused on the three main organisations within the Kent, Surrey and Sussex clinical network. At the outset of the project these were: Kent and Medway STP, Surrey Heartlands STP and Sussex and East Surrey STP.

During the course of this project regional services have entered a transitional period, with Surrey Heartlands STP becoming Surrey Heartlands ICS, and Sussex and East Surrey STP becoming Sussex Health and Care Partnership. These changes have been announced over the course of the year, during the process of our health economic modelling, as such some of the organisations are listed under their original names, reflecting the populations used during calculations.

3.5 Current Pathway

Through discussion with clinicians across the region over the course of this evaluation, an image of a convoluted and decentralised treatment pathway emerged, as illustrated by Figure 2 below. Regardless of when a patient's spasticity first emerged (in an outpatient, inpatient or community setting), there may be clinical variation in the treatment the patient receives. Some would receive treatment and guidance from specialised spasticity services, but others would be subject to local expertise, either permanently or while waiting for an appointment with a spasticity specialist in another area. Some patients may also not receive treatment targeting their spasticity at all until the condition deteriorates, increasing the risk of costlier interventions being required.

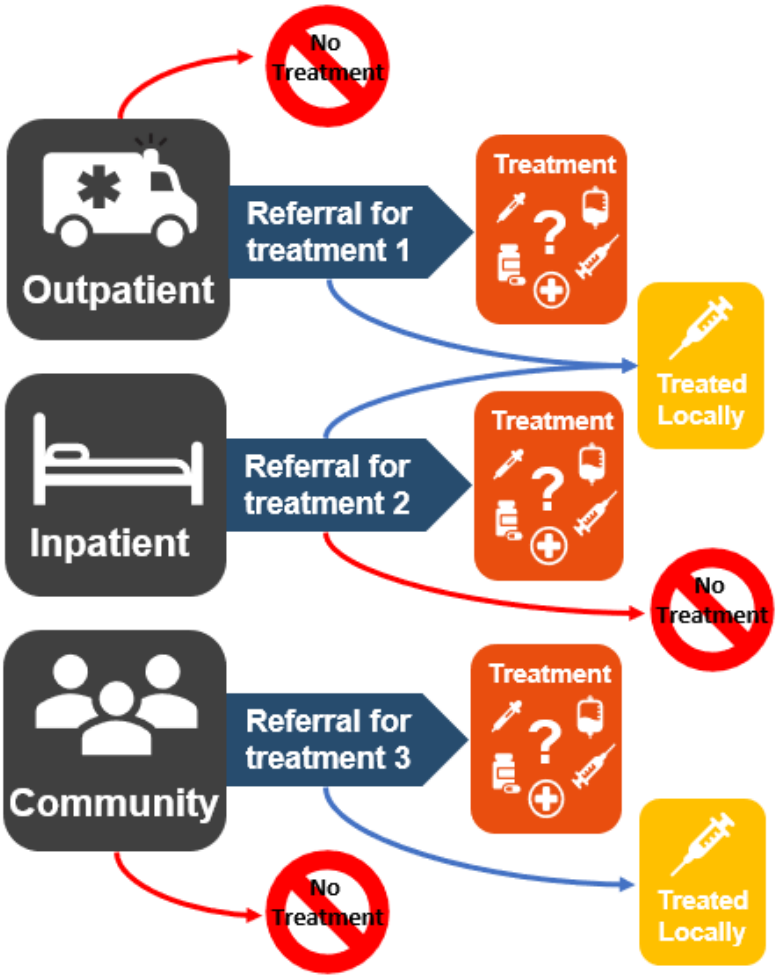


Figure 2: Current Treatment Pathway

According to RCP guidance, "the management of spasticity is complex and requires a multidisciplinary team (MDT) working with the patient and family/carers" (RCP, 2018). Unfortunately, as the emergence and presentation of spasticity varies so greatly, patients may not be referred to a group of clinicians capable of incorporating the perspectives recommended within the guidelines and the full range of treatments an MDT may be equipped to deliver.

There is therefore a risk of unwarranted clinical variation emerging, as patients fall between the gaps of specialised rehabilitation services and do not receive the optimal treatment mix to meet their individual needs. This variation may result in symptoms and aggravating factors

being treated rather than the underlying spasticity, allowing it to develop in severity. Patients may also be treated with inappropriate measures that either cause side-effects or even interfere with the patient achieving their broader rehabilitation goals.

The process presented within Figure 2 also highlights that there are several points of access currently in use for spasticity services, with varying levels of efficiency as they each rely on clinicians' own knowledge of the pathway. This is partially a result of the variation in how the condition may initially present, but also reflects the nature of how the process has developed through necessity rather than design. One of the key challenges targeted by the proposed service model is to remove this source of variation by providing a single point of access in the form of a centralised triage and governance function.

With services across the region currently operating independently of each other, different approaches have developed, with pockets of the patient population receiving different levels of care. A lack of central governance and data collection not only makes it difficult to know the true size of the local spasticity population, but also difficult to check that best practice is being followed.

As mentioned, specialised spasticity services in place across the region have developed as a result of the available expertise, rather than as part of a co-ordinated strategy and, as a result, do not cover the entirety of Kent, Surrey and Sussex. Patients that fall between the gaps, and whose spasticity is severe enough to warrant referral, may be referred to an external service, often based in London. These referrals subject patients to lengthy waiting lists and additional travel costs, which are sometimes paid for by the referring CCG.

SUSSEX

Services across the Sussex area mainly revolve around the Sussex Rehabilitation Centre (SRC) in Brighton. Accepting referrals from around Sussex, SRC operates under a Block contract to provide rehabilitation and spasticity management outpatient services. There are currently two rehabilitation medicine consultants (RMCs) in place, supporting a weekly spasticity MDT clinic in addition to a monthly spasticity clinic.

SRC accepts the majority of referrals from across Sussex, with the exception of the Western part of the county, which is often supported by the specialist neurological rehabilitation service at Donald Wilson Neuro Rehab Centre (DWNRC), within St Richard's hospital in Chichester.

DWNRC provides a monthly MDT clinic to assess spasticity treatments for patients. Following the establishment of the clinic, demand is reported to have grown, mainly by word of mouth, with referrals coming from as far as Lancing and Midhurst. DWNRC has an RMC in place, as well as an BoNT prescriber and injector.

As shown in Figure 1, coastal Sussex has some of the highest levels of stroke incidence per person in the region, but also has some of the more established services in place to handle it. In addition to SRC and DWNRC, the Irvine Unit in Bexhill-on-Sea provides inpatient stroke rehabilitation with a qualified non-medical injector and prescriber in-house, who also supports ad hoc inpatient rehabilitation support at Eastbourne District General Hospital where patients are not fit to travel to an external clinic.

Despite having some of the more established services in the area, some outpatients with spasticity needs may still be subjected to lengthy journeys to access specialist services. This is clearest in East Sussex areas, such as Rye, where patients would need to travel over an hour to reach SRC, their closest specialist service.

KENT

Services in Kent are primarily focused around East Kent Hospitals University NHS Foundation Trust, which supports spasticity management referrals across hospitals associated with the Trust, as well as some community-based services within the area. Based primarily in Canterbury, where the local RMC is based, clinics are conducted on a weekly basis to manage patients across Ashford, Margate, Dover, Whitstable and Folkestone. BoNT treatment is administered, where required, by the RMC, ensuring concomitant therapy measures are in place to yield maximum benefit for the patient. Before the referral is accepted and scheduled as part of an upcoming clinic, the service is co-ordinated through a triage process. This captures the nature of the spasticity, alongside the therapy and treatment measures already being undertaken.

Whilst a large portion of East Kent has expertise in place, the western and northern parts of the county do not have direct access to the same level of expertise. Without specialist spasticity management services between Dartford and Tunbridge Wells, patients with complex requirements are currently referred into London-based services, such as King's College Hospital, or the National Hospital for Neurology and Neurosurgery, Queen Square.

Conversations between the task and finish team and local physiotherapists have highlighted that some staff in this area are trained, or undergoing training, to deliver BoNT but do not hold specific spasticity expertise and therefore would not be able to devise full treatment plans for patients in need without further consultation.

SURREY

The Bradley Neurorehabilitation Unit based in Woking, under Ashford and St Peter's Hospitals NHS Foundation Trust provides the focus for services in Surrey. With an RMC and multidisciplinary team in place to support patient assessment and management, this inpatient service is commissioned to support adults with acquired brain injury and complex neurological conditions. Whilst the Unit provides a holistic service, including BoNT capability, physiotherapists, occupational therapists and clinical psychologists, the inpatient service is relatively small, and concerns were raised regarding the team's capacity to support a larger workload.

Further to the inpatient service, Ashford and St Peter's Hospitals NHS Foundation Trust also utilise the medical team's expertise to operate regular outpatient clinics to assess patient needs and oversee their continued medical care.

Whilst the Bradley Unit operates as a focal point for services in the Central Surrey area, East Surrey patients do not benefit from the same access to expertise. Instead, similarly to West Kent, patients are often referred out of area when their condition deteriorates beyond the capabilities of the local service. Some patients remain within Surrey as there are trained non-medical injectors and prescribers within community services in the area, who can help deliver treatment to patients with a treatment plan in place, but others are subject to referrals to London-based services.

In the more southerly portion of the county, including Guildford, patients are likely to be referred to the Neurology department based in Frimley Park Hospital. The service includes Neurorehabilitation capability and primarily offers outpatient services. Patients with inpatient requirements are likely to be referred on to St George's Hospital in Tooting instead.

3.6 Proposed Changes

As detailed in the previous section, each county has concentrated pockets of expertise, capable of providing well-rounded spasticity management services. They are not, however, able to reach all patients in the area. This variation in access to treatment feeds a corresponding variation in how spasticity is treated across the region. The challenge has been

to identify a solution that will ensure that patients receive the care that they need, without overwhelming the resources that already exist.

Through the Spasticity Task and Finish group, facilitated by SECN, a Hub and Spoke approach was proposed, aiming to co-ordinate services through a centralised triage process. Following referral, patients would be stratified according to the complexity of their needs, and would then be assessed and receive effective treatment either through the central Hub, or a number of nominated Spoke services, which will usually consist of qualified therapists operating across the region.

This approach, illustrated by Figure 3 (below) in contrast to Figure 2 in section 3.5, is intended to ensure that all spasticity referrals are assessed centrally, ensuring that patients have access to RMC expertise regardless of their physical location. This centralisation is intended to allow complex and technical cases to be prioritised by the Hub services, while patients with milder or simpler needs can be treated as soon as possible by nearby health professionals operating under a Spoke service. This approach is intended to reduce the risk of the condition deteriorating while helping patients manage their overall rehabilitation goals.

Figure 3: Revised Treatment Pathway

While Figure 3 highlights the aim to streamline access to spasticity services through a centralised triage function, a more detailed view of the function itself is required to understand how the proposed system would operate. While primarily sited within a Hub, providing a settled base for data collection and governance, the project team envisage that the triage process would be supported through a combination of Hub and Spoke clinical staff, in addition to administrators. The process itself, illustrated below in Figure 4, is expected to provide a gateway through which cases can be passed and assessed between Hub and Spoke. This approach is hoped to encourage learning to be shared while benefitting from multidisciplinary expertise and engaging with orthotic and therapy teams, as required.

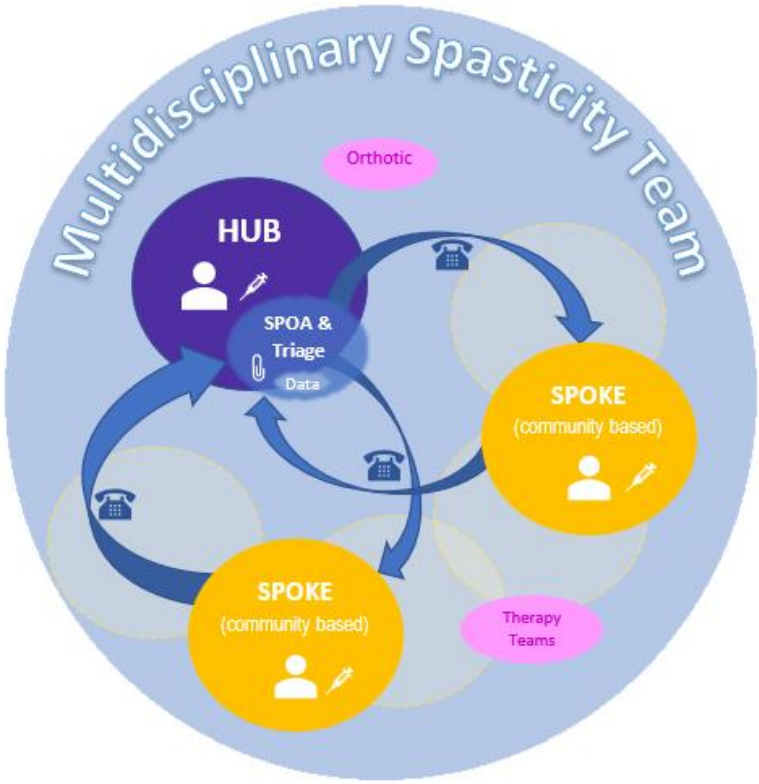


Figure 4: Triage Function

This proposed model was originally intended to yield several benefits for the healthcare system and patient population, such as:

- Increasing access to high-cost adjunct treatments, such as BoNT.
- More effective communication between services.
- Standardisation of spasticity measurement and documentation, improving governance standards across region.
- Sustainable job planning framework, reducing sole service reliance on individual experts.
- Reduction in waiting times where patients are currently subject to referrals into London-based clinics for specialised spasticity management services.
- Improved patient outcomes in terms of reducing the distance patients need to travel for an appointment and stratifying caseloads to provide an effective, co-ordinated approach to support patients' rehabilitation efforts.

DEVELOPMENT OF THE HUB AND SPOKE APPROACH

Over the course of this project, KSS AHSN has worked with members of the Task and Finish group to help define and develop the proposed delivery model. Multiple approaches were used to help inform the development of the delivery model, including:

- A mapping of potential complications and their respective treatment options, which helped KSS AHSN to understand the complexity of existing pathways.
- Clinician feedback from across the region, collected by KSS AHSN and the Task and Finish team, which yielded the following key findings (amongst others):
    - Reliance on Individual Funding Requests to cover costs of treatment.
    - Patients referred to services outside of their own STP to arrange for treatment, where treatments (and the expertise required to deliver them) are unavailable.
    - Testimonials of the cost of failure (examples of multiple referrals to surgery).
- A cross-functional flowchart depicting the theoretical Patient Journey, which was used to illustrate the process and involved and the associated roles within a proposed Hub and Spoke approach (see Appendix 2).

Taking into consideration this initial research, members of the Task and Finish group defined a Governance Framework, with an overview shown in Figure 5 below, and further developed the referral process. The outcomes of this process were then presented to a wider Clinical

Advisory Group in November 2019. The framework provided details of the referral form and process, the roles of the Hub and Spoke and expected workforce competencies.

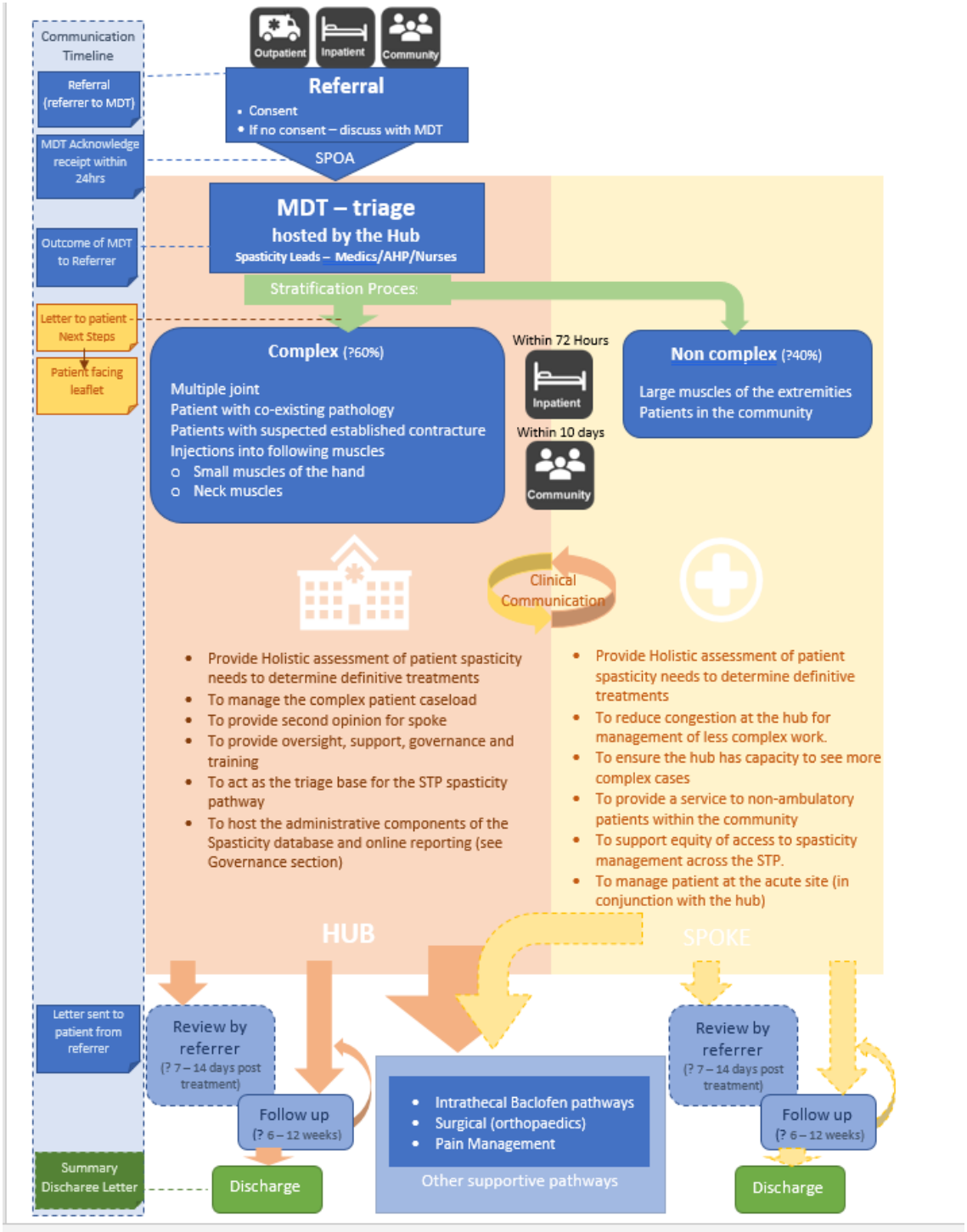


Figure 5: Governance Flow Chart

PROPOSED HUB

Under the proposed model, a Hub is defined as a specialised rehabilitation centre, providing holistic assessment of patient spasticity needs to determine definitive treatments. Expectation to manage complex cases from around the region, while supporting Spokes by providing oversight or a second opinion when necessary. On-site access to a broad range of spasticity management services and established connections for onward referral. As the Hubs are situated in specialist rehabilitation centres, they should be led by a Rehabilitation Medicine Consultant in alignment with British Society of Rehabilitation Medicine service standards (BSRM, 2015).

The Hub is also anticipated to provide a central location for patient triage and data capture. While the full triage methodology is yet to be fully agreed, it is expected that the full spasticity team (including clinicians from both the Hub and Spoke) would be included in the process. The Hub would act as the host to ensure the process remains centralised and consistent, with access to consultant expertise where required, while feeding data directly into a streamlined governance process.

Patient Cohort:

- Complex spasticity needs:
    - Multi-focal or generalised spasticity
    - Co-morbidities
    - Contraindications for treatment
    - Deterioration and contracture
    - Technically challenging treatment (i.e. small muscles of the hand or neck muscles)
- Failure of previous attempts to address spasticity
- Generally able to travel to Hub

PROPOSED SPOKE

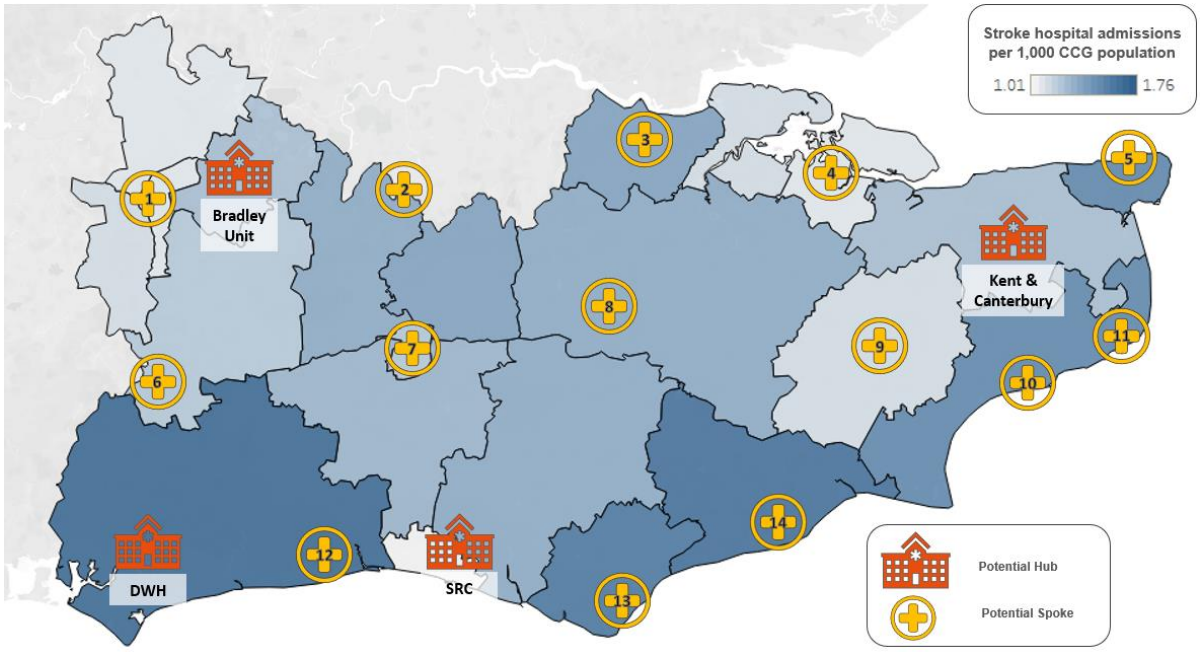
Clinicians trained in neurological rehabilitation or spasticity management, providing a flexible resource to support equity of access to spasticity management across the area. Allied Health Professionals working onsite and in local area to assess, agree and deliver treatment to help

prevent deterioration and achieve specific goals. Expectation to support treatment of non-ambulatory patients that may not be able to attend a Hub outpatient clinic.

Patient Cohort:

- Simple spasticity needs
  - Early onset of spasticity (within 3 months)
  - Focal presentation
  - Few co-morbidities
  - No contraindications
- Follow-up therapy available
- Including support, assessment and treatment of patients in bedded care

Although Spoke sites for rehabilitation services have not been formally agreed, there are many potential sites spread across Kent, Surrey and Sussex. Figure 6 illustrates some of these, although it is not an exhaustive list, with several sites that have not yet been fully explored.



1. Frimley Park Hospital
2. The Poplars, Epsom
8. Tunbridge Wells Hospital
9. William Harvey Hospital

3. Gravesham Community Hospital
4. Medway Maritime Hospital
5. Queen Elizabeth, The Queen Mother Hospital
6. Holy Cross Hospital
7. Crawley Hospital
10. Royal Victoria Hospital
11. Buckland Hospital
12. Worthing Hospital
13. Eastbourne DGH
14. Irvine Unit, Bexhill

Figure 6: Existing services seeking to address spasticity

CHALLENGES AND RISKS

Through the development of the proposed service model, a number of potential risks were raised, along with challenges that will need to be resolved in order for a successful implementation, such as:

- Agreeing and securing funding for the proposed model and treatments delivered under the model. As each Hub and related Spokes would cover a large catchment area, patients would be referred from a broad range of commissioning areas, some of which may not usually fund high-cost treatments. This may present a logistical challenge to ensure a fully funded, seamless patient experience.
- Similarly, challenges have been raised in terms of addressing the lines of responsibility where patients are receiving the bulk of their treatment in one area but are supported in doing so by a service in another part of the region. This raises potential risks relating to complaint ownership, legal liability and prescription of drugs and medication.
- As presentation of spasticity varies greatly from patient to patient, spasticity management models must be flexible in nature to respond to patient needs. Whilst this is a challenge that the proposed model has been designed to address, it remains an important point to note that systems will need to be adaptable to changing demands and services compositions in order to remain sustainable.
- Some patients may be unable to attend outpatient clinics and services may need to adapt to resolve logistical challenges to provide the appropriate level of expertise and assess their needs (i.e. with Spoke staff attending the patients and consulting with the Hub beyond the standard referral process).

- Despite the existence of lengthy guidelines (RCP) for the delivery of BoNT, research into the most effective delivery and treatment is still emergent and rapidly developing. Ongoing studies such as BEST and ULIS are developing measures to effectively capture spasticity data, with outcomes still being published. The model would need to adapt to important findings without jeopardising the fundamental aims of the proposal.
- The lack of spasticity specific data has meant unbundling the pathway to understand the issue has been a significant challenge, leading to reliance on assumptions in the economic modelling. The proposed service model may uncover hidden cohorts of spasticity patients, raising demand beyond the anticipated numbers. The service will need to be overseen to ensure that such risks do not impact the quality of care available to patients.

4 Health Economic Analysis Methodology

A health economic analysis has been conducted to assess, from the healthcare system's perspective, the impact of the proposed delivery model, relative to the current state of services within the region. The analysis aims to assess the current uptake of botulinum toxin treatment across the region and how this may change with the proposed model, in addition to the impact this may have in achieving related rehabilitation goals and a reduction in the long-term effects and costs related to spasticity.

The analysis may also support the final design of the proposed delivery model, with a greater understanding of the potential costs and benefits informing the number of Hubs and Spokes required to effectively serve the network. To support this, the assessment has considered multiple scenarios, reflecting the roll out of multiple Hubs serving individual STPs, ICSs or counties.

4.1 Perspective

A health economic model can provide answers to multiple stakeholders as described in Table 2.

Table 2: Perspectives of key stakeholders towards a health economic and qualitative evaluation

Relevant Stakeholder	Purpose of the Health Economic Model
Commissioners	▪ Can be used to show current resources and costs required for the service. ▪ Demonstrates wider social and economic benefits, rather than just cost savings. ▪ Helps illustrate options for service configuration, highlighting areas which can be targeted to improve the local infrastructure. ▪ Provides a broader understanding of the post-stroke spasticity population and the impact of not having a consistent, joined-up service upon it. ▪ Can provide some guidance for future commissioning and funding decisions.
Providers	▪ Helps to demonstrate where current service provision may lead to additional expense at a later date. ▪ Provides an understanding of where the individual services fit into the broader spasticity pathway. ▪ Can provide evidence to highlight the potential time savings of a co-ordinated effort to prevent spasticity from deteriorating.
NHS Workforce	▪ Furthers understanding of the risks and issues present within the existing pathway. ▪ Provides evidence of the benefit of having a defined support structure in place. ▪ Can help illustrate the benefit of using expertise within the region to support complex cases.
Patients / Citizens	▪ Highlights the potential release of pressure upon care-workers that preventing deterioration may bring. ▪ Helps quantify the potential improvement in quality of life that patients could enjoy through a holistic rehabilitation programme, both in terms

	of preventing deterioration and improving the patient experience through a more responsive and co-ordinated service.

4.2 General Approach and Sources

This study deploys a tried and tested approach to compute the cost-benefit model. For each outcome stream identified, data is needed to determine inputs for the model. The input data required include:

- Hospital Episode Statistics, informing estimated stroke incidence and mortality across Kent, Surrey and Sussex. This data has, primarily, informed our estimation of the population that would likely benefit from the revised service model (see section 5.2 for a full description of the calculations).
- Aggregated service data provided by Sussex Rehabilitation Centre and Donald Wilson Neuro Rehab Centre, including the number of patients attending clinics throughout 2018/19, the number of patients injected with BoNT and the dosage administered.
- Scientific research papers and guidance documents relating to the treatment of spasticity and the efficacy of BoNT in particular, these are detailed in section 5.4.
- Expert insight from clinicians throughout the region, including staff from:
    - Sussex Rehabilitation Centre
    - Donald Wilson Neuro Rehab Centre
    - Irvine Unit, Bexhill Hospital
    - Kent and Canterbury Hospital
    - Other members of the SECN Spasticity Task and Finish Group and Stroke Clinical Advisory Group

This health economic analysis is assessed in line with the standard HM Treasury guidance. This guidance, as outlined in the 'The Green Book' (HM Treasury, 2016), applies throughout the public sector to ensure consistent estimation of costs and benefits in cost-benefit appraisals. In recent years, this has been supplemented by several departmental or sectorial 'supplementary guidance' documents. This evaluation attempts to retain consistency with this

landscape, except where the supplementary guidance documents contradict each other. In such cases, the study takes a 'first principles' approach to identifying an appropriate methodology based on economic fundamentals.

The supplementary guidance documents of most relevance are:

- Public Service Transformation (HM Treasury, 2018)
- Risk (HM Treasury, 2018)
- Policy appraisal and Health (Department of Health, 2004)
- Spasticity in adults: management using botulinum toxin (RCP, 2018)

In addition to the framework described above, HM Government has sought to enable quicker and more efficient delivery of cost-benefit appraisals, particularly by local government. This has been achieved through the funding and development of two sets of standardised unit cost databases, from which data will be sought as standard. These are:

- PSSRU's 'Unit Costs of Health and Social Care 2010 - 2018' (PSSRU, 2019)
- New Economy 'Unit Cost Database' (2015), which divides costs into financial costs and economic costs. These terms broadly equate to 'public sector delivery costs' and 'all other socio-economic costs' (New Economy, 2015)

These sources present an efficient but effective mechanism for identifying values for many costs and outcome benefits. They are broadly consistent with one another but where they are not, the original source data has been sought where possible to identify the most relevant data.

4.3 Choice of Analysis and Methodology:

4.3.1 DECISION TREE

Decision tree analysis in healthcare can be applied when choices or outcomes of treatment are uncertain, and when such choices and outcomes are significant.

Due to the complexities of the current stroke care pathway, a decision tree approach was applied in order to illustrate the various patients' journeys along the pathway. This provides insight into how patients will receive treatment under the proposed model and the costs associated with each branching path. In doing this, it has helped shape both the benefit and

cost streams associated with the proposed pathway, which are used in developing the cost-benefit model for the analysis.

The structure of a decision tree can be seen in Figure 7 below:

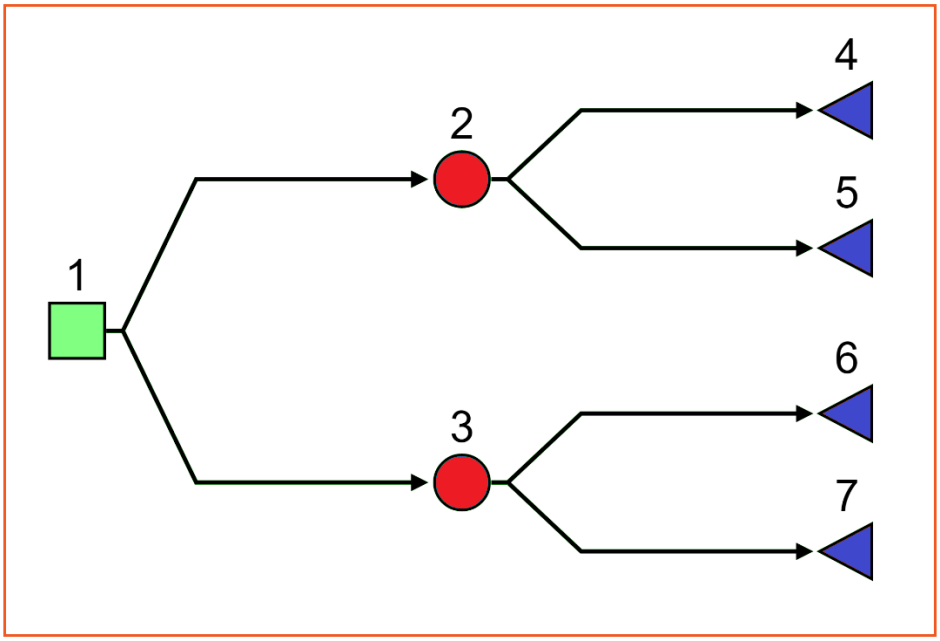


Figure 7: Decision Tree Structure

Each node represents either a **decision**, **uncertainty** (external event) or **outcome**. Below shows the context of each for the Stroke pathway:

Represents a **decision** made by either a health professional or the patient**,** such as whether to have repeat treatment or not.

Shows an event that is **uncertain,** such as whether muscle weakness is developed following widespread spasticity

The **outcome** following the decisions made and the external uncertain events. This is usually a cost to the healthcare system, or a patient quality of life outcome measure.

4.3.2 COST-BENEFIT ANALYSIS

The aim of a cost-benefit analysis, which follows a similar approach to a cost-effectiveness analysis, lies in determining if the economic value of an intervention can justify its cost by comparing the cost of two or more alternatives and reviewing the return on investment. Savings are estimated from the healthcare system's perspective and the effects of an intervention on all costs should be considered (i.e. direct cost, effect on health expenditures, social and health outcomes to the patient). Costs and benefits ought to be discounted to reflect the lower economic value of an expense, accounting for the time value of money, as well as the higher value of a benefit that is realised earlier (HERC, 2019).

APPROACH AND STRUCTURING OF OUTCOMES

To turn outcomes into a financial benefit, each stream had to be monetised. There are two broad benefit categories relevant to the cost-benefit analysis: NHS cash and non-cash releasing benefits.

How these benefits are realised depends on the *cash ability* of the saving. Cash ability refers to the way a change in an outcome will result in a reduction of fiscal expenditure. The ability to cash depends on the type of benefit, scale, timing and the leadership in place to realise the savings. This report takes a prudent approach to identifying benefits and separates the fiscal savings into the following benefit streams:

- ***NHS related cash releasing benefits:*** These benefits produce immediate cashable savings to the provider; an example of this benefit would be a direct reduction in procurement costs such as, in the case of a manufactured product, lower material costs.
- ***NHS related non-cash releasing benefits:*** These benefits are important to reducing demand and strain on services, but a fiscal value cannot be realised without decommissioning of services. Benefits which can be described as non-cash releasing include the generation of time savings for staff that allows staff to either improve the quality of their activity or carry out alternative activities.
- ***Social benefits*****:** The overall benefit to the public, including, but not limited to, employment related benefits, such as fewer sick days and improved health and wellbeing. A key element of understanding these benefits is the approach the model takes in calculating quality of life changes. Quality of life related benefits use a Quality

Adjusted Life Year (QALY) calculation. The basic construction of a QALY valuation for a particular health state is the number of years of life spent in that state multiplied by a health state utility-based weighting (cf. Williams, 1985). So, for example, a health state which lasts 10 years and is valued at 0.9 in terms of health state utility would give 9 QALYs. The QALY provides a single index allowing a measurement of the effects of health interventions on mortality and morbidity.

This QALY is then given a financial value using the willingness to pay threshold value used by NICE on behalf of the NHS. NICE methods guides refer to a threshold of £20 000-£30 000 per QALY. A sensitivity range is used to reflect the range within which this threshold is applied, with the lower value (£20,000) taken as the modal value.

- ***Other benefits*:** It is important to acknowledge other benefits that might not have an accurate value and may be attributed through qualitative review, e.g. staff experience or patient experience.

BENEFIT STREAM

For each outcome, data is needed to determine inputs for the model. The input data required are:

- Total population in the project area, *e.g. KSS Population*
- Target population, i.e. the population at risk, *e.g. derived from stroke incidence across KSS Population.*
- Level of engagement with the target population, e.g. those who develop spasticity and are eligible to have treatment.
- Scale of impact in changing the outcome (percentage success at achieving the desired outcomes), e.g. percentage reduction of patients developing infection due to PSS and therefore reduction in treatment costs.

This process takes a standard approach of calculating the number receiving the treatment, multiplied by the net benefit or impact per person, to give a total net benefit for the relevant benefit stream, over and above the counterfactual.

Figure 8 below shows the calculation used for the total net present benefits.

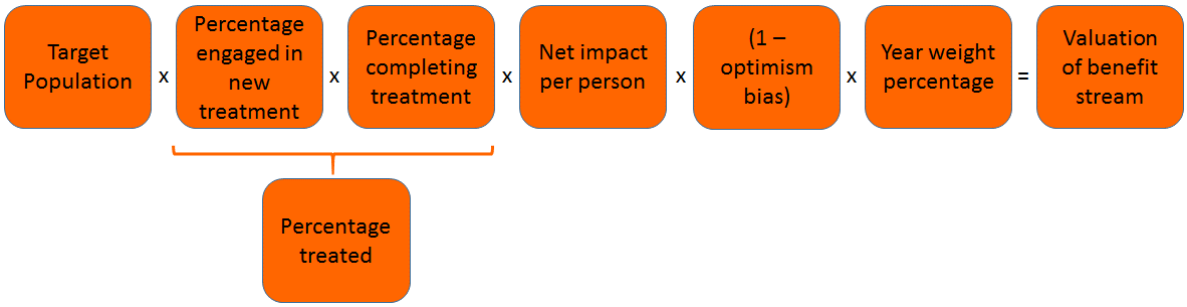


Figure 8: Calculation of total net present benefits

OPTIMISM BIAS

When the data and evidence upon which the cost effectiveness model is based are uneven, old or incomplete, a certain factor needs to be applied to correct for these. Therefore, the model applies optimism bias correction factors in response to the level of uncertainty in the data or assumptions used. The optimism bias approach used is based on the confidence grade definitions shown in Table 3.

Table 3: Optimism bias correction grading

Confidence grade	Colour coding in model	Data Source	Age of data	Known data error	Optimism bias correction
1		Formal service delivery contract costs Figures derived from local stats / RCT trials	1-2 years old	+/- 5%	5%
2		Practitioner monitored costs Figures based on national analysis in similar areas	2-3 years old	+/- 10%	10%
3		Costs developed from ready reckoners Figures based on generic national analysis	3-4 years old	+/- 15	15%
4		Costs from similar interventions elsewhere Figures based on international analysis	4-5 years old	+/-20%	25%
5		Cost from uncorroborated expert judgement Benefit from uncorroborated expert judgement	>5 years old	+-25%	40%

The confidence grade which the cost benefit analysis model applies to the data is determined by the lowest assessment in any of the descriptive columns. The optimism bias correction factor for the data is then determined, based on the lowest confidence grade found in relation to each individual outcome and costs are increased by the corresponding percentage factor (shown in Table 3).

This calculation is applied to all benefit streams realised by the programme and summarised to show the full benefit potential from a financial and economic perspective.

YEAR WEIGHT PERCENTAGE

Financial and economic weightings are applied to benefits to show how inflationary and economic pressures effect the value of benefit streams over time. For the in-year calculations, only inflationary pressures are applied to show effects in nominal terms, however for the NPV, a discount rate is applied to deflate the benefit to real terms to reflect the changing value of healthcare within GDP. A rate of 3.5% is applied to all benefits, other than those derived from QALYs gained, to which a rate of 1.5% is applied. The Green Book contains further details (HM Treasury, 2018).

This calculation is applied to all benefit streams realised by the programme and summarised to show the full benefit potential from a financial and economic perspective.

4.3.3 OUTPUT

NHS AND GROSS BENEFIT

The NHS monetary difference represents the difference between the monetary cash and non-cash benefits and the costs incurred from the intervention. Total Gross benefit represents the full economic impact and therefore includes social benefits.

$$\boldsymbol{NHS\ Benefit = Benefits\ incl.\ NHS\ cash\ and\ noncash\ savings}$$

$$\boldsymbol{Total\ Gross\ Benefit = Benefits\ incl.\ NHS\ cash\ and\ noncash\ savings + social\ benefits}$$

BENEFIT-COST RATIO

The benefit-cost ratio is a measure of benefits against costs and shows the return on investment. This can indicate the scale of investment and return based on the intervention's impact. This figure shows a measure of efficiency and good investment based on the overall return; £X return for every £1 invested. The calculation can be applied for both NHS benefits and total gross benefits to show the wider economic impact the intervention may have.

$$Benefit\ Cost\ ratio = \frac{Net\ Benefit\ Value}{Costs}$$

4.3.4 SENSITIVITY ANALYSIS

Monte Carlo analysis is a modelling technique which simulates the impact of the expected variance in key variables on the output of interest, in this case the net present value. The approach is best described using an example.

***Step One: Allocation of ranges**:*

Variables of interest are given base-case values (or mean estimates), and an expected range. In the example below we look at quality of life adjustment factor and expected life expectancy:

Table 4: Example of sensitivity range allocation

Variable	Lower range estimate	Base-case / mean estimate	Upper range estimate
Quality of life adjustment factor	0.420	0.565	0.710
Life expectancy (years)	4.73	6.30	7.88

Step Two: Allocation of a distribution shape

All data has a shape to its distribution. If there is equal likelihood of any value within a range being drawn, then a rectangular distribution can be used (so called because a graph of the probability of any specific value being drawn would appear to be a rectangle). If there is a lower likelihood of a value at the extreme ends of the range being drawn, then a triangular distribution could be used.

If there is reason to believe the distribution meets the statistical qualities required to be defined as normal, Poisson, etc, then these can be applied. In this evaluation, triangular distributions have generally applied as this best reflects the ranges used and diminishing probabilities of more extreme ends. Where a different distribution has been used, it is expressly noted in the text.

Step Three: Random selection of values within the range

The model selects at random a value for each variable from within the range between the upper and lower estimate and calculates the outcome from each draw, considering the distribution shape selected and therefore the probability of any particular value being drawn.

Step Four: Repetition

Table 5: Example of random variation within Monte Carlo simulation

Variable	Draw 1	Draw 2	Draw 3	Draw 4	Draw 5
Quality of life adjustment factor	0.45	0.50	0.55	0.60	0.75
Life expectancy (years)	4.5	5.0	5.5	6.0	7.5
Quality of Life Year monetary value	£20,000	£20,000	£20,000	£20,000	£20,000
Benefit (lives saved x value of lives saved)	£40,500	£50,000	£60,500	£72,000	£112,500

Five draws are given above, using a rectangular distribution. These deliver estimates lying between £40,500 and £112,500. The draw is repeated thousands of times. In this evaluation we use 10,000 runs as standard.

Creating 10,000 estimates allows the creation of a distribution of possible outcomes from the draws made. From this distribution we can then compute the range within which we expect 90% of the observations from the draws to fall. This is called the 90% confidence interval, illustrated in Figure 9.

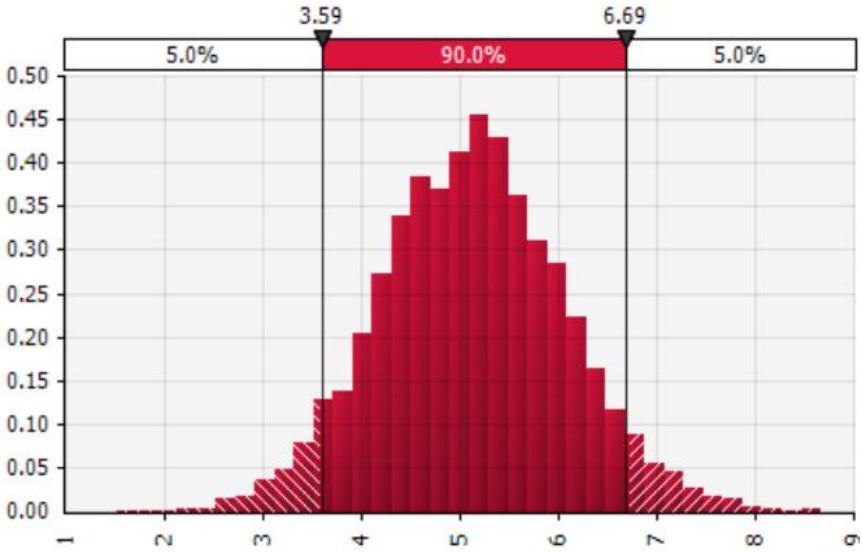


Figure 9: Illustration of sensitivity analysis

In Figure 9 above (used for illustrative purposes only), the 90% confidence interval is from 3.59 to 6.69, which essentially shows that the probability of the outcome resulting between these points is 90%.

4.3.5 MODELLED SCENARIOS

The data available has been deployed to measure the impact of two scenarios:

1) **Scenario 1:** Where each STP within the SECN region has a dedicated Hub, with Spokes (100% at point of inception).
2) **Scenario 2:** Where each STP within the SECN region has a dedicated Hub, with Spokes (Roll out over time from inception – with a delayed realisation of benefits based on how well-established existing services are within the STP).

Further explanation to Scenario 1 and 2 can be seen in section 5.1 Scenario Analysis.

5 Key inputs and outcomes

In order to build an economic model, such as a cost-benefit analysis, a certain number of inputs are required for calculation purposes and to compute the desired outputs. Various inputs are listed below in a structured approach, as used in the model.

5.1 Scenario Analysis

For the purpose of the analysis, two scenarios have been created which assess the identified cost and benefit streams, with distinct assumptions relating to the spread of the proposed service model. In terms of the composition of the model itself, both scenarios have assumed that each STP would have a single Hub, with a varying number of Spoke services to help manage the patient population and ensure geographical coverage. This approach was agreed with the SECN Spasticity Task and Finish group, which met on 23rd January 2019. At the Task and Finish group meeting, attendees were presented with four options to explore:

1. The Status Quo
2. Single Hub for Kent, Surrey and Sussex
3. Single Hub for each County
4. Single Hub for each STP/ICS

Having discussed the options, the group selected option four, which was then incorporated into the scope of the economic modelling.

Following the Task and Finish group in January, KSS AHSN also sought to clarify the geographical footprint of the evaluation and SECN confirmed that Frimley ICS would be out of scope for the modelling. Therefore, both scenarios cover Sussex Health & Care Partnership, Surrey Heartlands ICS and Kent and Medway STP.

SCENARIO 1: 100% BENEFITS FROM INCEPTION

Each STP/ICS within the KSS region has a dedicated Hub, with Spokes (100% at point of inception). This scenario assesses all benefits as though they could be realised on the first day of the new model.

SCENARIO 2: PHASED REALISATION OF BENEFITS

Each STP/ICS within the KSS region has a dedicated Hub, with Spokes, however the service is rolled out gradually using the below percentages (cumulative % per year):

Table 6: Phased implementation by Area

PSS pop per STP	2018/19 H1	2018/19 H2	2019/20 H1	2019/20 H2	2020/21	2021/22	2022/23
Kent and Medway STP	50	70	80	90	100	100	100
Surrey Heartlands STP*	50	70	80	90	100	100	100
Sussex and East Surrey STP*	80	90	100	100	100	100	100

*** As per section 3.4, ICS/STP footprints have since changed.**

The above structure was used to reflect that many of the services and personnel required to form the final service composition do exist but are not connected in any structured way to date. Services within Sussex were felt to be more established in a way that addresses coastal areas of higher stroke incidence, with Donald Wilson Neuro Rehab Centre and Sussex Rehabilitation Centre already linking with sites from Chichester to Hastings to support treatment efforts. Whilst there is potential growth within this service, especially linking with Neurological Consultants further North with the STP, it was felt to be in a better position than Kent and Medway (which does have established services in the East, but is largely reliant on London-bound referrals in the West) and Surrey (which has a few small services, but also relies heavily on out-of-area referrals).

5.2 Population

Both scenarios use the same assumptions regarding the spasticity population, measuring benefits against the incidence of stroke year-on-year across the region. Hospital Episode Statistics (HES) were used to assess the number of strokes occurring across the region between 2014 and 2018, as well as the mortality rate reported by Stroke Units in the area. The ICD-10 codes used to assess these figures are listed in Appendix 1. Stroke incidence was then projected forward over the timeframe of the evaluation, rising in line with population growth. These annual figures were then multiplied by a spasticity rate of 30% to estimate the number of patients that would develop the condition within a year of their original stroke.

As mentioned in section 5.2, estimates regarding the presentation of spasticity vary greatly from study to study. Estimations regarding prevalence can be as low as 4% or as high as 42.6%, with 'disabling spasticity' affecting 2-13% of survivors (Wissel et al., 2013). This may partially be the result of differing definitions of spasticity and individual tolerance of patients to early symptoms such as pain, but it is also heavily influenced by the timing of the study.

As spasticity management is inconsistently coded and often obscured in statistics by root causes (such as the stroke itself) and costly sequelae (such as falls and fractures, or infection) establishing a true rate of prevalence proved very difficult using the data available. This concern was raised with the SECN spasticity Task and Finish group, who agreed that a figure of 30% was appropriate and in-keeping with guidance from the Royal College of Physicians (RCP, 2018).

This approach was selected as a prudent estimate of the number of new cases entering the spasticity management pathway but doesn't incorporate estimates for the population of stroke survivors already living in Kent, Surrey and Sussex. This is a limitation of the model that will be discussed further in section 7.2.

As the governance for the proposed service model has developed, it was agreed that a pre-requisite for referral should be that a patient is either receiving, or has received, therapy as part of their general stroke rehabilitation. This is important to ensure that the benefit of potentially high-cost treatments is realised. However, it has been accepted that not all patients receive such therapy, or at least not to the level of meeting NICE guidance (5 x 45 minutes per week; NICE, 2019). Again, there is little data to identify the amount of resource currently

committed for stroke rehabilitation, as physio and occupational therapists must meet a wide range of demand for their services. A 2013 study into service provision in London (Siegert, 2013) found that only 46% of post-stroke patients received therapy as part of their rehabilitation and, having discussed this with the Task and Finish group clinical lead, this was agreed as a reasonable estimate to gauge eligibility within our target area.

The final assumption applied in calculating the target population of the proposed service model is to subtract patients that are already potentially receiving treatment so as not to over-estimate benefits. Data was provided by Sussex Rehabilitation Centre (SRC), representing the number of patients that were treated by the two existing spasticity management clinics over 2018/19, which was used to calculate the percentage receiving BoNT treatment already. These rates were extrapolated against the eligible population for all STPs within the evaluation to estimate remaining patients that could benefit from the Hub and Spoke service.

In some areas the number of patients currently receiving treatment may be overstated, as SRC is one of the more well established services in the area, but it was believed to be appropriate for the evaluation to set a high bar so benefits would be understated rather than overstated.

Figure 10, below, represents the population breakdown using 2019 figures. For years 2020 – 2023, the population figures have been projected forward based on the annual total STP population growth from 2015 – 2019:

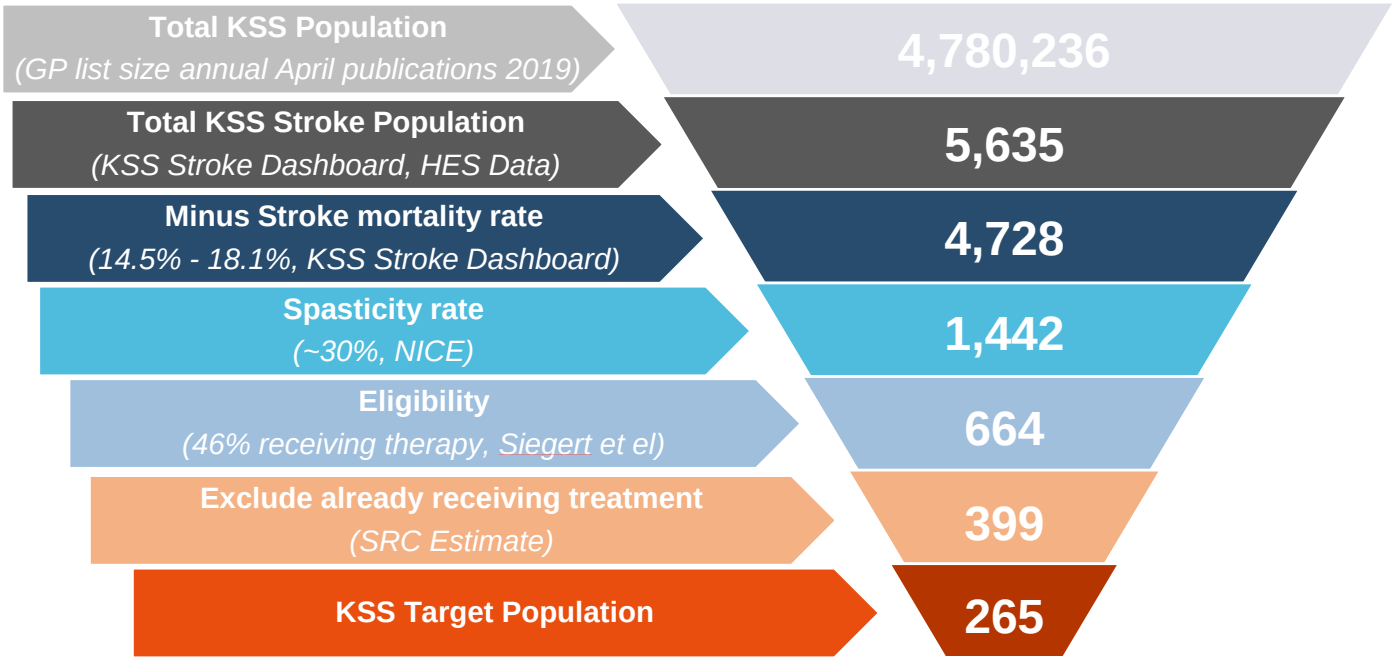


Figure 10: Target population 2019

The calculation in Figure 11 below shows, for each STP, how the target population figures have been calculated. This has been applied to project the target population per STP for years 2020 – 2023 for Kent and Medway, Surrey Heartlands and Sussex and East Surrey:

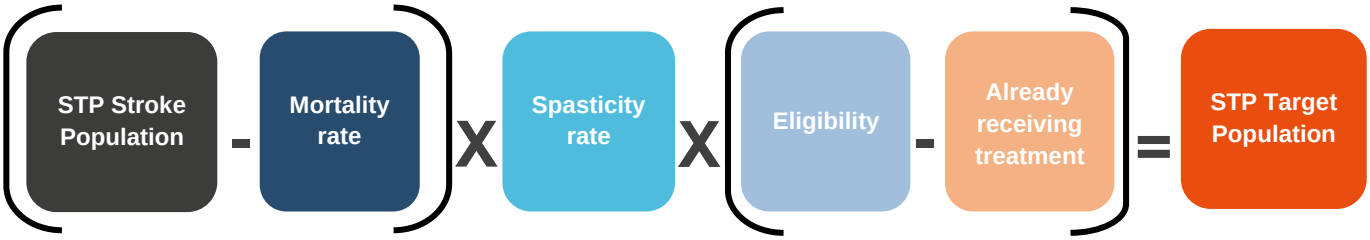


Figure 11: STP target population calculation

Using the assumptions mentioned above, the projected target populations have been calculated as, illustrated in Table 7. It is worth noting the significantly lower target population within Surrey Heartlands STP compared to the Kent and Medway STP and Sussex STP. This significance is reflected in the number of Spokes assumed to be required for this area.

Table 7: Target population by area

Target Population (year)	2019	2020	2021	2022	2023
Kent and Medway STP	117	119	120	121	123
Surrey Heartlands STP*	45	46	46	46	46
Sussex and East Surrey STP*	102	103	104	105	106
Total	***265***	***268***	***270***	***273***	***275***

*** As per section 3.4, ICS/STP footprints have since changed.**

5.3 Service Composition Assumptions

With the proposed service model still at a relatively early stage, KSS AHSN have had to estimate the number of potential Spokes required to support patient volumes for each of the ICS/STPs. These assumptions were informed by data collected from Sussex Rehabilitation Centre and Donald Wilson Neuro Rehab Centre, as both sites had been discussed as potential service Hubs and currently hold regular spasticity management clinics. Reviewing the data provided, a mean of 127 patients were treated by each clinic per annum, 41 of which were first time appointments.

The peak estimated need for each STP/ICS (based on the calculation in section 5.2) was used, minus 41 patients who would initially be seen by the Hub, to provide an estimate of the number of patients that would need to be attended to by the Spokes. On the basis that each Spoke would attend around a third of the patients of a Hub (around 14 first time appointments per year, 42 in total), the remaining group of patients was divided by the number of first time appointments to provide the number of Spokes used in cost and benefit calculations, as shown in table 8, below.

*Table 8: Estimated number of Spokes required per STP/ICS**

Kent and Medway	Surrey Heartlands	Sussex and East Surrey
7 Spokes	1 Spoke	5 Spokes

*** As per section 3.4, ICS/STP footprints have since changed.**

5.4 Outcome Streams

APPROACH AND STRUCTURING OF OUTCOMES

To turn outcomes into a financial benefit, each stream had to be monetised. Four broad benefit categories were considered as part of this evaluation: NHS cash and non-cash releasing benefits, social and other benefits (for full details, please see section 4.3). The following section summarises the process undertaken to identify the final benefit and cost streams incorporated in the health economic modelling.

SELECTION OF BENEFIT / COST STREAMS

During the initial preparations for this evaluation, a list of prospective benefit streams and potential data sources was compiled. These were captured under four core outcomes:

1. Prevention of Long-term physical effects
2. Reduction in reliance on care
3. Psychological Effects
4. Organisational benefits.

A number of metrics were identified through a review of clinical guidance, to provide quantifiable evidence to illustrate the potential benefits and improvements available under the proposed model, such as Goal Attainment Scaling (GAS), Focal Spasticity Index (FSI), EQ-5D, and Hospital Statistics.

Unfortunately, as the evaluation progressed and these metrics were discussed with clinicians, concerns were raised as to whether they would form a reliable evidence base for any assumptions. Whilst spasticity and rehabilitation-specific metrics such as GAS and FSI formed part of clinical guidance, they are subjected to both the patient and physician's interpretation,

and so are rarely aggregated beyond the patient's own records. Furthermore, whilst structured spasticity clinics may capture this information, application in less established services may be inconsistent or missing altogether, making an effective comparison of data almost impossible. Similar concerns were raised in relation to quality of life metrics, with some clinicians preferring a less formulaic approach to understanding and engaging their patients, while others used a variety of tools and approaches.

Establishing incidence of the physical sequelae of spasticity was also a major challenge, with coding standards meaning complications could rarely be attributed to spasticity. Literature research was explored to try to provide an insight into the root cause of effects such as falls or infection, but studies generally focusing on efficacy on treatment did not often capture the risks of non-treatment, understandably, in favour of taking a structured approach to monitoring function and muscle tone.

As the service model itself is still being developed alongside this study, there were no pilot services to use direct data collection and so existing data has been collected from established services to help inform baseline assumptions, costs and service composition.

Alongside the source data, benefit streams have been developed, primarily based on literature research, allowing a set of assumptions to be applied to the patient population to estimate the potential benefits. Three of the four core outcomes remain in the model, with only the prevention of long-term physical effects not being specifically accounted for (although still implied through a combination of quality of life improvement and reduction in formal care requirements).

A more detailed list of benefit and cost streams has been provided below:

NHS related non-cash releasing benefits:

Due to the lack of quantifiable data, or the evidence to link attribute complications to spasticity, assessment of savings to the healthcare system has primarily been based on a study conducted by Anthony Ward et al (2005) titled "Cost-Effectiveness Of Botulinum Toxin Type A In The Treatment Of Post-Stroke Spasticity". The study directly compares the formal care expense between patients just receiving post-stroke therapy, and those that also receive BoNT alongside therapy. This example ties directly into the proposed service model and

provides a useful perspective on the potential benefits to downstream organisations of reducing the variation in access to high-cost treatments such as BoNT.

- Reduction in average Bed Days per patient
- Reduction in GP Visits per patient
- Reduction in Nursing hours per patient

As these all relate to fixed costs that would not reduce the budget of the organisations that realise the benefit, they have been included as non-cash releasing benefits.

***Social benefits*:**

Quantifying social benefits has also hinged on literature research and has required a mixed approach, using multiple sources to estimate the scale of benefits and how to apply these to the patient population appropriately.

- **Quality of Life**: There are numerous studies which address quality of life improvement as a result of varying approaches to spasticity management. However, the tools used to measure patient condition vary greatly and finding results with enough detail to convert the results into Quality Adjusted Life Years (QALY) gained proved challenging once again. A 2015 German study was found that provided comparable results between conventional therapy and therapy with BoNT scenario (Dressler, 2015). Particularly useful was that the results allowed QALYs gained to be captured from both a physical and mental perspective. The results published suggest 0.076 and 0.065 QALYs gained for physical and mental measurements respectively.
- **Reduction in Informal Carer Burden**: With costs of informal care estimated to spiral over the next 20 years, from £18.2billion in 2015 to £54.4billion in 2035 according to the Stroke Association (2017), potential reduction in carer burden was a central element of any assessment of social benefits. The nature of this benefit is preventative, the assumption being that through a co-ordinated care pathway, with access to appropriate treatment, deterioration of spasticity will be avoided. Research conducted in the USA has highlighted how the number of hours spent caring for patients grows in line with the development of spasticity. Using the Disability Assessment Scale (DAS), carers were found to spend on average 19 hours per week caring for patients with mild spasticity, 38 hours for moderate spasticity and 49 hours where the condition had

developed to a severe level (Ganapathy, 2015). A further study (Elovic, 2008) found that BoNT treatment, delivered with appropriate therapy, can lead to a 0.8 reduction in DAS on average.

- Using the severity assessment included in the BEST study (Ward, 2014), the estimated eligible population was proportionally divided into Mild, Moderate and Severe cohorts. The groups were then recalculated, having factored the potential reduction into the equation, and the number of patients estimated to have moved from severe to moderate, and moderate to mild were used to calculate potential savings made through co-ordinated care.

MONETISATION OF OUTCOMES

In order to monetise these benefit streams, the differential factor between baseline and intervention for each outcome had to be converted into a monetary figure. To do so, specific cost figures were used:

- **Reduction in average Bed Days per patient:** An optimism bias of 25% was applied to the average number of bed days saved per patient receiving BoNT treatment. The reduced estimate of bed days saved was then multiplied by the cost of a Bed Day taken from NHS Reference costs for 2017/18.
- **Reduction in GP Visits per patient:** An optimism bias of 25% was applied to the number of visits saved per patient, in line with the methodology used for Bed Days. The result was then multiplied by the estimated cost of a GP appointment published earlier in 2019 (NHS, 2019).
- **Reduction in Nursing hours per patient:** As with the above two examples, an optimism bias of 25% was applied to the estimated number of Nursing hours saved, again dampening the potential benefits. Nursing hours were monetised using a pro-rata calculation against the lowest salary in band 5 taken from Agenda for Change (2019). Whilst many nurses may earn more than this banding, it was felt that adhering to the lower end of the scale was the most prudent approach to model the potential benefits.
- **Quality of Life:** An optimism bias of 25% was also applied to both physical and mental QALYs gained. Benefits were calculated based on the improvement applying to a

single year, using the lowest valuation of a QALY (£20,000) as per KSS AHSN's standard methodology.

- **Reduction in Informal Carer Burden:** As this benefit stream has been calculated using multiple sources, largely relying on US studies, an optimism bias of 40% was applied to the equation at multiple points. Carer time was valued using the minimum wage of £8.21, reduced to £4.93 through the application of the bias. The bias was also applied to the number of hours estimated to be spent caring for patients suffering from spasticity and the average reduction in DAS that dictated the number of patients whose condition had not deteriorated compared to the baseline.

COST STREAMS:

In order to estimate the potential cost of delivering the service to eligible patients, the following cost streams were identified:

- The triage process was estimated using administrator and RMC time, for a two-hour session held on a fortnightly basis for each area. Hourly costs for staff time were based on data provided by Sussex Rehabilitation Centre (SRC). An optimism bias of 15% was applied to the time spent to inflate this cost.
- There are multiple forms of BoNT available on the market but, for the purpose of this economic model, Dysport was selected as the data we had received from services within the area provided the fullest summary of average dosage and costs of treatment. Each patient receiving the treatment was assumed to receive 2 courses of injections over a 12-month period, based on findings by the ULIS-III study (Turner-Stokes, 2019)
- For each Hub appointment, a cost of 1.5 hours of RMC time was applied, based on data provided by SRC, in addition to administrator time of 1 hour. An optimism bias of 5% was applied.
- For each Spoke appointment, a cost of 1.5 hours of AHP time was applied, based on a band 6 salary from NHS Agenda for Change, in addition to administrator time calculated on the same basis as above. Further to this, an additional amount equivalent to two hours of AHP time was included to represent AHP travel time between patients. An optimism bias of 25% was applied to travel time, with 5% applied to the appointment costs themselves.

- Training Costs were calculated as requiring one additional qualified injector per Spoke, with the cost taken from the cost of the relevant master's level module from Plymouth university's prospectus. This cost was only applied to the first year of implementation, with a 25% optimism bias applied.

6 Cost-Benefit Model Findings

6.1 Summary of Results

The following section provides an overview of the findings of our modelling, based on the assumptions, cost and benefit streams outlined in the previous section. It should be noted that, as these figures are not modelled using real world data in all instances, there may be additional benefit streams that have not been factored into the evaluation. Similarly, there may be additional costs that sit outside the assumptions used and care should be taken to ensure the costs of delivering any final service proposition. For example, it should be noted that under scenario two, a small loss was found related to the Kent and Medway STP. This reflects the additional training costs associated with the number of Spokes estimated to be required to meet the needs of the patient population. Sections 7.1 and 7.2 will provide additional commentary on such insights and limitations of the evaluation.

6.2 Scenario Results

6.2.1 SCENARIO 1

Table 9 Highlights the monetary outcomes of the scenario one modelling. This shows potential NHS non-cash releasing benefits of £1.64million against estimated costs of £1.12million, providing a return on investment of £1.46 for every £1 spent. Social benefits make up the majority of the benefits, accounting for £3.60million across the five years and return £4.66 for every £1 invested.

Table 9: All Combined ICS/STP outcomes (NPV)

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£334,689	£327,537	£326,685	£325,782	£324,948	**£1,639,641**
Costs	£249,934	£226,659	£221,208	£215,861	£210,694	**£1,124,357**
NHS Net Present Value (benefits – costs)	£84,755	£100,878	£105,477	£109,921	£114,254	**£515,285**
NHS Benefits Cost Ratio	**£1.34**	**£1.45**	**£1.48**	**£1.51**	**£1.54**	**£1.46**
With Social (£)						
Social Savings	£748,210	£730,591	£718,126	£705,824	£693,937	**£3,596,687**
Total Net Present Value (benefits – costs)	£832,965	£831,469	£823,602	£815,745	£808,191	**£4,111,972**
Total Benefits Cost Ratio	**£4.33**	**£4.67**	**£4.72**	**£4.78**	**£4.84**	**£4.66**

***Figures have been rounded to the nearest pound, as such totals may not add.**

Table 10 highlights the savings at an STP level for Kent and Medway. Key findings show an NHS non-cash releasing benefit cost ratio of £1.51 for every £1 invested, increasing to £4.79 when social benefits are taken into account.

Table 10: Kent and Medway STP scenario one breakdown

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£148,217	£148,166	£148,036	£147,878	£147,745	**£740,041**
Costs	£106,389	£96,567	£96,280	£95,980	£95,701	**£490,917**
NHS Net Present Value (benefits – costs)	£41,828	£51,599	£51,756	£51,898	£52,044	**£249,125**
NHS Benefits Cost Ratio	**£1.39**	**£1.53**	**£1.54**	**£1.54**	**£1.54**	**£1.51**
With Social (£)						
Social Savings	£331,345	£327,017	£322,524	£318,073	£313,778	**£1,612,737**
Total Net Present Value (benefits – costs)	£373,173	£378,616	£374,280	£369,971	£365,822	**£1,861,862**
Total Benefits Cost Ratio	**£4.51**	**£4.92**	**£4.89**	**£4.85**	**£4.82**	**£4.79**

***Figures have been rounded to the nearest pound, as such totals may not add.**

Table 11 shows the outcomes for Surrey Heartlands STP, total net present value (NPV) inclusive of social benefit shows a total of £658,212 and benefit cost ratio of £3.74 for every £1 invested. As mentioned in section 3.4, this economic modelling was performed using STP boundaries before the transition to Surrey Heartlands ICS, therefore the below figures do not incorporate the population of East Surrey CCG.

Table 11: Surrey Heartlands STP scenario one breakdown.

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£57,026	£56,826	£56,533	£56,235	£55,952	£282,573
Costs	£49,842	£48,152	£47,779	£47,404	£47,045	£240,222
NHS Net Present Value (benefits – costs)	£7,184	£8,675	£8,755	£8,831	£8,907	£42,351
NHS Benefits Cost Ratio	**£1.14**	**£1.18**	**£1.18**	**£1.19**	**£1.19**	**£1.18**
With Social (£)						
Social Savings	£127,483	£125,422	£123,168	£120,957	£118,830	£615,861
Total Net Present Value (benefits – costs)	£134,667	£134,096	£131,923	£129,788	£127,737	£658,212
Total Benefits Cost Ratio	**£3.70**	**£3.78**	**£3.76**	**£3.74**	**£3.72**	**£3.74**

***Figures have been rounded to the nearest pound, as such totals may not add.**

Table 12 shows a monetary value of £1.40million for social benefits captured within this report and a further £642,000 for NHS non-cash releasing benefits. Overall there is an NPV of £1.67million and benefit cost ratio of £4.82 for every £1 invested. As mentioned above, this modelling was performed using STP boundaries before the transition to Surrey Health and Care partnership and therefore includes East Surrey CCG.

Table 12: Sussex and East Surrey STP scenario one breakdown

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£129,446	£128,999	£128,553	£128,089	£127,654	£642,741
Costs	£93,702	£86,407	£85,953	£85,491	£85,052	£436,605
NHS Net Present Value (benefits – costs)	£35,743	£44,527	£46,485	£48,449	£50,436	£225,640
NHS Benefits Cost Ratio	**£1.38**	**£1.52**	**£1.54**	**£1.57**	**£1.59**	**£1.52**
With Social (£)						
Social Savings	£289,381	£284,715	£280,075	£275,508	£271,111	£1,400,790
Total Net Present Value (benefits – costs)	£325,125	£333,512	£335,026	£336,542	£338,183	£1,668,388
Total Benefits Cost Ratio	**£4.47**	**£4.86**	**£4.90**	**£4.94**	**£4.98**	**£4.82**

***Figures have been rounded to the nearest pound, as such totals may not add.**

6.2.2 SENSITIVITY ANALYSIS

The sensitivity analysis was calculated on the NPV (sensitivity calculated benefits minus costs) with the costs assumed to have remained the same between the modelled scenarios and sensitivity scenarios.

The scenario one sensitivity analysis shows NPV to vary between £3.82 million and £4.43 million at the 90% confidence interval. It is worth noting that changes to the QALY assumption could lead to substantial differences to the total NPV.

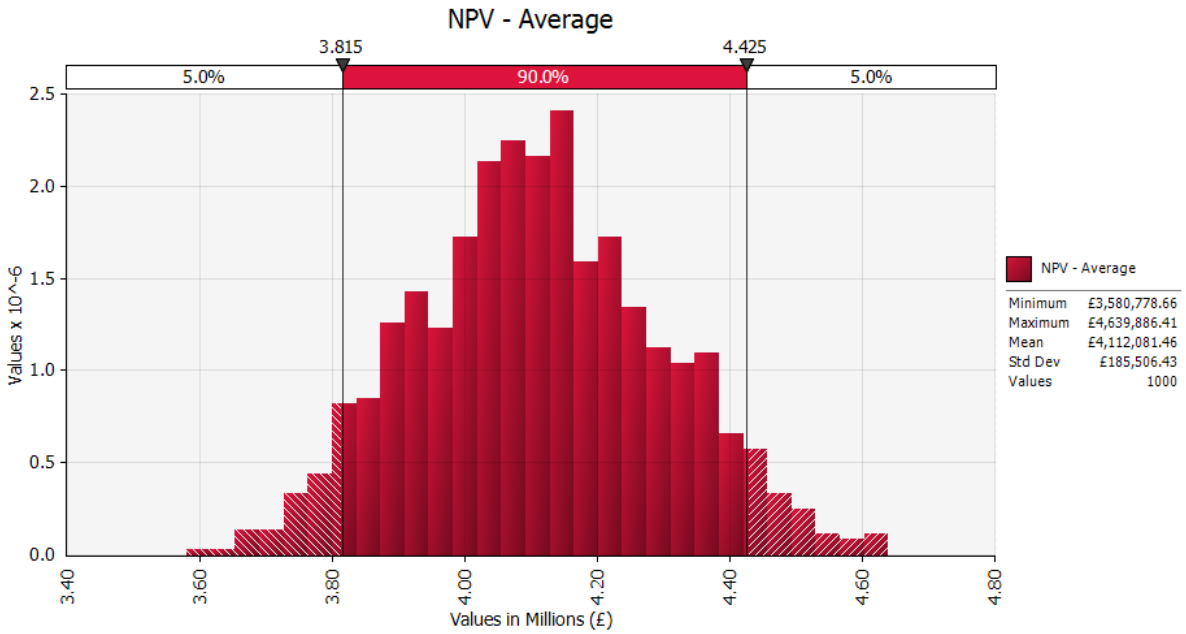


Figure 12: Sensitivity analysis – scenario one

6.2.3 SCENARIO 2

Table 13 highlights the monetary outcomes for scenario 2 for all STPs combined. There is an NHS-only benefit cost ratio of £1.35 per £1 invested, increasing to £4.39 with social benefits and a total NPV of £3.61 million.

Table 13: All Combined ICS/STP outcomes for scenario 2

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£201,258	£303,242	£333,122	£332,202	£331,351	£1,501,175
Costs	£189,372	£226,659	£221,208	£215,861	£210,694	£1,063,795
NHS Net Present Value (benefits – costs)	£11,886	£70,723	£99,164	£97,452	£95,778	£375,003
NHS Benefits Cost Ratio	**£1.06**	**£1.31**	**£1.45**	**£1.45**	**£1.45**	**£1.35**
With Social (£)						
Social Savings	£473,699	£664,512	£715,355	£699,081	£683,319	£3,235,966
Total Net Present Value (benefits – costs)	£485,585	£735,235	£814,519	£796,533	£779,097	£3,610,970
Total Benefits Cost Ratio	**£3.56**	**£4.24**	**£4.68**	**£4.69**	**£4.70**	**£4.39**

***Figures have been rounded to the nearest pound, as such totals may not add.**

Table 14 highlights the monetary outcomes for scenario 2 within the Kent and Medway STP. Across the five years there is a total NHS non-cash releasing NPV benefit of £179,218, however within the first year there is a loss of £10,652 when looking solely at NHS benefits, this changes to a £141,282 monetary saving when social benefits are included.

Table 14: Kent and Medway STP outcomes for scenario 2

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£57,013	£125,941	£148,036	£147,878	£147,745	£626,613
Costs	£67,665	£80,495	£92,595	£90,523	£88,515	£419,794
NHS Net Present Value (benefits – costs)	-£10,652	£43,012	£49,775	£48,947	£48,136	£179,218
NHS Benefits Cost Ratio	**£0.84**	**£1.53**	**£1.54**	**£1.54**	**£1.54**	**£1.43**
With Social (£)						
Social Savings	£151,934	£275,981	£317,897	£311,193	£304,682	£1,361,686
Total Net Present Value (benefits – costs)	£141,282	£318,992	£367,672	£360,140	£352,818	£1,540,904
Total Benefits Cost Ratio	**£3.09**	**£4.96**	**£4.97**	**£4.98**	**£4.99**	**£4.67**

***Figures have been rounded to the nearest pound, as such totals may not add.**

Table 15 shows a total NPV, inclusive of NHS and social benefits, of £573,445 across the five years equating to a benefit cost ratio of £3.80 per £1 invested. As mentioned in section 3.4, this economic modelling was performed using STP boundaries before the transition to Surrey Heartlands ICS, therefore the below figures do not incorporate the population of East Surrey CCG.

Table 15: Surrey Heartlands STP outcomes for scenario 2

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£34,215	£48,302	£56,533	£56,235	£55,952	£251,238
Costs	£30,452	£40,138	£45,950	£44,709	£43,513	£204,762
NHS Net Present Value (benefits – costs)	£3,763	£7,231	£8,420	£8,329	£8,238	£35,980
NHS Benefits Cost Ratio	**£1.12**	**£1.18**	**£1.18**	**£1.19**	**£1.19**	**£1.18**
With Social (£)						
Social Savings	£76,490	£105,848	£121,401	£118,341	£115,386	£537,465
Total Net Present Value (benefits – costs)	£80,253	£113,079	£129,821	£126,669	£123,623	£573,445
Total Benefits Cost Ratio	**£3.64**	**£3.82**	**£3.83**	**£3.83**	**£3.84**	**£3.80**

***Figures have been rounded to the nearest pound, as such totals may not add.**

Table 16 highlights a total benefit cost ratio across the five years of £4.75 per £1 invested when including NHS and social benefits, this reduces to £1.47 when looking solely at NHS benefits. As mentioned above, this modelling was performed using STP boundaries before the transition to Surrey Health and Care partnership and therefore includes East Surrey CCG.

Table 16: Sussex and East Surrey STP for outcomes scenario 2

	2019/20	2020/21	2021/22	2022/23	2023/24	Total
NHS Benefits (£)						
NHS Non-Cash Releasing Savings	£110,029	£128,999	£128,553	£128,089	£127,654	£623,324
Costs	£80,673	£84,738	£82,663	£80,630	£78,666	£407,370
NHS Net Present Value (benefits – costs)	£29,355	£41,769	£40,969	£40,176	£39,404	£191,674
NHS Benefits Cost Ratio	**£1.36**	**£1.49**	**£1.50**	**£1.50**	**£1.50**	**£1.47**
With Social (£)						
Social Savings	£245,275	£282,683	£276,057	£269,548	£263,252	£1,336,815
Total Net Present Value (benefits – costs)	£274,631	£324,452	£317,026	£309,724	£302,655	£1,528,489
Total Benefits Cost Ratio	**£4.40**	**£4.83**	**£4.84**	**£4.84**	**£4.85**	**£4.75**

***Figures have been rounded to the nearest pound, as such totals may not add.**

7 Discussion, Limitations and Suggestions

7.1 Insights

SOCIAL BENEFITS

As the results of the evaluation indicate, the potential social benefits comprise the majority of returns on the initial investment. A broad approach has been taken to try and capture a fair reflection of the potential benefits to patients and carers that greater access to the best treatment options and clinical expertise could bring. Through the research undertaken in support of this report, there is a broad acceptance that treatments such as BoNT can be an effective part of spasticity management services, helping patients achieve their rehabilitation goals and regain limb function. There have been challenges in quantifying some of these personal benefits, as goals and functional requirements can vary from patient to patient (where one patient may want to return to work, another's goal might be to regain the independence to maintain their own hygiene). However, it is important to remember that, for many patients, accessing effective spasticity management services may have an even greater impact on their quality of life.

BoNT is accepted by RCP as an effective treatment to help reduce spasticity, but as highlighted throughout their clinical guidelines (published in 2018), there is no clear established process for clinicians to follow to ensure it is used correctly and effectively. Furthermore, as BoNT is a highly potent toxin, clinicians require specialised training in order to deliver the treatment. This esoteric aspect of the treatment has created a postcode lottery that means some patients, even in areas with relatively high stroke incidence rates, do not have access to services with the expertise to prescribe and administer the most effective treatment for the patient. Therefore, they may be left at risk of having to live with the condition or having to deal with non-focal treatments such as oral medication and the side-effects associated with them.

The proposed service model aims to formalise a process through which patients can access expertise from across the region. Through referral and triage, each individual presentation of spasticity would be captured using standard terminology and methods. This would allow the

multidisciplinary spasticity team to assess each case according to complexity and severity to advise on treatment options and whether the patient would need to attend a clinic with a Rehabilitation Consultant. Whilst BoNT may not form part of the treatment package for all patients, the assumptions are built on the basis that the condition will be managed through proper, co-ordinated care, thus preventing the deterioration that can otherwise occur.

The benefit streams used to quantify the social benefits apply assumptions relating to patient quality of life and care burden to the eligible patient population. To ensure that monetisation of these benefit streams was prudent and reasonable, an optimism bias of 25% was applied to reduce the QALYs assumed to be gained through proper management of spasticity. Similarly, a bias of 40% was applied to assumptions relating to reduced carer burden, both in terms of reducing the number of hours assumed to be spent by carers and to the valuation of this time. A general optimism bias of 15% and sensitivity analysis add further assurance that the figures produced in the final results reflect a reasonable and realistic evaluation of the potential benefits.

KENT AND MEDWAY – IMPLEMENTATION COSTS

As reflected within Section 6.2, the results for the Kent and Medway STP show a net loss of around £10,000 for the first year of implementation, in terms of NHS non-cash releasing savings only. This is the result of training costs measured against the number of Spokes (seven) assumed to be required to effectively serve the Kent population. It must be noted that this loss highlights the risk that implementation costs can easily outstrip NHS savings during the early implementation of a new service model. There may be additional costs, or, it may be found over the course of the project that additional Spokes are required to cover the geographical area. Despite this, it should also be mentioned that once social benefits are accounted for, a positive return is realised.

BROADER PATIENT POPULATION

Throughout the evaluation, clinicians across Kent, Surrey and Sussex have been keen to emphasise that the spasticity population is not limited to post-stroke patients. As well as stroke survivors, sufferers of traumatic brain injury and multiple sclerosis (MS) may also develop spasticity and would benefit from a co-ordinated service offering. Whilst these groups are smaller in size compared to the post-stroke population; spasticity is believed to occur in a

larger proportion of patients. According to MSTrust, there are an estimated 110,000 people living with MS in the UK, with between 60-90% affected by spasticity at some point (MSTrust, 2018). Up to 75% of patients with physical disability following severe traumatic brain injury will develop spasticity requiring targeted treatment (RCP, 2018). The charity Headway estimate that there were over 348,000 admissions for acquired brain injury in 2016/17 (Headway, 2019).

Whilst these patients have not been included and treatments may not yield the same level of benefit, it should be considered that a Hub and Spoke approach to service delivery will impact other groups of patients that currently do not have a structured system for spasticity management.

Our assumptions have been applied to new stroke cases based on regional incidence, however there is also a significant existing population within the region. Some of these existing patients may already be suffering from spasticity or may develop it later than the first twelve months post-stroke. These patients could also be referred into the restructured pathway.

These additional patient groups have two main implications for the evaluation's findings. They represent unaccounted potential benefits that the proposal may help realise, but they also represent additional demand upon services and this activity should be considered in drawing up a full business case.

7.2 Limitations and Caveats

PROPOSED SERVICE MODEL IS NOT CURRENTLY IN PLACE

Over the course of this evaluation, a great deal of work has been undertaken to develop the potential service proposal and accompanying process. It has been a rewarding part of the evaluation to engage with clinicians and support this development, but it also introduces challenges in measuring the full costs and impacts of the proposed service model. As the proposed service model is not currently in place, real world data reflecting the impact the change could have was not available. Assumptions have therefore been based on data collected by existing services, with estimated impacts taken from literature reviews and research.

INCORPORATION OF WORKFORCE REQUIREMENTS

Related to the previous point is the matter of workforce requirements. Whilst our research into the services currently in place within KSS suggest that many of the key staff required to deliver the proposed model are in place, there are elements that have not been fully evaluated. In particular, whilst the model is not in place it is difficult to ascertain the number of additional administrative and data processing staff that could potentially be required, as this will largely depend on the expertise currently in place across several sites, as well as the existing demands on such staff. There is a risk that additional employment costs may be incurred that are not factored into the model. Similarly, whilst we have incorporated assumptions into the potential training needs of staff in order to deliver treatment, if the patient population is discovered to be larger than anticipated, there may be the need to train additional non-medical injector/prescribers.

LIMITED DATA AROUND PATHWAY ASSUMPTIONS

The scope of research has been partially led by the data available. Many studies and reports have been reviewed, however, finding outcomes that apply to post-stroke spasticity patients and could be monetised proved a further challenge. In addition to this, due to inconsistency in data collection and difficulty in attributing the costs of spasticity to spasticity, the report does not provide a full evaluation of potential benefits as had been originally hoped. Since use and effectiveness of BoNT is a particular focus of recent research, the final set of assumptions primarily revolve around its use and potential benefits on the basis that extending access to this treatment was a fundamental aim of the proposed model.

QUANTIFICATION OF EXISTING SPASTICITY POPULATION

As previously mentioned in section 5.2, this evaluation has based its calculations against stroke incidence, rather than the standing population of stroke survivors. This does mean that there are cohorts of patients that may emerge and feed into the service model that have already developed spasticity, which may impact the costs of administering the triage process in the long-term. Quantifying the scale of this cohort, the treatments currently in place and the potential benefits of the model is difficult as these patients largely form the hidden cohort the model is designed to address. Instead, the approach taken focused on the benefits of preventing, or slowing, patient deterioration for future incidence.

STROKE INCIDENCE AND POPULATION HEALTH

Future projections of stroke incidence have not factored in any population health assumptions. Understanding the true impact of population health initiatives is a difficult task; there is debate as to whether a potential drop in stroke incidence will result in an actual drop in stroke admissions. Furthermore, as acute stroke services improve, survival rates may correspondingly improve, meaning that a larger number of patients who suffer a stroke may develop spasticity simply because they survived to the rehabilitation phase of their treatment.

EMERGENT RESEARCH NOT INCORPORATED

As clinical acceptance of the efficacy of BoNT as part of spasticity management has developed, further studies have been launched to measure the impact of these treatments in improving patient outcomes and quality of life. Unfortunately, there are some studies currently underway which are only publishing their findings as this evaluation is nearing completion. Data has been incorporated from the BEST and ULIS-III studies as relevant elements are published, but there may well be more published over the next twelve months that could feed into future evaluations.

INCLUSION OF IMPLEMENTATION COSTS

Similarly, the model has assumed that changes largely represent a reconfiguration of existing services into a cohesive, co-ordinated system. Any implementation of such a system may involve additional facilities and staffing costs that extend beyond this assumption. When sites are considered, and delivery planned, these practicalities will need to be taken into account.

7.3 Suggestions

IMPROVING DATA COLLECTION AND GOVERNANCE

As has been referenced throughout this report, one of the significant challenges which has been encountered has been accessing reliable data to assess the scale of spasticity and its sequelae across Kent, Surrey and Sussex. As there is such diversity in symptoms and timing of spasticity developing, there are numerous potential entry points into the spasticity management pathway, each with their own approach to data collection and funding. This

complexity makes it very difficult to assess the issue and evidence all potential benefits that may lead to NHS savings. Furthermore, centralised data resources will usually not capture the root cause of complications that have required further treatment, meaning that where, for example, a patient has fallen due to spasticity and fractured a bone, the fracture will be recorded, but the cause will not. This also adds further challenge to assessing the potential savings to be made outside of a limited trial-based approach to data collection.

Diversity in presentation and patient circumstance also create an issue in that the goals of rehabilitation efforts can also vary greatly from patient to patient. Often measures taken to record the patient's goals rely on subjective interpretation by both the clinician and the patient. As a result, success against these goals is often not consistently recorded in any centralised form, reducing the amount of real-world evidence available to inform learning and decision-making as to which forms of treatment yield consistent benefits.

One of the potential benefits of implementing a Hub and Spoke model is the opportunity to standardise data collection and centralise records to evidence the number of patients treated, the treatments delivered and their efficacy. Even if the full Hub and Spoke model is not implemented, the AHSN recommends considering a standard form of appraisal and data collection for spasticity. Even if only used in a single locality for a trial period, organising and recording these details (with the appropriate approach to data security and protection), would provide a valuable evidence base for future commissioning decisions.

REVIEW ACTIVITY IN LINE WITH AGREED SERVICE COMPOSITION

As discussed in section 7.1, the scope of the Health Economic model does not encompass all possible patients suffering from spasticity. Whilst working with members of the Task and Finish group to help develop an understanding of regional services and expertise, a number of potential Spokes were identified across the region, however the final configuration is yet to be decided upon. Before Hub and Spoke sites and their eventual composition are finalised, a review of spasticity activity should be undertaken to ensure that sufficient resources are in place to manage regional demand in addition to the current caseload these services handle. If there are insufficient resources in place, additional Spokes should be incorporated in the configuration, or contingency plans should be agreed to help handle demand without imposing unreasonable delays to treatment.

FORMALISE TRAINING PATHWAYS

A further finding through discussion with clinicians and service providers over the course of this evaluation has been reference to colleagues who are either undertaking training, or hold an ambition to train, to inject or prescribe BoNT. A potential benefit of a centralised co-ordination of services is the opportunity to engage staff in this process, providing support and advice, as well as helping manage patient flow so staff can build and maintain competency.

A formal network, allowing interested staff to contact experienced colleagues for guidance, would help ensure that the model has the flexibility to absorb additional cases, in terms of both delivering treatment and assessing spasticity in the first instance. Further along the pathway it would also provide the potential to engage groups of staff in training initiatives to ensure understanding remains up-to-date, or to build expertise in recognising and handling warning signs to help support the mental health of patients and their carers.

Establishing a training pathway could also yield benefits for long-term Job Planning, providing a well-trodden path to take new staff through to competency and attracting staff that wish to specialise by becoming a non-medical injector. Such an approach could also create an opportunity to support regional, potentially even national, skills development.

ENGAGE PRIMARY CARE EFFECTIVELY

It is assumed that many referrals would likely originate from therapists that are well-versed in spasticity and stroke rehabilitation (such as physio and occupational therapists already working with the patient either in an acute or outpatient setting). However, reaching the wider population of stroke survivors and potential spasticity patients will require engagement with primary care, as patients who are beginning to encounter the symptoms of spasticity either at home or in full-time care are more likely to consult their GP in the first instance.

When implementing a new service model, it is important that an accessible process is communicated to primary care in a way that will help recognise the signs at an early stage. This should help avoid the implementation of treatment plans that may obscure the root cause, allowing the underlying spasticity to develop unchecked. The approach must be designed to ensure that the right information is captured to allow the patient to be assessed through triage. While primary care services have not yet been fully engaged by the project team, this is planned as part of the next stage of development and is expected to provide a single point of

access for referrals. Communicating that the service exists is a core challenge to ensure such access points become an accepted part of the landscape.

CONSIDER FUNDING STRUCTURE

As referenced in Section 3.5 any proposed model of care that seeks to co-ordinate services across multiple sectors (encompassing inpatient, outpatient and community services) is going to face the challenge of establishing a funding structure that ensures resources are available to deliver care, without having one service subsidise another.

With treatments such BoNT, which is not covered by the national tariff and is considered a 'high-cost drug', there is an additional challenge to ensure that a structure is in place to fund treatment without over-reliance on individual funding requests. Establishing the lines of responsibility for these treatments is an important hurdle to overcome, as is the question of liability for treatment delivered.

REINFORCE THERAPY REQUIREMENTS

As stated in RCP guidance, physical management of spasticity is "fundamental" to treatment. In particular, BoNT should not be used in isolation, but in parallel with physical therapy and other spasticity management strategies (RCP, 2018). This understanding has informed our approach to identifying the appropriate population for treatment (see section 5.2) and benefits may not be realised if patients do not receive the right level of therapy.

NICE guidance recommends "at least 45 minutes of relevant stroke rehabilitation therapy for a minimum of five days per week" (NICE, 2019), while additional therapy should also be considered where patients are able to participate and continue to make functional gains. The view that the NICE guidance should be considered the minimum level of intensity for many patients has been echoed by rehabilitation consultants who have spoken to the AHSN over the course of this evaluation.

The cost of delivering even the minimum level of therapy has not been included in the health economic model as it has been assumed that eligible patients will already be receiving, or have previously received, therapy as a prerequisite for accessing the referral process. It is important to note that when indicative costs are factored into the calculations, the proposed model returns a negative net present value:

Table 17: NPV Comparison (with therapy costs)

Net Present Value (without therapy costs)	Net Present Value (with therapy costs)
£4,126,999	-£1,283,570

This underlines the importance of delivering therapy at the required level to realise the benefits of adjunct treatments such as BoNT. If patients are not currently receiving therapy at the appropriate level of intensity, then the cost of providing the therapy may well undermine any benefits, both to the NHS and society at large.

8 Concluding Remarks

The need to develop and implement higher intensity rehabilitation models to support the effective management and prevention of long-term conditions associated with stroke is raised within the NHS Long Term Plan (NHS, 2019) as a need to help mitigate the rising costs of supporting stroke survivors. The outcomes of this report highlight the significant benefits which could be realised through taking a different approach to managing spasticity services, to ensure equity of access to expertise and resources across the region.

Having held numerous discussions with clinicians around Kent, Surrey and Sussex, it is also a real positive for the project that a lot of the expertise required to deliver such a model is not only in place around the area, but is partnered with enthusiasm about helping to deliver a structured system of care. This enthusiastic approach can largely be attributed to the consensus that the existing pathway is too unstructured and leaves some patients and staff without the resources or prime opportunity to deliver the best quality of care. The aim of the proposed solution is to help develop a system that will be more in line with the principle of Getting it Right First Time (GiRFT), rather than a purely reactive system where expert referral only really takes place once matters have deteriorated. This should help in creating the opportunity to provide the right treatment at the right time.

Over the course of this project, the proposal itself has developed greatly and formed a greater portion of the work required than originally anticipated. Through discussion with clinical staff and sharing of lessons and resources, the proposal has taken greater definition as the process has progressed. This is positive for the overall project but has also had an impact in setting a clear foundation for evaluation.

Whilst the results of the modelling provided a positive return on investment, in particular when social benefits had been taken into account, the challenges in quantifying and evidencing all the benefit and cost streams that could be realised have meant that many could not be included in the modelling. This report is intended to represent a balanced and prudent illustration of the benefits that could be realised, but without additional data collection and governance, the true scale and complexity of spasticity will always be hard to define.

Considering there are limitations with health economic analysis, this report and the methodology used provides a prudent measure of the estimated outcomes of applying such a model to emerging stroke incidence over a five-year period. As this service model is further tested in a real-world setting, and improved information and data emerges, the demonstrable benefits may increase or decrease through additional costs and benefits becoming monetizable. In partnership with ongoing engagement and development across the region, the findings of this evaluation will hopefully help form a foundation for a service proposal that will fulfil the ambitions of the NHS Long Term Plan and improve patient outcomes across the region.

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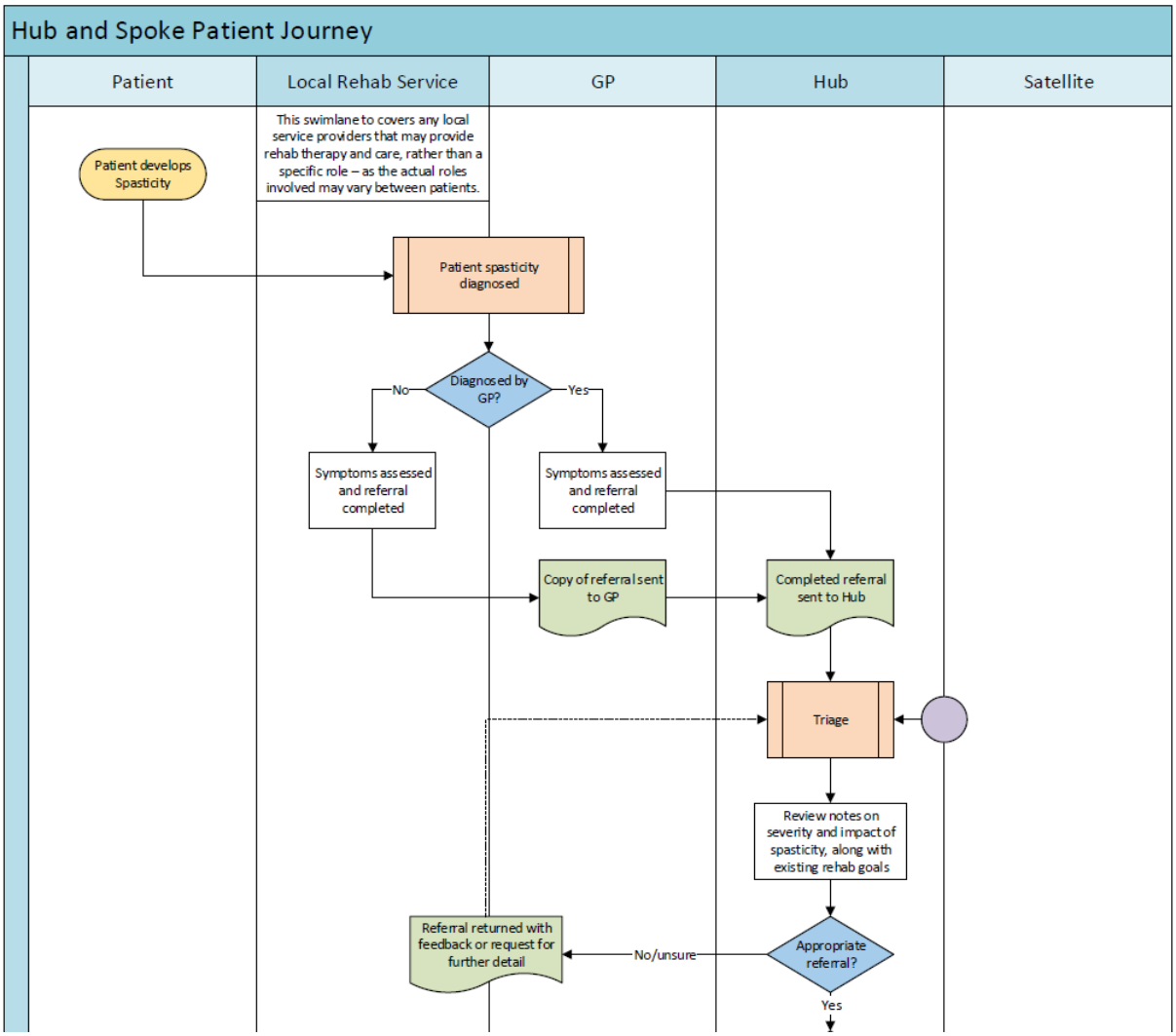
10 Appendices

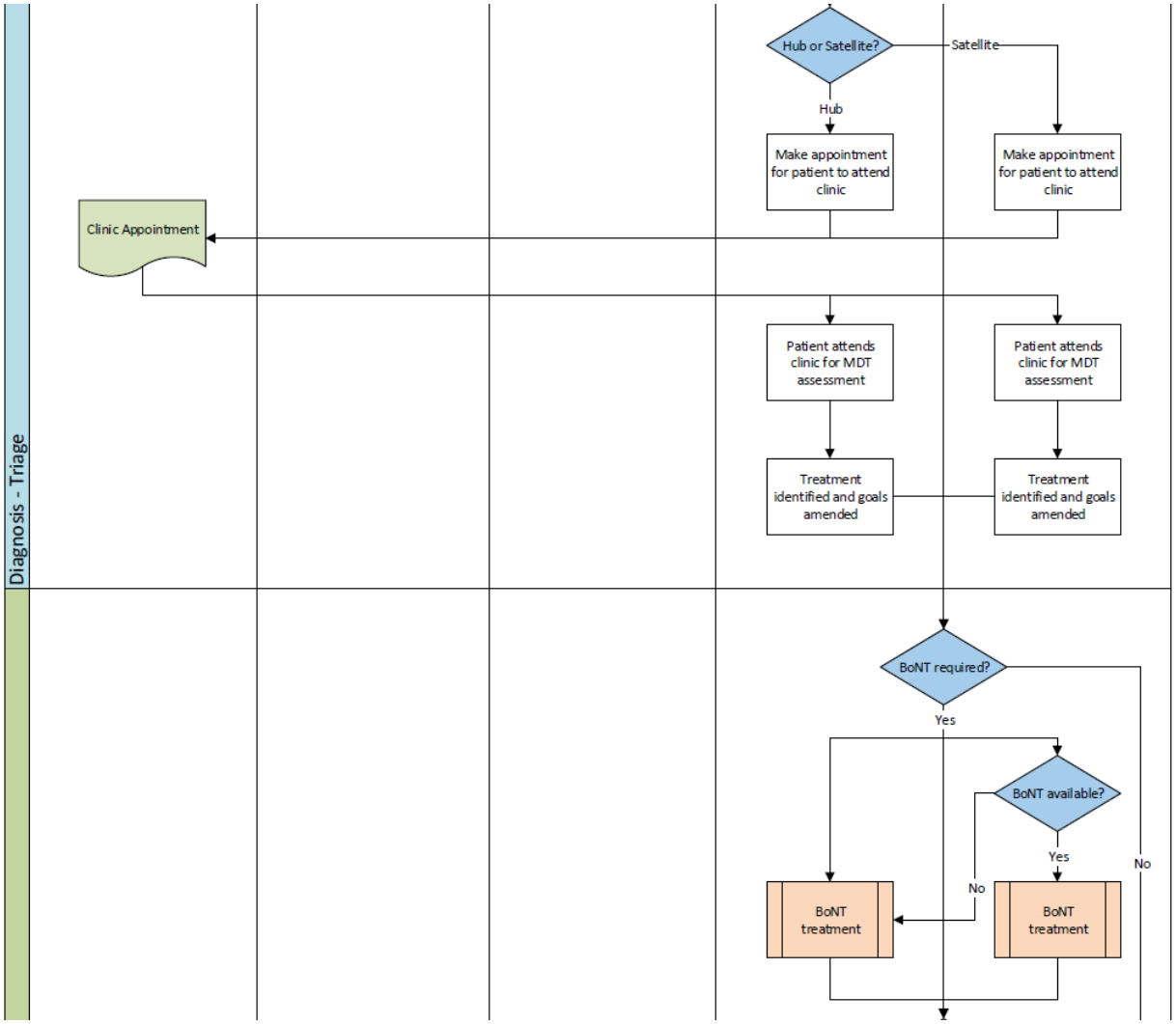
Appendix 1 – ICD Codes for HES Data Collection

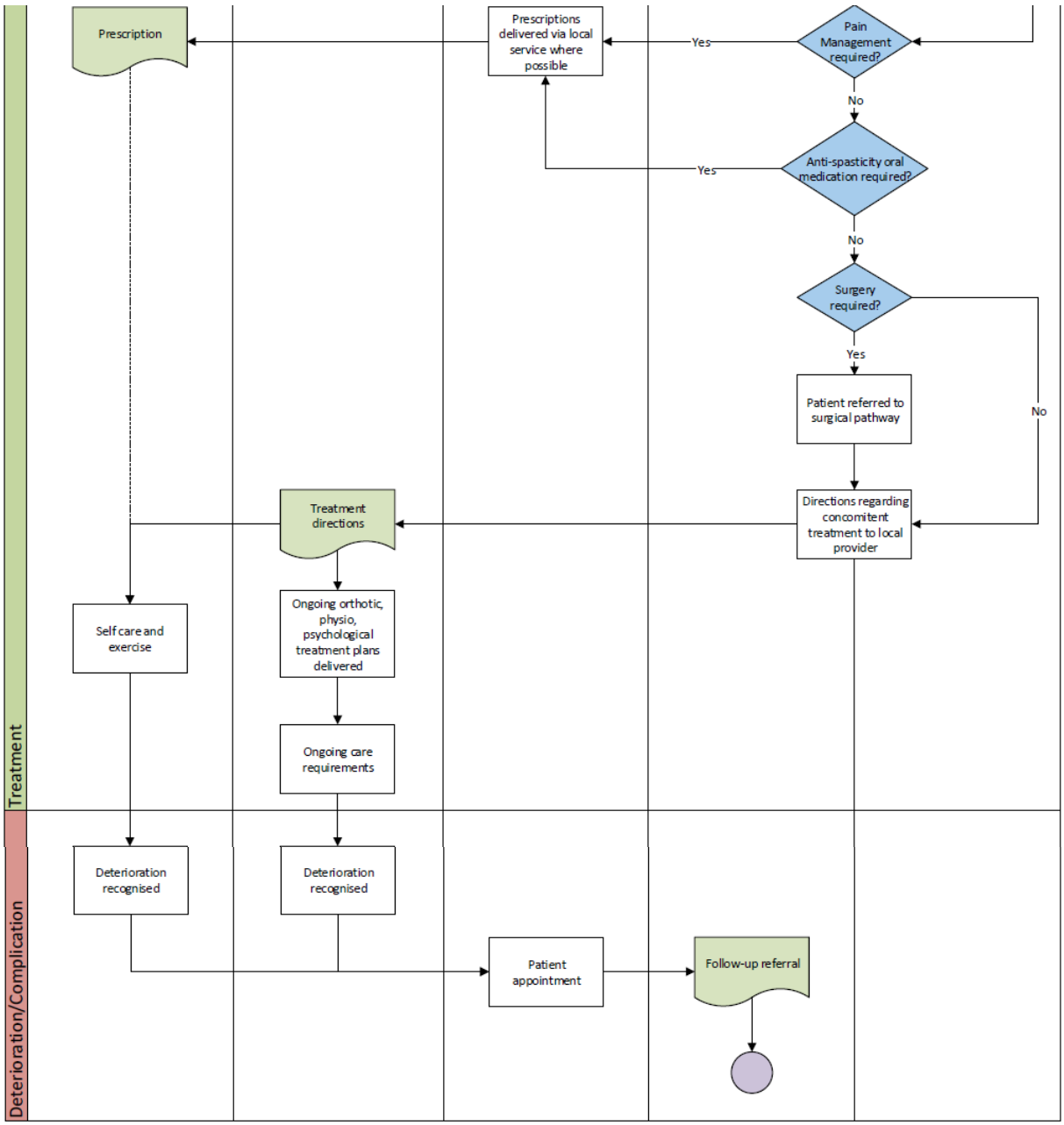
ICD-10 Codes for the HES Patient Outcomes Data

I610	Intracerebral haemorrhage in hemisphere, subcortical
I611	Intracerebral haemorrhage in hemisphere, cortical
I612	Intracerebral haemorrhage in hemisphere, unspecified
I613	Intracerebral haemorrhage in brain stem
I614	Intracerebral haemorrhage in cerebellum
I615	Intracerebral haemorrhage, intraventricular
I616	Intracerebral haemorrhage, multiple localized
I618	Other intracerebral haemorrhage
I630	Cerebral infarction due to thrombosis of precerebral arteries
I631	Cerebral infarction due to embolism of precerebral arteries
I632	Cerebral infarction due to unspecified occlusion or stenosis of precerebral arteries
I633	Cerebral infarction due to thrombosis of cerebral arteries
I634	Cerebral infarction due to embolism of cerebral arteries
I635	Cerebral infarction due to unspecified occlusion or stenosis of cerebral arteries
I636	Cerebral infarction due to cerebral venous thrombosis, nonpyogenic
I638	Other cerebral infarction
I639	Cerebral infarction, unspecified
I64X	Stroke, not specified as haemorrhage or infarction

Appendix 2 – Hub and Spoke Patient Journey Process Flow




Diagnosis - Triage
Hub or Satellite?
Satellite
Hub
Make appointment for patient to attend clinic
Make appointment for patient to attend clinic
Clinic Appointment
Patient attends clinic for MDT assessment
Patient attends clinic for MDT assessment
Treatment identified and goals amended
Treatment identified and goals amended
BoNT required?
Yes
BoNT available?
Yes
No
No
BoNT treatment
BoNT treatment


Treatment
Deterioration/Complication
Prescription
Prescriptions delivered via local service where possible
Yes
Pain Management required?
No
Anti-spasticity oral medication required?
Yes
No
Surgery required?
Yes
No
Patient referred to surgical pathway
Directions regarding concomitent treatment to local provider
Treatment directions
Self care and exercise
Ongoing orthotic, physio, psychological treatment plans delivered
Ongoing care requirements
Deterioration recognised
Deterioration recognised
Patient appointment
Follow-up referral