NOCA National Office of Clinical Audit

INAS Irish National Audit of Stroke

IRISH NATIONAL AUDIT OF STROKE
NATIONAL REPORT 2020

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NATIONAL OFFICE OF CLINICAL AUDIT (NOCA)

The National Office of Clinical Audit (NOCA) was established in 2012 to create sustainable clinical audit programmes at national level. NOCA is funded by the Health Service Executive National Office of the Chief Clinical Officer and operationally supported by the Royal College of Surgeons in Ireland. The National Clinical Effectiveness Committee defines national clinical audit as "a cyclical process that aims to improve patient care and outcomes by systematic, structured review and evaluation of clinical care against explicit clinical standards on a national basis" (National Clinical Effectiveness Committee, 2015, p. 2). NOCA supports hospitals to learn from their audit cycles.

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RCSI

HSE

ROYAL COLLEGE OF PHYSICIANS OF IRELAND

STROKE

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DESIGNED BY SWERVE

NOCA National Office of Clinical Audit

INAS Irish National Audit of Stroke

Irish National Audit of Stroke

National Report 2020

NOCA National Office of Clinical Audit

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23 November, 2021

Dear Prof Harbison,

I wish to acknowledge receipt of the *Irish National Audit of Stroke National Report 2020*.

Following your presentation to the NOCA Governance Board on the 18th November 2021 and feedback garnered from our membership, we are delighted to endorse this report.

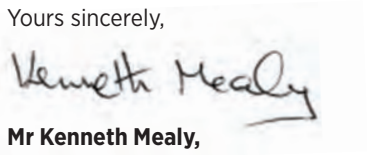
I wish to congratulate you, Audit Manager Joan McCormack and your governance committee in the development of this report which is a valuable quality improvement initiative.

We look forward to the findings of the once-off audit planned for later this year that will explore the impact of the use of direct oral anticoagulants on stroke.

We also look forward to the findings of the Organisational Survey, due for publication in the first quarter of 2022 that reviews staffing and structures that we expect will further inform quality improvement initiatives.

Please accept this as formal endorsement from the NOCA Governance Board of the *Irish National Audit of Stroke National Report 2020* and we wish you every success in your ongoing commitment to improving the care of stroke patients in Ireland.

Yours sincerely,



Mr Kenneth Mealy,
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FOREWORD

PROFESSOR PETER KELLY
CONSULTANT STROKE NEUROLOGIST
DIRECTOR OF THE STROKE SERVICE AT
THE MATER MISERICORDIAE UNIVERSITY HOSPITAL
ASSOCIATE PROFESSOR OF NEUROLOGY
AT UNIVERSITY COLLEGE DUBLIN

With heart disease and cancer, stroke is one of the 'big three' causes of death globally, the leading cause of acquired disability in adults, and a major contributor to cognitive decline and dementia. This report from the Irish National Audit of Stroke is the 9th since the inception of the Irish National Stroke Registry, and 2nd since incorporation of the Registry under the auspices of the National Office of Clinical Audit. The report describes the status of stroke care in Irish hospitals during 2020, the first year of the COVID-19 pandemic, when hospital services and acute healthcare staff were under extraordinary strain. The main message is that although some acute care metrics slightly worsened, probably as a consequence of COVID-related disruption in emergency care pathways, this did not translate into higher rates of death or disability for patients. Indeed, stroke-related case-fatality was reduced from 12% in 2019 to 11% in 2020, and the proportion of patients discharged home (an indicator of major disability) increased from 56% in 2019 to 59% in 2020. This is a testament to the hard work and dedication of healthcare staff throughout Ireland during this most challenging of years.

Several other indicators suggest that aspects of the acute care system are working well for patients with stroke. The median time from hospital arrival to medical review was short, 11 minutes in 2020, improved from 17 minutes in 2019. The median time to brain scanning was also short at just over one hour, improved significantly from 80 minutes in 2019. Just under 11% of patients received thrombolytic therapy, a time-sensitive clot-buster treatment that must be targeted towards carefully selected patients. This metric compares favourably with international data. Between 44-60% who required health and social care professional (physiotherapy, occupational therapy, speech and language therapy) expertise were assessed within 24 hours of hospital admission, also improved from previous years.

Despite these positive signs, there is no room for complacency. Most concerning, the proportion of patients admitted to stroke units remains stalled at 71%, unchanged over several years, and well below the national target of 90%. Stroke units have proven benefits for all stroke patients to reduce death and disability by as much as one-fifth. The current situation is likely to reflect capacity constraints within the acute hospital system. Sustained focus and resourcing is needed to increase stroke unit capacity nationally. Secondly, delays remain common among patients transferred from other hospitals for emergency thrombectomy, a time-sensitive procedure for patients with severe stroke. More work needs to be done to streamline processes to reduce these delays. The scope of the audit does not include subarachnoid haemorrhage, a severe form of stroke, which disproportionately affects young adults, or post-acute care, which patients and families consistently rate as of high importance to them. Although much progress has been made, there is much still to do.

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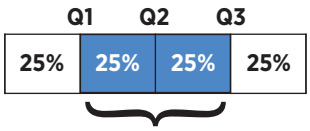
GLOSSARY OF TERMS AND DEFINITIONS

TABLE 1.0: ACRONYMS / ABBREVIATIONS

ACRONYM	FULL TERM
ADLs	activities of daily living
AF	atrial fibrillation
aphasia	A disorder that affects the ability to speak, read, write, and understand language.
AVERT	A Very Early Rehabilitation Trial after stroke.
carotid endarterectomy	Carotid endarterectomy is surgery that removes plaque build-up from inside a carotid artery in the neck.
carotid stenosis	Carotid stenosis is a narrowing of the carotid arteries, the two major arteries that carry oxygen-rich blood from the heart to the brain.
carotid stenting	Carotid stenting is a procedure in which a vascular surgeon or neuroradiologist inserts a stent which expands inside the carotid artery in order to increase blood flow in areas blocked by plaque.
cognitive linguistic communication disorders	Disorders that can affect attention, memory, problem-solving, and interpretive language, which in turn affect communication abilities.
COVID-19	Coronavirus disease 2019 - COVID-19 is the disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the coronavirus that emerged in December 2019.
CTA	computed tomography angiogram
DTI	'door to imaging' – this is a term used to indicate the time between the arrival of the patient at the hospital and the time of the first brain scan. Once the patient has a brain scan, a decision about treatment can be made.
DTN	'door to needle' – this is a term used to indicate the time between the arrival of the patient at the hospital and the time of thrombolysis treatment.
DVR	Data Validation Report
dysarthria	A speech disorder caused by muscle weakness.
dyspraxia	A condition that affects movement and coordination.
ESD	Early Supported Discharge
EVT	endovascular thrombectomy
EVT stroke centre	A hospital that can provide a thrombectomy service.
FAST	face, arm, speech, time
FEES	fiberoptic endoscopic evaluation of swallowing
haemorrhagic stroke	Haemorrhagic stroke occurs when a blood vessel in the brain leaks or ruptures.
HIPE	Hospital In-Patient Enquiry
HIQA	Health Information and Quality Authority
HPO	Healthcare Pricing Office
HSCP	health and social care professional

ACRONYM	FULL TERM
HSE	Health Service Executive
ICD-10-AM	International Classification of Diseases, Tenth Revision, Australian Modification, Tenth Edition
IHF	Irish Heart Foundation
INAS	Irish National Audit of Stroke
INR	international normalised ratio
IQR	 Interquartile range = Q1–Q3 The interquartile range is a measure of variability, based on dividing a dataset into quartiles. It represents the middle 50%.
ischaemic stroke	This is the most common type of stroke. It happens when the brain's blood vessels become narrowed or blocked, causing severely reduced blood flow (ischaemia).
KPI	key performance indicator
LOS	length of stay
MCA	middle cerebral artery
median	The median is the middle number in a sorted (ascending or descending) list of numbers and can be more descriptive of that dataset than the mean.
MRI	magnetic resonance imaging
mRS	modified Rankin Scale
NCPS	National Clinical Programme for Stroke
NIHSS	National Institutes of Health Stroke Scale
NOAC	novel oral anticoagulant
NOCA	National Office of Clinical Audit
NSP	National Stroke Programme
NSR	National Stroke Register
NTS	National Thrombectomy Service
onset of stroke symptoms	This is the first time that stroke symptoms were noticed by the patient or a family member/friend.
OT	occupational therapist
PPI	Public and Patient Interest
Protocol 37	Emergency Inter-Hospital Transfer Policy
proximal occlusion	The location of the blood clot in either the large arteries in the neck or at the base of the brain.
PT	physiotherapist

ACRONYM	FULL TERM
recanalisation	The term used to describe when blood flow in the occluded blood vessel is restored.
subarachnoid haemorrhage	Subarachnoid haemorrhage is a life-threatening type of stroke caused by bleeding into the space surrounding the brain.
SLT	speech and language therapist
SPSS	Statistical Package for the Social Sciences
SSNAP	Sentinel Stroke National Audit Programme
stroke unit	A geographically discrete area in a ward where patients with a stroke are cared for by a multidisciplinary team that has specialist knowledge, protocols, training and skills in stroke care and the ability to monitor and regulate basic physiological function.
thrombectomy	The mechanical removal of a blood clot in the brain.
thrombolysis	The breakdown of blood clots formed in blood vessels using medication.
Time is Brain	'Time is Brain' is a phrase that simply means that the more time passes before a patient with a stroke receives treatment, the worse the outcome will be. It also means that if the stroke is treated immediately, brain damage will be minimised.
UK	United Kingdom
WTE	whole time equivalent

EXECUTIVE SUMMARY

This is the second annual report of the Irish National Audit of Stroke (INAS) since its incorporation into the National Office of Clinical Audit (NOCA). Stroke remains the third leading cause of death in Ireland and Western Europe, and the leading cause of severe, adult-onset physical disability. We report on patients aged 17 years and over who were treated in the 24 public hospitals that provide acute stroke care in Ireland and that admit more than 25 stroke cases annually. Data are typically collected by stroke services on behalf of the participating hospitals. In order to be included in the audit report, hospitals must have collected data on more than 80% of patients with a stroke. This year's report incorporates data from the 23 participating hospitals that met the mandatory 80% coverage threshold; overall, despite the effects of the coronavirus disease 2019 (COVID-19) pandemic, coverage improved from 83% to 93% across the hospital system for patients with a stroke identified through the Hospital In-Patient Enquiry (HIPE) system as having been admitted with acute stroke, either ischaemic or haemorrhagic. The audit does not currently collect data on subarachnoid haemorrhage; however, we are exploring how these data may be effectively incorporated in future years' audits. Because of the increased coverage, the number of individuals on whom data have been collected increased by more than 20% in 2020 from 2019. This important increase in coverage does appear to have led to substantial changes in proportional outcomes for most variables, but caution should be exercised in interpretation of minor changes from previous years.

The stroke audit portal supports three datasets related to stroke (see Appendix 2):

a) core clinical dataset: reporting on the care provided to all patients with a stroke within the inclusion criteria; the results from this dataset are presented in Chapters 4, 6, 7 and 9
b) thrombectomy dataset: reporting on the care provided to patients who underwent a thrombectomy procedure in either of the two endovascular thrombectomy (EVT) stroke centres; the results from this dataset are presented in Chapters 5 and 9
c) health and social care professional (HSCP) dataset: reporting additional HSCP data from participating hospitals and disciplines; the results from this dataset are presented in Chapter 8.

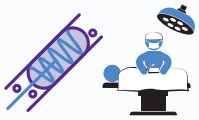
This year we have included an additional chapter outlining the effects of the pandemic and the actions taken to mitigate its effects on stroke care (see Chapter 9). Reassuringly, it is evident that the care of patients with a stroke was not adversely affected in most measured parameters; indeed, some measures of care improved. We summarise these data in the Key findings – emergency care section below: in short, we have identified some changes in the acute response to people admitted with stroke, which may reflect changes associated generally with pandemic precautions in emergency departments. Overall, this year's annual report shows that stroke services during 2020 were robust enough to stay effective and operational throughout what was a very challenging year, despite redeployment of specialist nursing and HSCP staff in a limited number of stroke centres.

KEY FINDINGS

EMERGENCY CARE

- The majority of stroke cases in 2020 were ischaemic stroke (85%, n=4379).
- The average age of patients with a stroke was 72 years, and one-quarter (n=1333) of all patients with a stroke were aged under 65 years.
- Fifty-seven percent (n=2944) of patients with a stroke were male and 43% (n=2209) of patients with a stroke were female.
- One-half of cases (50%, n=1400) arrived at hospital within 3 hours of symptom onset, a time frame that was unchanged from 2019.
- The median time to contact with the medical team after hospital arrival was 11 minutes, a decrease of 6 minutes from 2019.
- The median 'door to imaging' (DTI) time was 1 hour and 3 minutes, an improvement from 1 hour and 20 minutes in 2019.
- The intravenous thrombolysis rate among patients with ischaemic stroke was 10.6% (n=466).
- The median 'door to needle' (DTN) time nationally was 55 minutes.
- Patients who have a stroke while an inpatient for another condition are older and have a higher mortality rate than those within the main population.

THROMBECTOMY



- The thrombectomy rate for patients with ischaemic stroke was 8.6% (n=370), similar to 2019 (8.5%, n=302).
- Hospital arrival to computed tomography scan for thrombectomy cases was 23 minutes.
- In 2020, the median time from onset of stroke symptoms to arrival at the endovascular thrombectomy (EVT) stroke centre was 1 hour and 34 minutes for patients who arrived directly to the EVT stroke centre, similar to 2019 (1 hour and 33 minutes), and 4 hours and 25 minutes for those who were transferred to the EVT stroke centre, an increase of 25 minutes from 2019.
- The national median computed tomography angiogram to decision time for thrombectomy was 31 minutes, an increase from 26 minutes in 2019.
- The median time from arrival at the primary hospital to recanalisation for patients who were transferred to the EVT stroke centre was 3 hours and 24 minutes. For those who were admitted directly to the EVT stroke centre, it was 1 hour and 56 minutes.
- The number of patients with moderate to severe stroke symptoms more than halved from 68 patients (23%) pre-thrombectomy to 30 patients (10%) by 24 hours post-thrombectomy.

KEY FINDINGS

STROKE UNIT CARE

- In 2020, 71% (n=3649) of patients with a stroke were admitted to a stroke unit; this was unchanged from 2019, but remains well below the target of 90%.
- A larger proportion of patients with a stroke were unable to access a stroke unit due to infection control risk in 2020 (13%, n=195) compared to 2019 (3%, n=34). ↑
- Sixty-eight percent (n=3507) of patients had the safety of their swallow screened in 2020; of those, only 43% (n=1507) had the screen completed within the recommended 4 hours of admission.
- Patients were 1.7 times more likely to receive swallow screening and twice as likely to receive mood screening if they were admitted to a stroke unit.
- Only 5% (n=241) of patients with a stroke had a psychological assessment.
- Most patients with a stroke were assessed by a clinical nurse specialist (79%, n=4093); however, this was a reduction from 84% (n=3593) in 2019. ↓
- In 2020, 17% (n=891) of all stroke cases had a diagnosis of atrial fibrillation (AF) pre-stroke, and treatment with anticoagulant medication was reported in 85% (n=756) of these cases.
- Twenty-eight percent (n=1117) of patients with ischaemic stroke who were alive at discharge were diagnosed with AF, and 79% (n=878) of those were prescribed an anticoagulant.

OUTCOMES

- For patients with a stroke who were admitted to an acute stroke unit, the percentage of their hospital stay spent in the stroke unit was 75% – the target is 90%.
- Stroke is the leading cause of acquired disability, and the modified Rankin Scale scores indicate that 71% (n=2781) of ischaemic stroke cases and 60% (n=413) of haemorrhagic stroke cases had disabilities on discharge.
- Median stroke unit length of stay (LOS) varied between hospitals from 3 to 12 days.
- For patients with a stroke, who spent some or all of their hospital stay in a stroke unit, the total bed days spent in hospital was 56,536, 75% (n=42285) of those bed days were spent in a stroke unit – the target is 90% (Figure 7.4).
- More than one-half (n=3017, 59%) of patients with a stroke were discharged home in 2020. This is an increase from 2019, when 56% (n=2402) of patients with a stroke were discharged home. ↑
- In 2020, there were seven Early Supported Discharge (ESD) teams in Ireland. Seven percent (n=335) of patients nationally were discharged home with ESD, an increase from 5% (n=210) in 2019. ↑
- The reported mortality rate for patients with a stroke in 2020 was 11% (n=586), a reduction from 12% in 2019. ↓

KEY FINDINGS

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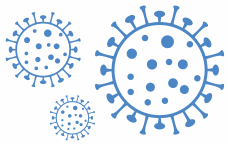
HEALTH AND SOCIAL CARE PROFESSIONAL DATASET

- In 2020, 15 hospitals had additional data recorded for patients who were seen by a health and social care professional (HSCP) (n=2609), a reduction from 17 hospitals in 2019. ↓
- Improvements were observed in 2020 across the HSCP dataset in seeing patients with a stroke on the day of or the day after hospital arrival. One-half (53%, n=968) of patients with a stroke who were seen by a physiotherapist (PT), almost one-half (44%, n=404) who were seen by an occupational therapist (OT), and 60% (n=747) who were seen by a speech and language therapist (SLT) were seen on the day of or the day after hospital arrival.
- In 2020, all therapists reported that a larger proportion of patients with a stroke had sufficient therapy compared to 2019. ↑
- About one-quarter of patients with a stroke who were assessed by a PT (29%, n=529) or an OT (26%, n=242) were physically dependent following their stroke, requiring the simultaneous assistance of more than one therapist or therapy assistant for rehabilitation.
- All therapists reported an increased proportion of patients with a stroke who were referred to ESD in 2020 compared to 2019:
  - PT – 2020: 9% (n=169) versus 2019: 4% (n=70)
  - OT – 2020: 27% (n=124) versus 2019: 21% (n=126)
  - SLT – 2020: 7% (n=92) versus 2019: 4% (n=43). ↑
- There was a reduction in the proportion of patients with a stroke who were referred to OT and SLT community services in 2020 compared to 2019:
  - OT – 2020: 14% (n=65) versus 2019: 25% (n=152)
  - SLT – 2020: 16% (n=200) versus 2019: 21% (n=210). ↓

COVID-19

There was no substantial change in stroke activity between the pre-COVID-19 and COVID-19 periods.



SOME ACUTE CARE PROCESSES IMPROVED DURING THE COVID-19 PERIOD:

- The median time from arrival at hospital to review by a medical team decreased from 16 minutes (interquartile range [IQR]: 0–129 minutes) in the pre-COVID-19 period to 12 minutes (IQR: 0–75 minutes) in the COVID-19 period.
- The DTI time was 60 minutes or less for 44% (n=1224) of patients in the pre-COVID-19 period, which increased to 47% (n=1443) of patients in the COVID-19 period.
- The median DTI time decreased from 79 minutes in the pre-COVID-19 period to 67 minutes in the COVID-19 period.
- The proportion of patients with a stroke who were discharged home with ESD increased during the COVID-19 period (8%, n=277) compared to the pre-COVID-19 period (5%, n=166).

SOME ACUTE CARE PROCESSES WORSENED:

- The median DTN time in the pre-COVID-19 period was 54 minutes; this increased to 58 minutes in the COVID-19 period.
- In the pre-COVID-19 period, 44% (n=961) of patients with a stroke who had swallow screening performed had it performed within 4 hours of admission; this decreased to 41% (n=993) in the COVID-19 period.
- In the pre-COVID-19 period, 83% (n=2590) of patients with a stroke had their care discussed at multidisciplinary team meetings; this declined to 73% (n=2464) in the COVID-19 period.
- The median LOS was shorter during the COVID-19 period compared to the pre-COVID-19 period for both total hospital stay (median: 8 days versus 10 days) and stroke unit stay (median: 7 days versus 8 days).

KEY FINDINGS

KEY FINDINGS 2020

EMERGENCY CARE

11 minutes - the median time to contact with a doctor after arrival at hospital was 11 minutes, a decrease of six minutes from 2019

1 hour and 3 minutes - the median time from arrival at hospital to brain scan was 1 hour and 3 minutes, an improvement from 1 hour and 20 minutes in 2019

10.6% - IV thrombolysis rate. Thrombolysis is the breakdown of blood clots formed in blood vessels using medication

8.6% of all ischaemic stroke patients had a thrombectomy. This is a procedure where large clots can be removed from arteries in the brain

STROKE UNIT CARE

71% of patients with a stroke were admitted to a stroke unit (below the target of 90%)

68% of patients with a stroke had the safety of their swallow screened in 2020; of those, only 43% had the screen completed within the recommended 4 hours of admission

5% of patients with a stroke had a psychological assessment

88% of all patients with a stroke were assessed by at least one type of health and social care professional (HSCP)

2609 PATIENTS WITH A STROKE FROM 15 HOSPITALS
HAD ADDITIONAL DATA RECORDED ON THE HSCP DATASET

ATRIAL FIBRILLATION

Atrial fibrillation (AF) is a fast, irregular beating of the heart resulting in a slow flow of blood through the heart, which can result in the formation of blood clots.
If a clot leaves the heart and travels to the brain, it can cause a stroke by blocking the flow of blood through the arteries in the brain.
AF is treated with medications called anticoagulants which prevent the formation of blood clots in the heart.

17%

17% of all stroke cases had a diagnosis of AF pre-stroke and treatment with anticoagulant medication was reported in 85% of these cases

28%

28% of patients with ischaemic stroke, alive at discharge, were diagnosed with AF and 79% were prescribed an anticoagulant

OUTCOMES

75% - for patients with a stroke who were admitted to an acute stroke unit, the percentage of their hospital stay spent in the stroke unit was 75%

7 days – median length of stay on a stroke unit

59% of patients with a stroke were discharged home

13% of patients with a stroke were discharged to offsite rehabilitation

7% of patients with a stroke were discharged home with Early Supported Discharge (stroke specific rehabilitation in the home setting)

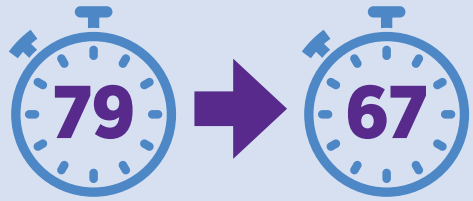
71% of ischaemic stroke cases and **60%** of haemorrhagic stroke cases had disabilities on discharge

11% mortality rate

STROKE ACTIVITY AND COVID-19

The median time from arrival to review by a medical team reduced from **16 minutes** in the pre-COVID-19 period to **12 minutes** in the COVID-19 period

The door to imaging time was within one hour for **44%** of cases in the pre-COVID-19 period increased to **47%** in the COVID-19 period



The median door to imaging time reduced from **79 minutes** pre-COVID-19 to **67 minutes** in the COVID-19 period

The proportion of patients with a stroke who were discharged home with Early Supported Discharge increased to **8%** during the COVID-19 period, when compared to the pre-COVID-at **5%**

KEY RECOMMENDATIONS

RECOMMENDATIONS FOR THE NATIONAL OFFICE OF CLINICAL AUDIT

- Complete a study in order to explore the factors contributing to stroke in patients prescribed anticoagulation therapy.
- Increase the participation of HSCPs in the HSCP dataset within the Irish National Audit of Stroke (INAS).

RECOMMENDATIONS FOR THE NATIONAL STROKE PROGRAMME

- Develop a stroke awareness campaign.
- Pilot a large vessel occlusion ambulance bypass for patients with a stroke to the EVT stroke centres in Dublin and Cork.
- Improve the level of swallow screening for patients with a stroke.
- All stroke services should have access to a clinical neuropsychologist/psychologist as part of a specialist multidisciplinary team providing care to patients with a stroke.

PUBLIC AND PATIENT INTEREST PERSPECTIVE

My name is Martin Quinn and I am very pleased to have the opportunity to contribute a message, as a public and patient interest representative, to the Irish National Audit of Stroke (INAS) annual report and summary report for 2020. This is my second year to have such an opportunity, as I also contributed a message to the 2019 reports. I am a native of Bansha, Co Tipperary, and I am a stroke survivor, having suffered a stroke in 2013 while I was doing an interview on local radio. The experience of hospitalisation and recovery left me with a desire to advocate on behalf of stroke survivors and their families, and I have been active with the Irish Heart Foundation (IHF) in many of their campaigns for better services and awareness for stroke survivors. I was really pleased to be nominated by the IHF to serve on the INAS Governance Committee and to contribute to its valuable work. In any health-related forum, the voice of the patient should never be overlooked so as to ensure that the interests of the patient and the public are best served. It should never be forgotten that the patient is the central figure in healthcare, and the patient's voice must always be heard, as it is by the INAS Governance Committee.

In providing a message for this report, I would like to highlight a number of points. In November 2019, I – along with my colleagues Dr Rónán Collins, and Mr Chris Macey of the IHF – met with then Minister for Health Mr Simon Harris TD to discuss a number of issues in relation to stroke. However, a general election followed in February 2020, which resulted in a change of Minister and therefore a loss of opportunity to follow up directly with the then Minister. As a public and patient interest representative, I call on Minister for Health, Mr Stephen Donnelly TD to follow up with us so that we can further discuss the issues raised in November 2019. One of those issues raised, and one that I am very passionate about, is that of a stroke awareness campaign. As also indicated in this year's annual report, the INAS continues to highlight the need to increase public awareness of the symptoms of stroke and the importance of seeking immediate emergency care. I fully agree with the INAS recommendation that a stroke awareness campaign should be funded as a priority in order to ensure that patients can access care as quickly as possible. We need a firm commitment to implement this by the end of 2022.

Another issue discussed in the November 2019 meeting was the piloting of a large vessel occlusion bypass model that would enable patients within the catchment area of specified Dublin and Munster hospitals to be redirected from their nearest hospital directly to the endovascular thrombectomy (EVT) stroke centre in Beaumont Hospital or Cork University Hospital. As in the annual report for 2019, the INAS continues to recommend this pilot scheme and I would very much welcome its implementation in 2022. I am very pleased that these and other issues – such as improving the level of swallow screening and ensuring that all hospitals offering a stroke service provide psychology services – are included as some of the key recommendations in the INAS annual report for 2020. I am delighted to be a member of the INAS Governance Committee, representing and advocating for public and patient interests in stroke care, and ensuring that the patient's voice is always heard and listened to.

Thank you.

Martin Quinn
Public and Patient Interest Representative
Irish National Audit of Stroke Governance Committee

CHAPTER 1
INTRODUCTION

CONTENTS >

CHAPTER 1: **INTRODUCTION**

INTRODUCTION

Stroke is the third leading cause of death in Western Europe and is the leading cause of severe long-term adult disability (The Stroke Alliance for Europe, 2020). Stroke is an important health issue for people in Ireland, as approximately 5,800 adults were admitted to hospitals with a stroke in 2020. Stroke can affect people physically, emotionally and socially. It has a significant impact on Health Service Executive (HSE) resources, accounting for up to 4% of total health expenditure annually (Health Information and Quality Authority, 2017a). Although the economic costs of stroke in terms of lost employment and the cost of support in the community are significant, the impact on family members or friends who care for stroke survivors is massive. It is therefore important that all hospitals providing acute stroke services deliver high-quality and equitable stroke care.

This is the second Irish National Audit of Stroke (INAS) annual report, reporting on the care that patients with a stroke received in 2020. In December 2019, a novel strain of coronavirus, commonly known as coronavirus disease 2019 (COVID-19), was identified and spread globally, causing significant disruption to, and strain on, healthcare services, societal life and economies all over the world. This report includes an additional chapter (see Chapter 9) reporting on the impact of COVID-19 on stroke care in Ireland, and compares the 'pre-COVID-19 period' (4th of March 2019 to 29thDecember 2019) to the 'COVID-19 period' (2nd March 2020 to 27th December 2020). We would like to pay tribute to all the healthcare professionals who continued to provide stroke care to patients during this period of unprecedented pressure within our hospitals, particularly to the clinical nurse specialists in stroke, advanced nurse practitioners in stroke, and health and social care professionals (HSCPs) who continued to record data, thus ensuring that we have additional clinical data on the impact of COVID-19 on stroke care in Ireland.

WHAT IS A STROKE?

A stroke occurs when the blood supply to part of the brain is interrupted or reduced, preventing brain tissue from getting oxygen and nutrients. Brain cells begin to die in minutes. Stroke is a medical emergency, and prompt treatment is crucial. Early action can reduce brain damage and other complications.

There are two main causes of stroke: a blocked artery (ischaemic stroke) or a blood vessel leaking or bursting (haemorrhagic stroke). Some people may have only a temporary disruption of blood flow to the brain, known as a transient ischaemic attack (TIA), which does not cause lasting symptoms.

Ischaemic stroke

This is the most common type of stroke, accounting for approximately 85% of strokes. It happens when the brain's blood vessels become narrowed or blocked, causing severely reduced blood flow (ischaemia). Blocked or narrowed blood vessels are caused by fatty deposits that build up in blood vessels, or by blood clots or other debris that travel through the bloodstream and lodge in the blood vessels in the brain (Figure 1.1).

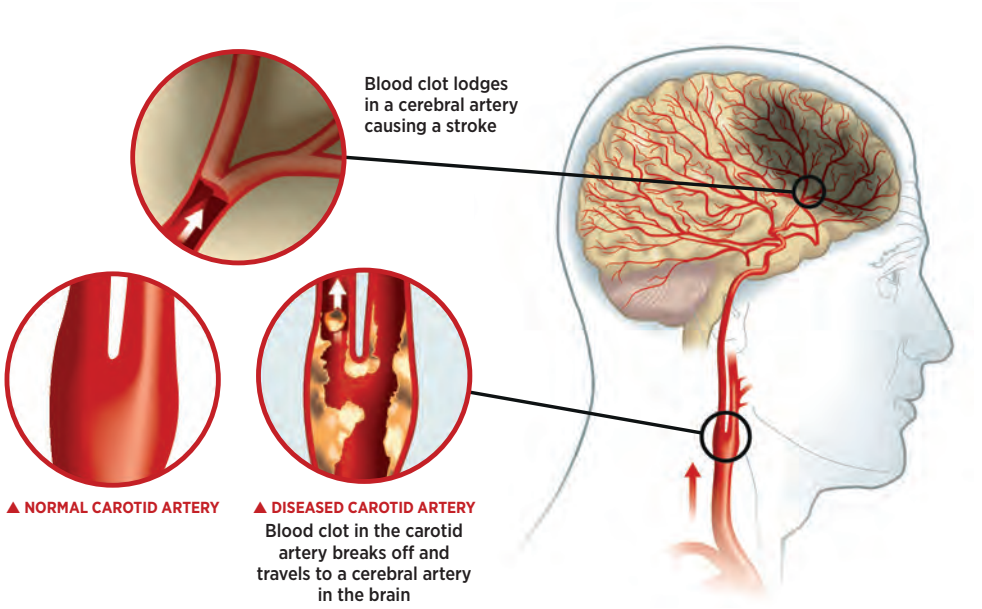


FIGURE 1.1: ISCHAEMIC STROKE

Haemorrhagic stroke

Haemorrhagic stroke occurs when a blood vessel in the brain leaks or ruptures (Figure 1.2).

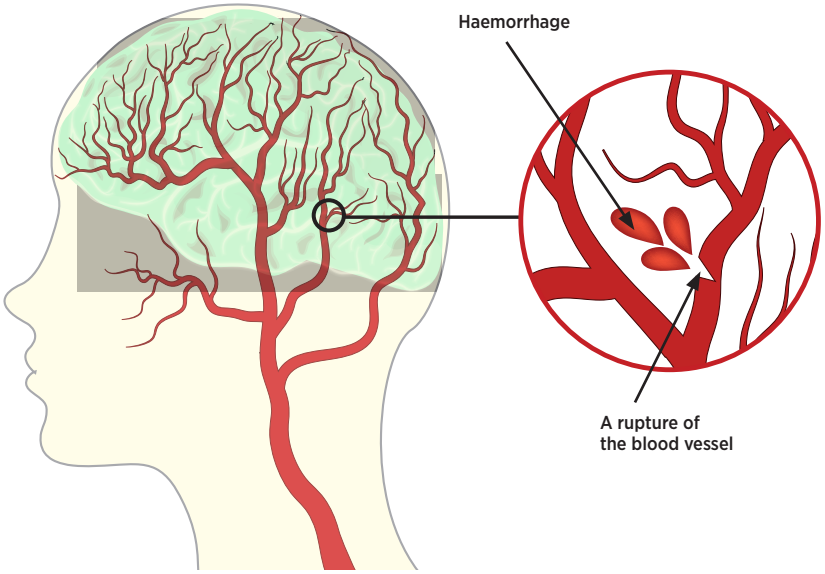


FIGURE 1.2: HAEMORRHAGIC STROKE

ESTABLISHMENT OF THE IRISH NATIONAL AUDIT OF STROKE

The HSE National Stroke Programme was established in 2010 with a mission to shape the delivery of better care through better use of resources, and in 2012, the *Stroke Model of Care* was published (HSE, 2012a). The National Stroke Programme is also known as the National Clinical Programme for Stroke, but will be referred to herein as the National Stroke Programme (NSP). In 2012, the NSP developed the National Stroke Register (NSR) in partnership with the Health Research and Information Division of the Economic and Social Research Institute (ESRI) to measure the effect of the implementation of the Stroke Model of Care. Through collaboration with the Hospital In-Patient Enquiry's (HIPE's) existing information system and the addition of a stroke-specific data entry system, the NSR provided data for the planning and estimation of resource requirements for stroke services, for evaluation, and for clinical audits. The NSR has evolved to include data collection on thrombectomy and on discipline-specific rehabilitation metrics. The integration of quality improvement initiatives throughout the system highlighted the importance of national clinical audit to improve stroke pathways of care for patients with a stroke. In 2019, governance of the NSR was transferred to the National Office of Clinical Audit (NOCA), and in 2020 the first INAS annual report was published (NOCA, 2020).

NATIONAL OFFICE OF CLINICAL AUDIT (NOCA)

NOCA enables the Irish healthcare system to continually improve by maintaining a portfolio of prioritised national clinical audits measured against national and international standards. By making reliable data available to those who use, manage and deliver healthcare, clinical audits help to refine Irish healthcare, improve patient outcomes, and achieve change at local and national level. NOCA works to promote an open culture of shared learning from national clinical audit in order to improve clinical outcomes and patient safety.

NOCA is funded by the HSE National Office of the Chief Clinical Officer, is governed by an independent voluntary board, and is operationally supported by the Royal College of Surgeons in Ireland (RCSI) (Figure 1.3).

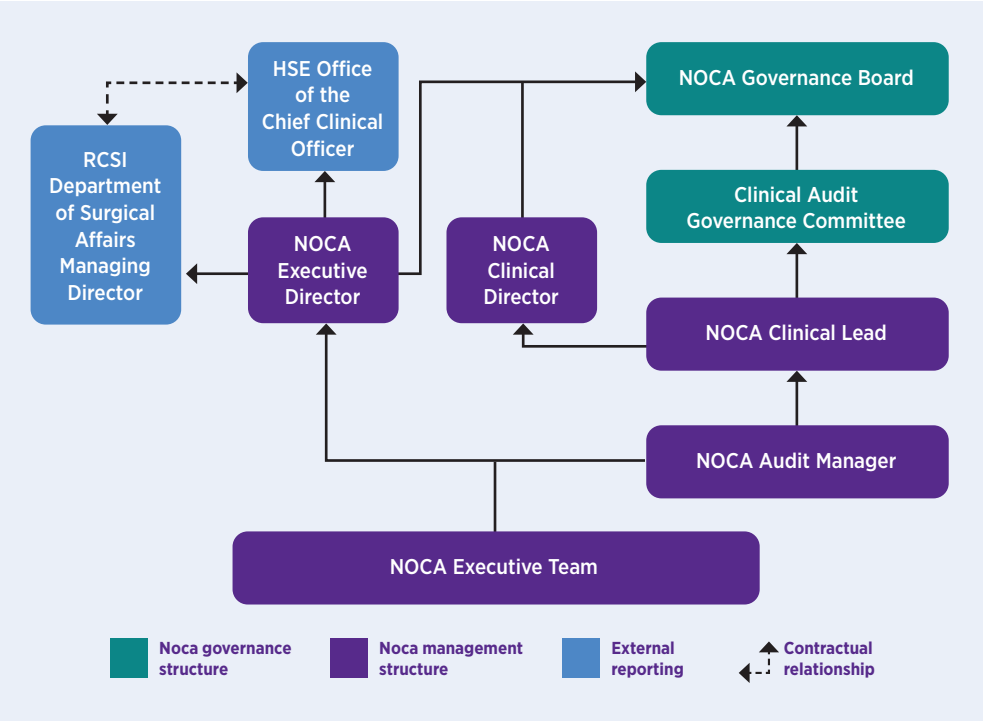


FIGURE 1.3: GOVERNANCE AND MANAGEMENT TEAMS FOR NOCA AUDITS

IRISH NATIONAL AUDIT OF STROKE GOVERNANCE COMMITTEE

The INAS Governance Committee (Appendix 1) continues to oversee the INAS. Its membership comprises clinical experts, public and patient interest representatives, the Healthcare Pricing Office (HPO), senior accountable healthcare management, and research and specialist bodies. The INAS Governance Committee also ensures that all relevant stakeholders are represented in order to verify that outputs of the audit findings are interpreted appropriately. The Clinical Lead, supported by the NOCA Executive Team, has operational responsibility for implementation of the INAS.

AIM AND OBJECTIVES OF THE IRISH NATIONAL AUDIT OF STROKE

The INAS Governance Committee developed the aim and objectives for the INAS (Table 1.1). The INAS Governance Committee ensures that these objectives are met and that confidential processes are upheld.

TABLE 1.1: IRISH NATIONAL AUDIT OF STROKE AIM AND OBJECTIVES

AIM
To conduct audit of stroke care, including clinical care and service organisation.
OBJECTIVES
▶ To maintain a database of all inpatients with a stroke in Ireland in order to drive continuous quality improvement and to deliver the best patient outcomes.
▶ To support the collection of high-quality data on all inpatient strokes in Ireland in order to permit local and national reporting of outcomes.
▶ To disseminate the outputs of the data in a timely manner to all relevant stakeholders.
▶ To benchmark stroke care and outcomes against national and international standards.
▶ To support/promote the use of stroke data for quality improvement initiatives at local and national level.
▶ To provide data to support and inform national policy for stroke and related conditions.

WHO IS THIS REPORT AIMED AT?

The INAS annual report is intended for use by a wide range of individuals and organisations, including:

1. patients and carers
2. patient advocacy organisations
3. healthcare professionals; hospital managers; Hospital Groups
4. policy-makers.
5. researchers.

The report has been designed in two parts:

1. The *Irish National Audit of Stroke National Report 2020* presents the key findings on the INAS, case mix, patient pathway and outcomes.
2. *The Irish National Audit of Stroke National Report 2020: Summary Report* will be of particular interest to patients, patient organisations and the public.

CHAPTER 2
METHODOLOGY

CONTENTS >

CHAPTER 2: **METHODOLOGY**

The INAS collects additional stroke-specific data on patients with a stroke through a stroke audit portal on the HIPE system in collaboration with the HPO. Data from the HIPE system, such as age, sex, admission source, etc., are merged with additional INAS data, such as hospital arrival and stroke unit admission data. The reference population for this INAS national report includes patients aged 17 years and over who were treated in public hospitals that provide acute stroke care and that admit more than 25 stroke cases annually. An extract of data for the national report is sent to NOCA from the HPO, with the cases anonymised.

The dataset has three sections (Appendix 2):
a) core clinical dataset
b) thrombectomy dataset
c) HSCP dataset.

Chapters 4, 6, 7 and 9 of this document will report on the core clinical dataset, Chapter 5 will report on the thrombectomy dataset and Chapter 8 will report on the HSCP dataset.

INPATIENT STROKE

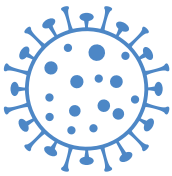
The ability to collect additional clinical data on patients who had a stroke while in hospital with another condition (inpatient stroke) has always been available within the stroke audit portal but collecting these data was not mandatory. Furthermore, cases of inpatient stroke were not included in the total number of strokes in each hospital. It is estimated that inpatient stroke accounts for approximately 10% of patients with a stroke, and it is important to audit the care they receive; therefore, it became mandatory from 2020 to collect data on inpatient stroke.

HIPE records a 'hospital acquired diagnosis' (HADx) indicator for any additional diagnoses that were not present on admission but were acquired by the patient during the current episode of care. This is defined within HIPE as a condition that arises during the episode of admitted patient care and would not have been present or suspected on admission (HPO, 2021). This stroke HADx flag has been in use in HIPE since 2011 and is assigned to relevant diagnoses by the HIPE coder based on the information available in the patient record.

In previous stroke reports, only cases in the stroke audit portal with a principal diagnosis of stroke as coded by HIPE were included in the total number of stroke cases in each hospital. From 2020, patients with a principal diagnosis of stroke, as well as patients with a secondary diagnosis of stroke who have been assigned a stroke HADx flag, are included in the total number of stroke cases in each hospital.

There are patients with 'stroke' recorded in the stroke audit portal who are identified as an inpatient stroke and whose diagnosis of stroke in HIPE does not have an associated HADx flag. Where this occurs, there will need to be a cross-check between HIPE and the stroke audit portal before inpatient strokes can be reported. The Data Validation Report will be adapted in order to support these checks.

Initially, a description of the numbers of inpatient strokes will be provided in the 2020 INAS annual report, and detailed analysis will be reported on in the 2021 report.



COVID-19 REPORTING

In 2021, NOCA published the *NOCA COVID-19 Stroke Report Issue 1.0* (NOCA, 2021), which reported on the impact of COVID-19 on stroke services in Ireland using preliminary data from 1 January 2020 to 30 May 2020. Chapter 9 of this report will report on the impact of COVID-19 on stroke services in Ireland using stroke audit portal data comparing the pre-COVID-19 period (4th March 2019 to 29th December 2019) against the COVID-19 period (2nd March 2020 to 27th December 2020).

INCLUSION CRITERIA

Analysis for this report is based on records as captured on the stroke audit portal software. It includes cases that were:

i discharged between 1 January 2020 and 31 December 2020, inclusive
ii reported on HIPE, using the International Classification of Diseases, Tenth Revision, Australian Modification, Tenth Edition (ICD-10-AM) codes I61, I63 or I64 as a principal diagnosis[1] (Independent Hospital Pricing Authority 2017).
iii aged 17 years and over
iv core clinical dataset – all cases with the stroke unit field populated with either '1=Yes' or '2=No' within the stroke audit portal
v thrombectomy dataset – all cases with the thrombectomy field populated with '1=Yes' within the stroke audit portal
vi HSCP dataset – all cases with '1=Yes' populated for the seen by physiotherapist and/or occupational therapist and/or speech and language therapist fields within the stroke audit portal.

EXCLUSION CRITERIA

i patients aged 16 years and under
ii hospitals with fewer than 25 cases of acute stroke admitted in the reporting period
iii patients with a HADx stroke code of I61, I63 or I64
iv core clinical dataset – hospitals with less than 80% coverage of stroke cases included on the stroke audit portal
v core clinical dataset – patients who had a thrombectomy in Beaumont Hospital or Cork University Hospital and were transferred back to the referring hospital on the same day.

[1] The principal diagnosis on HIPE is defined as "The diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care, an episode of residential care or an attendance at the health care establishment, as represented by a code" (Independent Hospital Pricing Authority 2017).

DATA COLLECTION

Each hospital has an audit coordinator and a clinical lead who lead on stroke service governance within the hospital. The audit coordinator collects the core clinical data through the stroke audit portal in the individual hospital. A list of cases eligible for inclusion is identified by running a HIPE Discharge Report within the stroke audit portal. Additional cases may be identified manually. Most data are entered retrospectively.

Thrombectomy data are entered by the audit coordinators in the EVT stroke centres in Beaumont Hospital and Cork University Hospital.

HSCP data are entered by discipline (i.e. physiotherapy, occupational therapy, and speech and language therapy) in participating hospitals. The HSCP data collection began in 2018 and remains in the implementation phase; it will take time for data collection and reporting to become embedded into practice in all hospitals.

The HPO issues monthly coverage reports to the INAS Audit Manager, and issues extracts of data on a quarterly basis to NOCA for analysis. These data are analysed and quarterly reports are issued to the HSE Business Intelligence Unit and Hospital Groups. Most data are entered retrospectively and in accordance with the data collection targets (Table 2.1).

TABLE 2.1: REPORTING CALENDAR

Submission dates	Data Validation Reports (DVRs) sent to hospitals	Data entry target	Data reporting date
Q1: 01/01/2020–31/03/2020	N/A	31/07/2020	22/09/2020
Q2: 01/04/2020–30/06/2020	N/A	31/10/2020	12/01/2021
Q3: 01/07/2020–30/09/2020	N/A	31/01/2021	16/04/2021
Q4: 01/10/2020–31/12/2020	N/A	30/04/2021	01/06/2021

The final date for submission of 2020 data was 30 April 2021, after which the 2020 national HIPE file was closed.

DATA VALIDATION

In 2019, the NOCA statistical analysis team developed a data validation process for the INAS core clinical dataset. This process involves the data analyst producing a report of any missing information within the data and any data anomalies. The report is sent to the audit coordinators, who amend the record. A pilot DVR was successfully implemented in two hospitals in January 2020. In February 2020, a limited version of the DVR was sent to each hospital for completion prior to the close of the 2019 national HIPE file. In order to minimise the demands on the audit coordinators, many of whom had been redeployed to other clinical roles due to the impact of COVID-19, no DVRs were sent to hospitals in 2020. In 2021, DVRs will be sent to hospitals quarterly in order to reduce missing data and data anomalies, thus improving data quality.

DATA ANALYSIS

NOCA received the full stroke audit portal 2020 data extract from the HPO on 14 May 2021, and analysis was completed by the NOCA Data Analyst following data checks with the HPO. The analysis was conducted using Statistical Package for the Social Sciences (SPSS) V25.

HOSPITALS AND PEOPLE WE WORK WITH

Each hospital that participates in the INAS should have a local governance committee that includes a clinical lead and an audit coordinator. We would like to acknowledge the work of those who are involved in producing high-quality data – particularly the audit coordinators – and the efforts of interdisciplinary teams in each hospital to ensure that the stroke pathway for patients is continuously monitored and improved.

NOTE: Dublin Hospitals have been displayed collectively by hospital group

SAOLTA UNIVERSITY HEALTH CARE GROUP
Letterkenny University Hospital
Mayo University Hospital
Sligo University Hospital
Portiuncula University Hospital
University Hospital Galway

RCSI HOSPITALS
Beaumont Hospital
Cavan General Hospital
Connolly Hospital
Our Lady of Lourdes Hospital, Drogheda

DUBLIN MIDLANDS HOSPITAL GROUP
Tallaght University Hospital
Naas General Hospital
St James's Hospital

IRELAND EAST HOSPITAL GROUP
Mater Misericordiae University Hospital
Regional Hospital Mullingar
St Vincent's University Hospital
Wexford General Hospital

UL HOSPITAL GROUP
University Hospital Limerick

SOUTH/SOUTH WEST HOSPITAL GROUP
Bantry General Hospital
Cork University Hospital
University Hospital Kerry
Mercy University Hospital
South Tipperary General Hospital
University Hospital Waterford

LETTERKENNY UNIVERSITY HOSPITAL
CLINICAL LEAD: Dr Ken Mulpeter
AUDIT COORDINATOR: Christine McLaughlin

MAYO UNIVERSITY HOSPITAL
CLINICAL LEAD: Dr Tom O'Malley
AUDIT COORDINATOR: Niamh Murtagh

SLIGO UNIVERSITY HOSPITAL
CLINICAL LEAD: Dr Paula Hickey
AUDIT COORDINATOR: Una Moffatt

PORTIUNCULA HOSPITAL
CLINICAL LEAD: Dr Niamh Hannon
AUDIT COORDINATOR: Mary Diskin

UNIVERSITY HOSPITAL GALWAY
CLINICAL LEAD: Dr Niamh Hannon
AUDIT COORDINATOR: Mary O'Malley

UNIVERSITY HOSPITAL LIMERICK
CLINICAL LEAD: Dr Margaret O'Connor
AUDIT COORDINATOR: Nora Cunningham
AUDIT COORDINATOR: Ingrid O'Brien
AUDIT COORDINATOR: Shiji Paulose

CORK UNIVERSITY HOSPITAL
CLINICAL LEAD: Dr Simon Cronin
CLINICAL LEAD: Dr Liam Healy
AUDIT COORDINATOR: Glen Arrigan
AUDIT COORDINATOR: Karena Hayes

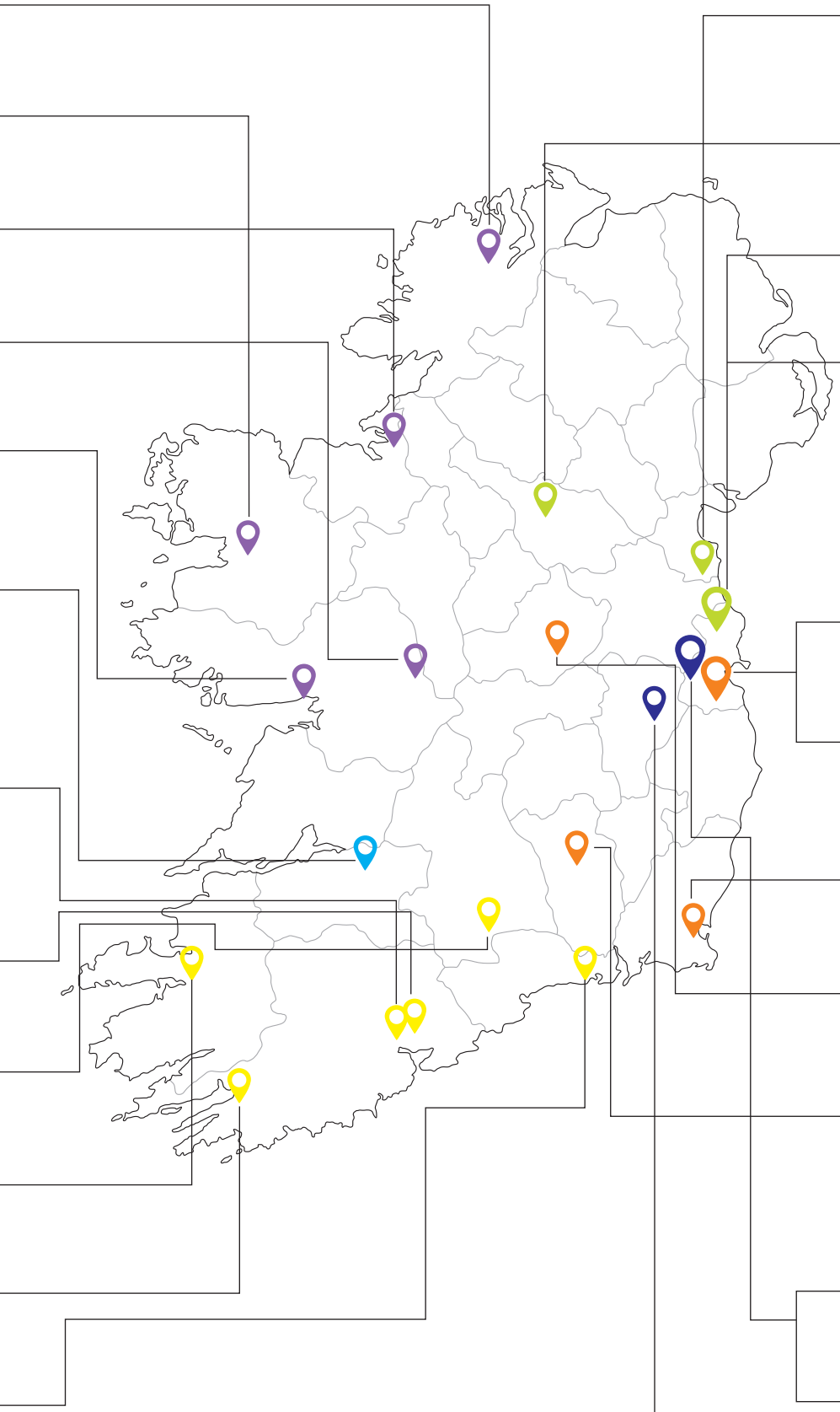
MERCY UNIVERSITY HOSPITAL
CLINICAL LEAD: Dr Catherine O'Sullivan
AUDIT COORDINATOR: Inês Saramago

SOUTH TIPPERARY GENERAL HOSPITAL
CLINICAL LEAD: Dr Christine Donnelly
AUDIT COORDINATOR: Bency Varghese

UNIVERSITY HOSPITAL KERRY
CLINICAL LEAD: Dr Barry Moynihan
AUDIT COORDINATOR: Mary Donovan

BANTRY GENERAL HOSPITAL
CLINICAL LEAD: Dr Brian Carey
AUDIT COORDINATOR: Noreen Lynch

UNIVERSITY HOSPITAL WATERFORD
CLINICAL LEAD: Prof. Riona Mulcahy
CLINICAL LEAD: Dr George Pope
AUDIT COORDINATOR: Breda Jones
AUDIT COORDINATOR: Catherine Whittle



OUR LADY OF LOURDES HOSPITAL, DROGHEDA

CLINICAL LEAD: Dr Olwyn Lynch
AUDIT COORDINATOR: Fiona Connaughton

CAVAN GENERAL HOSPITAL

CLINICAL LEAD: Dr John Corrigan
AUDIT COORDINATOR: Frances Smith

CONNOLLY HOSPITAL

CLINICAL LEAD: Dr Eamon Dolan
AUDIT COORDINATOR: Lisa Donaghy

BEAUMONT HOSPITAL

CLINICAL LEAD: Dr Karl Boyle
CLINICAL LEAD: Prof. John Thornton
AUDIT COORDINATOR: Emma Hickey
AUDIT COORDINATOR: Julie Lynch
AUDIT COORDINATOR: Leonie Weekes

MATER MISERICORDIAE UNIVERSITY HOSPITAL

CLINICAL LEAD: Dr Sean Murphy
AUDIT COORDINATOR: Caroline Deegan

ST VINCENT'S UNIVERSITY HOSPITAL

CLINICAL LEAD: Dr Tim Cassidy
AUDIT COORDINATOR: Imelda Noone
AUDIT COORDINATOR: Mary Kate Meagher

WEXFORD GENERAL HOSPITAL

CLINICAL LEAD: Dr Emma O'Sullivan
AUDIT COORDINATOR: Elaine Crosby

REGIONAL HOSPITAL MULLINGAR

CLINICAL LEAD: Dr Clare Fallon
AUDIT COORDINATOR: Sinead Gallagher

ST LUKE'S GENERAL HOSPITAL CARLOW-KILKENNY

CLINICAL LEAD: Dr Paul Cotter
AUDIT COORDINATOR: Ann Flahive

ST JAMES'S HOSPITAL

CLINICAL LEAD: Prof. Joe Harbison
AUDIT COORDINATOR: Orla Kennedy

TALLAGHT UNIVERSITY HOSPITAL

CLINICAL LEAD: Prof. Rónán Collins
AUDIT COORDINATOR: Nicola Cogan
AUDIT COORDINATOR: Helen Hobson
AUDIT COORDINATOR: Suzanne Dunne

NAAS GENERAL HOSPITAL

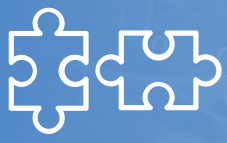
CLINICAL LEAD: Dr Paul O'Brien
AUDIT COORDINATOR: Trish Daly

CHAPTER 3
DATA QUALITY

Relevance

Accuracy and reliability

Timeliness and punctuality



Coherence and comparability

Accessibility and clarity

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CHAPTER 3: **DATA QUALITY**

The purpose of the data quality statement (Table 3.1) is to highlight the assessment of the quality of the INAS 2020 data using nationally agreed dimensions of data quality as laid out in *Guidance on a data quality framework for health and social care* (Health Information and Quality Authority, 2018).

The overall objectives of the INAS are to benchmark the quality of care across acute hospital stroke services in Ireland and to drive improvements in the quality of care. This data quality statement supports the interpretation and judgement of the information covering the reporting time period from 1 January to 31 December 2020, and it identifies strengths and areas for improvement.

DATA QUALITY STATEMENT

TABLE 3.1: OVERVIEW OF DATA QUALITY FOR THE IRISH NATIONAL AUDIT OF STROKE 2020

Dimensions of data quality	Definition (HIQA, 2018)	Assessment of dimension (INAS)
Relevance 	**Relevant data meet the current and potential future needs of users.**	Relevance of the INAS data for 2020 is assessed based on the following characteristics: • release of the data • value of the data • adaptability of the data • access to the data. **Release of the data** The INAS Audit Manager and Clinical Lead work in collaboration with data users to determine relevance. Data users include the Hospital Groups, the NSP and the HSE Business Intelligence Unit. Each participating hospital has the functionality to access and use its own data to support quality improvement initiatives and service development. The data are also used to inform responses to parliamentary questions and freedom of information requests. Release of the data for research and service evaluation is supported by NOCA's policies and procedures. One request was received by NOCA in this reporting period. **Value of the data** Annual reporting of the NSR data since 2013 has informed clinical practice both locally and nationally. Results of key performance indicators (KPIs) are informed by INAS data and released quarterly to the HSE. Reporting on the timeliness of processes of care has led to quality improvement initiatives such as the Door to Decision in Under 30! (Figure 5.11) quality improvement project led by Professor John Thornton, which has been key to improving the timeliness of brain imaging and of delivering acute stroke treatments such as thrombolysis and thrombectomy (NOCA, 2020). In 2021, NOCA published the *NOCA COVID-19 Stroke Report Issue 1.0* (2021), reporting on the impact of COVID-19 on stroke services in Ireland using preliminary INAS data from 1 January 2020 to 30 May 2020. The report provided the HSE and the Department of Health with information on early learnings of the impact of COVID-19 on stroke services that would help support the planning and management of the healthcare system during the COVID-19 pandemic.

Dimensions of data quality	Definition (HIQA, 2018)	Assessment of dimension (INAS)
Relevance 	**Relevant data meet the current and potential future needs of users.**	**Adaptability of the data** Amendments to the dataset are governed by the INAS Governance Committee. The thrombectomy dataset was amended in 2020 to include information on the patient's arrival at the referring hospital where applicable; this facilitates accurate 'door to reperfusion' reporting. The ability to collect additional clinical data on patients who had a stroke while in hospital with another condition (inpatient stroke) has always been available within the stroke audit portal, but collecting these data was not mandatory. It is estimated that inpatient stroke accounts for approximately 10% of patients with a stroke, and it is important to audit the care they receive; therefore, it became mandatory from 2020 to collect data on inpatient stroke. Initially, a description of the numbers of inpatient strokes will be provided in the 2020 INAS annual report, and detailed analysis will be reported on in the 2021 annual report. In 2019, NOCA, in collaboration with the NSP and the RCSI, secured funding through the Health Research Board's Applied Partnership Awards to develop an internationally benchmarked core minimum dataset for the INAS; 1.4 whole time equivalent research posts have been secured for 24 months to optimise the current dataset, and there are plans to further develop the audit to include post-acute rehabilitation along with patient-reported outcome measures. This project commenced in January 2021, and the partnership approach will ensure that the dataset will be adaptable and useful to users. The addition of a HSCP dataset to assess discipline-specific variables for physiotherapy, occupational therapy, and speech and language therapy came into effect in 2018, following extensive collaboration with discipline-specific professional bodies. **Access to the data** All data requests for research and service evaluation are supported by NOCA's policies and procedures. One data access request was submitted to the INAS in 2020 to identify the feasibility and acceptability of screening for atrial fibrillation in primary care in Ireland. This request was granted by the INAS Governance Committee.

Dimensions of data quality	Definition (HIQA, 2018)	Assessment of dimension (INAS)
Accuracy and Reliability 	**The accuracy of data refers to how closely the data correctly describe what they were designed to measure. Reliability refers to whether those data consistently measure, over time, the reality of the metrics that they were designed to represent.**	The accuracy and reliability of INAS data for 2020 is assessed based on the following characteristics: • coverage • data capture and collection • data completeness and validity. **Coverage** The INAS collects data on patients with acute stroke through a stroke audit portal in the HIPE system that was developed in collaboration with the HPO. In 2020, collection of data on patients who had a stroke while in hospital with another condition (inpatient stroke), as described in Chapter 2, commenced. In addition, HIPE records a HADx indicator for any additional diagnoses that were not present on admission but were acquired by the patient during the current episode of care. In previous stroke reports, only cases in the stroke audit portal with a principal diagnosis of stroke as coded by HIPE were included in the total number of stroke cases for each hospital. From 2020, patients with a principal diagnosis of stroke, as well as patients with a secondary diagnosis of stroke who have been assigned a stroke HADx flag in HIPE, are included in the total number of stroke cases in each hospital and in the coverage report (Table 3.2). Initially, a description of the numbers of inpatient strokes will be provided in the 2020 INAS annual report, and detailed analysis will be reported on in the 2021 annual report. The reference population for the 2020 INAS annual report includes patients aged 17 years and over, with a principal diagnosis of ICD-10-AM codes I61, I63 or I64, who are admitted to any of the 24 public hospitals that provide acute stroke services to more than 25 patients annually in Ireland. In 2020, Our Lady's Hospital, Navan ceased to provide acute stroke care. Patients with a stroke who would have previously gone to Our Lady's Hospital, Navan are now bypassed to the nearest hospital that provides acute stroke care, and their data will be recorded in that hospital. Data on subarachnoid haemorrhage or traumatic haemorrhage are not collected. The stroke audit portal has three distinct datasets: • core clinical dataset • thrombectomy dataset • HSCP dataset. **Core clinical dataset** The core clinical dataset comprises additional clinical data that are collected for all eligible stroke cases. In 2020, full coverage is defined as when all acute stroke admissions coded with stroke as a principal diagnosis or who have a stroke HADx flag (ICD-10-AM codes I61, I63 or I64) in the HIPE system have additional clinical information submitted to the stroke audit portal. Cases that were transferred to an EVT stroke centre for a thrombectomy and then transferred directly back to the referring hospital are excluded from the denominator when calculating the performance and quality indicators within this report. This will also avoid double counting. The expected standard for inclusion in INAS reporting is a minimum of 80% coverage of stroke cases. In 2020, HIPE recorded 5,824 stroke cases in the 24 participating hospitals. Of these, 5,422 had additional core clinical data submitted. This gives a national coverage rate of 93%, an increase from 83% in 2019. Hospitals must have at least 80% coverage in order to be included in the analysis. Twenty-three out of the 24 participating hospitals had at least 80% coverage for 2020, and data from these hospitals informed the analysis of this report (Table 3.2).

Dimensions of data quality	Definition (HIQA, 2018)	Assessment of dimension (INAS)
Accuracy and Reliability 		**Thrombectomy dataset** The thrombectomy data are submitted by the two EVT stroke centres for patients who have a thrombectomy. In order to assess coverage, the number of cases with thrombectomy data is measured against the number of cases reported in the *National Thrombectomy Service Annual Report 2020* (National Thrombectomy Service, 2021). In 2020, 392 cases were reported in the *National Thrombectomy Service Annual Report 2020* (National Thrombectomy Service, 2021), and the INAS is reporting on 380 of these cases. This gives a coverage rate of 97% of thrombectomy cases nationally. **HSCP dataset** In 2018, a HSCP dataset to capture discipline-specific variables for physiotherapy, occupational therapy, and speech and language therapy was added to the stroke audit portal. This was a HSCP-led initiative of the NSP, and it was expected that it would take time for data collection and reporting to be embedded into practice. In 2020, there was no effective way to calculate coverage for the HSCP dataset. Currently, therapists from 15 hospitals are submitting data to the HSCP dataset. This does not represent all the activities of physiotherapy, occupational therapy, or speech and language therapy in a named hospital, nor does it imply that there is no activity in hospitals that are not currently represented in this analysis. Rather, it is an overview of some key discipline-specific information about the therapy provided to patients with a stroke. **Data capture and collection** Data for the core clinical dataset are collected by audit coordinators in each participating hospital. Some validation is inbuilt within the stroke audit portal, minimising errors at data entry. Guidance manuals for stroke teams are available, and further training is provided by the Audit Manager. The HPO provides NOCA with monthly coverage reports, and these are discussed at audit coordinator teleconferences, which commenced in 2020. Thrombectomy data are collected by the audit coordinators at the two EVT stroke centres for patients who have a thrombectomy. Data for the HSCP dataset are collected and entered by personnel from each individual discipline in participating hospitals. **Data completeness and validity** Data quality will be a standing agenda item for the INAS Governance Committee, and data quality initiatives will be agreed and implemented in 2021–2022. In order to ensure that the data collected are complete and valid, a DVR for the core clinical dataset was developed by the data analytics team. The DVR was piloted in January 2020 and was rolled out to all hospitals in February 2020 for 2019 data; however, due to the impact of COVID-19, no further DVRs were sent to the hospitals in 2020. Reporting on 2020 data includes identification of missing data for each variable. The reintroduction of the DVRs has commenced for the 2021 data, and DVRs, along with coverage reports, will be sent quarterly to the Audit Coordinator in each hospital. The corrections will be made within the stroke audit portal and saved. Any variables causing concern will be discussed by the INAS Governance Committee in order to review their relevance and to check with the HPO regarding ways to reduce input errors. This will inform part of a data quality improvement plan for 2022.

Dimensions of data quality	Definition (HIQA, 2018)	Assessment of dimension (INAS)
Coherance and comparability 	**Coherent and comparable data are consistent over time and across providers and can be easily combined with other sources.**	The coherence and comparability of the 2020 INAS data is assessed based on the following characteristics: • standardisation • coherence • comparability. **Standardisation** The INAS clinical dataset was created based on an alignment with the United Kingdom (UK) and Swedish stroke registries and adapted to the Irish context. All variables are developed using evidence-based standards (Royal College of Physicians, 2016; Irish Heart Foundation, 2010). The *National Clinical Guidelines and Recommendations for the Care of People with Stroke and Transient Ischaemic Attack* were developed in 2010 by an interdisciplinary group convened by the Irish Heart Foundation (IHF) Council for Stroke. After 11 years, we have need for an updated set of guidelines, but the consensus of the Royal College of Physicians of Ireland (RCPI) Clinical Advisory Group for Stroke and the IHF Council for Stroke is that it would be more appropriate to formally adopt an international set of guidelines, preferably European guidelines, and make modifications to reflect Irish service organisation rather than to develop a specific set of guidelines for Ireland from scratch. Data are collected using national and international classifications, including the ICD-10. Standardised scores used within the dataset include the modified Rankin Scale, the National Institutes of Health Stroke Scale and the Glasgow Coma Scale. Revision of the INAS dataset has commenced and will facilitate standardisation with stroke datasets internationally. The HSCP dataset collects data on agreed standards for stroke rehabilitation based on the *National clinical guideline for stroke* (Royal College of Physicians, 2016). **Coherence** A data dictionary is available to data users as part of the training manual and, in 2020, was published on the NOCA website in line with the Health Information and Quality Authority (HIQA) data dictionary standards (HIQA, 2017a). Aggregated data within the INAS are compared with the aggregated data on HIPE by NOCA, ensuring coherence within each hospital. **Comparability** The INAS variables are comparable to some of the UK's Sentinel Stroke National Audit Programme (SSNAP) variables (SSNAP, 2020). This can facilitate comparability with Northern Ireland.

Dimensions of data quality	Definition (HIQA, 2018)	Assessment of dimension (INAS)
Timeliness and punctuality 	**Timely data are collected within a reasonable agreed time period after the activity that they measure.** **Punctuality refers to whether data are delivered on the dates promised, advertised, or announced.**	NOCA issues data collection targets for each hospital to collect a minimum of 80% of data per reporting quarter, one quarter in arrears; a data collection calendar is used to assist this process. The submission timeliness per quarter (i.e. the number of eligible cases on HIPE with INAS data added) for 2020 was as follows: Q1: 55%; Q2: 69%; Q3: 79%; and Q4: 93%. The impact of redeployment of audit coordinators during the COVID-19 pandemic is evident in these results, and achieving a final coverage rate of 93% is a significant achievement by all the audit coordinators. The data are processed by NOCA and reported in the NOCA quarterly reports to the Hospital Groups and to the HSE Business Intelligence Unit. Both datasets are reported 6 months in arrears and only if the hospital has reached greater than 80% coverage. Dashboard reporting is due to commence in Q1 2022, and the results will be one quarter in arrears. The INAS reporting calendar is provided in Chapter 2, Table 2.1. Data entry targets are reviewed quarterly at each INAS Governance Committee meeting. The final data entry date is linked to the HIPE closure date for the reporting year and is updated annually.
Accessibility and clarity 	**Data are easily obtainable and clearly presented in a way that can be understood.**	There are several inbuilt reports on the stroke audit portal that can be run by the audit coordinator at hospital level. Stroke audit portal data can be exported locally into Microsoft Excel for further analysis. Access to the data for research or service evaluation is managed by the Audit Manager following NOCA data access policies. The 2017 and 2018 NSR annual reports are available on the HSE website (https://www.hse.ie/eng/about/who/cspd/ncps/stroke/resources/). The *Irish National Audit of Stroke National Report 2019* is available on the NOCA website (https://www.noca.ie/documents/irish-national-audit-of-stroke-2019). The INAS dashboard has now been developed. Six key quality indicators have been agreed by the INAS Governance Committee and the data from 2016 will be accessible using the dashboard's filters. The dashboard is expected to be available to users online and to be updated quarterly, 3 months in arrears.

DATA COVERAGE

In 2020, data coverage is defined as the number of stroke cases with ICD-10-AM diagnosis codes of I61, I63 or I64 as the principal diagnosis, or as a secondary diagnosis with a HADx flag assigned, which have additional stroke audit data added to stroke cases. One participating hospital was excluded from the analysis in 2020 as it did not reach the 80% coverage target (Table 3.2).

TABLE 3.2: DATA COVERAGE

Hospital	Stroke audit portal	HIPE total	HIPE Principal diagnosis	HIPE HADx	Coverage
Bantry General Hospital	80	80	78	2	100.0%
Beaumont Hospital	501	500	490	10	100.0%
Connolly Hospital	231	229	216	13	100.0%
South Tipperary General Hospital	92	92	86	6	100.0%
Letterkenny University Hospital	185	183	182	1	100.0%
Our Lady of Lourdes Hospital Drogheda	267	270	256	14	98.9%
Regional Hospital Mullingar	160	164	159	5	97.6%
Mercy University Hospital	104	106	97	9	98.1%
Wexford General Hospital	121	123	121	2	98.4%
Mayo University Hospital	224	230	213	17	97.4%
University Hospital Galway	250	258	229	29	96.9%
University Hospital Kerry	156	163	155	8	95.7%
Cavan General Hospital	140	147	136	11	95.2%
University Hospital Waterford	173	184	154	30	94.0%
Cork University Hospital	540	576	513	63	93.8%
Mater Misericordiae University Hospital	315	340	307	33	92.6%
Sligo University Hospital	195	211	183	28	92.4%
St Luke's General Hospital, Carlow/Kilkenny	136	148	136	12	91.9%
Tallaght University Hospital	276	302	261	41	91.4%
St Vincent's University Hospital	422	465	422	43	90.8%
St James's Hospital	267	306	234	72	87.3%
Naas General Hospital	185	214	179	35	86.4%
University Hospital Limerick	375	453	366	87	82.8%
Portiuncula University Hospital*	27	80	27	53	33.8%
Total	**5422****	**5824**	**5200**	**624**	**93.1%**

*Excluded from the 2020 analysis due to <80% coverage
** Out of the 5,422 stroke audit portal cases, 5,153 met the inclusion criteria and these form the final cases for analysis (for inclusion criteria see Chapter 2)

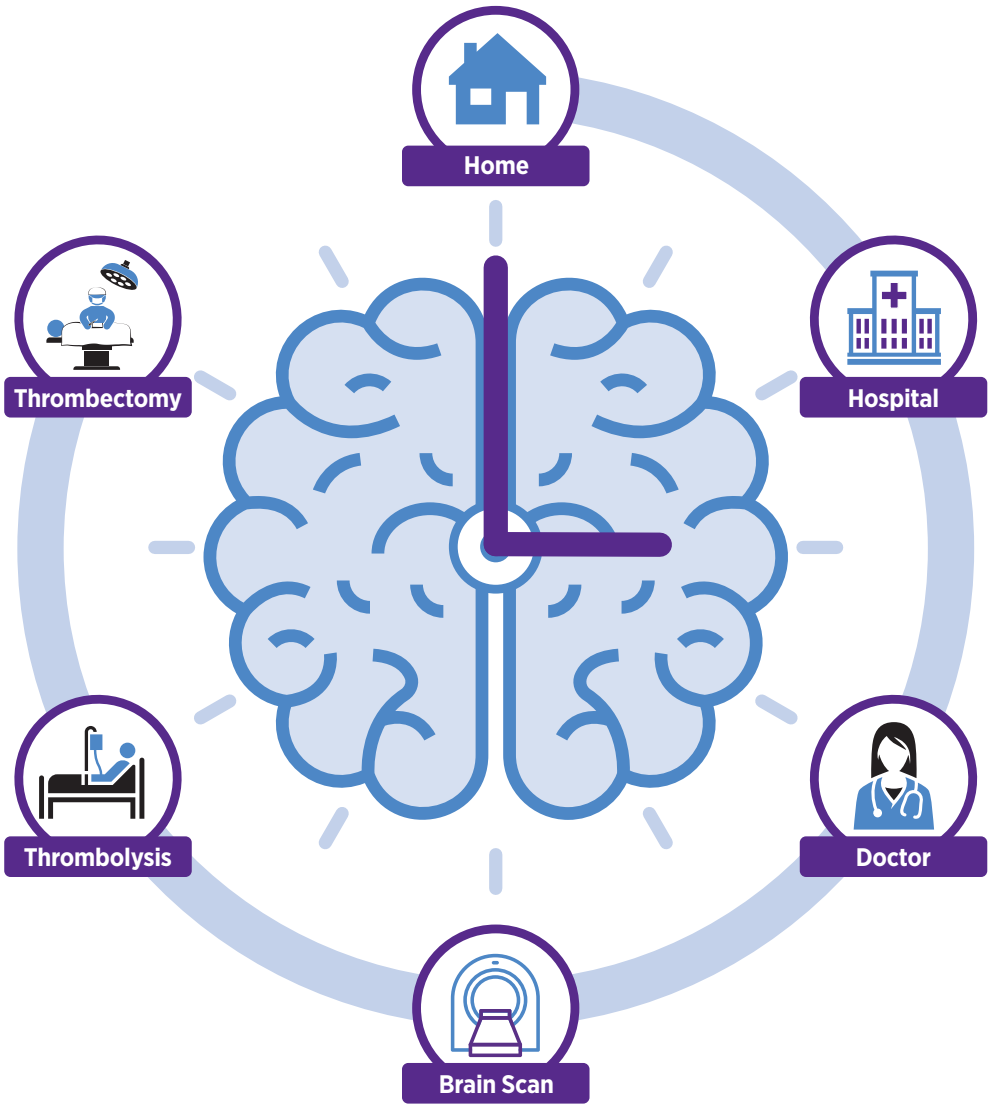
CHAPTER 4
EMERGENCY CARE

CONTENTS >

CHAPTER 4: **EMERGENCY CARE**

Stroke is a medical emergency and if outcomes are to be optimised, there should be no time delays in determining the diagnosis and treatment (Royal College of Physicians, 2016). Timely emergency department (ED) evaluation and stroke team assessment is paramount for all patients with a stroke, particularly with the increasing availability of acute stroke treatments.

The image below indicates the emergency pathway of care for patients with a stroke from onset of stroke symptoms through to decision to treat with thrombolysis and/or thrombectomy.



TIME IS BRAIN

SEX AND AGE BAND

This report examines 5,153 cases of stroke with ICD-10-AM codes I61 (intracerebral haemorrhage), I63 (cerebral infarction) or I64 (stroke, not specified as haemorrhage or infarction) as the principal diagnosis, which were reported through the stroke audit portal in 2020. The absolute number of strokes occurring annually in Ireland depends on the definition used, but it ranges from 6,000 to 8,000 cases per annum. Strokes occurring in the community that are not admitted to hospital cannot be identified and included. People suffering subarachnoid haemorrhage (ICD-10-AM code I60) are not included, as management pathways for this condition differ substantially from those for other strokes.

More than one-half (57%, n=2944) of all patients with a stroke in 2020 were male (Figure 4.1). The median age of patients with a stroke recorded in 2020 was 74 years (interquartile range [IQR]: 64–82 years), and the mean age was 72 years. These figures are consistent with data from other Western European countries (The Stroke Alliance for Europe, 2020) and remain unchanged from 2019 (NOCA, 2020). The mean age of female patients with a stroke was 75 years, and the mean age of male patients with a stroke was 70 years. One-quarter (26%, n=1333) of all patients with a stroke were aged under 65 years. Within the male population with a stroke, 30% (n=890) were aged under 65 years and within the female population with a stroke, 20% (n=443) were aged under 65 years. This is similar to the sex breakdown reported in 2019.

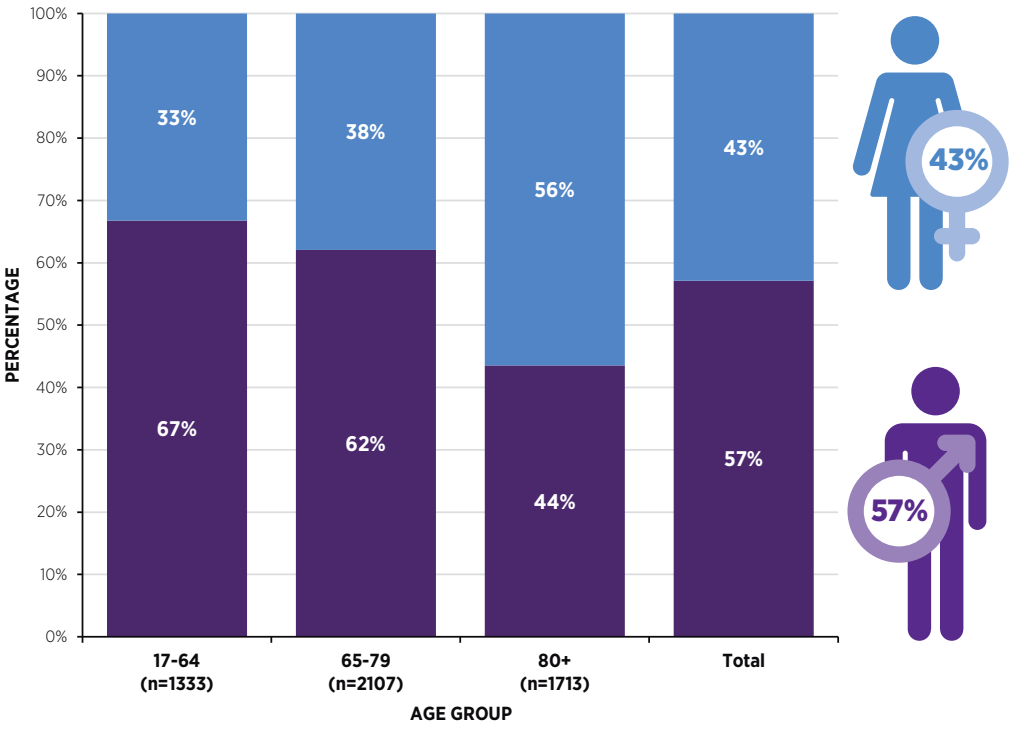


FIGURE 4.1: PERCENTAGE OF PATIENTS WITH A STROKE, BY SEX AND AGE GROUP (N=5153)

ADMISSION SOURCE

The majority (97%, n=4997) of stroke cases reported in 2020 were classified as emergency admissions. The admission source data (Figure 4.2) show that most patients with a stroke (89%, n=4588) were living at home prior to their stroke.

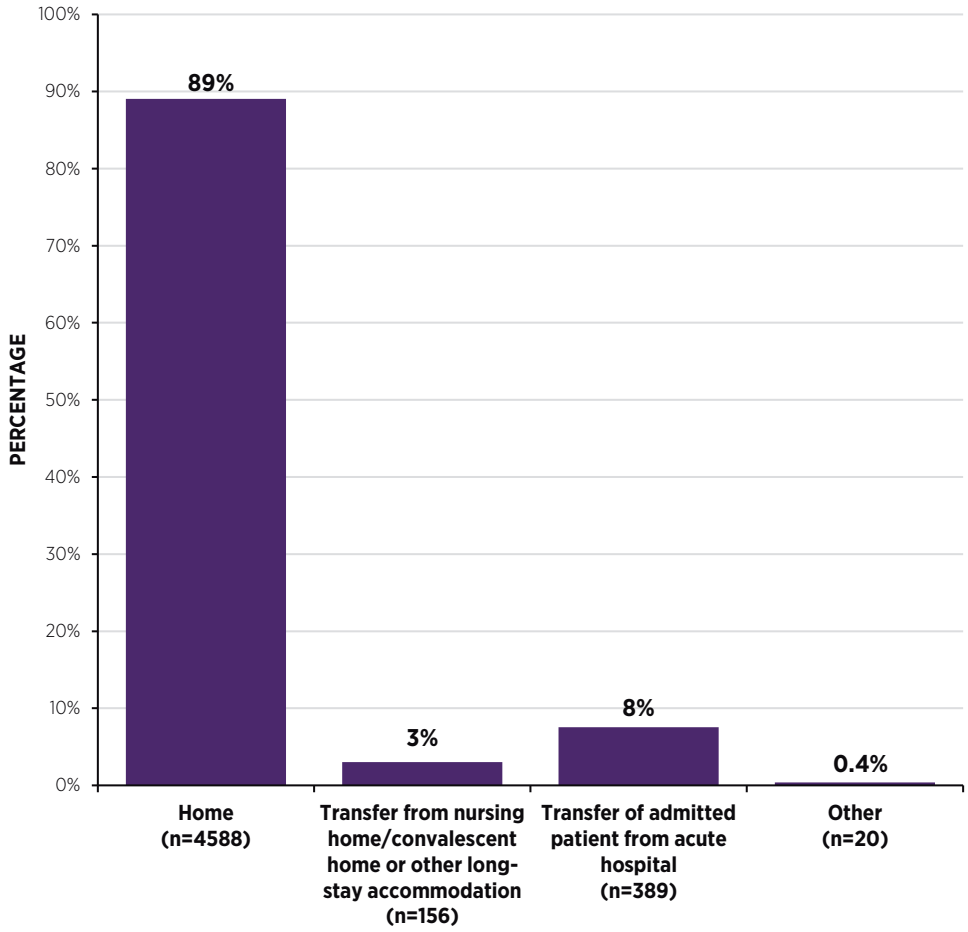


FIGURE 4.2: ADMISSION SOURCE (N=5153)

TIME FROM STROKE SYMPTOM ONSET TO HOSPITAL ARRIVAL

It is increasingly recognised that delays between onset of stroke symptoms and arrival at hospital, assessment, and clinical investigation are associated with worsening stroke outcomes and reduced effectiveness of treatment interventions. This phenomenon is characterised in stroke medicine by the phrase 'Time is Brain', implying that the shorter the time to intervention, the more brain can be saved, with reductions in disability and handicap (Saver *et al*., 2016). While the HIPE system records the date of admission to hospital, the time of admission is not recorded. Stroke teams are asked to record hospital arrival date and hospital arrival time. This can then be used to calculate delays to hospital arrival from onset of stroke symptoms in hours and minutes, which is important for stroke care when 'Time is Brain'. We are aware that some discrepancies in defining time of admission may exist between hospitals, with some using definitions such as time of registration as a substitute for time of admission. We are engaged in a quality improvement exercise to enhance consistency in recording this data item. In the audit, the date and time of both the onset of stroke symptoms and of hospital arrival must be ascertained and recorded in order to accurately calculate the delay between the onset of stroke symptoms and hospital arrival. When calculating hospital arrival and onset of stroke symptom times, cases recorded as inpatient strokes, even though they have a principal diagnosis of stroke, are excluded (n=190). This is because there is a variance between the stroke portal recording and HIPE recording of stroke occurring after admission which requires further study. This will form part of the data quality initiatives for 2022. In 2020, the date and time of onset of stroke symptoms was specified in 58% (n=2890) of cases. Of those, the hospital arrival date and time was known in almost 100% (n=2879) of cases. In total, the time of onset of stroke symptoms and of hospital arrival was known in just 57% (n=2825) of cases, a marginal increase from 55% in 2019.

Only 50% of cases arrived at hospital within 3 hours of onset of stroke symptoms

For those cases which had time from onset of stroke symptoms to hospital arrival available, the median interval was 3 hours and 2 minutes. One-half (50%, n=1400) of cases arrived at hospital within 3 hours of onset of stroke symptoms (Figure 4.3). While this represents a deterioration from 2015 (McElwaine *et al*., 2015), it is similar to 2019 results, and the COVID-19 pandemic does not seem to have caused a further delay in responding to stroke symptoms. Any patient arriving at the hospital more than 4.5 hours after onset of stroke symptoms is not a candidate for thrombolysis; however, the patient could be considered for thrombectomy. It must also be recognised that in those cases where the time of onset of stroke symptoms and of hospital arrival was not recorded, the mean delay was likely considerably longer than 4.5 hours. Improving awareness of the symptoms of stroke and the importance of seeking timely emergency services remains a recommendation of this report.

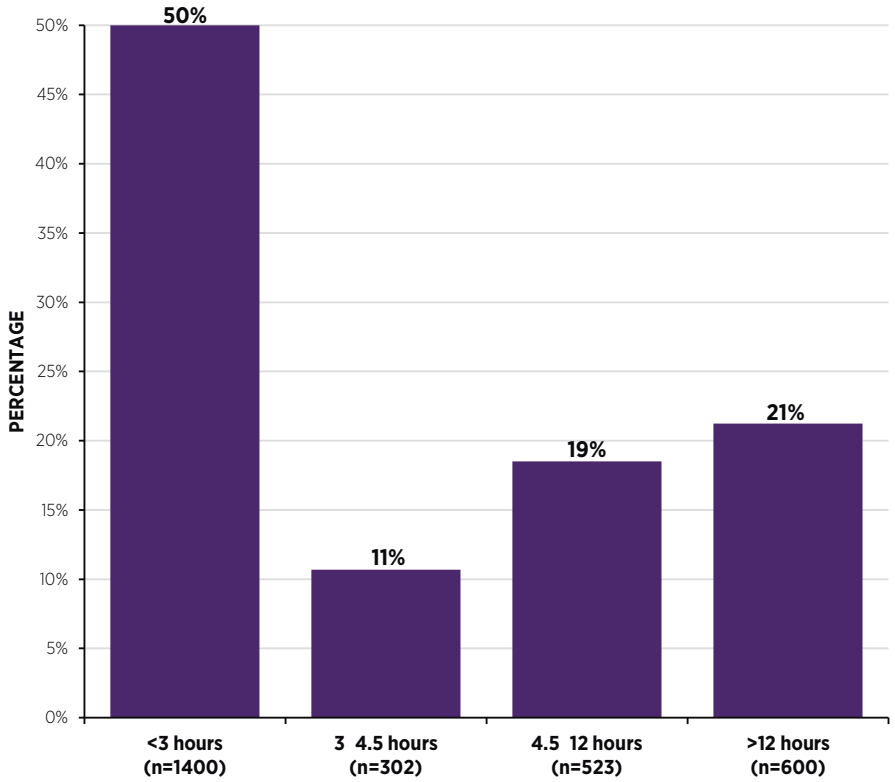


FIGURE 4.3: DISTRIBUTION OF TIME FROM STROKE SYMPTOM ONSET TO HOSPITAL ARRIVAL (n=2825)[2]

[2] Cases recorded as inpatient strokes (n=190) and cases that had no time information recorded or it was recorded incorrectly (n=2138) were excluded from Figure 4.3.

DAY AND TIME OF HOSPITAL ARRIVAL

The distribution of day and time of hospital arrival indicates that 43% (n=2132) of cases arrived during working hours, while 57% (n=2774) arrived outside of working hours (any time on Saturday or Sunday, or between 5.00pm and 8.59am, Monday to Friday) (Figure 4.4). These data are consistent with findings of previous years and with international data. Research is underway, in collaboration with University Hospital Limerick, to investigate whether stroke treatment and outcomes differ based on admission to hospital outside of working hours; this research will be published in 2022.

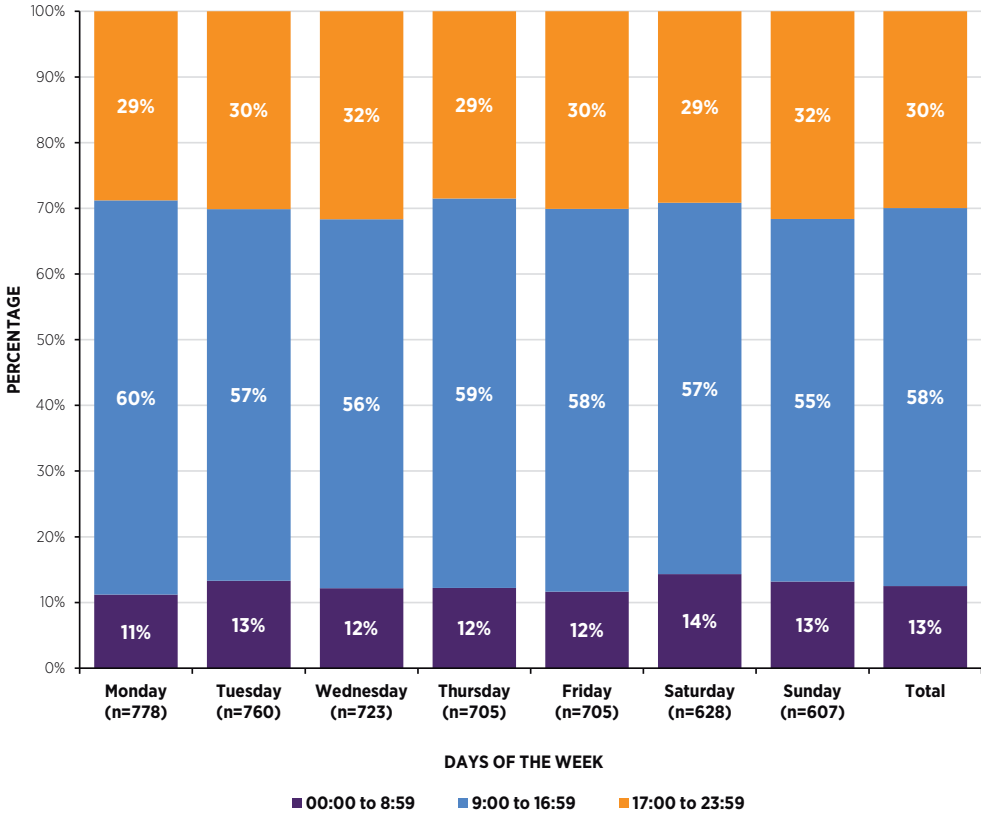


FIGURE 4.4: DISTRIBUTION OF DAY AND TIME OF HOSPITAL ARRIVAL (n=4906)[3]

[3] Cases recorded as inpatient strokes (n=190) and cases that had no time information recorded or it was recorded incorrectly (n=57), excluded from Figure 4.4.

TIME BETWEEN HOSPITAL ARRIVAL AND TIME REVIEWED BY MEDICAL TEAM

Early review by the medical team ensures that the patient has an initial stroke assessment and a brain scan completed as soon as possible. This facilitates prompt treatment, thus reducing brain cell death (Saver *et al*., 2016). Cases recorded as inpatient strokes on the stroke portal where a principal diagnosis of stroke is recorded in the HIPE system are excluded from this analysis (n=190),[4] as described in the section 'Time from stroke symptom onset to hospital arrival' above. The time and date of hospital arrival and time and date of review by the medical team were available and recorded correctly for 83% (n=4127) of cases; 71% (n=2911) of these were seen by the medical team within 1 hour of hospital arrival (Figure 4.5), an increase from 2019 (66%, n=1989) (NOCA, 2020). The median time to contact with the medical team after hospital arrival was 11 minutes, a decrease from the 2019 median of 17 minutes. This increase in timely medical review was also seen in the *NOCA COVID-19 Stroke Report Issue 1.0* (NOCA, 2021) and may represent reduced congestion in emergency departments during the pandemic. In addition, the ongoing quality improvement programme through the National Thrombectomy Service, which monitors the 'door to decision' times for patients with an ischaemic stroke in some hospitals, is continuing to drive timely emergency care (Chapter 5).

71% of patients were seen by a doctor within 1 hour of arrival at hospital

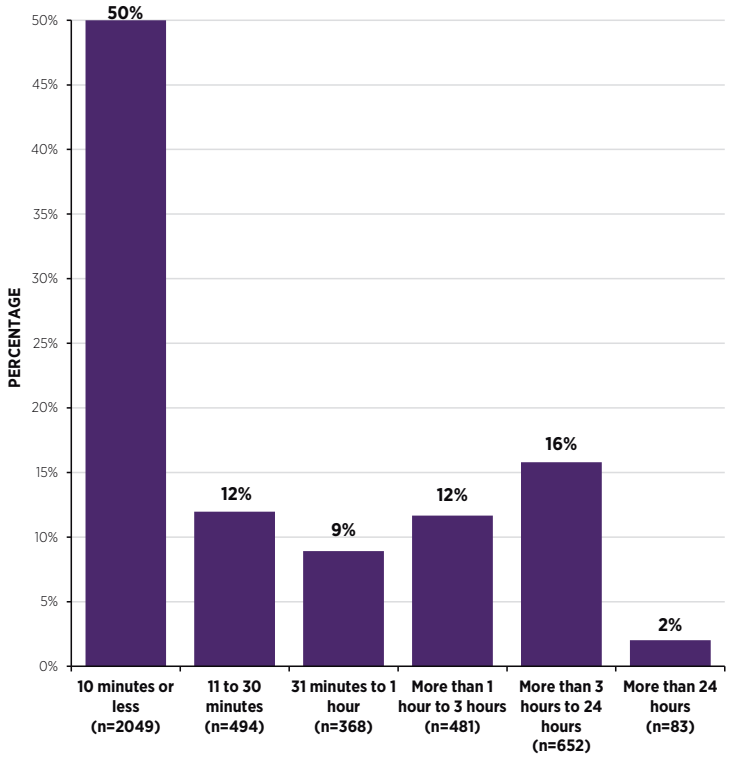


FIGURE 4.5: TIME BETWEEN HOSPITAL ARRIVAL AND TIME REVIEWED BY MEDICAL TEAM (n=4127)[5]

[4] 159 were recorded as inpatient stroke and 31 did not have information recorded.
[5] Cases recorded as inpatient strokes are excluded. 836 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 4.5.

DOOR TO IMAGING

Standard: Patients with suspected acute stroke should receive brain imaging urgently – at most within 1 hour of arrival at hospital (Royal College of Physicians, 2016).

In total, 94% (n=4674) of patients with a stroke had a computed tomography (CT) or magnetic resonance imaging (MRI) scan in their hospital of admission after their stroke, with a further 5% (n=268) of patients having a CT or MRI scan performed pre-admission, or in a previous hospital in cases of hospital transfer. Of those who had CT or MRI brain scanning, information about time and date was available for 97% (n=4518) of patients. As previously noted, cases recorded as inpatient strokes with a principal diagnosis of stroke are excluded (n=190).

99% of patients had a brain scan. 49% had a scan within 1 hour of arrival at hospital

Data in relation to the timeliness of imaging have always been important in order to ensure prompt decision to treat; however, given recent advances in understanding of the acute phase of stroke, it is even more important to improve the timeliness of access to imaging and treatment within each hospital. Acute management for ischaemic and haemorrhagic stroke now differs substantially, and timely performance of a brain scan is the only reliable method of distinguishing between the two. In 2020, the national median 'door to imaging' (DTI) time for all patients with a stroke was 1 hour and 3 minutes (Figure 4.6A), and 49% (n=2206) of patients with a stroke received imaging within 1 hour of arrival (Figure 4.6). This is an improvement from 2019, when the national median for DTI was 1 hour and 20 minutes and 44% of patients with a stroke received imaging within 1 hour of arrival. Figure 4.6A indicates the median DTI times for each participating hospital in 2020. Improvement in this key time point has the potential to change processes to support the provision of thrombolysis and thrombectomy.

Of the 23 hospitals included in this report, 11 (48%) had a median DTI time of 60 minutes or less. While this is an improvement from 2019, when 30% of hospitals (n=6) had a median DTI time of 60 minutes or less, it does represent a delay in the process of care and treatment for patients with a stroke. The reasons for these results are likely to be multifactorial, including difficulties accessing imaging out of hours in some hospitals. Research is underway, as described in the earlier section 'Day and time of hospital arrival' to assess whether stroke treatment and outcomes differ based on admission to hospital outside of working hours.

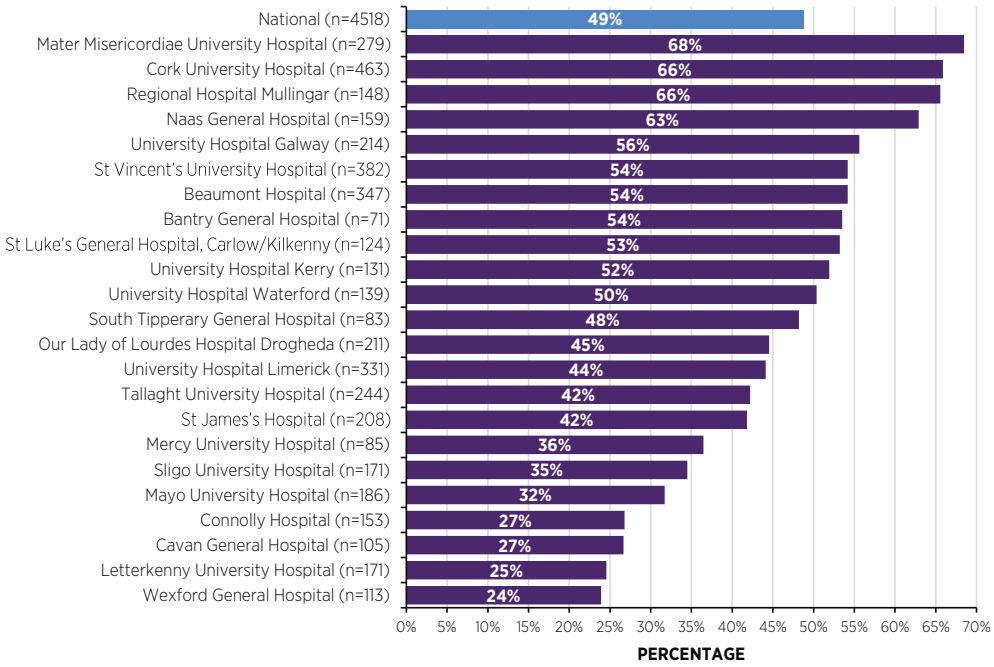


FIGURE 4.6: PROPORTION OF PATIENTS WHO RECEIVED BRAIN IMAGING WITHIN 1 HOUR OF HOSPITAL ARRIVAL (n=4518)[6]

[6] Cases recorded as inpatient strokes (n=190) and cases that had no time information recorded or it was recorded incorrectly (n=156) were excluded from Figure 4.6.

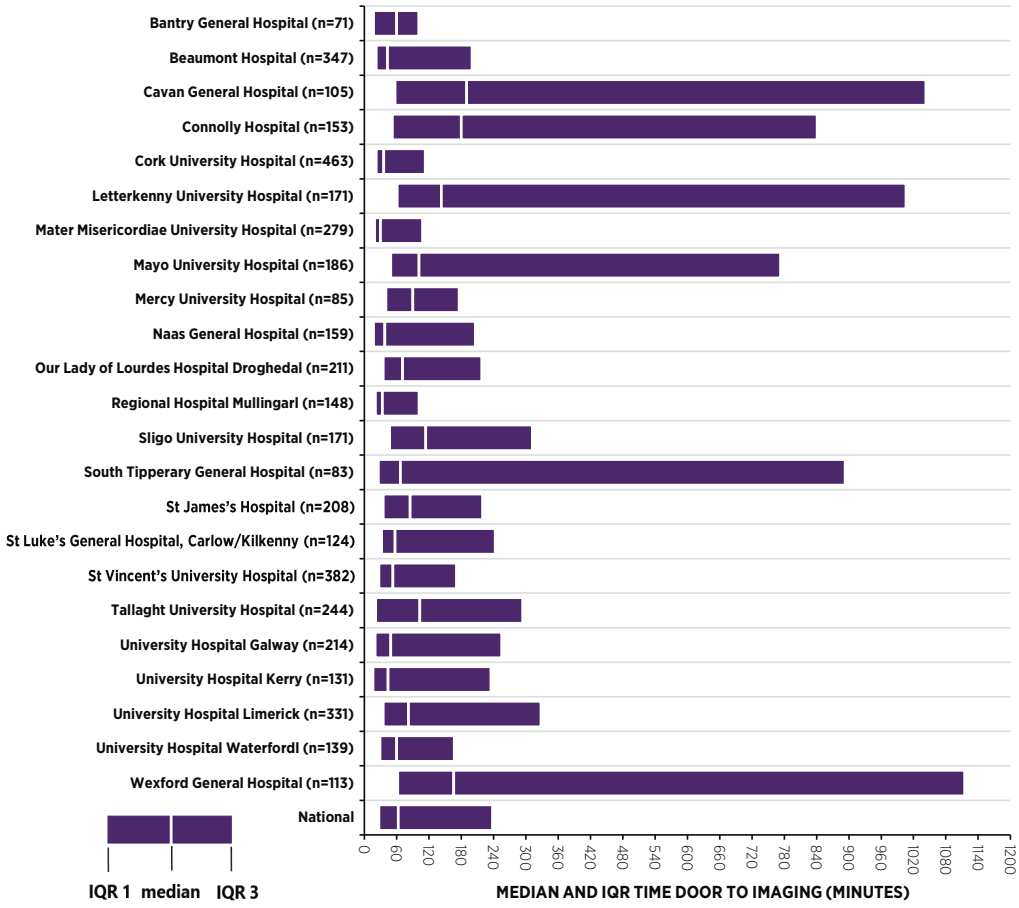


FIGURE 4.6A: DOOR TO IMAGING TIME, INTERQUARTILE RANGE, BY HOSPITAL, IN MINUTES (N=4518)[7]

[7] Cases recorded as inpatient strokes (n=190) and cases that had no time information recorded or it was recorded incorrectly (n=156) were excluded from Figure 4.6A.

TYPE OF STROKE

The majority of stroke cases in 2020 were ischaemic (85%, n=4379) (Figure 4.7), reflecting known prevalence rates. Notably, the INAS has not to date recorded data on the care of people with subarachnoid haemorrhage (ICD-10-AM code I60) because of differences in the process of care and management of this type of stroke compared with other patients with a stroke – e.g. patients with subarachnoid haemorrhage frequently do not pass through stroke teams or stroke units where register data are recorded. However, in the absence of alternate data collection methods, it may be appropriate to explore the feasibility of collecting data on these patients in future, using alternate processes. An ongoing research project looking at what is collected internationally in national stroke data collections may suggest collecting these data within the INAS.

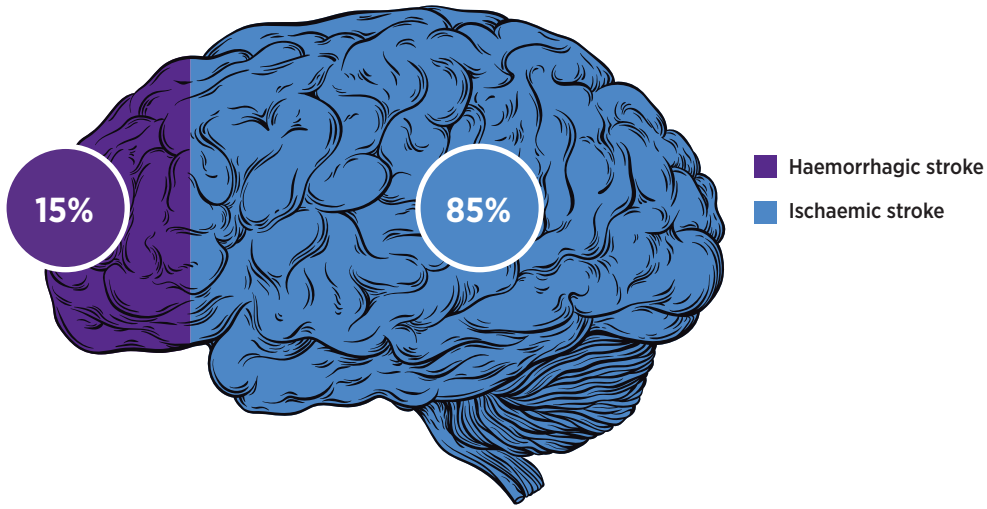


FIGURE 4.7: PERCENTAGE OF PATIENTS WITH A STROKE, BY STROKE TYPE (N=5153)

THROMBOLYSIS IN ISCHAEMIC STROKE

Standard: Patients with acute ischaemic stroke, regardless of age or stroke severity, in whom treatment can be started within 4.5 hours of known stroke onset, should be considered for treatment with thrombolysis (Royal College of Physicians, 2016).

The intravenous thrombolysis rate was 10.6%

Figure 4.8 shows that for patients with ischaemic stroke (n=4379), the intravenous thrombolysis rate was 10.6% (n=466). This is consistent with the 2019 INAS annual report (10.6%); however, it does represent a decrease from 2015 (11.1%) (McElwaine et al., 2015) and 2018 (11.6%) (NSP, 2019). This may reflect slight changes in practice with regard to thrombolysis of minor strokes, and increased availability of alternative treatment strategies, such as use of thrombectomy in some cases. A concern would be if the reduction in thrombolysis reflects the apparent increased delay between the onset of stroke symptoms and presentation to hospital, which may reflect a deterioration in public awareness of stroke symptoms and appropriate responses if symptoms occur. There is considerable variation in the intravenous thrombolysis rate between hospitals, which may be multifactorial. Issues affecting delivery of acute therapies will be addressed in the organisational audit to be undertaken in 2021. It is reassuring that COVID-19 does not appear to have impacted on the rate of intravenous thrombolysis; further details will be reported in Chapter 9.

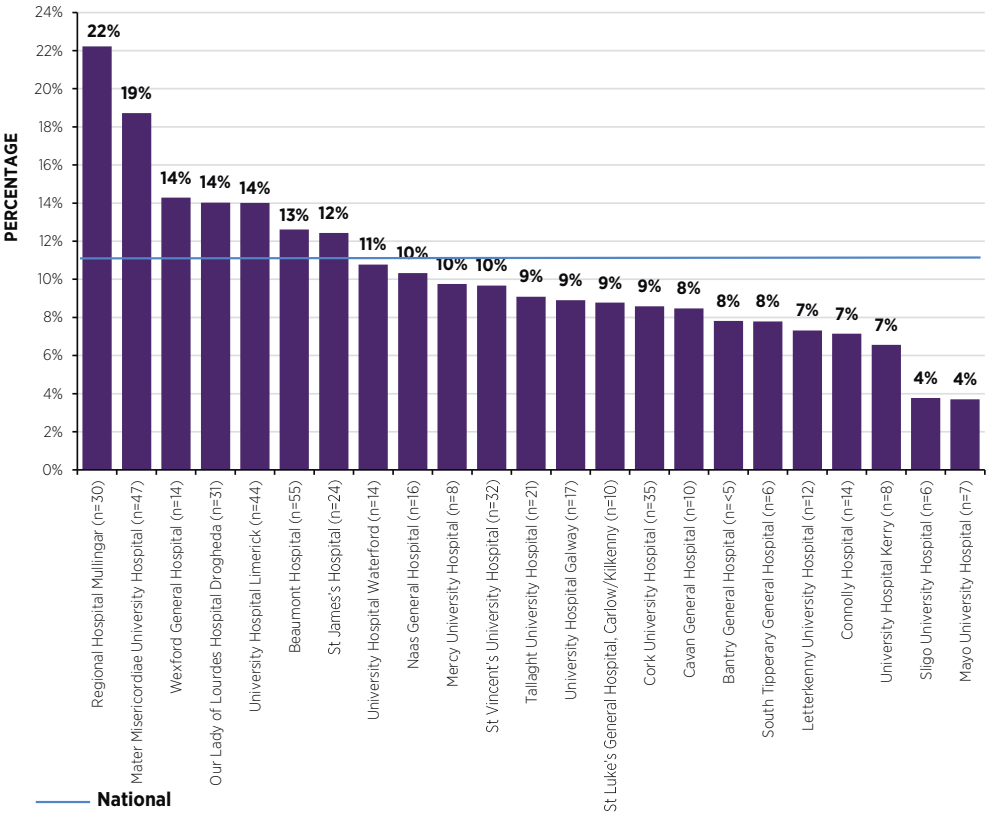


FIGURE 4.8: PERCENTAGE OF ISCHAEMIC STROKE CASES TO RECEIVE THROMBOLYSIS, BY HOSPITAL (n=4379)

TIME BETWEEN HOSPITAL ARRIVAL AND TIME OF THROMBOLYSIS

Standard: 'Door to needle' time less than 60 minutes (Irish Heart Foundation, 2015).

The 'door to needle' (DTN) time was available and recorded correctly in 92% (n=427) of cases of ischaemic stroke where thrombolysis was performed in 2020.

The median DTN time nationally was 55 minutes (Figure 4.9A); the median DTN time has been gradually decreasing, from 71 minutes in 2017 (NSP, 2018), to 58 minutes in 2018 (NSP, 2019), and to 56 minutes in 2019. This improvement is aligned with the 'Door to Decision in Under 30!' quality improvement project led by Professor John Thornton, which commenced in 2018 (further details of this quality improvement project are provided in Chapter 5) (Figure 5.11). Internationally, a DTN target of 45 minutes is considered a good goal. Figure 4.9 shows the distribution of time between hospital arrival and time of thrombolysis. In total, more than one-half (57%, n=243) of patients with ischaemic stroke received thrombolysis within 1 hour of hospital arrival, and 38% (n=163) within 45 minutes.

The median 'door to needle' time was 55 minutes

As with all box plot figures in this report, the median time was not calculated for hospitals that had five or fewer cases recorded, as the median tends to be less accurate and more biased when the sample size is small. Those cases were, however, included in the analysis of the national median figure.

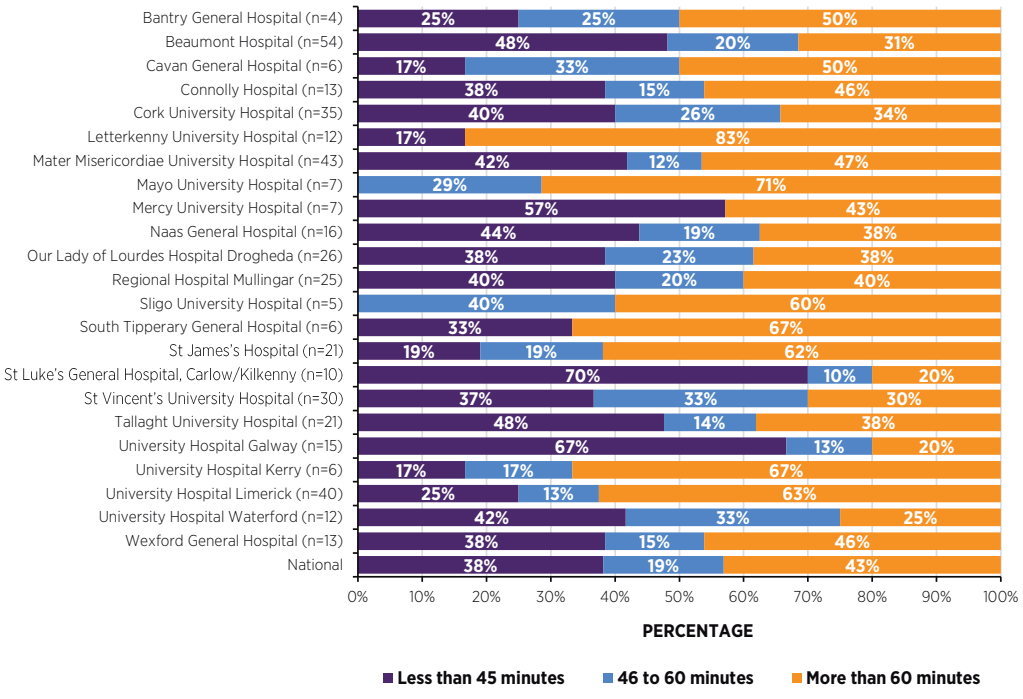


FIGURE 4.9: DISTRIBUTION OF TIME BETWEEN HOSPITAL ARRIVAL AND TIME OF THROMBOLYSIS, BY HOSPITAL (n=427)[8]

[8] Refers to ischaemic stroke with thrombolysis only. Cases that had no time information recorded or it was recorded incorrectly (n=39) were excluded from Figure 4.9.

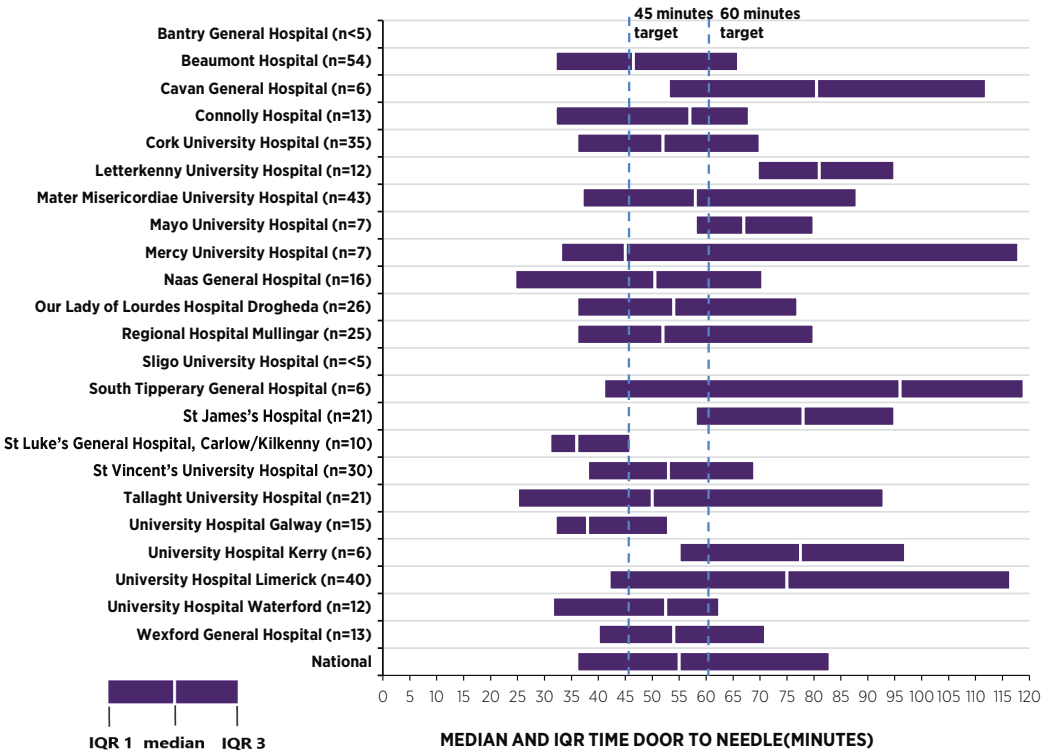


FIGURE 4.9A: DOOR TO NEEDLE TIME, MEDIAN AND INTERQUARTILE RANGE, BY HOSPITAL, IN MINUTES (n=427)[9]

[9] Refers to ischaemic stroke with thrombolysis only. Cases that had no time information recorded or it was recorded incorrectly (n=39) were excluded from Figure 4.9A.

INPATIENT STROKE

An inpatient stroke is defined as a stroke that occurs when a patient has a stroke while in hospital with another condition. The ability to collect additional clinical data on inpatient stroke has always been available within the stroke audit portal, but collecting these data was not mandatory. In addition to the audit coordinator recording a patient with a stroke as an inpatient stroke, HIPE also records a 'hospital acquired diagnosis' (HADx) indicator for any additional diagnoses that were not present on admission but were acquired by the patient during the current episode of care (HPO, 2021). If this is noted by the HIPE coder, the patient is assigned a HADx flag.

Because it is estimated that inpatient stroke accounts for approximately 10% of patients with a stroke, and because auditing the care they receive is so important, it has been mandatory since 2020 to collect data on inpatient stroke. This report presents some high-level data on inpatient stroke as the number of these cases is low. Analysis of inpatient stroke care over 2 years will be completed in the 2021 INAS report.

The total number (n=570) of inpatient stroke cases is a combination of inpatient stroke cases that were identified by the audit coordinator (n=489)[10,11] and/or assigned a HADx flag by a HIPE coder (n=263), and represents 9% of the total number of stroke cases (Table 4.1).

This section of Chapter 4 examines 570 inpatient cases with a stroke that were reported through the stroke audit portal in 2020.

TABLE 4.1: IDENTIFICATION OF INPATIENT STROKE CASES

	n
Identified by an audit coordinator	489
Assigned a HADx flag by a HIPE coder	263
Either/or	570

Table 4.2 shows the distribution of sex and age for inpatient cases with a stroke. Fifty-six percent (n=321) of inpatient cases with a stroke were male and 44% (n=249) were female. The same distribution is observed in the main cohort of this report (Figure 4.1).

TABLE 4.2: PERCENTAGE OF INPATIENT STROKE CASES, BY SEX AND AGE GROUP (n=570)

Age group	Male		Female		Total	
	N	%	N	%	N	%
17-64 years	71	63%	42	37%	113	100%
65-79 years	140	63%	84	38%	224	100%
≥80 years	110	47%	123	53%	233	100%
Total	321	56%	249	44%	570	100%

[10] 442 cases were recorded as inpatient stroke cases identified by an audit coordinator. 47 did not have information recorded about whether they had stroke in the hospital, however additional analysis suggested they were inpatient strokes.
[11] 489 includes both cases with a principal diagnosis of inpatient stroke (n=190) and cases with a secondary diagnosis of inpatient stroke (n=299).

There was a larger proportion (80%, n=457) of patients aged 65 years and over within the inpatient population (Table 4.2), compared to the main cohort in this report (74%, n=3820) (Figure 4.1). Specifically, the largest proportion of inpatient stroke cases in 2020 (41%, n=233) was in the 80 years and over age group compared to 33% (n=1713) of cases in the same age group in the main cohort of this report (Figure 4.1). The majority (76%, n=431) of inpatient stroke cases had ischaemic stroke, 9% (n=51) had haemorrhagic stroke, 7% (n=41) had both, and 6% (n=37) did not have the type of stroke recorded. This compares to 85% (n=4379) of cases being ischaemic strokes in the main cohort of this report, and 15% (n=774) being haemorrhagic strokes (Figure 4.7). The rate of thrombolysis for inpatient ischaemic stroke cases (10%, n=47) is similar to that for patients with ischaemic stroke in the main cohort of this report (10.6%, n=466) (Figure 4.8). Home was the discharge destination for 41% (n=235) of inpatient stroke cases, compared to 59% (n=3017) in the main analysis. Almost one-quarter (21%, n=119) of patients who had a stroke as an inpatient died.

KEY FINDINGS FROM CHAPTER 4

- The majority of stroke cases in 2020 had an ischaemic stroke (85%, n=4379) (Figure 4.7).
- The average age of patients with a stroke was 72 years, and one-quarter (n=1333) of all patients with a stroke were aged under 65 years.
- Fifty-seven percent (n=2944) of patients with a stroke were male, and 30% (n=890) of males were aged under 65 years.
- Forty-three percent (n=2209) of patients with a stroke were female, and 20% (n=443) of females were aged under 65 years.
- The majority (97%, n=4997) of stroke cases reported were classified as emergency admissions.
- One-half of stroke cases (50%, n=1400) arrived at hospital within 3 hours of symptom onset (Figure 4.3). This is unchanged from 2019.
- The median time to contact with the medical team after hospital arrival was 11 minutes, a decrease of 6 minutes from 2019.
- Seventy-one percent (n=2911) of patients with a stroke were seen by the medical team within 1 hour of hospital arrival (Figure 4.5).
- The median DTI time was 1 hour and 3 minutes, an improvement from 1 hour and 20 minutes in 2019.
- The intravenous thrombolysis rate for patients with ischaemic stroke in 2020 was 10.6% (n=466).
- The median DTN time nationally was 55 minutes in 2020.
- Patients who have a stroke while an inpatient for another condition are older and have a higher mortality rate than those within the general population of patients with a stroke.

CHAPTER 5
THROMBECTOMY

CONTENTS >

CHAPTER 5: **THROMBECTOMY**

Thrombectomy in stroke is the mechanical removal of a blood clot in a large blood vessel in the brain (Figure 5.1).

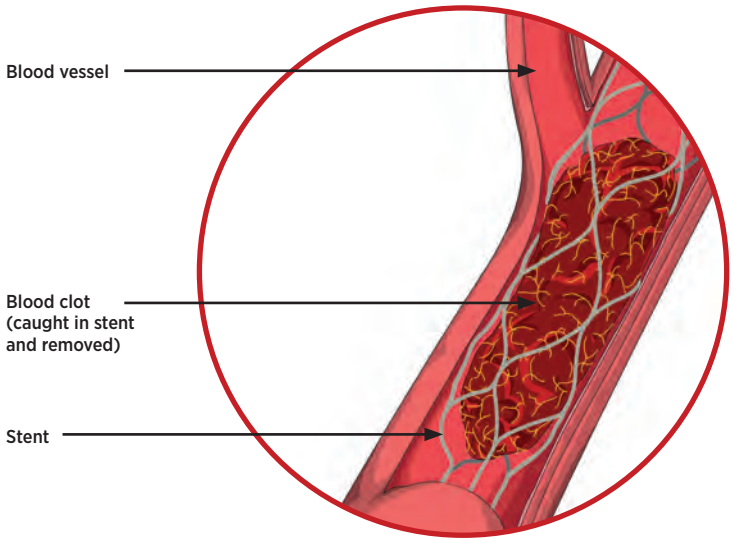


FIGURE 5.1: THROMBECTOMY

Multiple randomised controlled trials and meta-analyses have proven this treatment to be very effective in appropriately selected patients up to 24 hours after the onset of stroke symptoms. 'Time is Brain', and emergency thrombectomy is one of the most time-sensitive medical treatments for stroke. On average, every minute saved for a patient undergoing thrombectomy results in an additional week of independent living (Meretoja *et al*., 2017).

There are two endovascular thrombectomy (EVT) stroke centres providing a National Thrombectomy Service (NTS) for patients with ischaemic stroke in Ireland. Beaumont Hospital provides this service on a 24-hour basis, 7 days a week and, since 2020, Cork University Hospital has provided an 8.00am to 8.00pm service 5 days a week for its surrounding region. Outside these hours, suitable patients may be transferred to Beaumont Hospital for treatment.

Data on thrombectomy are collected in Beaumont Hospital and Cork University Hospital; they are recorded on the NTS database in the two EVT stroke centres and they are also uploaded to the stroke audit portal. In addition, the NTS manages a national QI project called 'Door to Decision in 30!' further detail is provided at the end of this chapter (Figure 5.11). The NTS produced its 2020 annual report (NTS, 2021) using data from the NTS database, and this provides further detailed analysis of the thrombectomy service. When comparing the INAS 2020 annual report and the NTS 2020 annual report, it is important to note that different methodologies were used. Three particular differences to note are as follows:

1. When calculating the rate of thrombectomy, the *National Thrombectomy Service Annual Report 2020* uses as its denominator the total number of ischaemic stroke cases discharged from hospitals in 2020, as reported by the HIPE system. The INAS report uses as its denominator the total number of ischaemic stroke cases discharged from INAS participating hospitals, as reported by the HIPE system, which have additional stroke audit information and meet the 80% coverage target as outlined in the data quality statement in Chapter 3 (Table 3.1).

2. The *National Thrombectomy Service Annual Report 2020* reports on the number of thrombectomies performed in 2020, bearing in mind that a small number of these could have been discharged in 2021. The INAS reports on thrombectomy cases that were discharged in 2020, bearing in mind that a small number of these may have had the thrombectomy in 2019.
3. The INAS thrombectomy dataset did not collect information related to the time of departure from the primary hospital to the EVT stroke centre. This means that some KPIs, such as 'door in door out' (DIDO) for thrombectomy patients as identified in the *National Thrombectomy Service Annual Report 2020*, are not available for comparison. This was an error in design that will be rectified for the 2021 data.

THROMBECTOMY IN ISCHAEMIC STROKE

In 2020, 380 thrombectomy cases were recorded on the stroke audit portal from the two EVT stroke centres, Beaumont Hospital and Cork University Hospital. Ischaemic stroke data were available for the 23 hospitals participating in the INAS (n=4284). In those hospitals, 8.6% (n=370) of patients with an ischaemic stroke had a thrombectomy performed (Table 5.1A). Aguiar de Sousa *et al*. (2018) reported a 1.9% thrombectomy rate across 44 European countries, highlighting how Ireland is at the forefront in endovascular intervention in stroke. The NTS receives data for patients with ischaemic stroke from hospitals that do not participate in the INAS and therefore data on ischaemic stroke from these hospitals were unavailable to calculate the thrombectomy rate in this analysis (Table 5.1B). As these patients had a thrombectomy, they are included in the remaining analysis in Chapter 5, but they are excluded from the analysis in Table 5.1A.

TABLE 5.1A: PERCENTAGE OF PATIENTS WITH ISCHAEMIC STROKE WHO RECEIVED A THROMBECTOMY, BY HOSPITAL[12]

Hospital	Number of ischaemic stroke cases	Number of thrombectomy cases	%
Bantry General Hospital	64	-	*
Beaumont Hospital	347	46	13%
Cavan General Hospital	118	-	*
Connolly Hospital	196	-	*
Cork University Hospital	402	59	15%
Letterkenny University Hospital	164	-	*
Mater Misericordiae University Hospital	251	44	18%
Mayo University Hospital	189	10	5%
Mercy University Hospital	82	-	*
Naas General Hospital	155	12	8%
Our Lady of Lourdes Hospital Drogheda	221	13	6%
Regional Hospital Mullingar	135	18	13%
Sligo University Hospital	159	-	*
South Tipperary General Hospital	77	-	*
St James's Hospital	193	22	11%
St Luke's General Hospital, Carlow/Kilkenny	114	8	7%
St Vincent's University Hospital	331	30	9%
Tallaght University Hospital	231	17	7%
University Hospital Galway	191	24	13%
University Hospital Kerry	122	-	*
University Hospital Limerick	314	24	8%
University Hospital Waterford	130	8	6%
Wexford General Hospital	98	10	10%
Total	**4284**[13]	**370**	**8.6%**

- Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

[12] In 10 thrombectomy cases, the total number of ischaemic strokes for each hospital was not available; see Table 5.1B.
[13] Excluding cases transferred to Beaumont Hospital and Cork University Hospital for thrombectomy (n=95).

TABLE 5.1B: CASES THAT RECEIVED THROMBECTOMY WITH NO ISCHAEMIC STROKE INFORMATION AVAILABLE

Hospital	Number of thrombectomy cases
Portiuncula University Hospital	-
Other[14]	9
Total	*

- Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

[14] Patients included from five hospitals, and hospitals recorded as 'other'.

TIME FROM HOSPITAL ARRIVAL TO COMPUTED TOMOGRAPHY SCAN

Standard: All patients with suspected acute ischaemic stroke should typically have a computed tomography (CT) scan and a computed tomography angiogram (CTA), and if there is a large vessel occlusion showing on the CTA, the patient should be considered for thrombectomy (IHF, 2015).

When calculating the time between hospital arrival and CT scan, the time of arrival to the EVT stroke centre was used for patients if they had arrived directly to the EVT stroke centre. For patients who were transferred to the EVT stroke centre from another hospital, arrival time at the primary hospital was used. The majority (81%, n=308) of thrombectomy cases had the date and time of arrival to hospital recorded. Patients who suffer a stroke while in hospital for another condition and have a thrombectomy (n=10) will not have an arrival date and time, as their arrival date and time was their arrival at hospital for the original condition. This could account for some of the missing data for this and other calculations that measure 'arrival time' as part of the calculation.

Seventy-six percent of thrombectomy cases (n=289) had both time of arrival to hospital and CT scan date and time recorded, and recorded correctly. In 2020, for thrombectomy cases, the national median time between arrival to hospital and CT scan was 23 minutes, which is also referred to as DTI time. Figure 4.6A in Chapter 4 shows that the median DTI time for all patients with a stroke was 63 minutes. As in 2019, this result indicates that patients with moderate to severe stroke do access emergency care quickly.

The median time between arrival to hospital and CT scan was 23 minutes

In 2019, the thrombectomy dataset on the stroke audit portal did not collect data on the time of arrival at the primary hospital, and therefore key quality indicators such as the DTI data were not available. This variable was added to the thrombectomy dataset in 2020 as one of the data quality initiatives from the 2019 report and facilitates reporting on modifiable aspects of the patient pathway to recanalisation.

In 2019, the time between onset of stroke symptoms and CT scan was used as a proxy for DTI time, and the median time between symptom onset and CT scan was 1 hour and 39 minutes. This increased by 26 minutes to 2 hours and 5 minutes in 2020. The DTI time in 2020 was only 23 minutes, so it is likely that the delay is in the pre-hospital phase.

Figure 5.2 displays the median time and interquartile range (IQR) from arrival to hospital to CT scan for thrombectomy cases for all hospitals. As with all figures in this report, the median time was not calculated for hospitals that had fewer than five thrombectomy cases recorded, as the median tends to be less accurate and more biased when the sample size is small. Those cases were, however, included in the analysis of the national median figure.

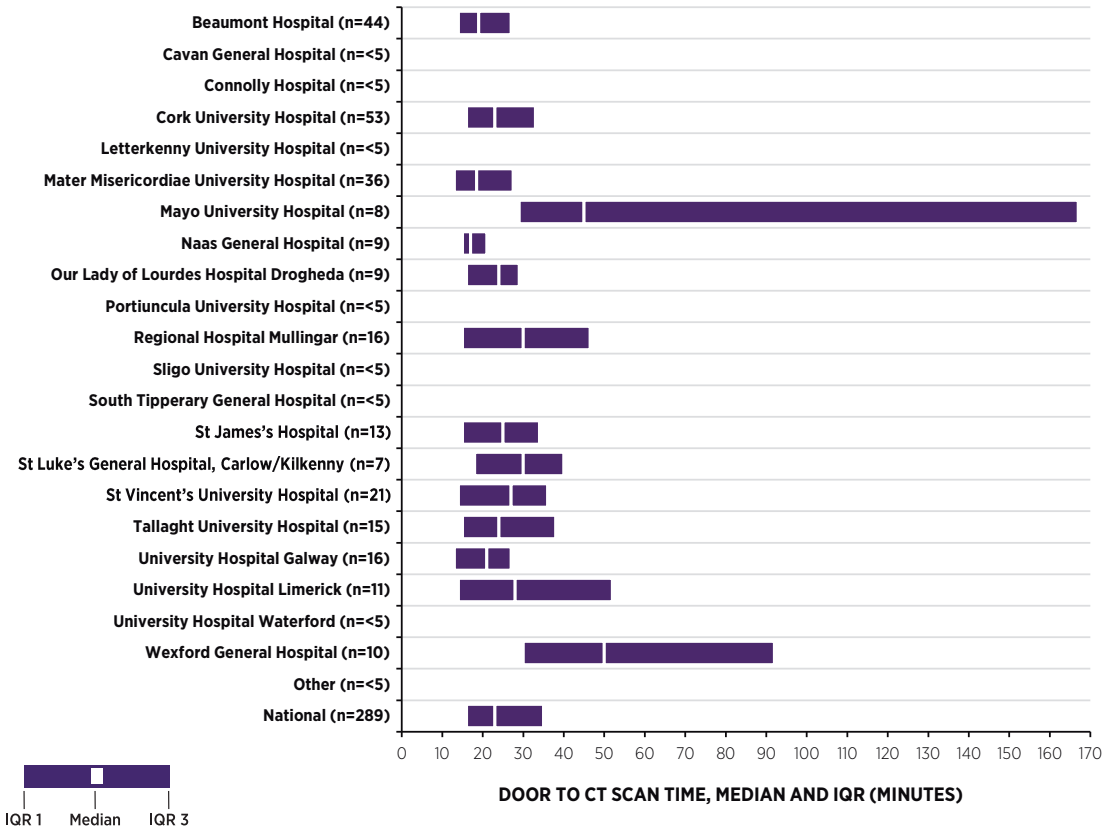


FIGURE 5.2 TIME FROM ARRIVAL TO HOSPITAL TO COMPUTED TOMOGRAPHY SCAN FOR THROMBECTOMY CASES, MEDIAN AND INTERQUARTILE RANGE, BY HOSPITAL (N=289)[15]

[15] 91 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 5.2. Hospitals with fewer than five cases do not have a median or IQR displayed.

TRANSFERS OF PATIENTS

Thrombectomy is performed in two EVT stroke centres in Ireland, and therefore, in the majority of cases, patients with ischaemic stroke who are suitable for thrombectomy will require transfer from the primary hospital to the EVT stroke centre. In 2020, the majority of thrombectomy cases were transferred to the EVT stroke centre (72%, n=275) from a referring hospital (Figure 5.3).

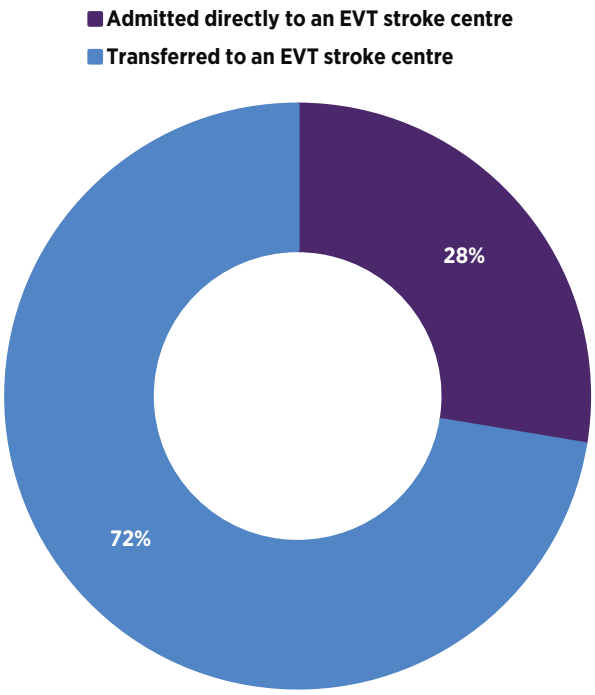


FIGURE 5.3: PERCENTAGE OF PATIENTS TRANSFERRED TO ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=380)

TIME FROM CTA TO DECISION TO TRANSFER PATIENT TO EVT STROKE CENTRE

The national median CTA to decision time for thrombectomy was 31 minutes

A CTA is a scan that shows whether there is an occlusion in the large arteries in the brain. Measuring the time from CTA to the decision to transfer the patient to an EVT stroke centre reflects the efficiency of radiology review, communication with the stroke team, and contact with the EVT stroke centre. Of those who were transferred to the EVT stroke centre in 2020, the time and date information was available for 78% (n=214) of patients (Figure 5.4). The national median CTA to decision time for thrombectomy was 31 minutes. This is an increase from 2019, when the national median was 26 minutes.

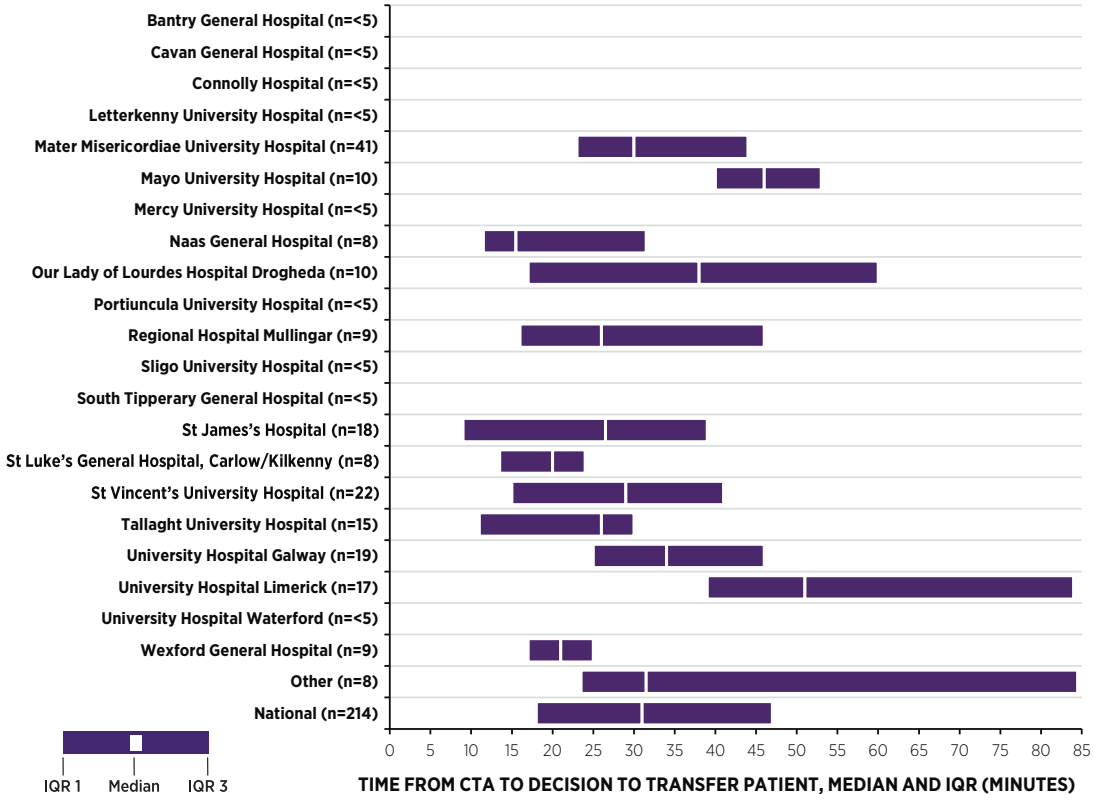


FIGURE 5.4 TIME FROM COMPUTED TOMOGRAPHY ANGIOGRAM TO DECISION TO TRANSFER TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE FOR THROMBECTOMY CASES, MEDIAN AND INTERQUARTILE RANGE, BY HOSPITAL (n=214)[16]

[16] Figure 5.4 refers to patients transferred to an EVT stroke centre. 61 cases did not have time information known or recorded, or it was recorded incorrectly. These cases have been excluded from Figure 5.4. Hospitals with fewer than five cases do not have a median or IQR displayed.

TIME FROM HOSPITAL ARRIVAL TO EVT STROKE CENTRE ARRIVAL

In 2020, 28% (n=105) of thrombectomy patients arrived directly to the EVT stroke centre. The remaining 72% (n=275) of patients were admitted to their nearby primary hospital, where they received immediate clinical and radiological evaluation followed by contact with the EVT stroke centre for a decision to transfer for thrombectomy. If accepted for thrombectomy, they were then transferred using Protocol 37 (the National Ambulance Service Emergency Inter-*Hospital Transfer Policy)* for urgent inter-hospital transfer.

Among patients transferred to an EVT stroke centre, 75% (n=207) had time and date known and recorded correctly for arrival at the referring hospital and for arrival at the EVT stroke centre.

In 2020, the median time from arrival at the primary hospital to arrival at the EVT stroke centre was 2 hours and 45 minutes for patients who were transferred from another hospital (Figure 5.5).

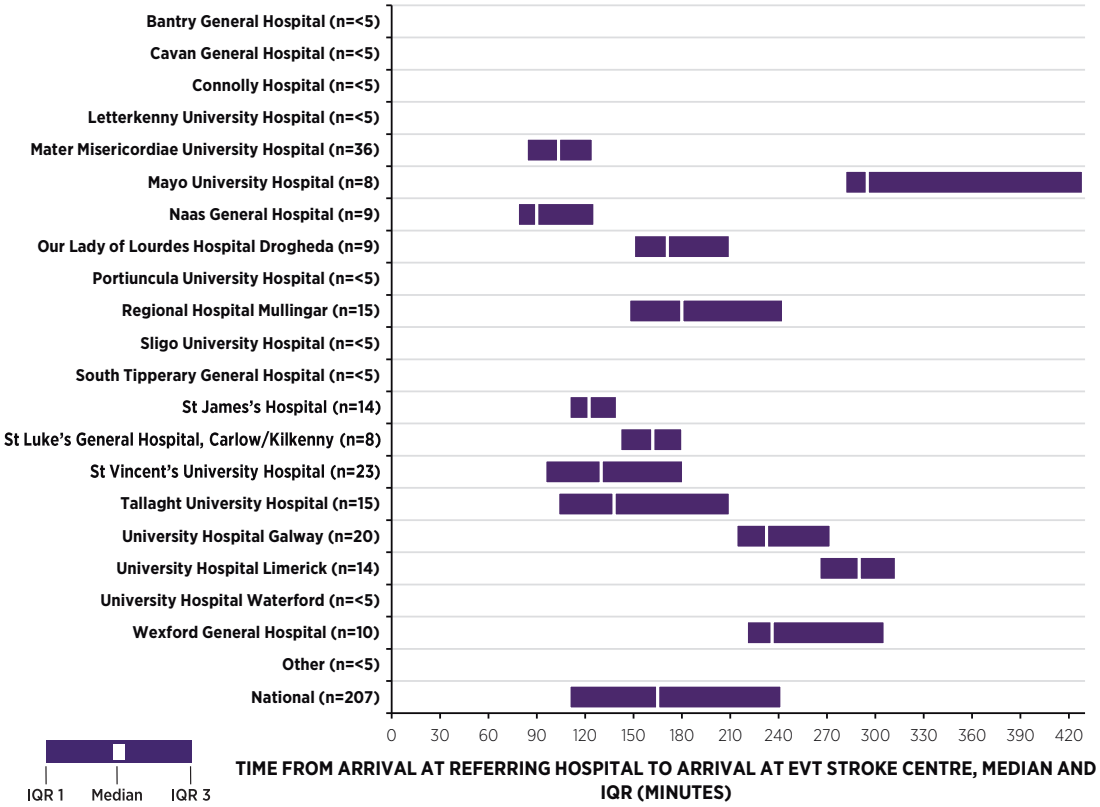


FIGURE 5.5: TIME FROM ARRIVAL AT PRIMARY HOSPITAL TO TIME OF ARRIVAL AT THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE, MEDIAN AND INTERQUARTILE RANGE, FOR THROMBECTOMY CASES THAT WERE TRANSFERRED TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=207)[17]

[17] Figure 5.5 refers to cases that were transferred to the EVT stroke centre. 68 cases did not have time information known or recorded, or it was recorded incorrectly. These cases have been excluded from Figure 5.5.

As referred to in the time from hospital arrival to computed tomography scan section, in 2019, the time of onset of stroke symptoms was used as a proxy for hospital time of arrival. In 2020, the median time from onset of stroke symptoms to arrival at the EVT stroke centre was 1 hour and 34 minutes for patients who arrived directly to the EVT stroke centre and 4 hours and 25 minutes for those who were transferred to the EVT stroke centre. This compares to 1 hour and 33 minutes for patients who arrived directly to the EVT stroke centre and 4 hours for those who were transferred to the EVT stroke centre in 2019.

However, these times are dependent on the travel time from a primary hospital to the EVT stroke centre. A more accurate modifiable measure of performance is to measure the time between arrival at the primary hospital and the time of departure from the primary hospital to the EVT stroke centre, otherwise known as the 'door in door out' (DIDO) time. As a data quality measure for 2021, the time of departure from the primary hospital will be added as a variable to the thrombectomy dataset.

PROXIMAL OCCLUSION SITE

Figure 5.6 shows the distribution of sites of proximal occlusion. More than one-half (54%, n=207) of thrombectomy cases had proximal occlusion in the middle cerebral artery (MCA) 1; 19% (n=74) of patients had proximal occlusion in MCA 2.

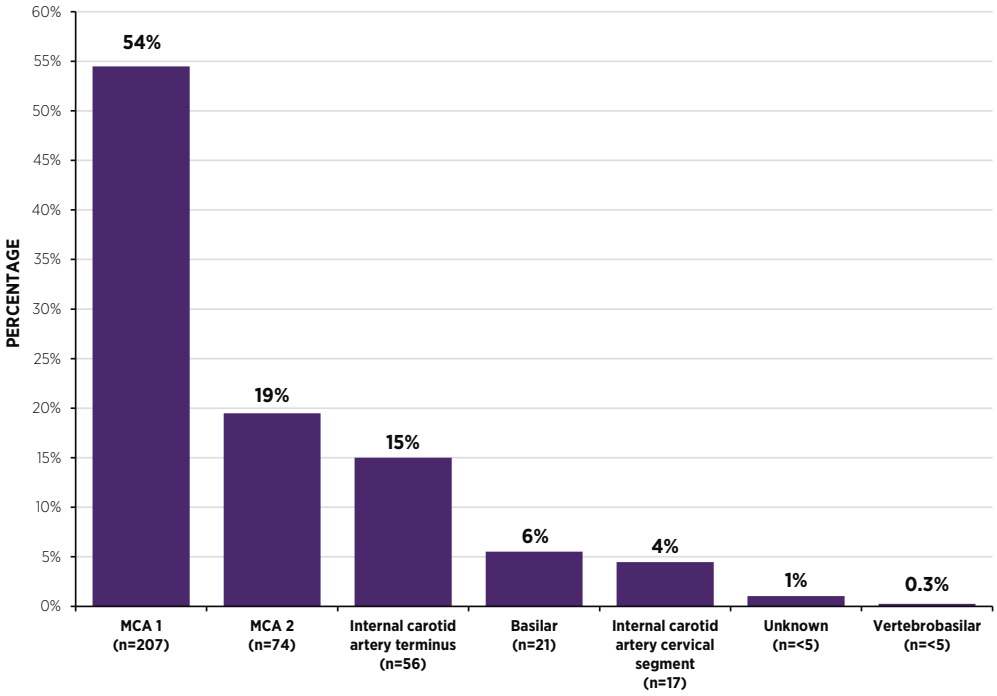


FIGURE 5.6: PROXIMAL OCCLUSION SITE (n=380)

TIME TO RECANALISATION

Recanalisation is the term used to describe when a blood clot is removed and blood flow is restored. Time to recanalisation reflects the time from arrival at the first hospital (primary hospital or EVT stroke centre) to the time of recanalisation. It includes the time to prepare for and perform the thrombectomy. Transferred patients mostly go directly to the angiography laboratory for the procedure, as they would have already been evaluated. Patients presenting directly to the EVT stroke centre require initial evaluation, diagnosis and decision prior to the procedure.

The median time to recanalisation for patients transferred from another hospital was 3 hours 24 minutes

The median time from arrival to the EVT stroke centre to recanalisation for patients who were admitted directly to the EVT stroke centre is displayed in Figure 5.7A, and the median time from arrival at primary hospital to recanalisation for patients who were transferred to the EVT stroke centre is displayed in Figure 5.7B. As expected, the median time to recanalisation was shorter for thrombectomy patients who were admitted directly to the EVT stroke centre (1 hour and 56 minutes) than for thrombectomy patients who were transferred from another hospital (3 hours and 24 minutes).

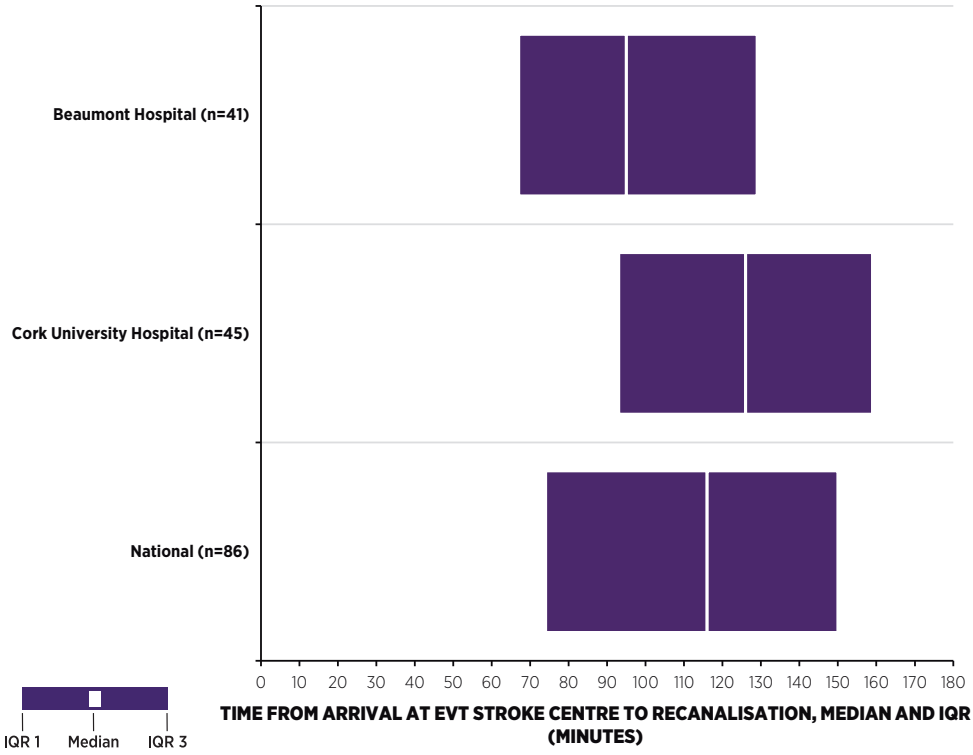


FIGURE 5.7A: TIME FROM ARRIVAL AT ENDOVASCULAR THROMBECTOMY STROKE CENTRE TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, FOR PATIENTS ADMITTED DIRECTLY TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=86)[18]

[18] Figure 5.7A refers to patients who were admitted directly to the EVT stroke centre. 19 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 5.7A.

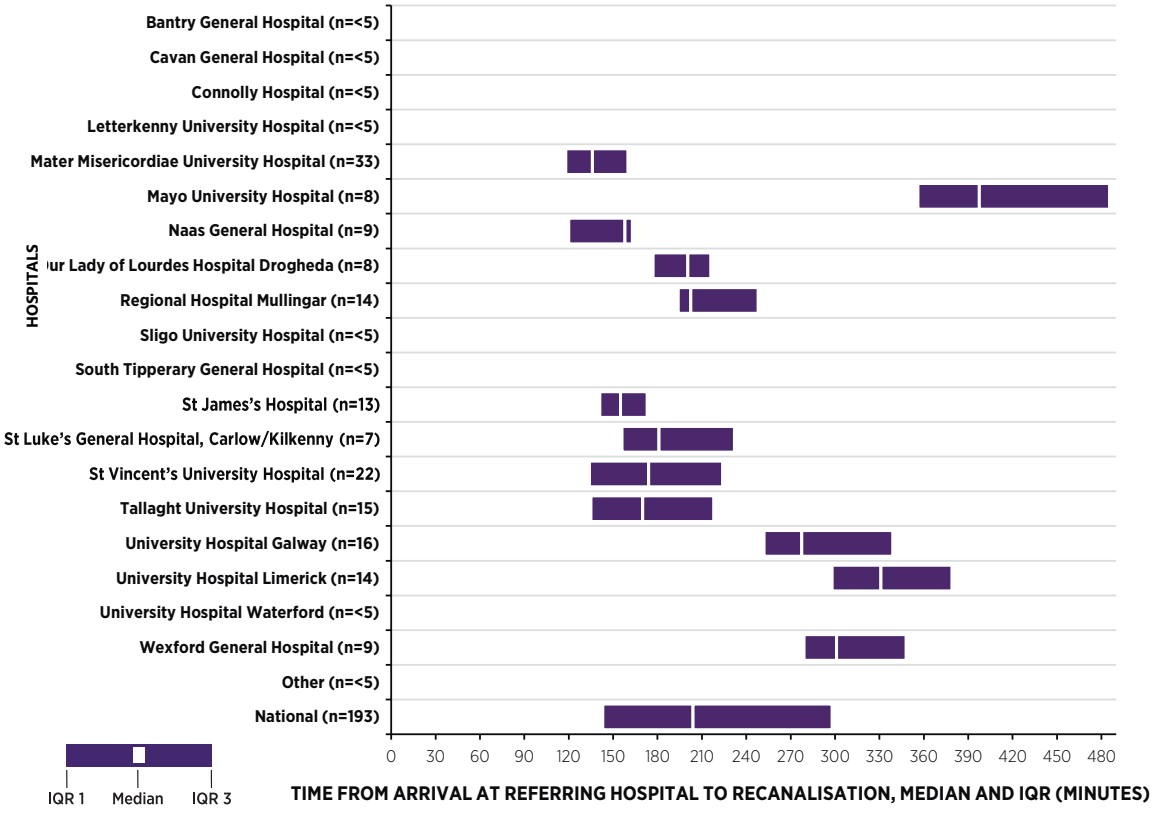


FIGURE 5.7B: TIME FROM ARRIVAL AT PRIMARY HOSPITAL TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, FOR PATIENTS TRANSFERRED TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=193)[19]

Again, in 2019, the time of arrival at the primary hospital was unavailable and so the time of onset of stroke symptoms was used as a proxy. In 2020, the median time from symptom onset to recanalisation was 3 hours and 39 minutes for patients admitted directly to the EVT stroke centre, and 5 hours and 12 minutes for those transferred to the EVT stroke centre. This compares to 3 hours and 32 minutes for patients admitted directly to the EVT stroke centre and 4 hours and 39 minutes for those transferred to the EVT stroke centre in 2019.

Reporting time intervals starting at time of hospital arrival (in addition to ongoing quality improvement initiatives) should facilitate improvements, and this is the time interval that will be used in future reports.

[19] Figure 5.7B refers to patients transferred from another hospital to the EVT stroke centre. 82 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 5.7B. Hospitals with fewer than five cases do not have a median or IQR displayed.

INTERVENTION OUTCOMES – NATIONAL INSTITUTES OF HEALTH STROKE SCALE

Early recovery is a good predictor of final outcome post-thrombectomy. The National Institutes of Health Stroke Scale (NIHSS) is a stroke scale that enables the doctor to rapidly determine the severity and possible location of the stroke. NIHSS scores are strongly associated with outcome and can help to identify those patients who are likely to benefit from reperfusion therapies, as well as those who are at higher risk of developing complications from the stroke itself or from potential reperfusion strategies (Wouters *et al*., 2018).

In 2020, 22% (n=85) of thrombectomy patients did not have an NIHSS score recorded, an increase from 9% (n=33) in 2019. The distribution of cases that had NIHSS scores recorded pre-thrombectomy and 24 hours post-thrombectomy is displayed in Figure 5.8. In 2020, 95% (n=281) of thrombectomy patients had at least moderate stroke symptoms prior to thrombectomy (NIHSS scores of 5 to 42).

The number of patients with moderate to severe stroke symptoms more than halved from 68 patients (23%) pre-thrombectomy to 30 patients (10%) by 24 hours post-thrombectomy. Similarly, the number of patients with severe stroke symptoms decreased from 60 patients (20%) pre-thrombectomy to 28 patients (9%) 24 hours post-thrombectomy. Six percent (n=18) of patients had no stroke symptoms recorded 24 hours post-thrombectomy. The percentage of patients with minor stroke symptoms increased from 4% (n=13) pre-thrombectomy to 30% (n=88) at 24 hours post-thrombectomy. When measured at 24 hours post-thrombectomy, an NIHSS score of ≤8 is highly predictive of long-term functional outcome for anterior circulation stroke (Meyer *et al.*, 2020). In 2020, 53% (n=157) of patients had an NIHSS score of ≤8 at 24 hours post-thrombectomy. The INAS does not collect a 90-day outcome measure; however, 90-day outcomes can be found in the *National Thrombectomy Service Annual Report 2020* (NTS, 2021).

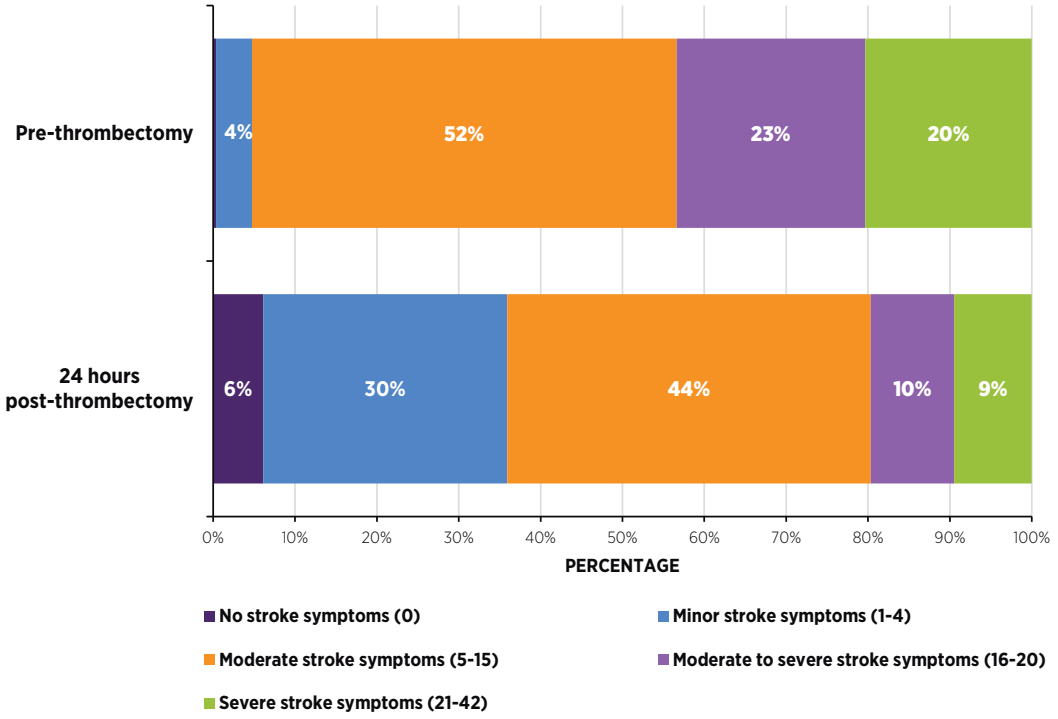


FIGURE 5.8: INTERVENTION OUTCOMES – NATIONAL INSTITUTES OF HEALTH STROKE SCALE SCORES (n=295)[20]

[20] 85 cases did not have an NIHSS score recorded. These cases have been excluded from Figure 5.8.

TRANSFERS OF PATIENTS BACK TO REFERRING HOSPITAL

The NTS provides its service on the basis of using the existing stroke service in all referring hospitals. It is essential for the ongoing functioning of the NTS that patients are repatriated to the referring hospital as soon as possible. This process works very well; for Beaumont Hospital, patients transferred from a hospital within a 90-minute drive are repatriated immediately post-thrombectomy if they are well enough. All other patients are kept for a period of observation and management until stable. Figure 5.9 shows that the majority (65%, n=179) of thrombectomy patients who were transferred to an EVT stroke centre for thrombectomy were transferred back to their referring hospital immediately after the procedure. Of those who were not transferred immediately back to the referring hospital, the majority (74%, n=70) were transferred back to the referring hospital following a period of time in the EVT stroke centre. The median length of stay in the EVT stroke centre for patients who were not immediately transferred back to their referring hospital was 3 days.

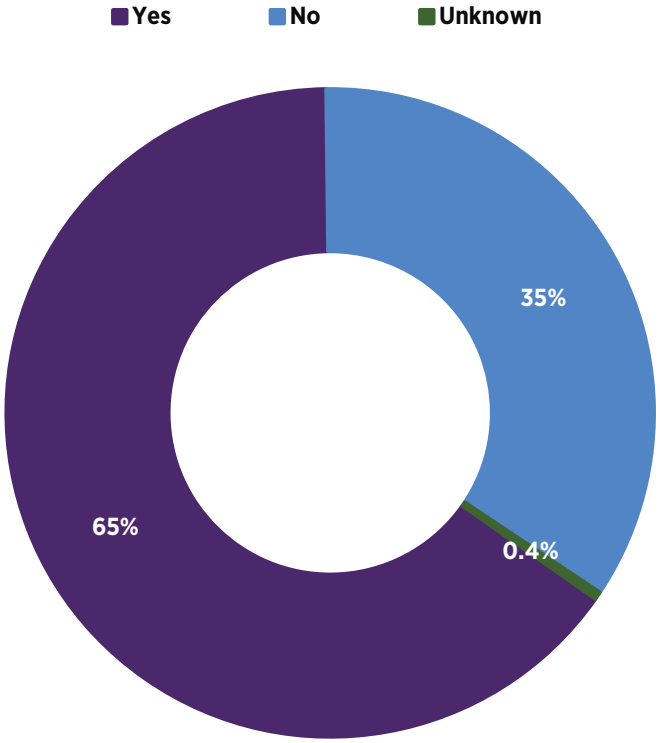


FIGURE 5.9: PERCENTAGE OF THROMBECTOMY CASES TRANSFERRED IMMEDIATELY BACK TO REFERRING HOSPITAL (n=275)[21]

[21] Figure 5.9 refers to patients transferred from another hospital to the EVT stroke centre for thrombectomy.

DISCHARGE DESTINATION

The thrombectomy dataset collects data from the two EVT stroke centres, and therefore the discharge destination is that following discharge from the EVT stroke centre. However, the majority of those cases are transferred back to the primary hospital, which is not an accurate discharge destination of thrombectomy cases. The INAS does not have the capability to follow a case from the thrombectomy dataset to the same case in the primary hospital. The ability to access an individual patient identifier would allow accurate recording of this follow-up information.

Figure 5.10 displays the discharge destination for thrombectomy patients who were admitted directly to an EVT stroke centre.

Fifty-nine percent (n=62) of thrombectomy patients were discharged directly home from hospital in 2020; this compares to 46% (n=32) in 2019. This change is most evident in Cork University Hospital, where 63% (n=37) of thrombectomy patients were discharged home in 2020 and 43% (n=15) were discharged home in 2019. There was a decrease in the proportion of thrombectomy patients who died, from 23% (n=16) in 2019 to 15% (n=16) in 2020. Beaumont Hospital had fewer than five thrombectomy cases (7%) that were transferred to a rehabilitation facility in 2020, and Cork University Hospital had none.

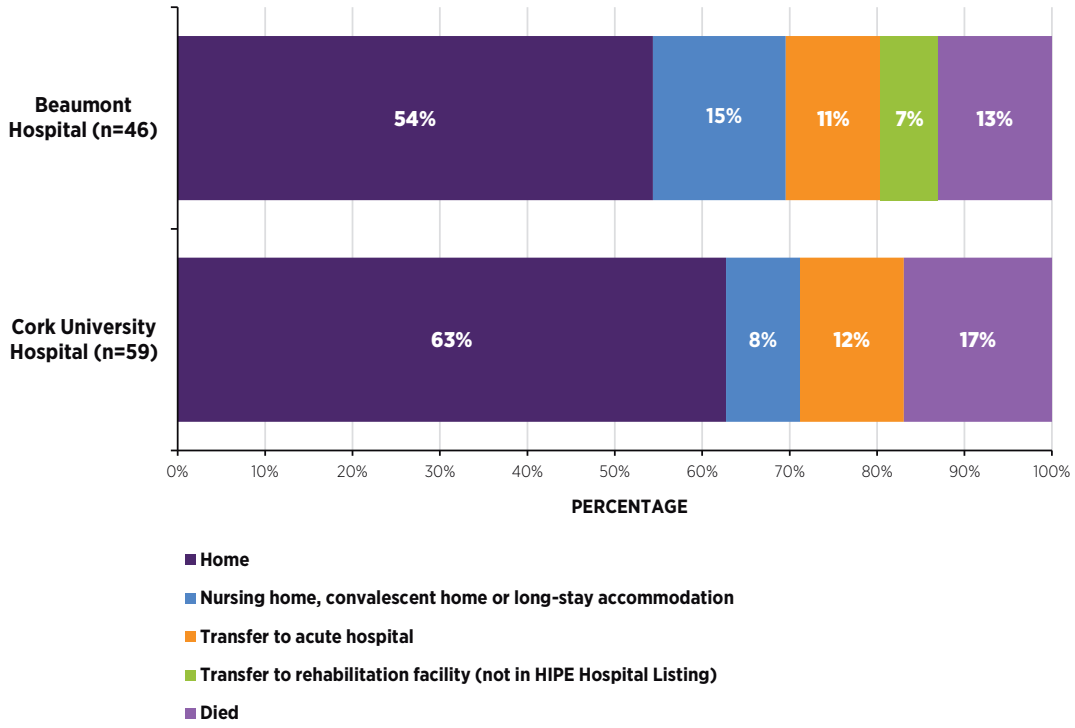


FIGURE 5.10: DISCHARGE DESTINATION FOR PATIENTS ADMITTED DIRECTLY TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=105)

KEY FINDINGS FROM CHAPTER 5

- In 2020, 8.6% (n=370) of patients for whom ischaemic stroke data were available underwent thrombectomy (Table 5.1A), similar to 2019 (8.5%, n=302).
- Ninety-five percent (n=281) of thrombectomy cases for which NIHSS data were recorded had at least moderate stroke symptoms prior to thrombectomy (Figure 5.8).
- The median time from onset of stroke symptoms to CT scan was 2 hours and 5 minutes in 2020, while median time from hospital arrival to CT scan was 23 minutes. Although time from onset of stroke symptoms to arrival at hospital includes the journey time to hospital, it is important to continue to improve patient awareness of stroke symptoms and of the need for a prompt response to symptoms.
- In 2020, 72% of thrombectomy cases were transferred from other hospitals to one of the EVT stroke centres (Figure 5.3). This compares to 81% (n=292) of thrombectomy cases that were transferred to an EVT stroke centre in 2019.
- In 2020, the median time from onset of stroke symptoms to arrival at the EVT stroke centre was 1 hour and 34 minutes for patients who arrived directly to the EVT stroke centre, which was similar to 2019 (1 hour and 33 minutes); for those who were transferred to the EVT stroke centre, this time was 4 hours and 25 minutes, an increase of 25 minutes from 2019.
- The national median CTA to decision time for thrombectomy was 31 minutes in 2020 (Figure 5.4). This is an increase from 2019, when the national median was 26 minutes.
- The median time from arrival at the primary hospital to arrival at the EVT stroke centre was 2 hours and 45 minutes for patients who were transferred from another hospital (Figure 5.5).
- In 2020, the median time from arrival at the primary hospital to recanalisation for patients who were transferred to the EVT stroke centre was 3 hours and 24 minutes (Figure 5.7B).
- The median time from arrival at the EVT stroke centre to recanalisation for thrombectomy patients who were admitted directly to the EVT stroke centre was 1 hour and 56 minutes in 2020 (Figure 5.7A).
- The number of patients with moderate to severe stroke symptoms more than halved from 68 patients (23%) pre-thrombectomy to 30 patients (10%) by 24 hours post-thrombectomy. Similarly, the number of patients with severe stroke symptoms decreased from 60 patients (20%) pre-thrombectomy to 28 patients (9%) 24 hours post-thrombectomy.

Door to Decision in 30! QI Project

A Quality Improvement Project ("Door to Decision in under 30!"), commenced in 2018 for the care of patients with acute ischaemic stroke. This was initiated by Dr. John Thornton, Director, National Thrombectomy Service, with the engagement of the QI Department in the RCPI and dedicated QI leads employed through the RCSI, Dr. Naomi Nowlan & Ms. Róisín Walsh, this was funded through industry grant and payments from hospitals involved in the project, 22 out of 23 hospitals admitting acute stroke patients participated in the programme.

7919

FAST + Patients

Improved data collection in FAST+ patients including those with possible strokes. To end of 2020, 7919 FAST patient journeys were documented as part of the QI project .

3512

Decisions Recorded

To end of 2020, 3512 patients had the time of decision regarding their suitability for thrombectomy recorded. Documented decision times focuses the team on the steps of the acute stroke pathway.

43mins

71 mins → 43 mins

Door to Decision

Median time from door to decision for treatment for all FAST+ patients decreased from 71mins in 2018 to 43mins in 2020.

22 of 23 Hospitals

22 hospitals have participated in the 8 month formal QI Collaborative, with continued participation and repeated PDSA cycles.

2020 Results (n3796)

Median Door to CT 29 mins (n3343)

Median CT to Decision 13 mins (n1500)

Median Door to Decision 43 mins (n1830)

Median Door to TPA 53mins (n426)

392 Thrombectomies

49% Functional Independence at 90 days post Thrombectomy

Examples of the many interventions tested to date, tailored to each hospital

- Pre-alert call from ambulance
- Early notification of relevant staff on one page system
- Clear roles for MDT
- Straight to CT & IV lysis in CT
- Decision makers in place
- Simulation training to improve efficiency
- Early contact with EVT centre
- Ambulance crew waits decision

For more information please contact The National Thrombectomy Service at thrombectomy@beaumont.ie

FIGURE 5.11: DOOR TO DECISION IN 30! QI PROJECT

Door to Decision in 30! QI Project

DOOR TO DECISION IN 30! COLLABORATIVE QI PROJECT

The aim of this collaborative was to design and run a training programme for all hospitals managing acute ischaemic stroke (AIS) patients, with the goal of achieving rapid diagnosis and processing, from the time of arrival to hospital in a patient with possible acute stroke, through the acute stroke pathway, including clinical and radiological assessment, stroke diagnosis , treatment with IV lysis and ultimately to the successful vessel recanalisation by endovascular thrombectomy, for those in whom this is required.
The decision regarding suitability for thrombectomy was selected as the primary outcome as it is a time critical element of the patient journey and it assumes prior decision regarding +/- administration of IV lysis.
The target is to make this decision in under 30minutes, hence the name:
Door to Decision in under 30!

THE COLLABORATIVE PROJECT PROCESS

The official collaborative process commenced in 2018. Each hospital identified a multidisciplinary team to attend formal learning sessions, with the support of a local hospital steering group. Participants needed to be key stakeholders in the management of the AIS patients' journey. Teams included staff representing different departments; Emergency care; Stroke teams ; Radiology ; Portering Services; Hospital Management; Ambulance Crew; Administration Services.
The formal collaborative took place in Dublin over an 8 month period. It comprised of 6 formal learning sessions led by Dr Peter Lachman (RCPI) and supported by the NTS QI leads Dr Naomi Nowlan & Ms. Róisín Walsh (RCSI) and Dr John Thornton (Beaumont Hospital). The hospital teams were supported to implement the learning from these sessions at their respective hospitals during the intervening action periods.
Regular hospital site visits were facilitated by the NTS QI leads, where each hospital steering group, participated in exercises to understand the patient journey and identify the areas for improvement. The teams then tested these improvements using PDSA (Plan, Do, Study, Act) cycles and evaluated the impact of the changes on the door to decision time. Where a change was successful it was integrated into current practice.

DATA COLLECTION

To ensure that data was comparable and suitable for national reporting, it was crucial to establish a standardised approach to data collection for all FAST+ patients. Time metrics are reflective of the efficiency of the emergency stroke service in individual primary stroke centers (PSC's).The agreed time points collected are: stroke onset date & time, arrival to hospital (door in time), time of: CT, CTA, IV lysis (if given), contact to EVT centre, decision re thrombectomy and departure for EVT centre. The data collected aims to reflect the acute stroke patients' journey from arrival to the hospital to decision regarding EVT. This data is collected on a regular basis and sent to the QI lead anonymously. It is then analysed and each hospital receives comprehensive feedback.

SUSTAINING IMPROVEMENTS

The support of a NTS QI lead is integral to the process, as they provide support to coordinate local teams, challenge current processes, offer shared learnings and experiences, and teach QI methodologies. This was a critical part to the project to ensure sustainability and ongoing data collection.
The National Stroke Strategy for 2021-2026 recognises that the acute treatment for patients with ischaemic stroke, especially in the time sensitive treatments of thrombolysis and thrombectomy, is an area for continuous quality improvement. It highlights the importance for teams to lock in the progress that has been made and to continually build upon it. The National Thrombectomy Service Annual Report 2020 (NTS, 2021) provides detailed 2020 results.
Going forward we can continue to apply these techniques in response to patients' needs, best practices and policy changes.

For more information please contact The National Thrombectomy Service at thrombectomy@beaumont.ie

CHAPTER 6
STROKE UNIT CARE

CONTENTS >

CHAPTER 6: **STROKE UNIT CARE**

ADMISSION TO A STROKE UNIT

Standard: People with stroke should be treated in a stroke unit throughout their hospital stay unless their stroke is not the predominant clinical problem (Royal College of Physicians, 2016; IHF, 2010).

Figure 6.1 shows that in 2020, 71% (n=3649) of all patients with a stroke were admitted to a stroke unit for some or all of their hospital stay. This is consistent with the 71% recorded in 2019 (NOCA, 2020), and is a significant improvement from the 54% (n=472) of patients who were admitted to a stroke unit in 2015 (McElwaine *et al*., 2015) and from the 2% (n=42) recorded in 2008 (Horgan *et al*., 2008). However, this is a national KPI with a target of 90%. To achieve the agreed target, patients with a stroke should have immediate access to a stroke unit and should remain there throughout their hospital stay. Additionally, they should be cared for by a multidisciplinary team that has specialist knowledge, protocols, training and skills in stroke care and the ability to monitor and regulate basic physiological function. This will require additional capacity in many stroke units and the development of geographically discrete stroke units in those hospitals without a dedicated acute stroke unit. In 2020, Letterkenny University Hospital was the only INAS participating hospital providing acute stroke services without a stroke unit; however, it did open a stroke unit in 2021.

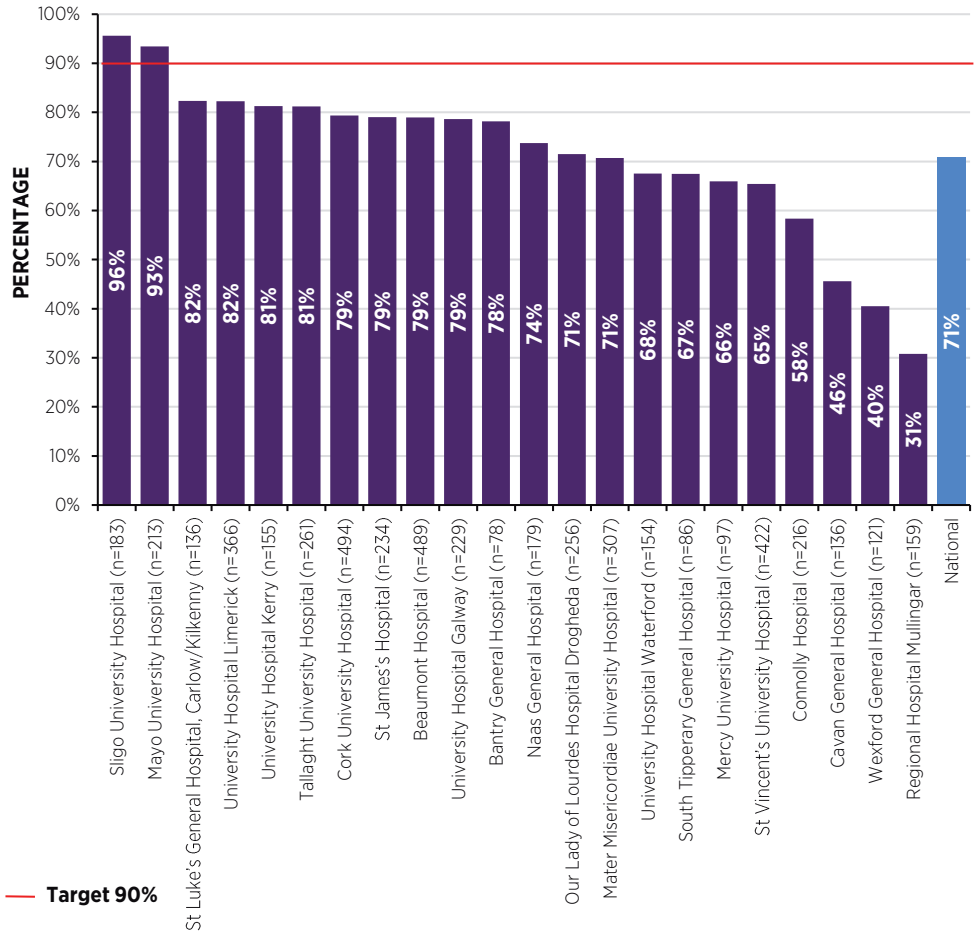


FIGURE 6.1: ADMISSION TO STROKE UNIT, BY HOSPITAL (N=5153)[22]

[22] Figure 6.1 does not include Letterkenny University Hospital, as this hospital did not have a dedicated stroke unit in 2020.

REASON FOR NON-ADMISSION TO A STROKE UNIT

In many cases (n=771, 51%) where patients were not admitted to a stroke unit, a stroke unit bed was unavailable; specifically, in 39% (n=587) of cases, there was no bed available in the stroke unit, and in 12% (n=184) of cases, the hospital did not have a stroke unit (Figure 6.2A). A much larger proportion of patients with a stroke were unable to access a stroke unit due to infection control risk in 2020 (13%, n=195) compared to 2019 (3%, n=34).

The proportion of patients not admitted to a stroke unit due to the hospital not having a stroke unit reduced from 20% (n=249) in 2019 to 12% (n=184) in 2020. In 2019, two hospitals did not have a stroke unit, compared to 2020 when only one hospital did not have a stroke unit.

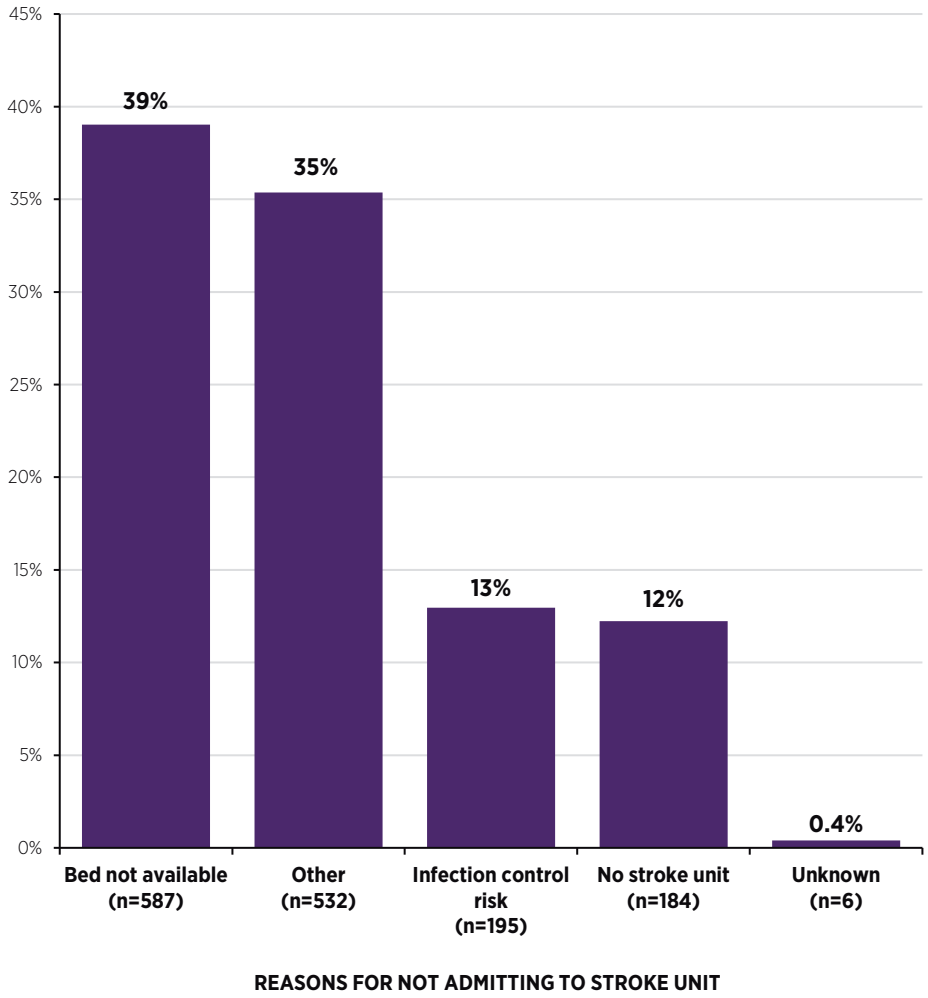


FIGURE 6.2A: REASON FOR NON-ADMISSION TO A STROKE UNIT (n=1504)[23]

[23] 1,504 refers only to the patients who were not admitted to a stroke unit in 2020.

A free text box enables the provision of further explanation for when 'Other' was selected as a reason for not admitting a patient to a stroke unit. This text was analysed and grouped into eight distinct categories (Figure 6.2B). There was no additional information provided for 24% (n=128) of cases. The most commonly documented reasons for patients not being admitted to a stroke unit were a lack of referral to the stroke service (n=91, 17%), because patients received palliative care in another setting (n=81, 15%), and because patients were too well/had no rehabilitation needs (n=80, 15%).

Admission to an intensive care unit may be the appropriate level of care in some circumstances, and having the KPI target for admission to a stroke unit set at 90% rather than 100% acknowledges the different care needs of patients. An organisational audit of current stroke unit facilities, as recommended in the 2019 report, will be undertaken in 2021 to review the availability and accessibility of stroke unit beds, the availability of the appropriate number of trained stroke staff, and the accessibility of diagnostic tests and investigations.

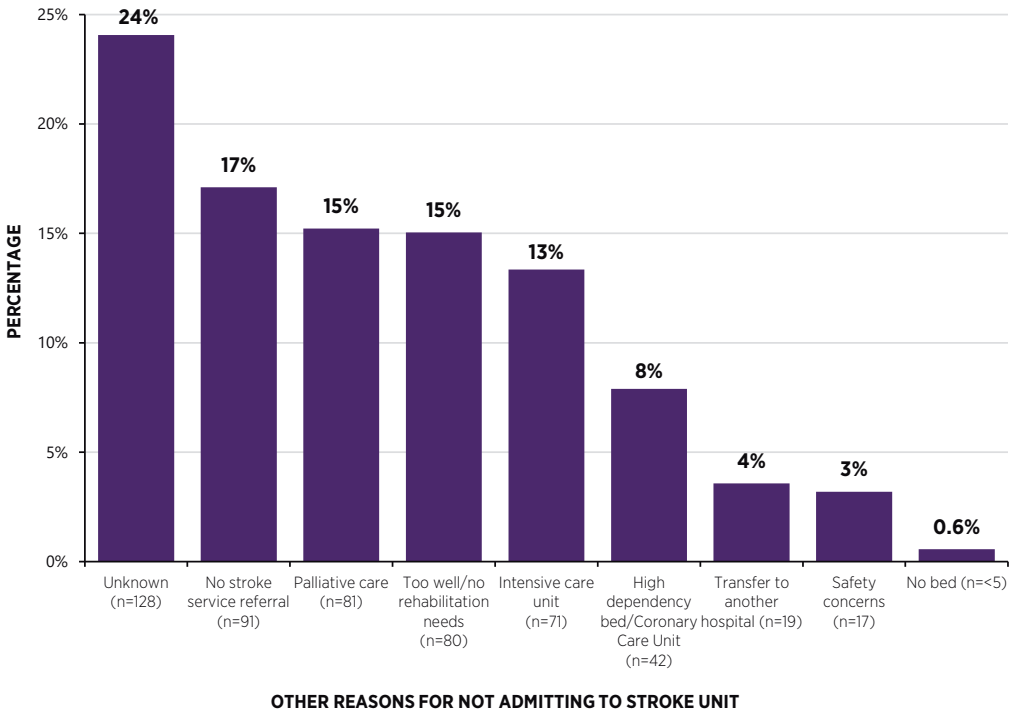


FIGURE 6.2B: OTHER REASONS FOR NON-ADMISSION TO A STROKE UNIT (n=532)

QUALITY IMPROVEMENT PROJECT
MERCY UNIVERSITY HOSPITAL

In 2020, Inês Saramago, Clinical Nurse Specialist in Stroke at Mercy University Hospital, developed a patient resource: the *Acute Stroke Unit Booklet: Bridging the information gap between patients, relatives and providers*.

She won the Quality Improvement prize for "Improving patient experience through person-centred care" at the Clinical Audit and Quality Improvement Day.

Inês Saramago, Clinical Nurse Specialist in Stroke, Mercy University Hospital

Acute Stroke Unit Booklet: Bridging the information gap between patients, relatives and providers

Inês Saramago
Stroke Clinical Nurse Specialist, Acute Stroke Unit, St. Finbarr's Ward, Mercy University Hospital

Background

Following a stroke, patients are often confronted with many impairments, which can trigger many questions from their relatives. Establishing clear and regular communication with the relatives can be challenging when using a multidisciplinary team (MDT) approach. Also, the ability to retain all the information and new medical terminology by both patients and their relatives can be limited during this stressful time.

Aim

The aim of the acute stroke unit booklet is to provide medical and practical information relevant to the acute stroke patients, and their relatives, admitted to the Acute Stroke Unit in St. Finbarr's Ward, Mercy University Hospital.

Design

The development of the Acute Stroke Unit Booklet was carried out in two phases:

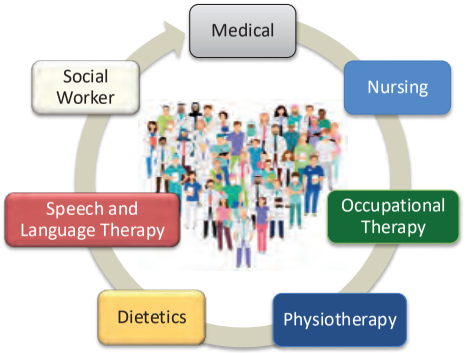
Phase I - review of the published Stroke unit Booklets from UK and Irish Hospitals/Organizations was conducted. MDT opinions and suggestions were also sought.

Phase II - the booklet was formally validated by inviting the MDT to assess each relevant section of the booklet for adequacy, coverage and readability of the content.

Results

The 44 page booklet was organized into 13 sections:

- About this Booklet
- Information for Relatives, Carers and Friends
- Contacting the Ward
- What is a Stroke?
- The Multidisciplinary Team
- The Rehabilitation Process
- Advice for Relatives, Carers and Friends
- Your Personal Information
- Personal thoughts, comments and questions
- Your Goals
- Useful Contacts
- Frequently asked questions
- References



The MDT section incorporates 7 departments and every department provided feedback.
The booklet was primarily distributed and explained to acute stroke patients. Where the patient's cognitive status was significantly impacted, the booklet was then assigned to the patients' relatives.

Conclusions

A simple, illustrated information booklet designed for acute stroke patients and their relatives using clear and plain language is an effective mean to maintain communication between patients, relatives and providers.
A similar approach focusing on aphasic stroke patients and cognitively impaired stroke patients could be adopted for the development of other accessible information booklets.

References

- Buckinghamshire Healthcare NHS Trust, & Buckinghamshire County Council. *Stroke Patient Portfolio - For patients, their carers, families and friends.*
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Acknowledgements

A special thank you for the valuable feedback and support from:

- Medical Stroke Team
- Director of Nursing
- CNM2 and CNM1 in St. Finbarr's Ward
- Stroke Occupational Therapist
- Physiotherapy department
- Dietetics department
- SLT department
- Social Worker department
- Patient Liaison & Access Officer

SWALLOW SCREENING

Standard: Swallow screening should be performed on all patients with a stroke within 4 hours of admission and before any oral intake (NSP, 2017; Royal College of Physicians, 2016; IHF, 2010).

Swallowing difficulties are common in patients with a stroke, and this can lead to food, fluid, and/or saliva entering the airway. This increases the risk of pneumonia (Bray *et al*., 2017) and therefore poor outcomes, including a longer hospital stay and a higher risk of disability and death (Martino *et al*., 2009). A guidance document on swallow screening was developed by the National Stroke Programme (NSP) (2017); the screen involves a 'sip test' performed by trained medical or nursing staff. If this test is failed, the patient may progress to a formal swallow assessment, typically performed by a speech and language therapist.

In 2020, 68% (n=3507) of stroke cases had a swallow screen performed (Figure 6.3), similar to 2019 (67%, n=2859). Forty-three percent (n=1507) of those patients who received a swallow screen had it completed within 4 hours of presentation to hospital. Increasing access to acute stroke unit care would have an immediate impact on the prevalence of swallow screening, as patients with a stroke are almost twice as likely to have a swallow screening when they are admitted to a stroke unit compared with those who are not admitted to a stroke unit (Table 6.1). However, a quality improvement initiative is necessary in order to increase training for stroke healthcare professionals in the application of validated swallow screening tools and is a recommendation of this report. Additionally, a plan for acute stroke units to provide outreach to other wards, including the emergency department, to support swallow screening out of hours could be considered. In the 2019 INAS national report, it was recommended that all stroke services should ensure that there is a swallow screening training programme available for all healthcare professionals, and this will be reported on as part of the organisational audit to be undertaken in 2021.

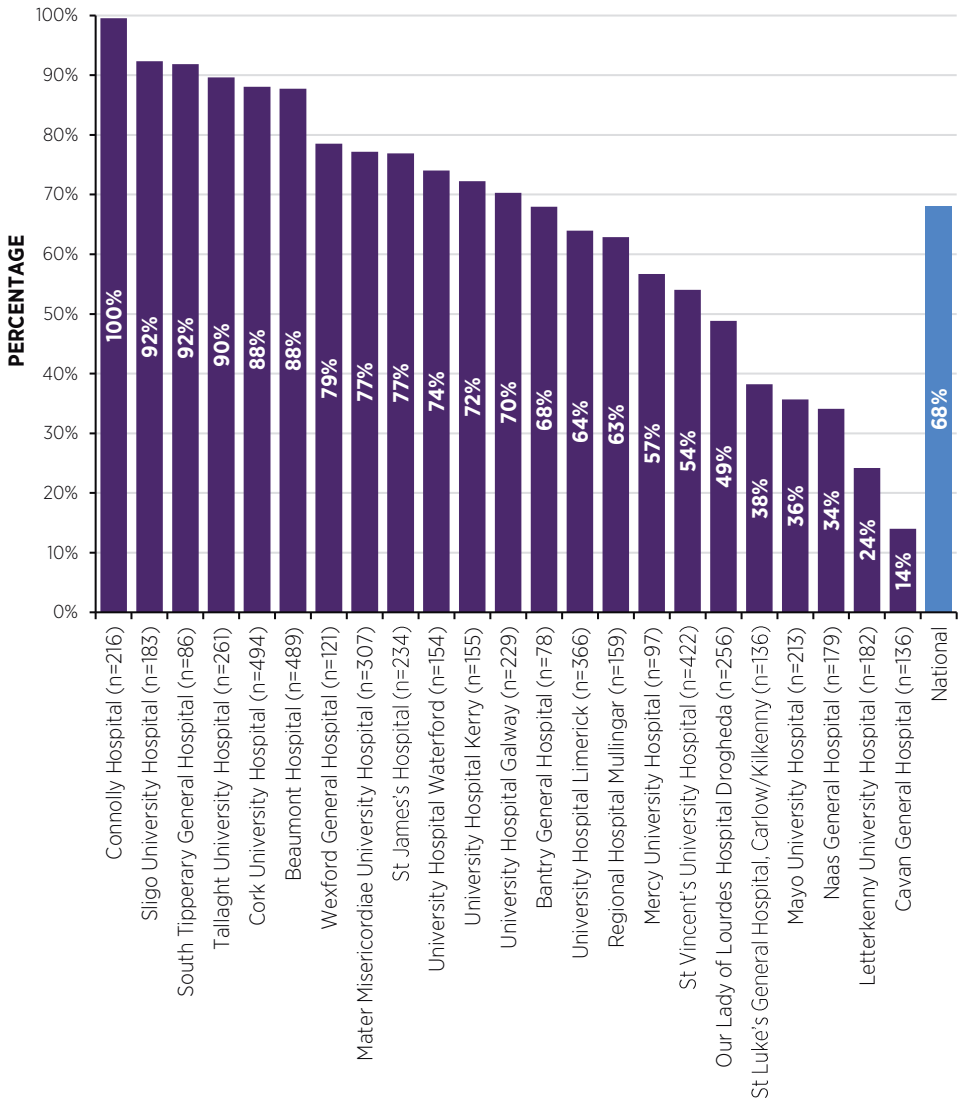

FIGURE 6.3: SWALLOW SCREENING, BY HOSPITAL (N=5153)

MOOD SCREENING

Standard: Stroke care should include provision of screening for mood disturbance (Royal College of Physicians, 2016).

More than one-quarter (29%, n=1488) of patients with a stroke were reported to have had a mood screen performed in 2020 (Figure 6.4), an increase from 22% (n=958) in 2019. For 35% (n=1811) of acute stroke cases, it was reported that mood screening was not indicated. Further education and training in relation to mood screening in the acute stage of stroke is required. The NSP is in the process of developing a guidance document to assist in the management of mood and cognition for patients with a stroke. Currently, a pathway for the assessment and management of depression following stroke in the acute setting is available on the NSP website (NSP, 2016).

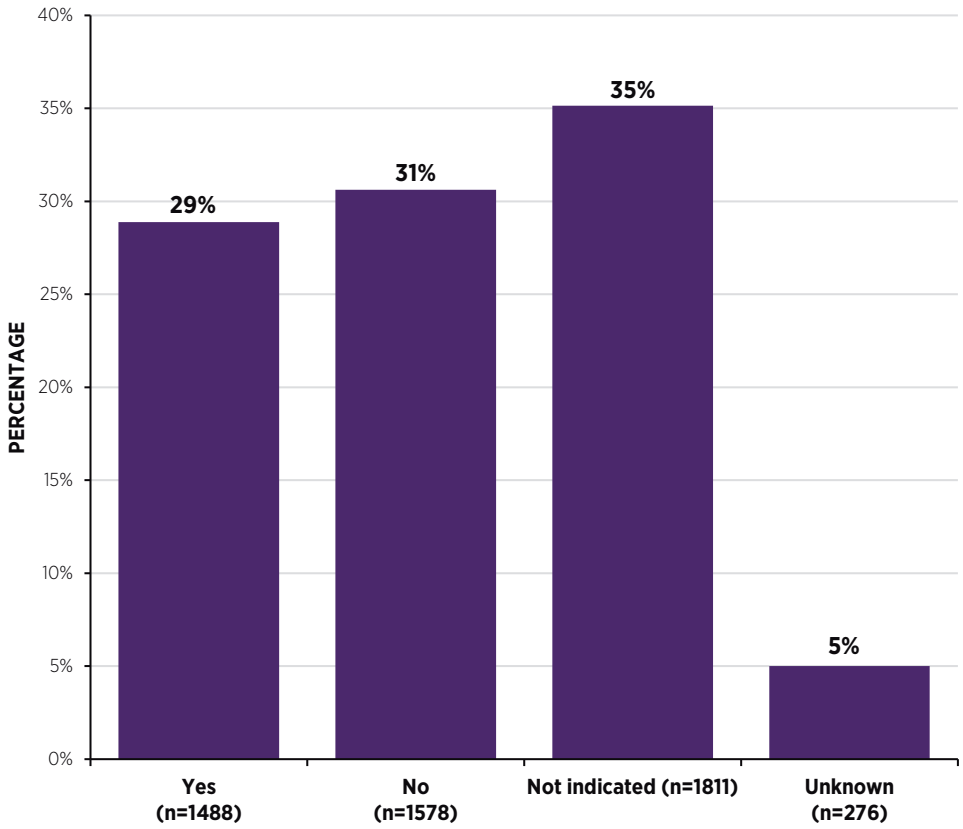

FIGURE 6.4: MOOD SCREENING (N=5153)

SWALLOW AND MOOD SCREENING IN STROKE UNITS

Table 6.1 shows that admission to a stroke unit increases the likelihood of a patient having a mood and swallow screen completed. Patients who were admitted to a stroke unit were 1.7 times more likely to have swallow screening, and twice as likely to have mood screening, compared to patients who were not admitted to a stroke unit.

TABLE 6.1: SWALLOW AND MOOD SCREENING

	Admitted to stroke unit (n=3649)		**Not admitted to a stroke unit (n=1504)**	
	N	**%**	**N**	**%**
Swallow screen completed	2834	78%	673	45%
Mood screen completed	1238	34%	250	17%

MULTIDISCIPLINARY TEAM ASSESSMENT

Figure 6.5A shows the percentage of patients who were assessed by each of six types of health and social care professionals (HSCPs): physiotherapists, occupational therapists, speech and language therapists, dietitians, medical social workers, and psychologists. Eighty-eight percent (n=4537) of patients were assessed by at least one type of HSCP in 2020. Patients were most commonly assessed by physiotherapists (94%, n=4247), followed by occupational therapists (89%, n=4043), speech and language therapists (68%, n=3085), dietitians (32%, n=1456), medical social workers (25%, n=1124), and psychologists (5%, n=241). The INAS does not measure the quantity or quality of therapy a patient receives, although additional information on rehabilitation through physiotherapy, occupational therapy, and speech and language therapy is presented in Chapter 8. The *Irish Heart Foundation/ HSE National Stroke Audit 2015* (McElwaine *et al*., 2015) highlighted the deficit of psychology services in stroke care. This is reflected in the limited number of cases assessed by a psychologist in 2020. Patients with a stroke should have access to a clinical neuropsychologist or clinical psychologist as part of the core multidisciplinary stroke rehabilitation team (Royal College of Physicians, 2016), and this remains a recommendation in this report.

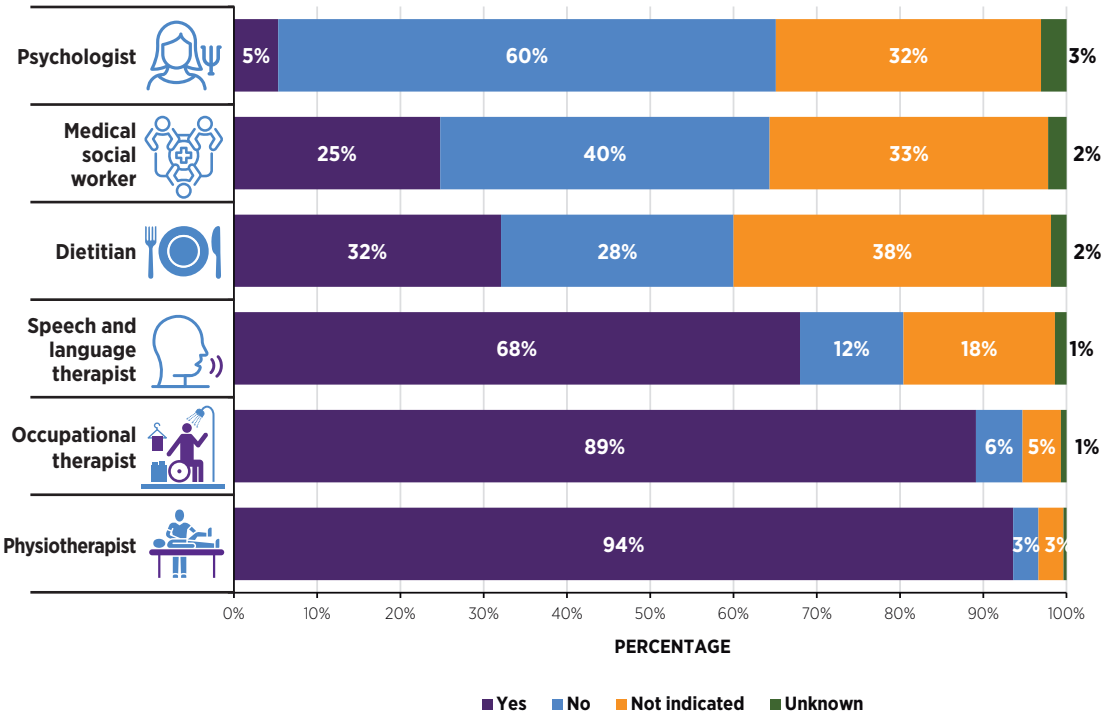

FIGURE 6.5A: HEALTH AND SOCIAL CARE PROFESSIONAL ASSESSMENT (n=4537)

The vast majority of patients with a stroke were assessed by a clinical nurse specialist (79%, n=4093) (Figure 6.5B) although this is a reduction from 2019 (84%, n=3593).

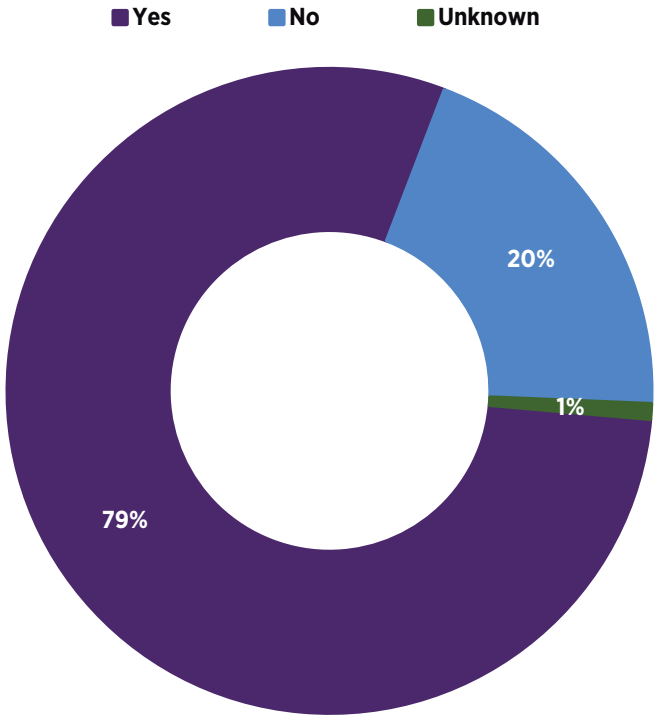

FIGURE 6.5B: ASSESSED BY A CLINICAL NURSE SPECIALIST (N=5153)

SECONDARY PREVENTION

When a person has had a stroke, they have an increased risk of further strokes over time; 26% of patients will experience another stroke within 5 years and 39% will experience another stroke within 10 years (Mohan *et al*., 2011). Patients should be assessed for, and given information on, risk factors and lifestyle management issues (e.g. exercise, smoking, diet, weight, alcohol, and stress management), and should be counselled on possible strategies to modify their lifestyle and risk factors (IHF, 2010). Secondary prevention includes early treatment with antithrombotic medication such as aspirin, and the diagnosis and treatment of atrial fibrillation and symptomatic carotid stenosis.

ANTITHROMBOTIC THERAPY

Standard: Patients with acute ischaemic stroke should be given 300 mg of aspirin as soon as possible within 24 hours of stroke, unless contraindicated (Royal College of Physicians, 2016; IHF, 2010).

In 2020, 89% (n=3900) of all patients with ischaemic stroke had antithrombotic therapy prescribed. Figure 6.6 shows that the majority (90%, n=3364) of patients for whom time information was available commenced antithrombotic therapy on the day of or the day after hospital arrival.

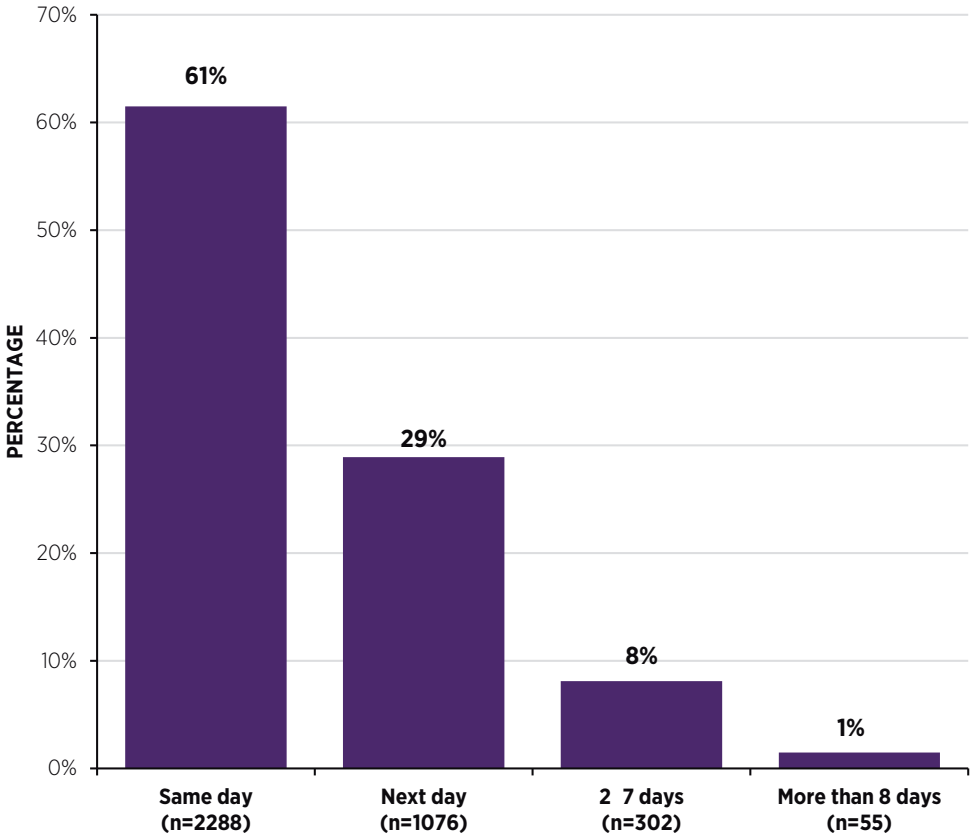

FIGURE 6.6: START TIMES FOR ANTITHROMBOTICS (n=3721)[24]

[24] Figure 6.6 refers to patients who had antithrombotic therapy. 179 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 6.6.

ATRIAL FIBRILLATION

Standard: For patients with atrial fibrillation and ischaemic stroke, anticoagulant medication is the standard treatment unless contraindicated (Royal College of Physicians, 2016; IHF, 2010).

ATRIAL FIBRILLATION PRE-STROKE

Atrial fibrillation (AF) is the rapid, irregular beating of the heart resulting in a slow flow of blood through the heart. As the blood slows down it pools, and this can result in the formation of blood clots. If a clot leaves the heart and travels to the brain, it can cause a stroke by blocking the flow of blood through cerebral arteries. AF is treated with medications that prevent the formation of blood clots in the heart.

In 2020, 17% (n=891) of all patients with a stroke had a diagnosis of AF pre-stroke. This is a decrease from 20% (n=832) in 2019. Treatment with anticoagulant medication pre-stroke was reported in 85% (n=756) of these cases: direct oral anticoagulant (DOAC) treatment was reported in 71% (n=540) of cases, warfarin treatment was reported in 12% (n=94) of cases and in 16% (n=122) other antiplatelet and/or anticoagulant were prescribed. This is an improvement in the levels of anticoagulant medication prescribed pre-stroke for patients with a pre-stroke AF diagnosis, from 83% in 2019. Thirty-five percent (n=33) of patients who were taking warfarin pre-stroke were within the 2–3 international normalised ratio (INR) range on admission; this compares to 27% in 2019. Figure 6.7 indicates the breakdown of AF data by stroke type. It is important to understand the reasons for anticoagulation failure, which are likely to be multifactorial and require further study within this population. A study to explore the factors contributing to stroke in patients who have been prescribed anticoagulation therapy is a recommendation in this report.

ATRIAL FIBRILLATION IN PATIENTS WITH A STROKE

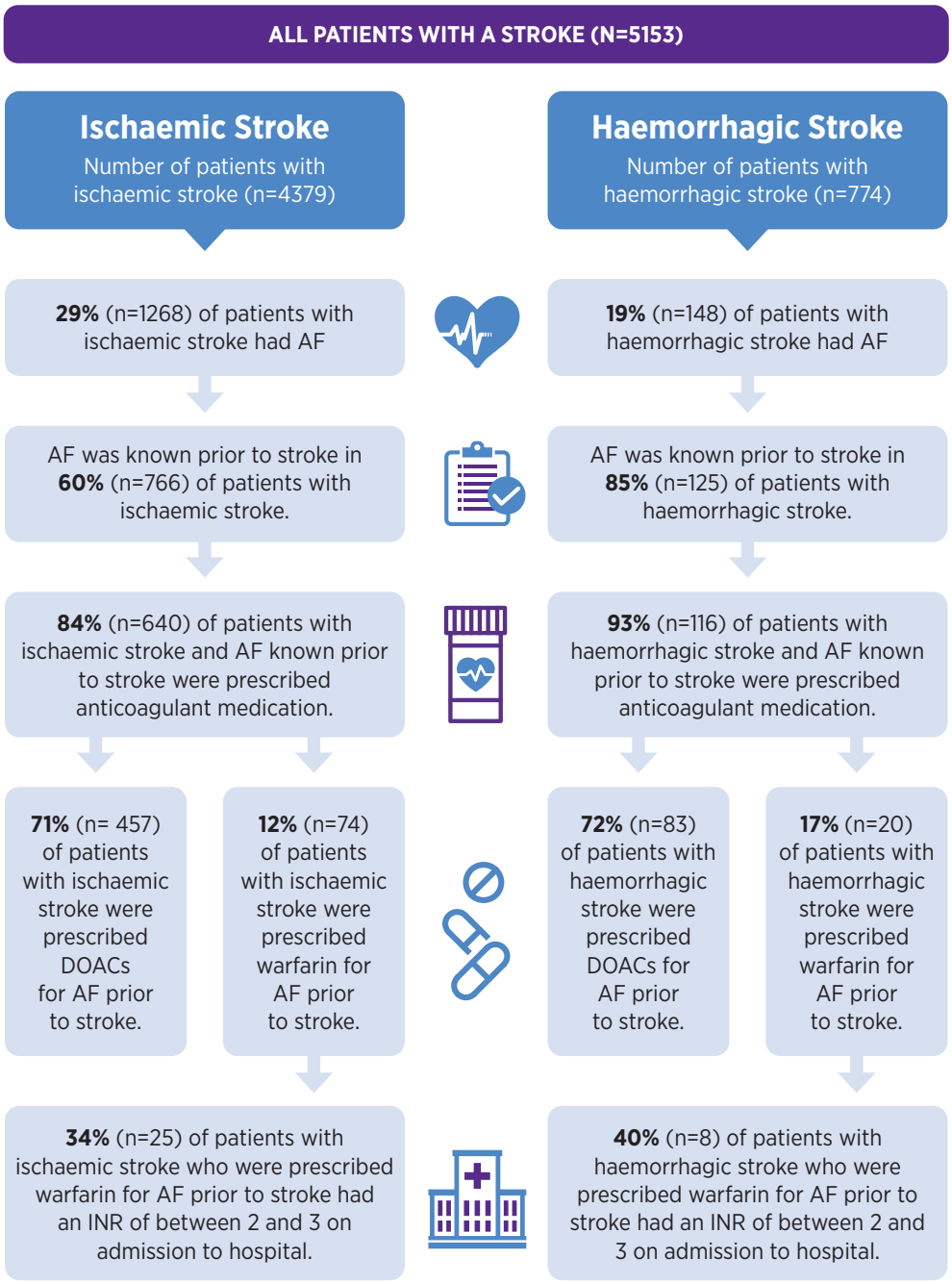

FIGURE 6.7: BREAKDOWN OF PRE-STROKE ATRIAL FIBRILLATION DATA FOR PATIENTS WITH ISCHAEMIC AND HAEMORRHAGIC STROKE (N=5153)

ATRIAL FIBRILLATION AFTER STROKE

A total of 1,268 ischaemic stroke cases in 2020 were reported to have an AF diagnosis; 60% (n=766) of those were diagnosed prior to stroke, meaning that more than 40% (n=502) of AF cases were undiagnosed pre-stroke and were only diagnosed after acute stroke. Moran *et al*. (2016) showed that opportunistic screening for AF in general practice is cost-effective in stroke prevention, and further work is currently underway (through the School of Public Health, University College Cork) to identify the barriers to and facilitators of the introduction of community-based screening for AF in Ireland. A clinical care pathway across primary and secondary care is required for the prevention and detection of AF. In 2020, the prevalence of AF in patients with ischaemic stroke in Ireland was 28% (n=1117).[25] Eighty-six percent (n=956) of patients with ischaemic stroke with an AF diagnosis had an antiplatelet or anticoagulant medication prescribed post-stroke for secondary prevention on discharge (Figure 6.8).

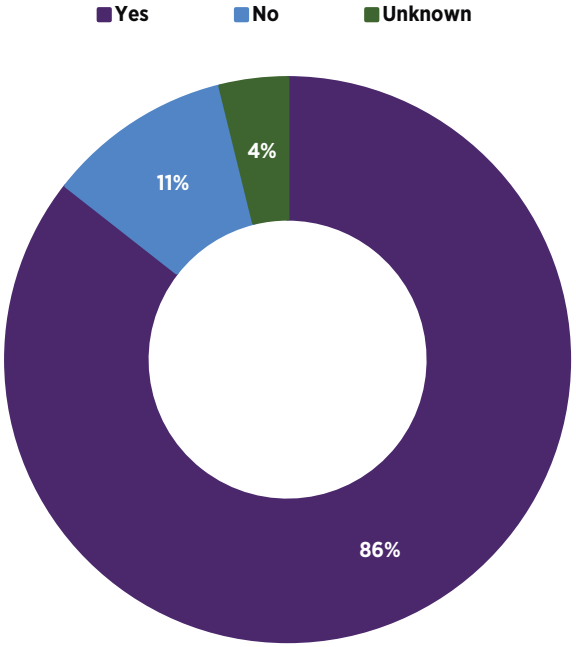

FIGURE 6.8: SECONDARY PREVENTION TREATMENT FOR ATRIAL FIBRILLATION IN PATIENTS WITH ISCHAEMIC STROKE (N=1117)

[25] Patients with ischaemic stroke who died (n=347) were excluded from this calculation.

When excluding patients with ischaemic stroke who died (n=347), 28% (n=1117) were diagnosed with AF. Figure 6.9 shows that, of those, 79% (n=878) were prescribed an anticoagulant and 7% (n=78) were prescribed an antiplatelet. Of those who were prescribed an anticoagulant, a DOAC was prescribed in 93% (n=816) of cases, while warfarin was prescribed in 3% (n=26) of cases; 4% (n=36) were prescribed an anticoagulant and antiplatelet in combination. Further evaluation is required to understand the high proportion of patients in this cohort who were not prescribed anticoagulant medication (18%, n=196)[26].

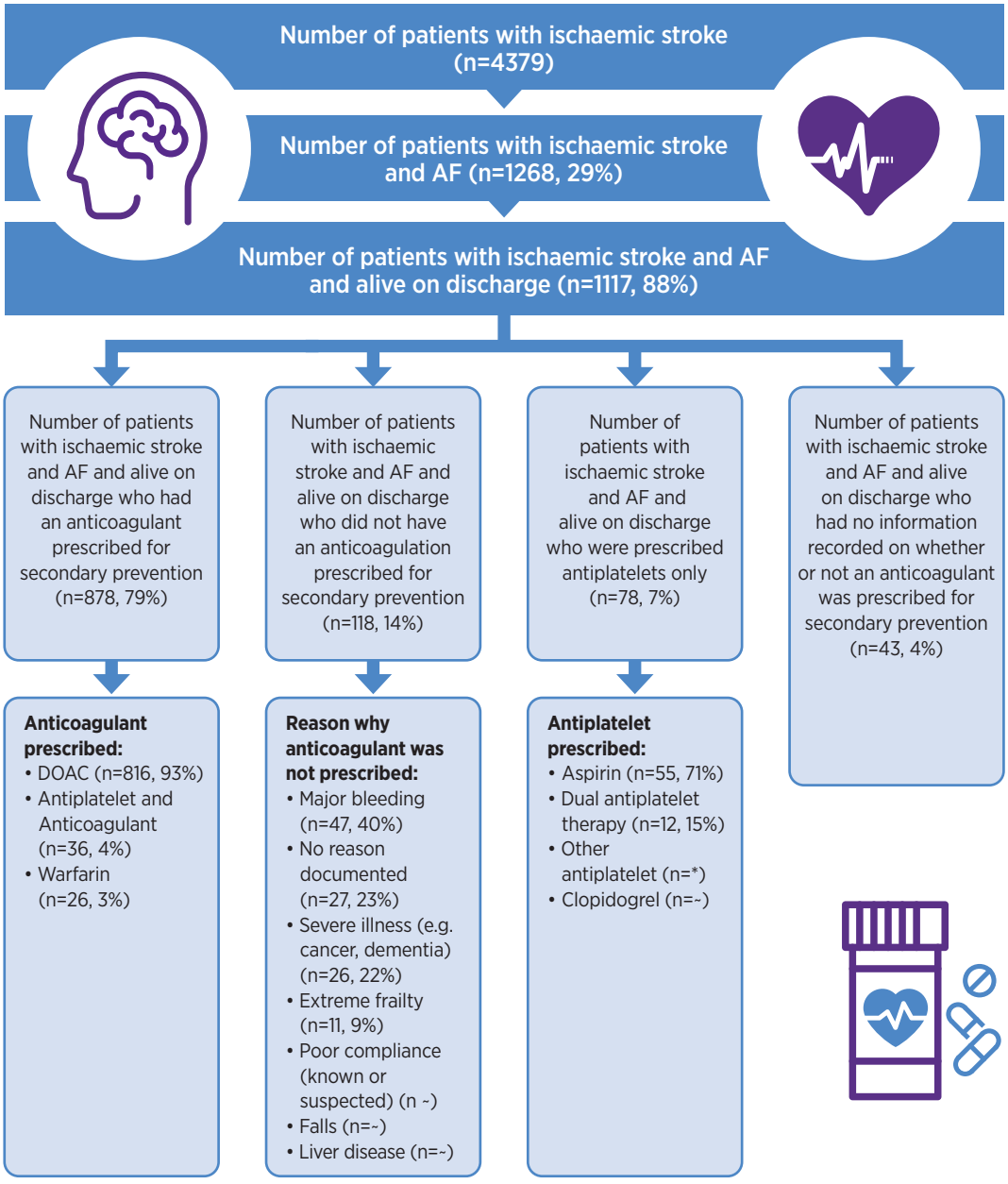

FIGURE 6.9: SECONDARY PREVENTION TREATMENT FOR PATIENTS WITH ISCHAEMIC STROKE AND WITH ATRIAL FIBRILLATION

- Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

[26] 78 of 196 were prescribed antiplatelet medication.

CAROTID STENOSIS

Standard: Patients with transient ischaemic attack (TIA) or an acute non-disabling stroke with stable neurological symptoms who have symptomatic severe carotid stenosis of 50–99% should be assessed and referred for carotid endarterectomy to be performed as soon as possible. Patients who meet the criteria for carotid intervention but who are unsuitable for open surgery (e.g. inaccessible carotid bifurcation, restenosis following endarterectomy, radiotherapy-associated carotid stenosis) should be considered for carotid angioplasty and stenting (Royal College of Physicians, 2016).

'Stenosis' is a medical term for narrowing of the blood vessels in the body due to a build-up of inflammatory substances and cholesterol deposits, called plaque. Two carotid arteries in the neck provide much of the blood flow from the heart to the brain. When stenosis occurs in these arteries, it is known as carotid stenosis. Patients with carotid stenosis are at increased risk of a stroke and should receive appropriate therapy. Six percent (n=316) of patients with a stroke in 2020 had symptomatic carotid stenosis (Figure 6.10), with 38% (n=121) of those patients referred for carotid endarterectomy, 13% (n=41) referred for carotid stenting and 9% (n=28) referred for both. Factors that led to a decision not to intervene in symptomatic carotid stenosis in 40% of patients with a stroke may require further exploration.

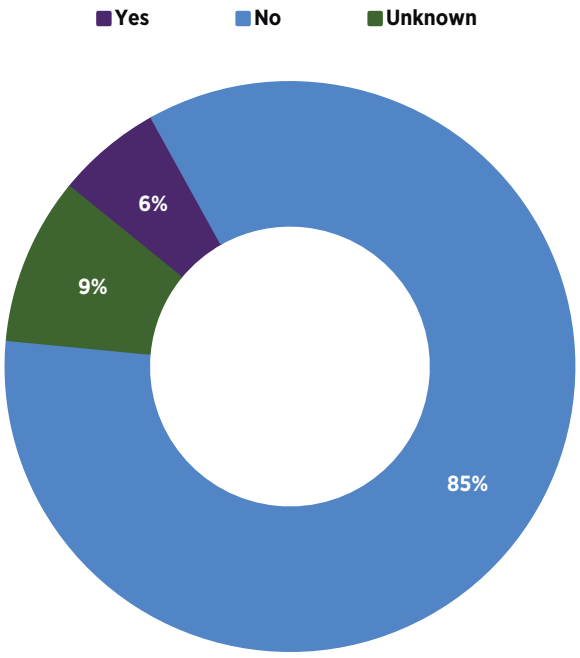

FIGURE 6.10: PATIENTS WITH A STROKE DIAGNOSED WITH SYMPTOMATIC CAROTID STENOSIS (N=5153)

KEY FINDINGS FROM CHAPTER 6

- In 2020, 71% (n=3649) of all patients with a stroke were admitted to a stroke unit, which is well below the target of 90% (Figure 6.1).
- Two of the most common reasons for non-admission to a stroke unit were a lack of capacity, with no stroke unit bed being available in 39% (n=587) of cases; and lack of a stroke unit, with the hospital not having a stroke unit in 12% (n=184) of cases (Figure 6.2A).
- A much larger proportion of patients with a stroke were unable to access a stroke unit due to infection control risk in 2020 (13%, n=195) compared to 2019 (3%, n=34).
- Sixty-eight percent (n=3507) of patients with a stroke had the safety of their swallow screened in 2020 (Figure 6.3); of those, only 43% (n=1507) had the guideline-recommended screen completed within 4 hours of hospital admission.
- Patients with a stroke were 1.7 times more likely to receive swallow screening and twice as likely to receive mood screening if they were admitted to a stroke unit (Table 6.1).
- More than one-quarter (29%, n=1488) of patients with a stroke had a mood screen performed in 2020; for 35% (n=1811) of patients, it was reported that mood screening was not indicated (Figure 6.4). Only 5% (n=241) of patients with a stroke had a psychological assessment in 2020 (Figure 6.5A).
- Most patients with a stroke were assessed by a clinical nurse specialist (79%, n=4093) (Figure 6.5B); however, this was a reduction compared to 2019 (84%, n=3593).
- Of the HSCP assessments for which data were collected in 2020, patients were most likely to have been assessed by a physiotherapist (n=4247, 94%), occupational therapist (n=4043, 89%), or speech and language therapist (n=3085, 68%) (Figure 6.5A). A minority of patients were assessed by a medical social worker (n=1124, 25%) or dietitian (n=1456, 32%).
- In 2020, 29% (n=1268) of ischaemic stroke cases had a diagnosis of AF. Pre-stroke, 17% (n=891) of all stroke cases had a diagnosis of AF, and treatment with anticoagulant medication was reported in 85% (n=756) of these cases (Figure 6.7). Out of 756 cases, DOAC treatment was prescribed pre-stroke in 71% (n=540) of cases, warfarin treatment was reported in 12% (n=94) cases and in 16% (n=122) other antiplatelet and/or anticoagulant were prescribed of cases.
- Eighty-nine percent (n=3900) of all patients with ischaemic stroke were prescribed antithrombotic therapy for post-stroke secondary prevention. The majority (90%, n=3364) of patients for whom time information was available commenced antithrombotic therapy therapy on the day of or the day after hospital arrival (Figure 6.6).
- Twenty-eight percent (n=1117) of patients with ischaemic stroke who were alive at discharge were diagnosed with AF, and 79% (n=878) were prescribed an anticoagulant.
- Six percent (n=316) of patients with a stroke in 2020 had symptomatic carotid stenosis, with 60% of these referred for carotid intervention.

CHAPTER 7
OUTCOMES

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CHAPTER 7: **OUTCOMES**

KEY PERFORMANCE INDICATORS (KPIs)

In 2012, the National Stroke Programme (NSP) agreed on three national key performance indicators (KPIs) to support the implementation of the Stroke Model of Care (HSE, 2012a); these KPIs also inform the HSE's National Service Plan 2021 (HSE, 2021). The three KPIs are displayed in Table 7.1.

In 2020, the percentage of patients with a stroke who spent all or some of their hospital stay in a stroke unit was 71% (n=3649); this percentage is unchanged from 2019 (NOCA, 2020). A detailed percentage breakdown by hospital is displayed in Figure 6.1.

Seventy-five percent (n=42285) of total bed days for patients with a stroke in 2020 who spent some or all of their hospital stay in a dedicated stroke unit, a marginal decline from 76% in 2019. Individual hospital percentages are shown in Figure 7.4.

In 2020, 10.6% (n=466) of patients diagnosed with ischaemic stroke received thrombolysis treatment, a percentage that is unchanged from 2019. Figure 4.8 displays the percentage of thrombolysis treatment in ischaemic stroke cases by hospital.

TABLE 7.1 KEY PERFORMANCE INDICATORS

	National 2020	
	Target	**Achieved**
KPI 1. Percentage of acute patients with stroke* who spent all or some of their hospital stay in a stroke unit	90%	71%
KPI 2. For patients with acute stroke admitted to an acute stroke unit, the percentage of their hospital stay spent in the stroke unit	90%	75%
KPI 3. The percentage of patients with confirmed acute ischaemic stroke who received thrombolysis	12%	10.6%

*Denotes wording used in the *National Service Plan 2021* (HSE, 2021)

DISCHARGE OUTCOMES

Pre-stroke and discharge modified Rankin Scale scores

The modified Rankin Scale (mRS) is a simple universal scoring system for disability (Figure 7.1). While it is criticised by some, as it can be subjective, it is recognised internationally and allows hospitals and countries to compare their stroke populations. This is important, as a patient's pre-stroke mRS score will have an impact on their outcome. The recording of mRS scores continues to improve; in 2020, pre-stroke and discharge mRS score data were inputted on a total of 89% (n=4588) of all stroke cases. Figure 7.1A shows mRS scores for patients with ischaemic stroke (n=3902) and Figure 7.1B shows mRS scores for patients with haemorrhagic stroke (n=686), who had information about their mRs recorded.

Modified Rankin Scale	
0	No symptoms
1	No significant disability, despite symptoms; able to perform all usual duties and activities
2	Slight disability; unable to perform all previous activities but able to look after own affairs without assistance
3	Moderate disability; requires some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requires constant nursing care and attention
6	Death

FIGURE 7.1: MODIFIED RANKIN SCALE

Before admission to hospital for stroke, 63% (n=2457) of patients with ischaemic stroke had no disability (mRS score=0). On discharge, the majority (71%, n=2781) of patients with ischaemic stroke had a disability. The number of cases with moderate to severe disability on admission (n=626, 16%) increased on discharge (n=1430, 37%). Stroke is a major cause of disability (Katan and Luft, 2018); consequently, Figures 7.1A and 7.1B reflect this decline in function after stroke. Eight percent (n=304) of patients with ischaemic stroke were reported to have died.

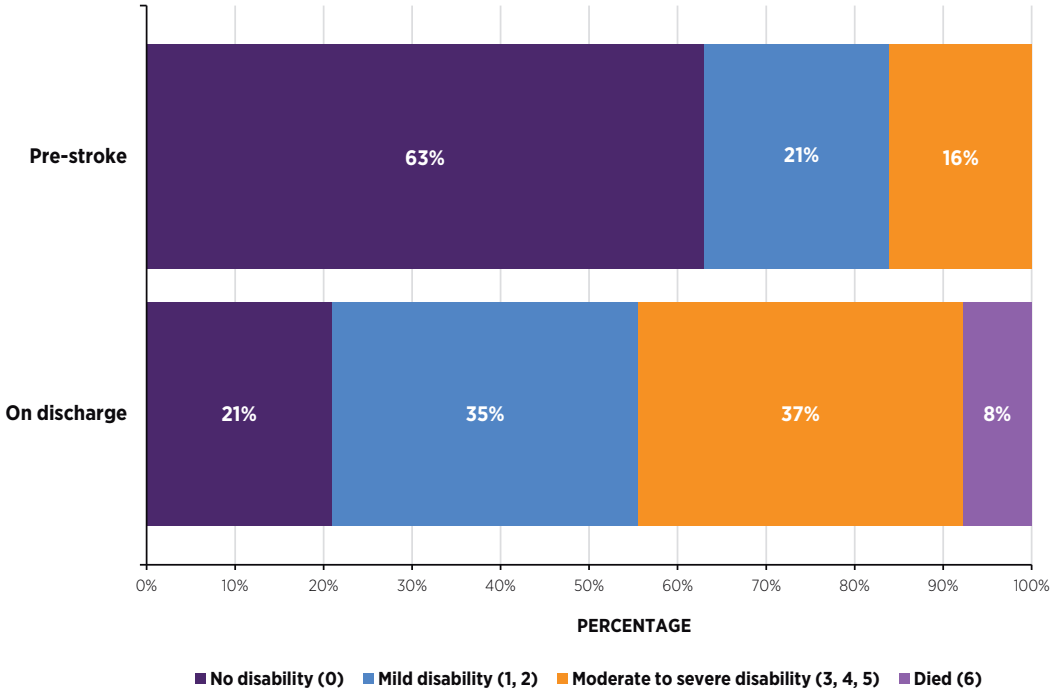

FIGURE 7.1A: MODIFIED RANKIN SCALE SCORES IN PATIENTS WITH ISCHAEMIC STROKE, PRE-STROKE AND ON DISCHARGE (n=3902) [27,28]

[27] 477 ischaemic stroke cases did not have a pre-stroke and/or discharge mRS score recorded. These cases were excluded from Figure 7.1A.
[28] Please note: Percentages may not sum to 100% due to rounding.

Similarly, 60% (n=415) of patients with haemorrhagic stroke had no disability pre-stroke (mRS score=0); however, only a small number (n=67, 10%) of these patients were discharged with no disability. In comparison, 21% (n=817) of patients with ischaemic stroke had no disability on discharge.

Patients with haemorrhagic stroke were also more likely to die (30%, n=206) than patients with ischaemic stroke (8%, n=304).

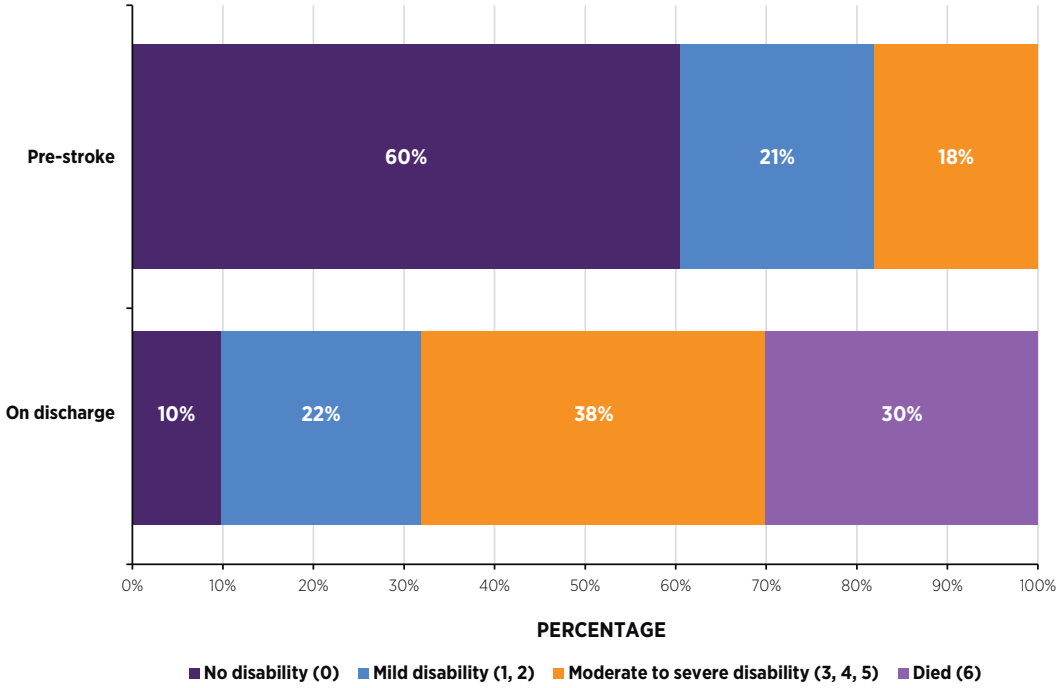

FIGURE 7.1B: MODIFIED RANKIN SCALE SCORES IN PATIENTS WITH HAEMORRHAGIC STROKE, PRE-STROKE AND ON DISCHARGE (n=686) [29,30]

[29] 88 haemorrhagic stroke cases did not have a pre-stroke and/or discharge mRS score recorded. These cases were excluded from Figure 7.1B.
[30] Please note: Percentages may not sum to 100% due to rounding.

Figure 7.2 shows the pre-admission mRS scores for all stroke cases by age group. The distribution of scores, when presented by age group, shows that the score increases with age. The majority (54%, n=933) of patients with a stroke who were aged 80 years and over had mild or moderate to severe disability pre-admission. The comparable figures were 29% (n=617) for patients aged between 65 and 79 years, and 14% (n=186) for patients aged between 17 and 64 years.

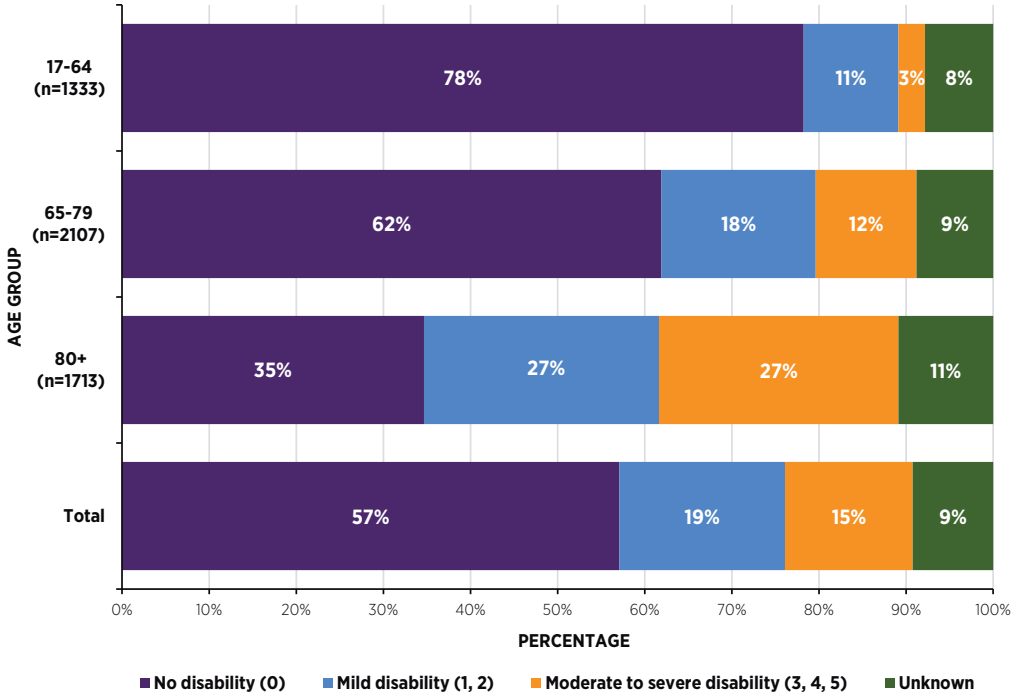

FIGURE 7.2: PRE-STROKE MODIFIED RANKIN SCALE SCORES, BY AGE GROUP (N=5153)[31]

[31] Please note: Percentages may not sum to 100% due to rounding.

HOSPITAL LENGTH OF STAY

In 2020, the national median length of stay (LOS) in hospital for patients with a stroke was 8 days (interquartile range [IQR]: 4–17 days). This is 1 day less compared to 2019, when the median hospital LOS was 9 days (IQR: 5–19 days). This is a likely consequence of COVID-19 measures within hospitals; NOCA (2021) found a reduction in the LOS during 2020 that Chapter 9 will report on in more detail. Table 7.2 displays the median and IQR of total bed days spent in hospital by age group. Patients with a stroke aged 80 years and over spent more days (median: 10 days) in hospital than younger patients with a stroke, possibly due to the fact that they were more likely to have a pre-existing disability (see Figure 7.2), thus limiting their ability to rehabilitate as quickly as the younger patients. Table 7.3 displays the median and IQR of total bed days spent in hospital, by hospital. In 2020, median LOS varied between 5 and 14 days, depending on the hospital, while 6 out of the 23 participating hospitals had a median LOS of 8 days.

Comparison of hospital LOS between hospitals is difficult due to different patient pathways in some stroke services. For example, an acute hospital may have a system in place for rapid transfer of patients with a stroke to an off-site rehabilitation unit. Where this occurs, the transfer of these patients with a stroke will lead to a lower LOS figure compared with that of patients with a stroke in a hospital that provides the majority of rehabilitation care on-site.

TABLE 7.2 MEDIAN AND INTERQUARTILE RANGE OF BED DAYS IN HOSPITAL FOR PATIENTS WITH A STROKE, BY AGE GROUP

Age group	Patients (n)	Bed days (n)	Median LOS (days)	IQR	
				Percentile 25 (days)	Percentile 75 (days)
17–64 years	1333	19 951	7	4	13
65–79 years	2107	31 120	8	4	16
80+ years	1713	30 754	10	5	21
Total	**5153**	**81 825**	**8**	**4**	**17**

TABLE 7.3: MEDIAN AND INTERQUARTILE RANGE OF BED DAYS IN HOSPITAL FOR PATIENTS WITH A STROKE, BY HOSPITAL

Hospital	Patients (n)	Bed days (n)	Median LOS (days)	IQR	
				Percentile 25 (days)	Percentile 75 (days)
Bantry General Hospital	78	1823	5	2	18
Beaumont Hospital	489	7479	7	4	14
Cavan General Hospital	136	1869	8	5	15
Connolly Hospital	216	4191	9	5	20
Cork University Hospital	494	8714	8	4	20
Letterkenny University Hospital	182	3901	10	5	26
Mater Misericordiae University Hospital	307	5029	8	4	18
Mayo University Hospital	213	2647	9	6	15
Mercy University Hospital	97	1039	7	3	11
Naas General Hospital	179	3216	9	4	22
Our Lady of Lourdes Hospital Drogheda	256	3663	9	5	14
Regional Hospital Mullingar	159	1541	7	4	13
Sligo University Hospital	183	1794	7	4	12
South Tipperary General Hospital	86	1311	14	6	20
St James's Hospital	234	2370	5	3	9
St Luke's General Hospital, Carlow/Kilkenny	136	1840	8	5	18
St Vincent's University Hospital	422	8044	9	5	20
Tallaght University Hospital	261	4717	8	5	15
University Hospital Galway	229	5044	10	5	23
University Hospital Kerry	155	1559	6	3	10
University Hospital Limerick	366	5560	11	6	20
University Hospital Waterford	154	2845	10	5	21
Wexford General Hospital	121	1629	8	4	15
Total	**5153**	**81 825**	**8**	**4**	**17**

LENGTH OF STAY IN STROKE UNITS

In 2020, 71% (n=3649) of patients with a stroke were admitted to a stroke unit (Figure 6.1). The majority of these cases had dates recorded for admission to and discharge from the stroke unit (96%, n=3499). The national mean LOS in a stroke unit was 13 days (standard deviation: 16). This is a decrease from 2019, when the national mean LOS in a stroke unit was 15 days (standard deviation: 22).

Figure 7.3 illustrates the median number of bed days in a stroke unit in 2020, by hospital. Although the national median LOS was 7 days, it varied by hospital from 3 to 12 days. The units with a shorter median LOS may have different arrangements for transfer out of an acute unit to a rehabilitation unit, thus leading to a shorter hospital LOS. The LOS for any patient with a stroke should be the sum of the time they spent in an acute unit and a rehabilitation unit until their discharge from the acute hospital sector. Therefore, caution needs to be taken when suggesting that stroke unit care shortens LOS, as this may just reflect local circumstances.

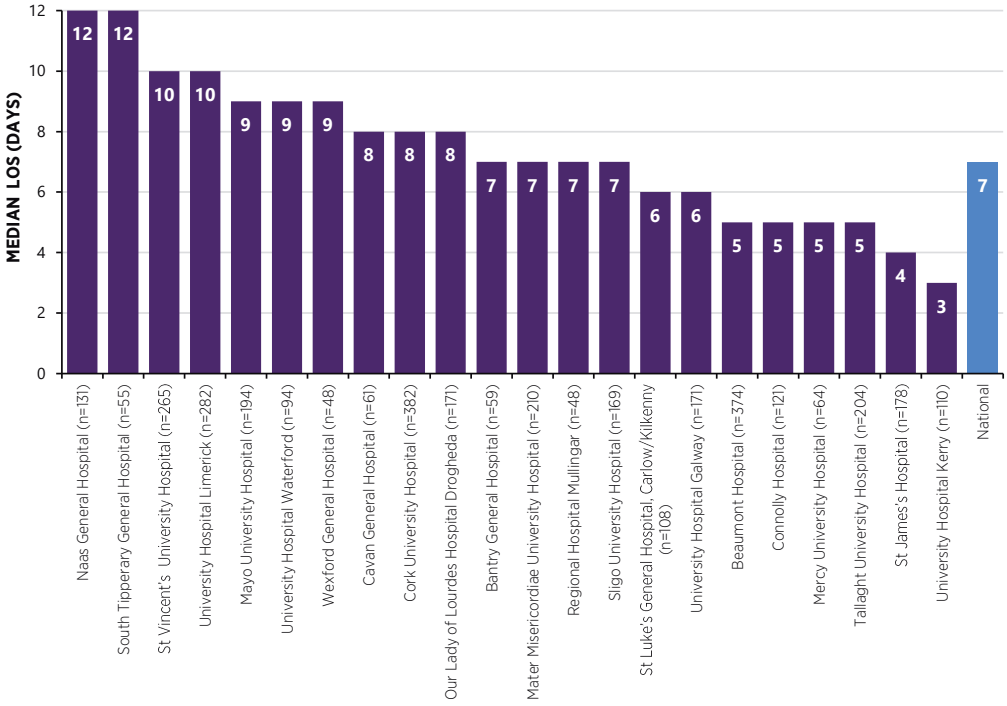

FIGURE 7.3: MEDIAN BED DAYS IN STROKE UNIT, BY HOSPITAL (n=3499)[32]

[32] Cases that had no time information recorded or it was recorded incorrectly (n=150) were excluded from Figure 7.3. Letterkenny University Hospital is not included in the Figure 7.3, as it did not have a dedicated stroke unit in 2020.

PERCENTAGE OF HOSPITAL STAY SPENT IN THE STROKE UNIT

Figure 7.4 illustrates the percentage of bed days spent in a stroke unit, by hospital. Among patients with a stroke, who spent some or all of their hospital stay in a dedicated stroke unit, out of 56,536 bed days spent in hospital in 2020, 75% (n=42285) were spent in a stroke unit. This is a marginal reduction from 2019, when 76% of total bed days were spent in a stroke unit.

This is an issue for our health service. If a patient with a stroke spends 1 day waiting either in the emergency department or on a general medical ward for transfer to a stroke unit, the patient has to spend 9 days in the stroke unit to achieve the KPI target of spending 90% of their hospital stay in a stroke unit.

There is great variability between hospitals in the percentage of time that patients with a stroke spent in stroke units, ranging from 36% to 95% (Figure 7.4), which is suggestive of a lack of sufficient stroke unit beds in the acute hospital sector. In order to achieve the KPI target of 90%, two factors are critical: First, there should be a free bed available to admit a patient with a stroke directly from the emergency department to the stroke unit. Second, the hospital should have a sufficient bed base not to move a patient with a stroke out of the stroke unit in order to make way for the next patient with a stroke. Figure 6.2A shows that the most common reason for non-admission to a stroke unit is lack of a stroke unit bed (39%, n=587).

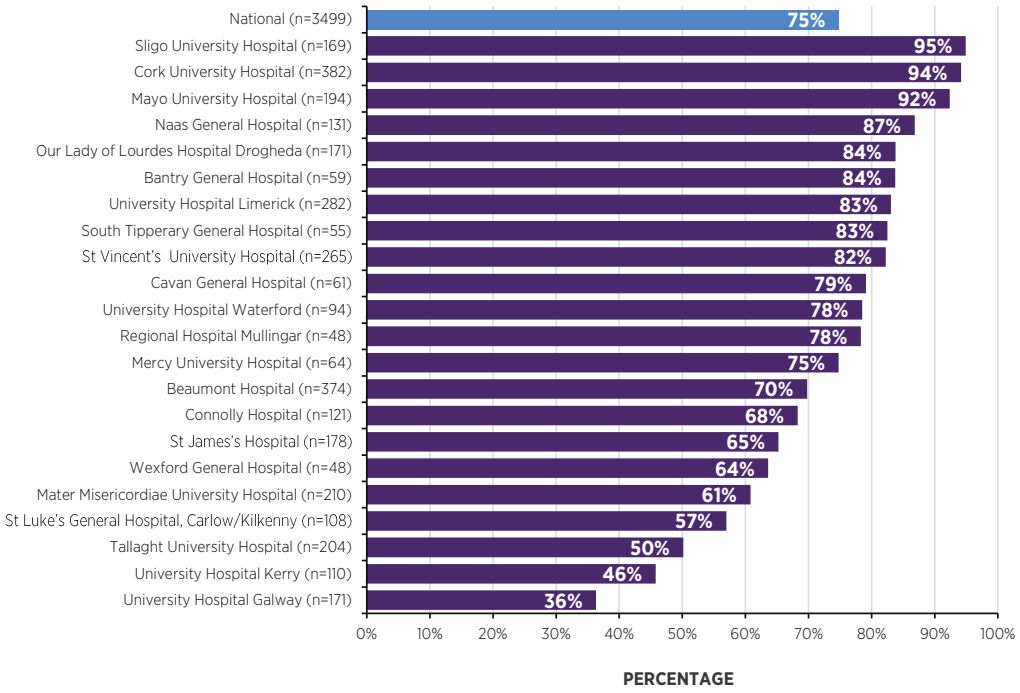

FIGURE 7.4: PERCENTAGE OF BED DAYS SPENT IN STROKE UNIT, FOR PATIENTS WHO SPENT SOME OR ALL OF THEIR HOSPITAL STAY IN A DEDICATED STROKE UNIT, BY HOSPITAL (n=56536)[33]

[33] Cases that had no time information recorded or it was recorded incorrectly (n=150) were excluded from Figure 7.4. Letterkenny University Hospital is not included in the Figure 7.4, as it did not have a dedicated stroke unit in 2020.

DISCHARGE DESTINATION

52% of patients with a stroke were discharged home, with an additional 7% discharged home with Early Supported Discharge (ESD)

In this report, the discharge destination is based on the reporting within the stroke audit portal. The majority of patients with a stroke were discharged home (52%, n=2682), with an additional 7% (n=335) discharged home with Early Supported Discharge (ESD). The numbers of patients with a stroke discharged home by hospital is shown in Figure 7.6. Six percent (n=323) of patients with a stroke were discharged to long-term care (Figure 7.5), a reduction from 8% in 2019. The Hospital In-Patient Enquiry (HIPE) system also codes discharge destination and, as in previous years, there is a discrepancy between HIPE and the stroke audit portal in relation to discharge to long-term care. In some cases, patients with a stroke who are discharged from an acute hospital to a rehabilitation unit are inadvertently classified as having been discharged to long-term care. The INAS is currently engaging with the Healthcare Pricing Office (HPO) on a review of the discharge destination codes available in the HIPE system, with the aim of introducing a discharge mode that would identify the type of care to which the patient transfers, in addition to the discharge code.

The reported mortality rate for patients with a stroke in 2020 was 11% (n=586), a reduction from 12% in 2019. When analysed by stroke type, the mortality rate was 8% (n=347) for patients with ischaemic stroke, reduced from 9% in 2019, and 31% (n=239) for patients with haemorrhagic stroke, which is unchanged from 2019.

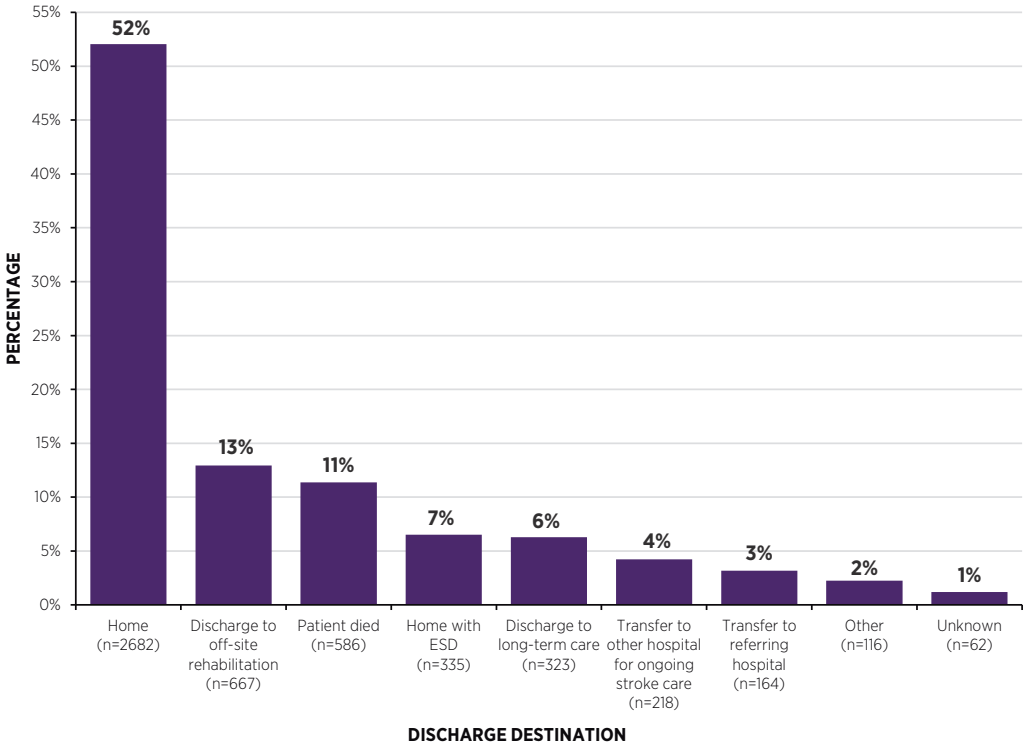

FIGURE 7.5: DISCHARGE DESTINATION OF PATIENTS WITH A STROKE (N=5153)

ESD is international best practice in providing care for patients with a stroke as it improves patient outcomes while facilitating a reduced LOS in hospital through the provision of stroke-specific rehabilitation in the home setting. Implementation of ESD is a fundamental aspect of the Stroke Model of Care (HSE, 2012a). However, only seven ESD teams are currently operational nationally, an increase of one since 2019 – St Vincent's University Hospital commenced an ESD service in September 2020. In 2020, 7% (n=335) of stroke cases were discharged home with ESD. This is a small increase from 2019, when 5% (n=210) of patients with a stroke were discharged home with ESD. When calculated on the basis of the provision of ESD services by hospitals that have access to an ESD team, this rate was 12%. In the UK, discharge home with ESD or a community rehabilitation team is reported in 39% of cases (SSNAP, 2020).

Figure 7.6 indicates the number of cases discharged home with ESD from each hospital that has access to an ESD team. It is important to note that no ESD team in Ireland has a fully resourced team, and this is reflected in the variable activity of each ESD team. Table 7.4 shows the composition of a fully resourced ESD team as recommended by the NSP.

TABLE 7.4: COMPOSITION OF A FULLY RESOURCED EARLY SUPPORTED DISCHARGE TEAM

Profession	Whole time equivalent (WTE)
Clinical nurse specialist	0.5 WTE
Occupational therapist, senior	1.0 WTE
Physiotherapist, senior	1.0 WTE
Speech and language therapist, senior	1.0 WTE
Medical social worker, senior	0.5 WTE
Therapy assistant	1.0 WTE

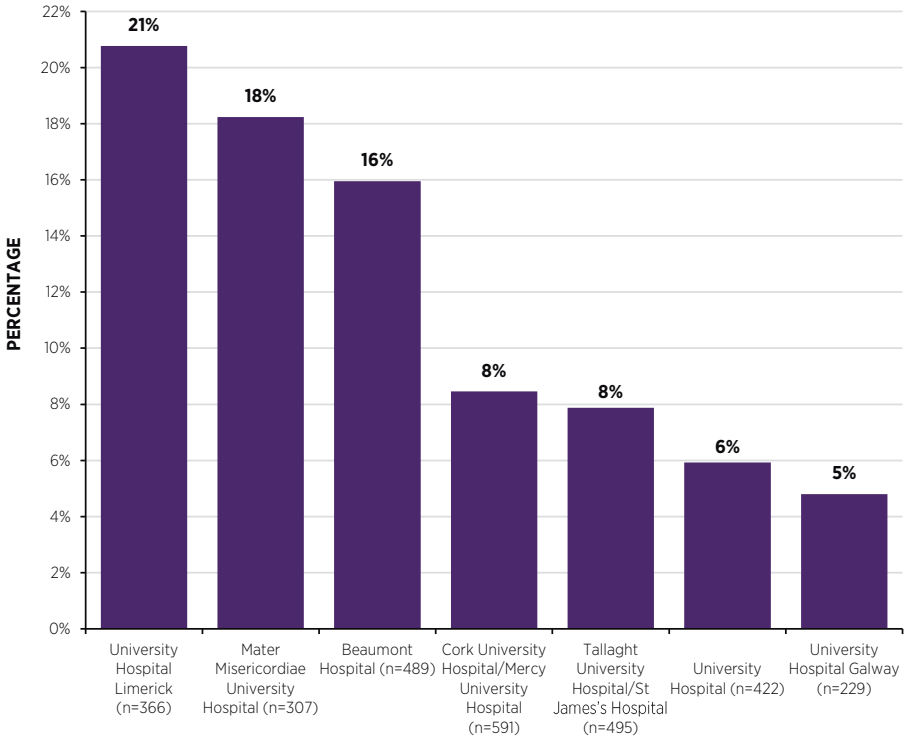

FIGURE 7.6: STROKE CASES DISCHARGED HOME WITH EARLY SUPPORTED DISCHARGE, BY HOSPITAL (n=2899)

KEY FINDINGS FROM CHAPTER 7

- The recording of mRS scores continues to improve, with a total of 89% (n=4588) of all stroke cases having both pre-stroke and discharge mRS data inputted in 2020.
- Stroke is the leading cause of acquired disability, and the mRS scores indicate that 71% (n=2781) of ischaemic stroke cases (Figure 7.1A) and 60% (n=413) of haemorrhagic stroke cases (Figure 7.1B) had disabilities on discharge.
- Median stroke unit LOS varied between hospitals from 3 to 12 days (Figure 7.3), and may reflect the rapid movement of patients with a stroke into and out of a stroke unit in order to accommodate new patients with a stroke.
- The shortage of beds was reflected in hospitals failing to hit their KPI target of patients with a stroke spending at least 90% of their hospital stay in a stroke unit (Table 7.1). Among patients with a stroke who spent some or all of their hospital stay in a dedicated stroke unit, out of 56,536 bed days spent in hospital in 2020, 75% (n=42285) were spent in a stroke unit.
- More than one-half (59%, n=3017) of patients with a stroke were discharged home or home with ESD (Figure 7.5). This is an increase from 2019, when 56% (n=2402) of patients with a stroke were discharged home or home with ESD.
- In 2020, there were seven ESD teams in Ireland (Figure 7.6). Only 7% (n=335) of patients nationally were discharged home with ESD. However, this is an increase from 2019 (5%, n=210).
- The reported mortality rate for patients with a stroke in 2020 was 11% (n=586), a reduction from 12% in 2019. The mortality figures for ischaemic stroke reduced from 9% (n=315) in 2019 to 8% (n=347) in 2020. The mortality rate for haemorrhagic stroke was 31% (n=239) in 2020; this percentage is unchanged from 2019.

CHAPTER 8

HEALTH AND SOCIAL CARE PROFESSIONALS

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CHAPTER 8: HEALTH AND SOCIAL CARE PROFESSIONALS

BACKGROUND

The health and social care professional (HSCP) dataset was developed by the NSP in collaboration with the professional bodies for physiotherapy (PT), occupational therapy (OT), and speech and language therapy (SLT). It was piloted in 2017 and the first publication of the data was in 2019 (NSP, 2019). Data are collected by therapists in the hospital and are presented in aggregate form. The HSCP dataset includes data from hospitals that are not reported on in other chapters of this report. Further information can be found in the data quality statement in Chapter 3.

It is important to highlight that this chapter does not represent all the PT, OT or SLT activity in a named hospital, nor does it imply that there is no activity in hospitals that are not currently represented in this analysis. Rather, it is an overview of some key discipline-specific information about the therapy provided to patients with a stroke.

PARTICIPATING HOSPITALS

In 2020, 15 hospitals had additional data recorded for patients who were seen by a HSCP; this was a reduction from 2019 (n=17). In Table 8.1, check marks (✓) signify that a hospital had additional HSCP information recorded. In 2020, 9 hospitals had all three included disciplines reporting to the audit, which was a decrease from 11 hospitals in 2019.

TABLE 8.1 PARTICIPATING HOSPITALS BY DISCIPLINE

Hospital	Number of cases with HSCP	PT	OT	SLT
Beaumont Hospital	367	✓	✓	✓
Mater Misericordiae University Hospital	171	✓	✓	✓
Naas General Hospital	124	✓	✓	✓
Our Lady of Lourdes Hospital Drogheda	143	✓	✓	✓
Regional Hospital Mullingar	113	✓	✓	✓
St. James's Hospital	159	✓	✓	✓
St. Vincent's University Hospital	269	✓	✓	✓
University Hospital Galway	130	✓	✓	✓
University Hospital Limerick	322	✓	✓	✓
Connolly Hospital Dublin	158	✓	✓	
Sligo University Hospital	118	✓	✓	
St. Luke's General Hospital, Kilkenny	90	✓		✓
Tallaght University Hospital	182	✓		✓
Cork University Hospital	195			✓
Mercy University Hospital	68		✓	
Bantry General Hospital				
Cavan General Hospital				
Letterkenny University Hospital				
Mayo University Hospital				
Midland Regional Hospital Tullamore				
Our Lady's Hospital Navan				
Portiuncula Hospital, Ballinasloe				
South Tipperary General Hospital				
St Colmcille`s Hospital, Loughlinstown				
Wexford General Hospital				

PARTICIPATING HSCP DISCIPLINES

In 2020, a total of 2,609 patients with a stroke had additional HSCP information recorded. Figure 8.1 displays the number of patients with a stroke who had information recorded by each participating HSCP discipline. There was an increase in the number of patients with HSCP information recorded for PT (n=1828 in 2020 versus n=1604 in 2019) and for SLT (n=1239 in 2020 versus n=993 in 2019). However, there was a reduction in the numbers of patients with HSCP information recorded for OT (n=917 in 2020 versus n=1194 in 2019). This report recommends increasing the participation of HSCPs in the HSCP dataset within the INAS (Chapter 11).

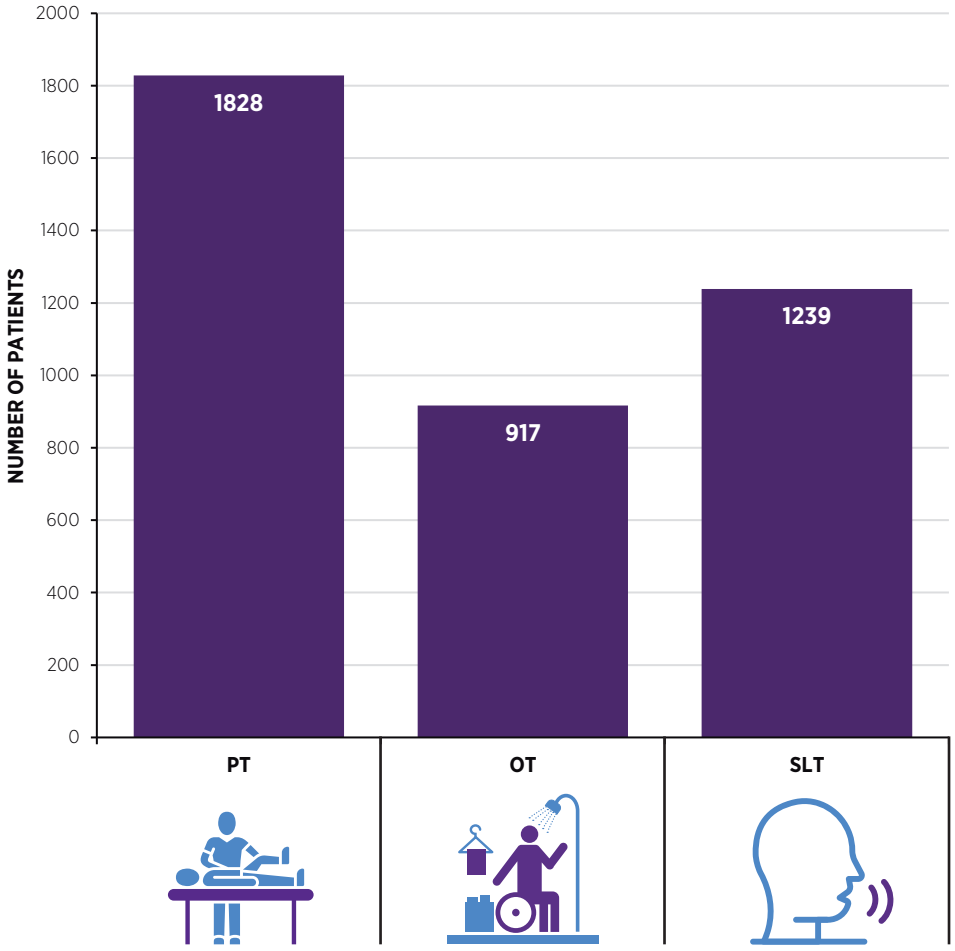

FIGURE 8.1: REPORTED NUMBER OF PATIENTS ASSESSED BY HEALTH AND SOCIAL CARE PROFESSIONALS (N=2609)[34]

[34] Figure 8.1 refers to number of assessments, i.e. a patient could have been assessed by one or more health and social care professionals.

HSCP ASSESSMENT

Time from hospital arrival to therapy assessment

The number of days between arrival at hospital and assessment by a HSCP is displayed in Figure 8.2 for each of the participating disciplines. One-half (53%, n=968) of patients with a stroke who were seen by a PT were seen on the day of or the day after hospital arrival. Almost one-half (44%, n=404) of patients with a stroke who were seen by an OT and 60% (n=747) who were seen by an SLT were seen on the day of or the day after hospital arrival. This was an improvement from 2019 (PT: 49%, n=778; OT: 32%, n=379; SLT: 44%, n=437).

The improvement in timeliness could have been influenced by the improvement in data collection in 2020. The proportion of patients with no date and/or time recorded for arrival at hospital, and no date and/or time of therapy assessment reduced from an average of 24% between the three disciplines of PT, OT and SLT in 2019 to an average of 7% in 2020.

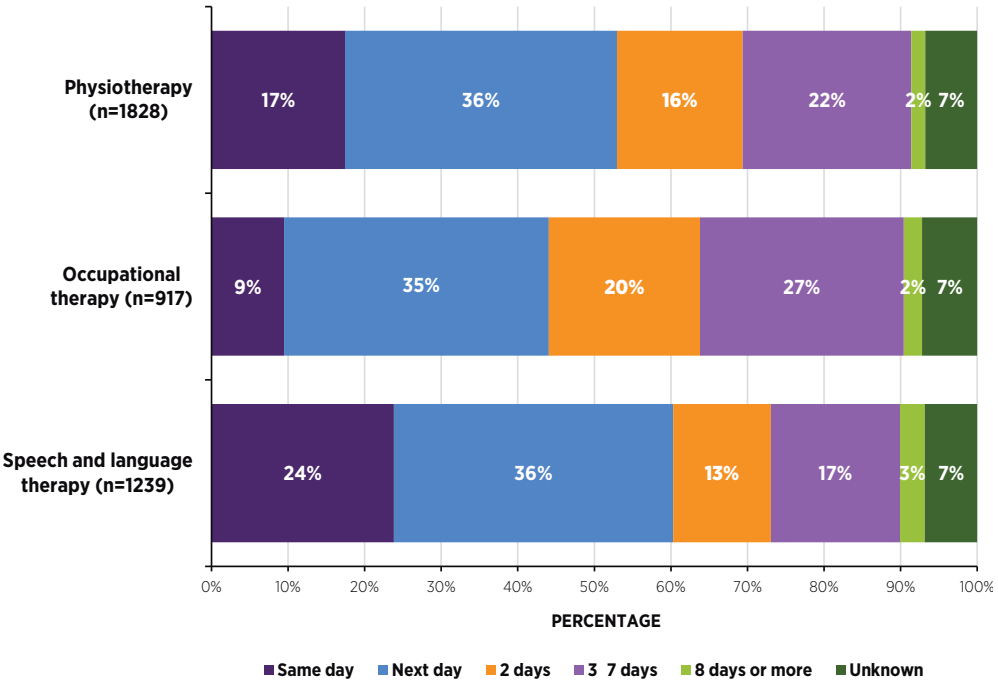

FIGURE 8.2: TIME FROM HOSPITAL ARRIVAL TO THERAPY ASSESSMENT, BY DISCIPLINE (N=2609)[35]

[35] Figure 8.2 refers to number of assessments, i.e. a patient could have been assessed by one or more health and social care professionals.

INTENSITY OF THERAPY

Standard: People with a stroke should accumulate at least 45 minutes of each appropriate therapy every day, at a frequency that enables them to meet their rehabilitation goals, and for as long as they are willing and able to participate and are showing measurable benefit from treatment (Stroke Foundation, 2019; Royal College of Physicians, 2016; IHF, 2010).

Intensity of therapy refers to the duration of an episode of physiotherapy, occupational therapy, or speech and language therapy, how often episodes of therapy occur, and how long patients continue to attend therapy. Not all patients with a stroke will require therapy from each discipline (e.g. a patient may have speech difficulties only and will not require physiotherapy or occupational therapy). If a patient was seen by a therapist, the therapist is asked to report if they believe that the patient received sufficient therapy during their hospital stay based on the standard of 45 minutes every day. The therapist can also calculate this more accurately based on the actual number of minutes of therapy that the patient received. In 59% (n=1075) of PT cases the amount of therapy provided to the patient was calculated on minutes of therapy received; this was 66% (n=603) in OT cases and 56% (n=688) in SLT.

In 2020, all therapists reported that a larger proportion of patients with a stroke had sufficient therapy compared to 2019. Physiotherapists reported that 56% (n=1016) of patients with a stroke received sufficient therapy compared to 47% in 2019. Occupational therapists reported that 39% (n=362) of patients with a stroke received sufficient therapy compared to 33% in 2019, and speech and language therapists reported that 45% (n=559) of patients with a stroke received sufficient therapy compared to 43% in 2019 (Figure 8.3). While there was some improvement in 2020, the majority of patients with a stroke did not receive sufficient therapy. In the 2019 INAS annual report, a recommendation was made to review the availability of stroke-trained staff. An organisational audit will be undertaken in 2021 to assess the number of therapists available in each stroke team.

Evidence has emerged that has resulted in the need to qualify this target for therapy in early stroke rehabilitation. The large international study known as AVERT (A Very Early Rehabilitation Trial) (Bernhardt *et al*., 2016; The AVERT Trial Collaboration group, 2015) suggested that in the first 2 weeks after stroke, therapy targeted at the recovery of mobility should be redesigned around frequent, short interventions, except for those people who require little or no assistance to mobilise (Stroke Foundation, 2019). Some Irish hospitals are participating in the next phase of the AVERT study, and recommendations may evolve based on future findings.

Figure 8.3 reflects the judgement of each participating HSCP regarding the amount of therapy their patients received.

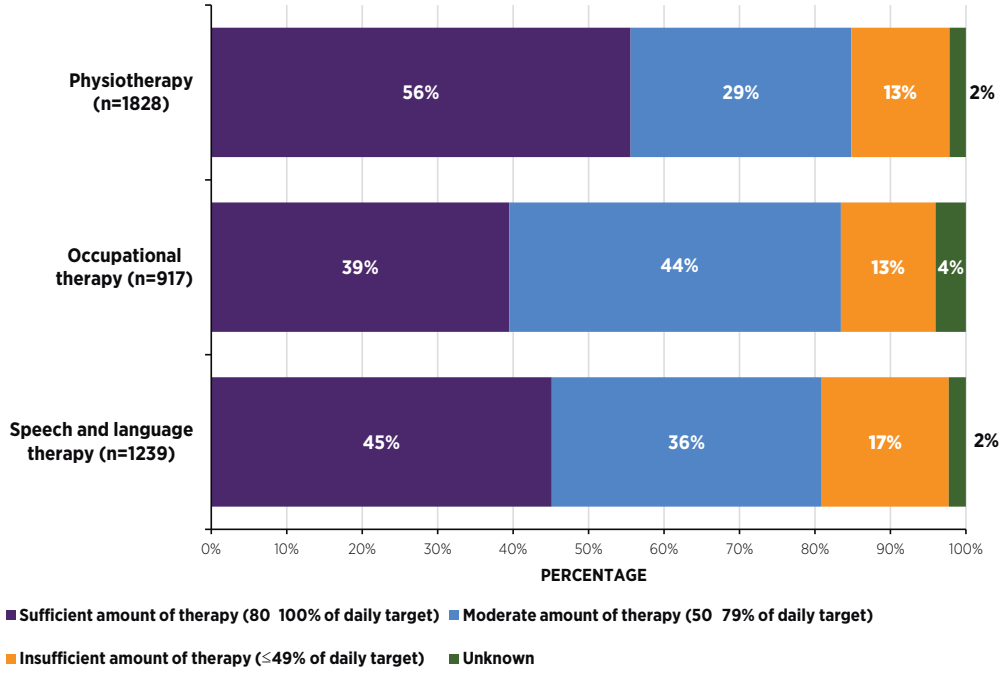

FIGURE 8.3: INTENSITY OF THERAPY, BY DISCIPLINE (N=2609)[36]

[36] Figure 8.3 refers to number of assessments, i.e. a patient could have been assessed by one or more health and social care professionals.

Figure 8.4 displays the discharge destination from hospital for each of the HSCP disciplines. The majority of patients with a stroke who were seen by a physiotherapist (57%, n=1047) and by an occupational therapist (60%, n=546) went home after hospital discharge and 49% (n=606) of patients with a stroke who were seen by a speech and language therapist, went home after hospital discharge. More than one-third of cases (35%, n=925) reported in the HSCP dataset were transferred to another care setting for long-term care or were transferred to another hospital for rehabilitation/ongoing care.

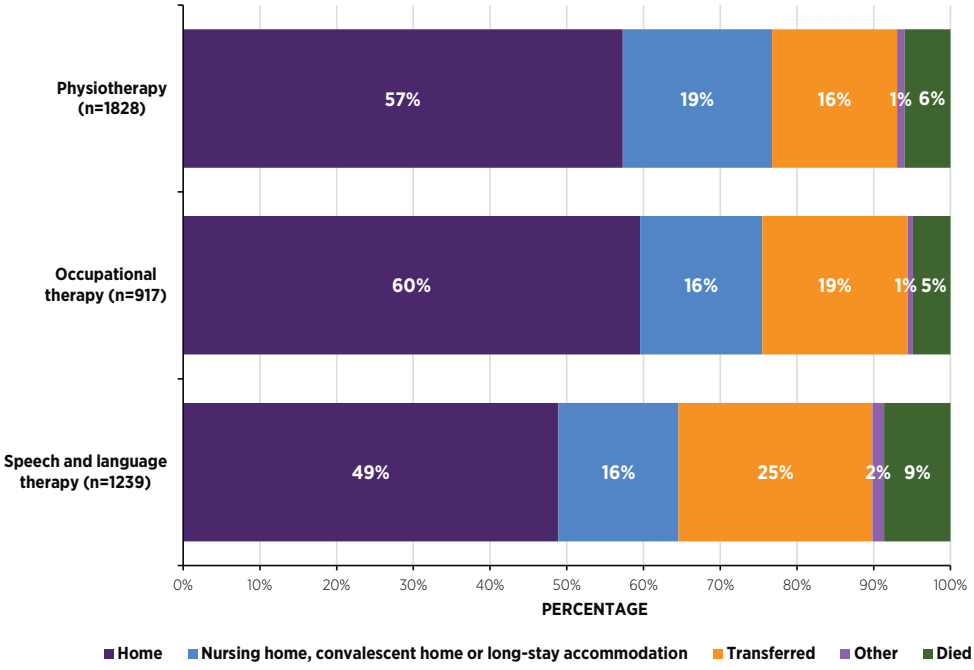

FIGURE 8.4: DISCHARGE DESTINATION, BY DISCIPLINE (N=2609)[37]

[37] Figure 8.1 refers to number of assessments, i.e. a patient could have been assessed by one or more health and social care professionals.

PHYSIOTHERAPY
PT: MOBILITY OUTCOMES

In 2020, the majority (77%, n=1310) of patients with a stroke who were seen by a physiotherapist were independent and did not require an aid for mobility prior to their stroke; however, this fell to 47% (n=800) on discharge from acute services after stroke. The percentage of patients who required the supervision or assistance of one person to walk increased from 5% (n=84) pre-stroke to 18% (n=310) on discharge. Post-stroke, 7% (n=119) required the assistance of another person to transfer from bed to a chair, and 8% (n=144) required a hoist to transfer. This remains largely unchanged from 2019. Figure 8.5 details patients' increased level of disability following stroke.

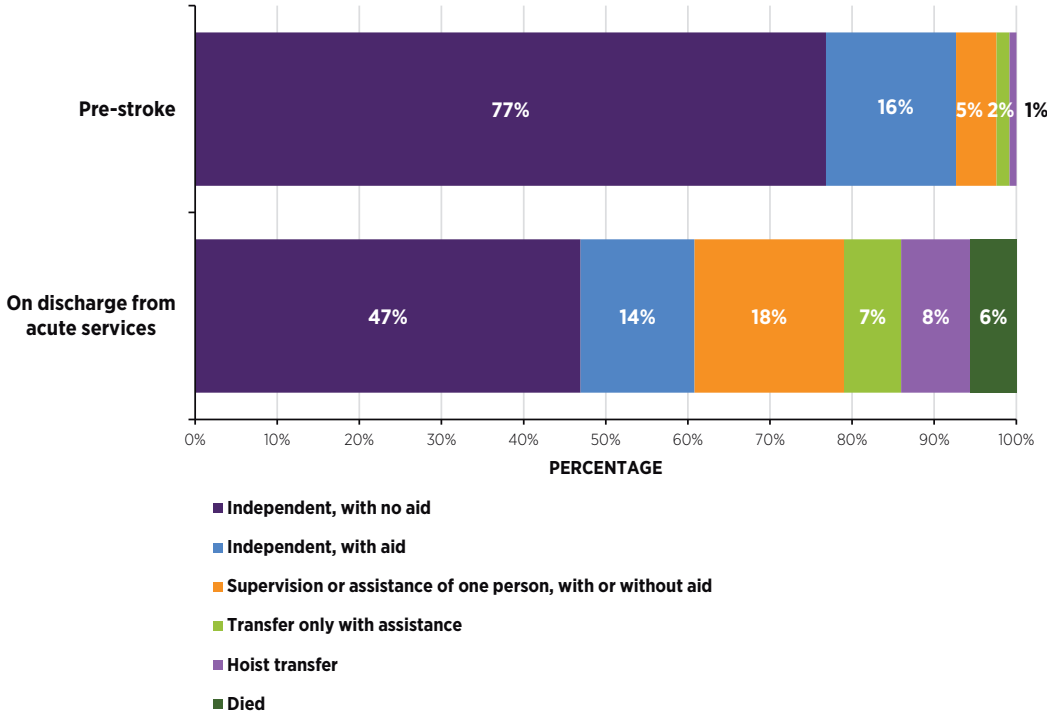

FIGURE 8.5: PHYSIOTHERAPY MOBILITY OUTCOMES (n=1705)[38]

[38] Information was not available for 123 cases. These cases were excluded from Figure 8.5.

PT: ASSISTANCE OF MORE THAN ONE THERAPIST

Figure 8.6 indicates that more than one-quarter (29%, n=529) of patients with a stroke who were assessed by a PT required the simultaneous assistance of more than one therapist or therapy assistant during therapy sessions. This contextual information is important when planning staffing and designing physiotherapy services for patients with a stroke, and is slightly higher compared to the proportion of such cases in 2019 (26%), reflecting the level of physical dependence in the stroke population.

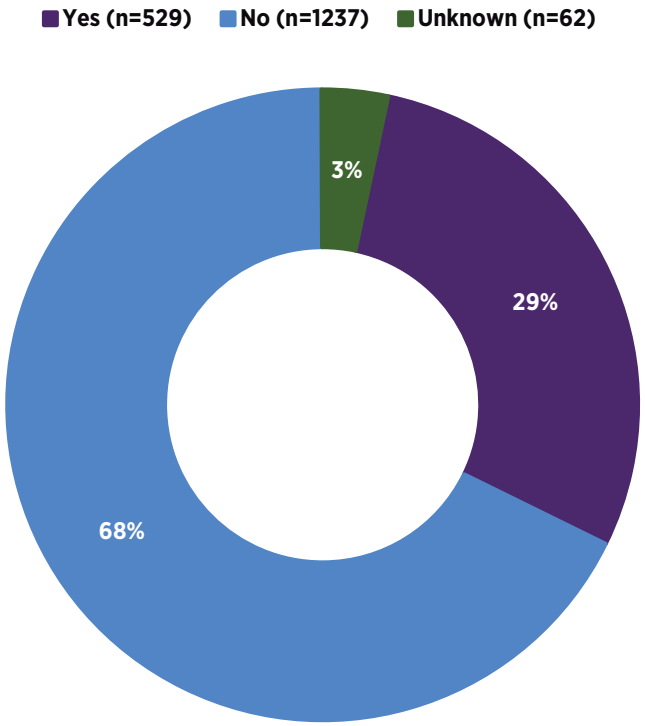

FIGURE 8.6: PHYSIOTHERAPY CASES REQUIRING THE ASSISTANCE OF MORE THAN ONE THERAPIST/THERAPY ASSISTANT (n=1828)

PT: ONWARD REFERRAL

Following a physiotherapy assessment, one-half (52%, n=955) of patients with a stroke required onward referral for physiotherapy (Figure 8.7). Nine percent (n=169) of patients were referred for ESD; this was an increase from 4% in 2019. There are currently seven ESD teams active across Ireland (see Chapter 7 for additional information).

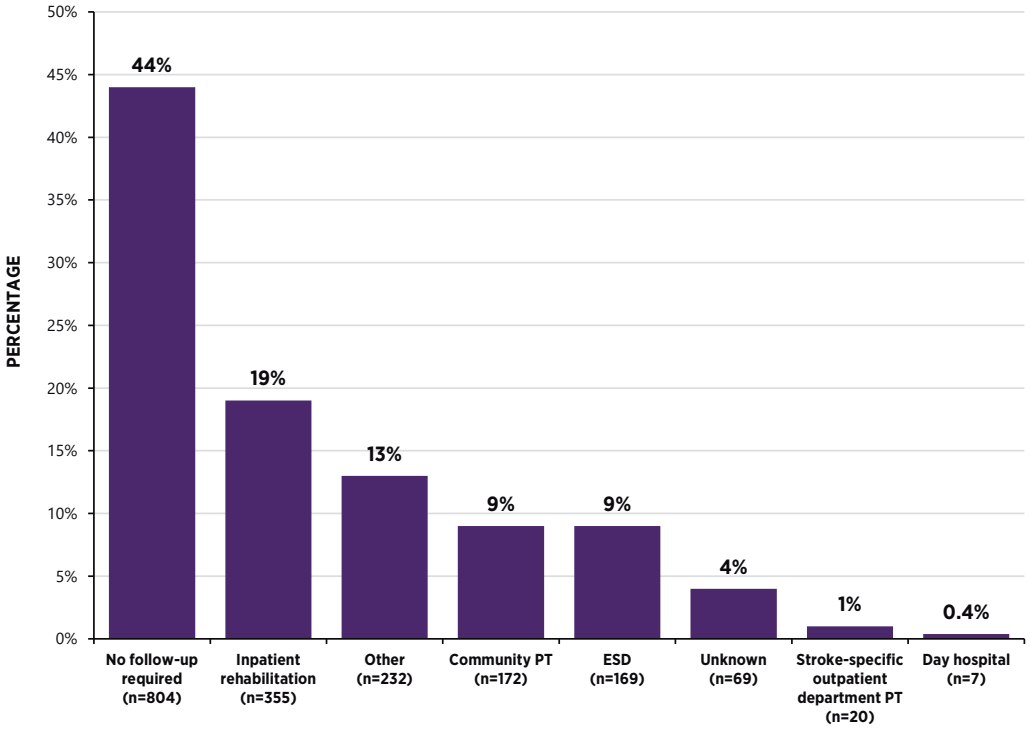

FIGURE 8.7: PHYSIOTHERAPY ONWARD REFERRAL DESTINATION (n=1828)

OCCUPATIONAL THERAPY

OT: ACTIVITIES OF DAILY LIVING PRE- AND POST-STROKE

The term 'activities of daily living' (ADLs) collectively describes the fundamental skills that are required to independently care for oneself, such as eating, bathing and mobilising. Figure 8.8 displays the distribution of ADLs among patients with a stroke both pre-admission and on discharge from acute services. Prior to admission, 78% (n=674) of patients with a stroke who were seen by an occupational therapist were independent in their ability to attend to their ADLs. On discharge, this fell to 42% (n=358). On discharge, 12% (n=99) of patients with a stroke required supervision or set-up (e.g. help cutting up food), 24% (n=207) required assistance with ADLs, and 12% (n=102) required full care. While these numbers are smaller in 2020, the proportions remain similar to those in 2019.

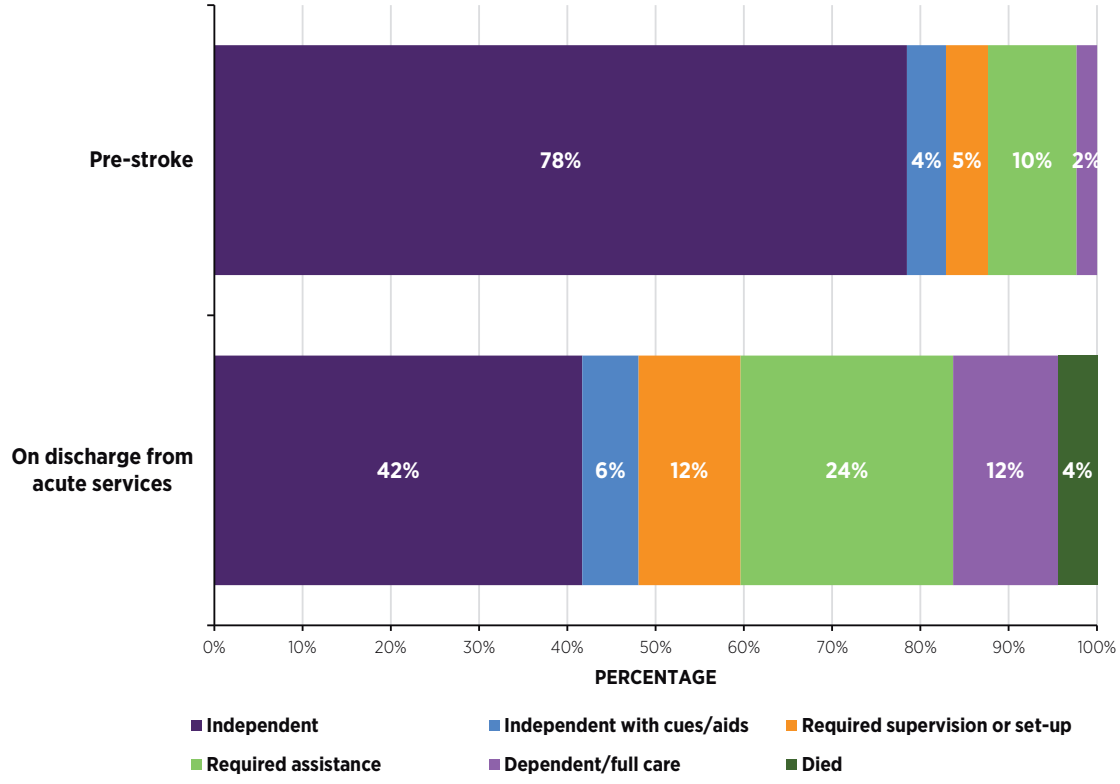

FIGURE 8.8: OCCUPATIONAL THERAPY ACTIVITIES OF DAILY LIVING PRE- AND POST-STROKE (n=859)[39]

[39] Information was not available for 58 cases. These cases were excluded from Figure 8.8.

OT: VISUAL FIELD ASSESSMENT

Standard: All patients should be screened for cognitive and perceptual deficits using validated and reliable screening tools (Stroke Foundation, 2019; Royal College of Physicians, 2016).

Sixty-one percent (n=557) of patients with a stroke who were assessed by an OT in 2020 were screened for cognitive problems, a decrease from 67% in 2019. The proportion of patients with a stroke who were unable to complete the screening due to patient factors increased from 12% in 2019 to 16% (n=143) in 2020.

Three-quarters (76%, n=694) of patients with a stroke had a visual field assessment completed by an OT during their admission in 2020. Figure 8.9 displays the percentage of patients who underwent specific types of visual field assessments.

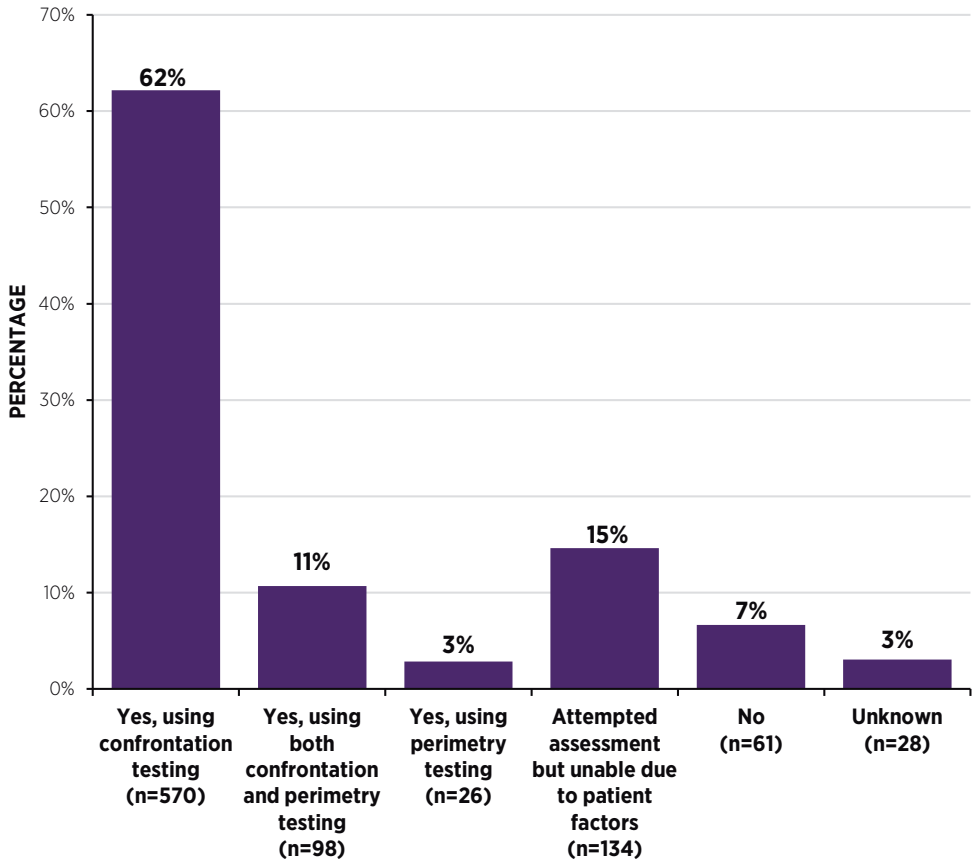

FIGURE 8.9: OCCUPATIONAL THERAPY VISUAL FIELD ASSESSMENT (n=917)

OT: PATIENT EDUCATION

Almost one-half (46%, n=419) of patients with a stroke who were seen by an OT in 2020 drove prior to admission. Figure 8.10 indicates that 85% (n=358) of those patients received individualised advice on driving limitations after stroke prior to being discharged from hospital. Twenty-three percent (n=206) of patients with a stroke who were seen by an OT were working prior to their stroke. On discharge, 62% (n=128) of those patients had been given advice about returning to work, with an additional 13% (n=27) referred onward for further advice (Figure 8.10).

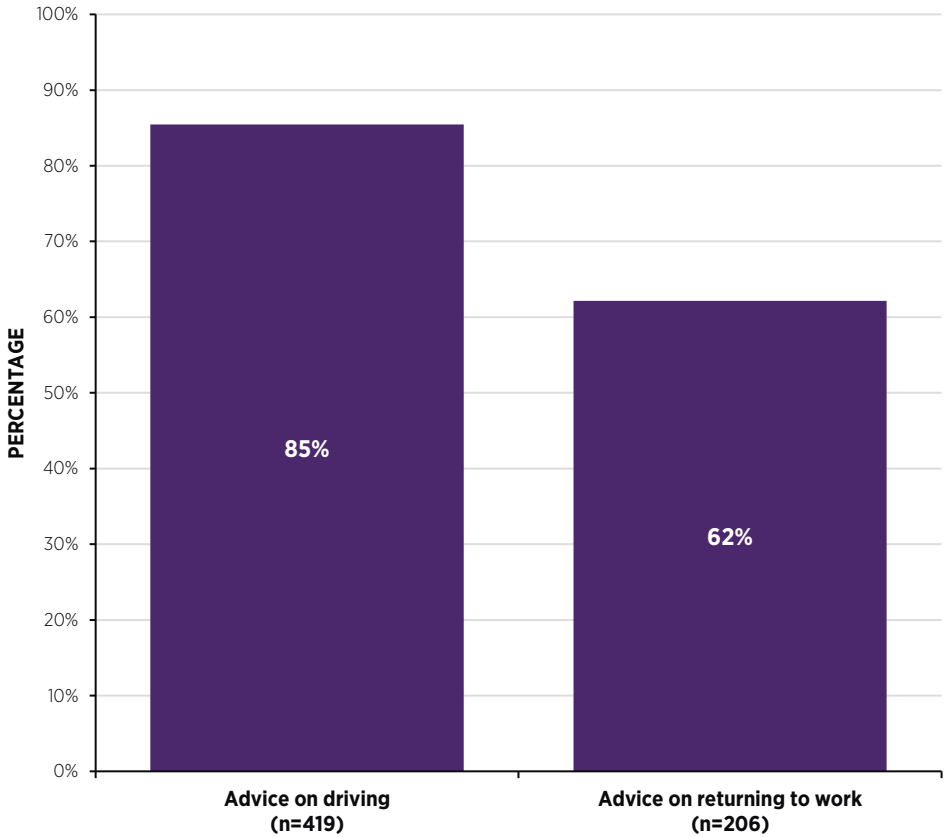

FIGURE 8.10: OCCUPATIONAL THERAPY PATIENT EDUCATION ON RETURNING TO WORK AND DRIVING (n=443)[40]

[40] Figure 8.10 refers to number of cases for each advice, i.e. a patient could have been employed and drove, therefore was counted twice.

OT: ASSISTANCE OF MORE THAN ONE THERAPIST

Figure 8.11 indicates that one-quarter (26%, n=242) of patients with a stroke in 2020 who were assessed by an OT required the assistance of more than one therapist or therapy assistant during therapy sessions more than half of the time. This is similar to what is reflected in the physiotherapy dataset.

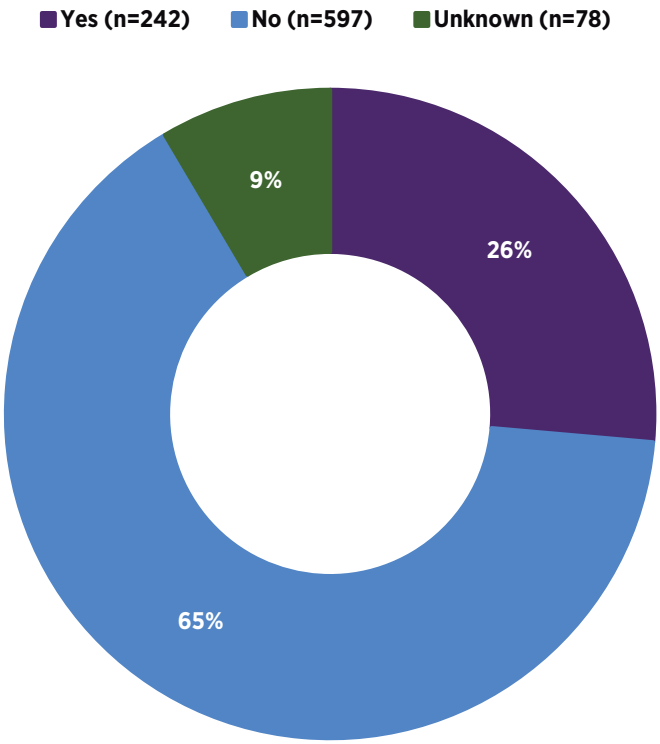

FIGURE 8.11: OCCUPATIONAL THERAPY CASES REQUIRING THE ASSISTANCE OF MORE THAN ONE THERAPIST/THERAPY ASSISTANT (n=917)

OT: ONWARD REFERRAL

Forty-nine percent (n=451) of patients with a stroke who received an occupational therapy assessment were referred for further assessment in 2020. Of these, 39% (n=176) of patients were referred to an inpatient rehabilitation service (off-site). The proportion of patients with a stroke who were referred to community OT decreased from 25% in 2019 to 14% (n=65) in 2020. There was an increase in the proportion of patients with a stroke who were referred for ESD, from 21% in 2019 to 27% (n=124) in 2020 (Figure 8.12).

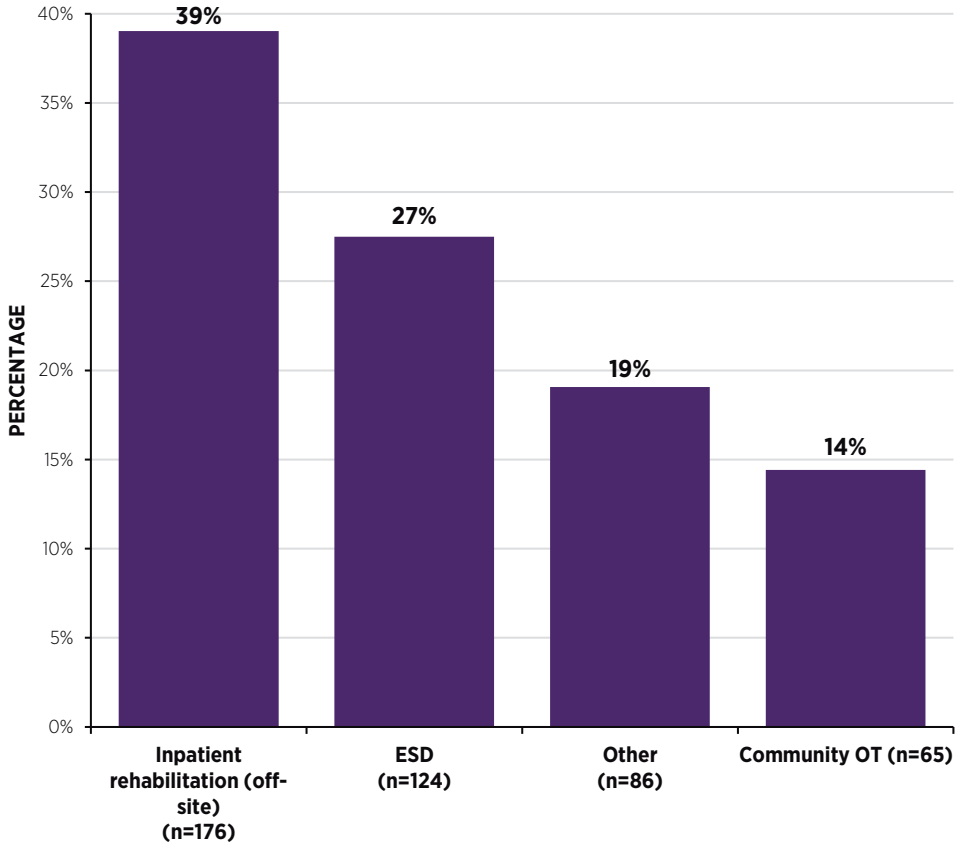

FIGURE 8.12: OCCUPATIONAL THERAPY ONWARD REFERRAL DESTINATION (n=451)

SPEECH AND LANGUAGE THERAPY

In 2020, data for 1,239 cases were added to the HSCP stroke audit portal by speech and language therapists, an increase from 993 cases in 2019.

SLT: COMMUNICATION AND SWALLOW DIFFICULTIES

Following initial assessment, a diagnosis of communication and/or swallow difficulties was made in 83% (n=1026) of patients with a stroke who were assessed by an SLT, while in 17% (n=213) of cases, no difficulties were identified, or the difficulty was unknown. Figure 8.13 displays the difficulties that were identified for the 1,026 patients who had a diagnosis of communication and/or swallow difficulties.

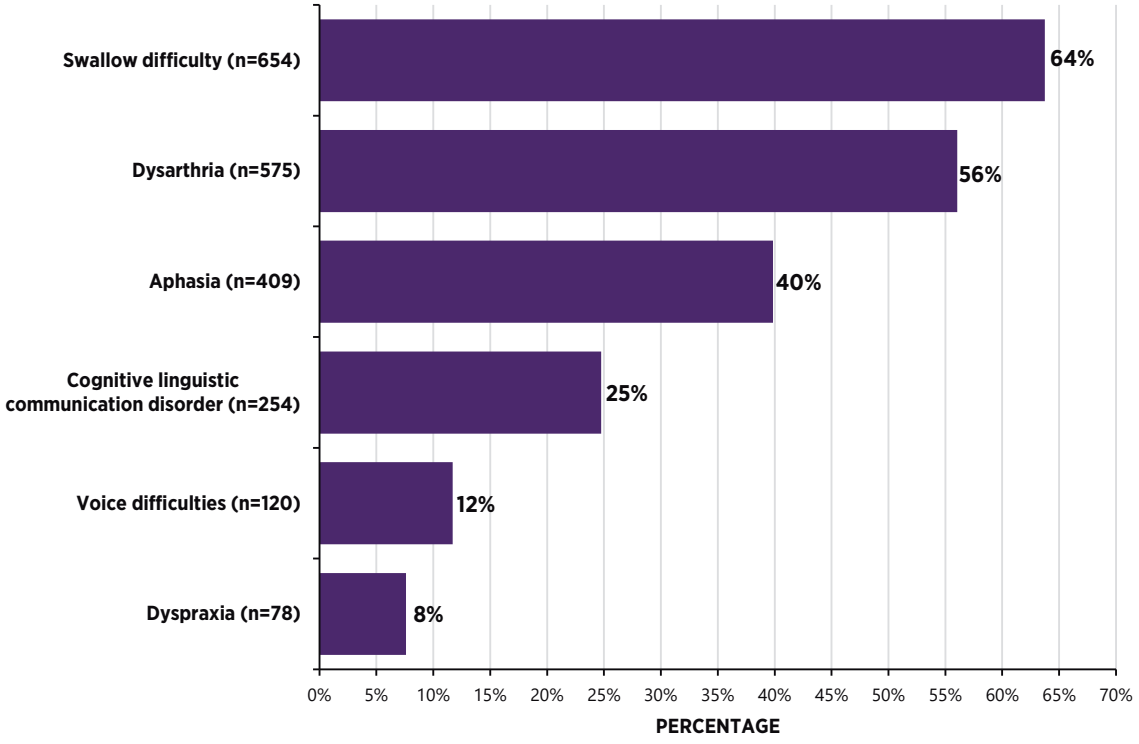

FIGURE 8.13: COMMUNICATION AND SWALLOW DIFFICULTIES IDENTIFIED BY SPEECH AND LANGUAGE THERAPISTS (n=1026) [41]

[41] Figure 8.13 represents patients who had a swallow and/or communication difficulty diagnosed by a speech and language therapist.

SLT: PRE- AND POST-STROKE COMMUNICATION

Figure 8.14 displays pre- and post-stroke communication ability. Prior to admission, the majority (79%, n=892) of patients with a stroke had no difficulties in their ability to speak and communicate. On discharge, there was an increase in the percentage of patients who were reported to have communication difficulties. Thirty-three percent (n=372) were reported to have mild communication difficulties, 18% (n=204) had moderate communication difficulties, 10% (n=114) had severe communication difficulties and 3% (n=37) had profound communication difficulties.

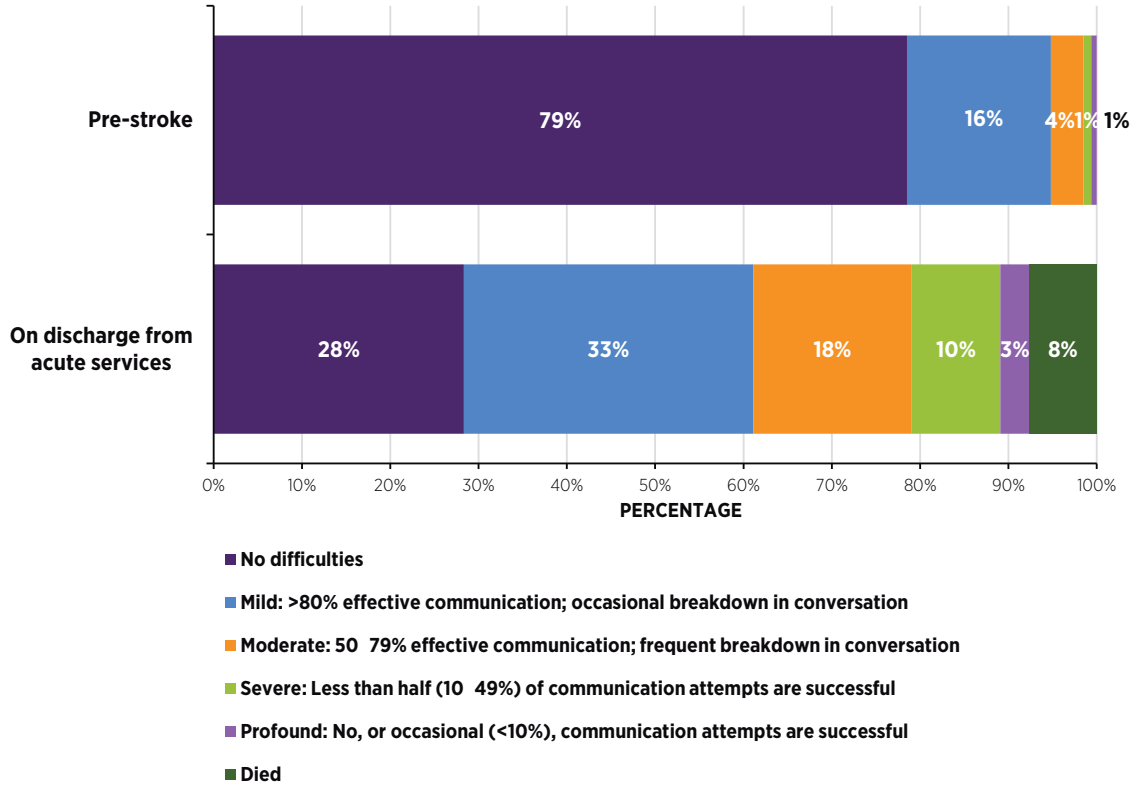

FIGURE 8.14: SPEECH AND LANGUAGE THERAPY PRE- AND POST-STROKE COMMUNICATION ABILITY (n=1136)[42]

[42] Information was not available for 103 cases. These cases were excluded from Figure 8.14.

SLT: SWALLOW INVESTIGATIONS

'Dysphagia' is a term that is used to describe difficulty swallowing food or fluids. People with dysphagia may have an unsafe swallow that can lead to food or fluid entering the airway (aspiration), which may cause coughing, gagging or breathing difficulties. The ability to swallow can be affected after a stroke. An SLT will assess a person's ability to swallow safely through clinical evaluation and sometimes using instrumental assessment, and can recommend a diet that is adjusted with regard to texture or content in order to reduce the risk of aspiration. This is referred to as a 'texture-modified diet'.

Figure 8.15 displays the percentage of patients who had an instrumental assessment of their swallow completed during hospital admission in 2020. Eight percent (n=97) of patients had a videofluoroscopy examination, a reduction from 11% in 2019, and 3% (n=35) had a fiberoptic endoscopic evaluation of swallowing (FEES) performed. These assessments are considered for patients who are suspected of aspiration or who require tube feeding or dietary modification (Royal College of Physicians, 2016).

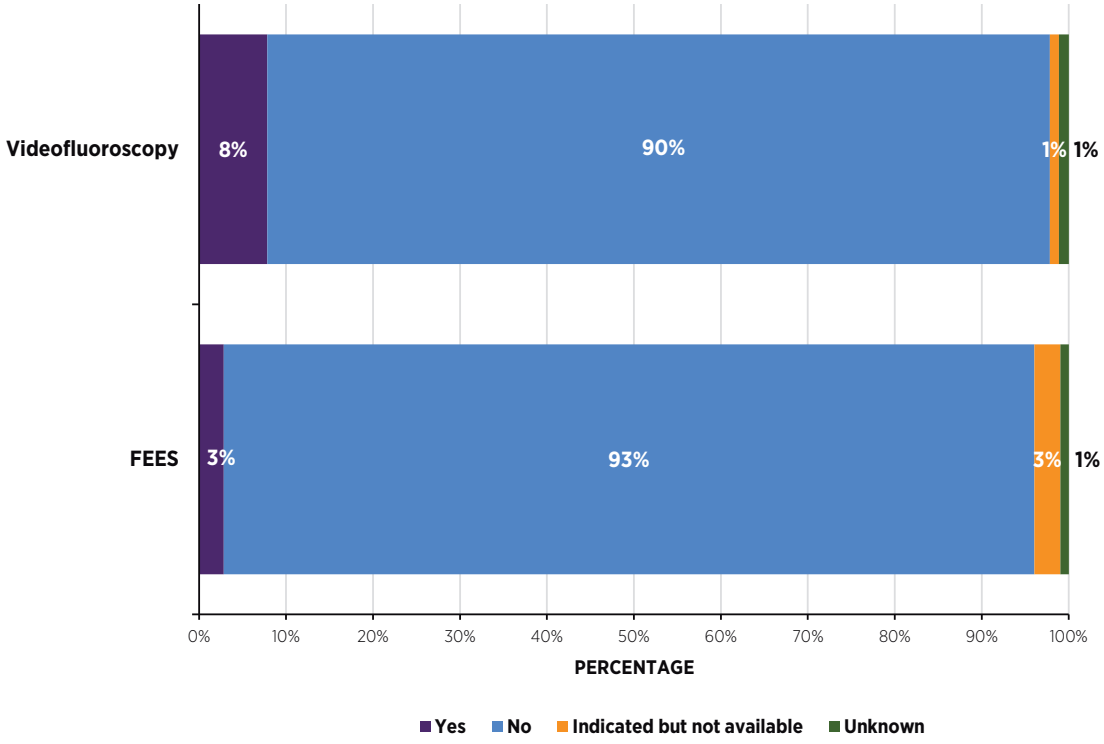

FIGURE 8.15: SPEECH AND LANGUAGE THERAPY SWALLOW INVESTIGATIONS (n=1239)

SLT: PRE- AND POST-STROKE MODIFIED DIET

Prior to admission, only 5% (n=64) of patients with a stroke who were seen by an SLT had been on a recommended modified diet in 2020. On discharge, more than one-quarter (28%, n=330) of patients with a stroke had a texture-modified diet recommended to them (Figure 8.16).

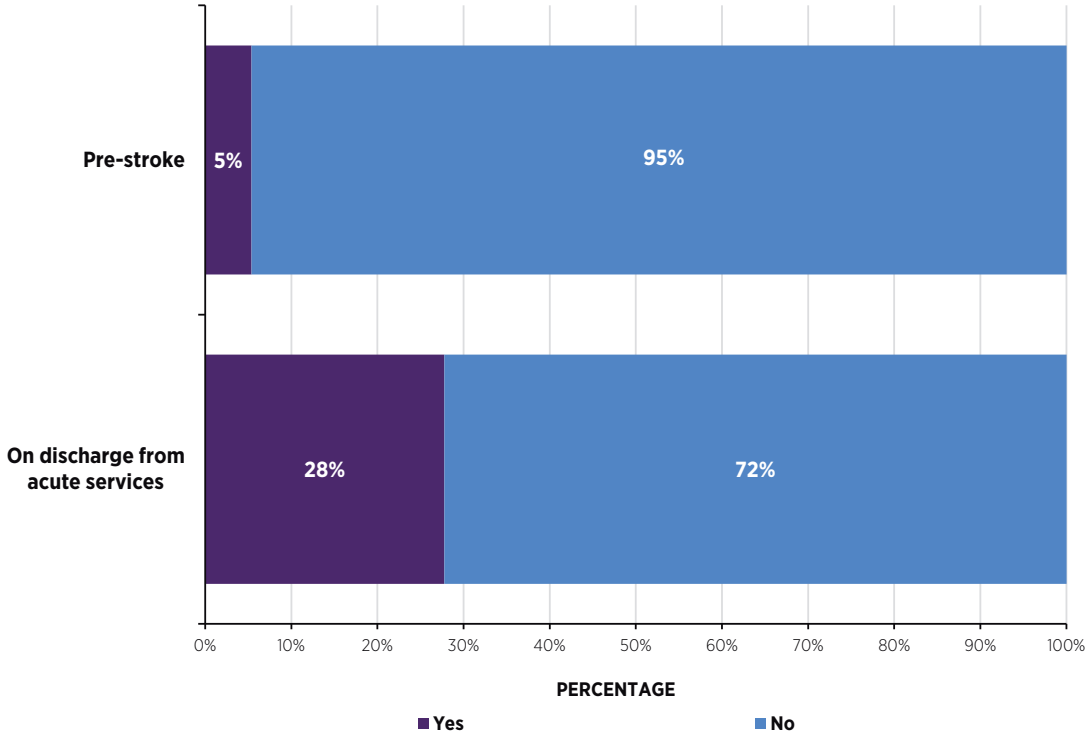

FIGURE 8.16: SPEECH AND LANGUAGE THERAPY PRE- AND POST-STROKE MODIFIED DIET (n=1189)[43]

[43] Information was not available for 50 cases. These cases were excluded from Figure 8.16.

SLT: PRE- AND POST-STROKE MODIFIED FLUIDS

The percentage of patients with a stroke who were recommended modified fluids (thickened liquids) increased from 2% (n=20) pre-admission to 18% (n=213) on discharge from acute services (Figure 8.17).

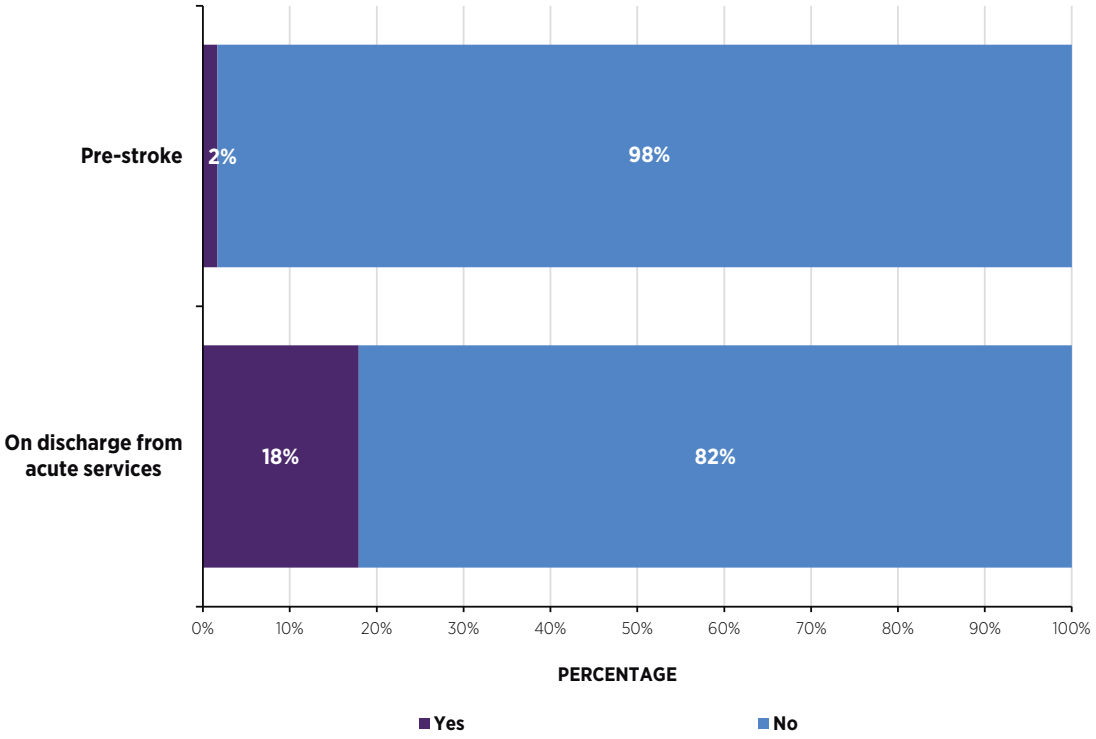

FIGURE 8.17: SPEECH AND LANGUAGE THERAPY PRE- AND POST-STROKE MODIFIED FLUIDS (n=1188)[44]

[44] Information was not available for 51 cases. These cases were excluded from Figure 8.17.

SLT: ENTERAL FEEDING ON DISCHARGE

Five percent (n=60) of patients with a stroke required enteral feeding on discharge from acute services (Figure 8.18).

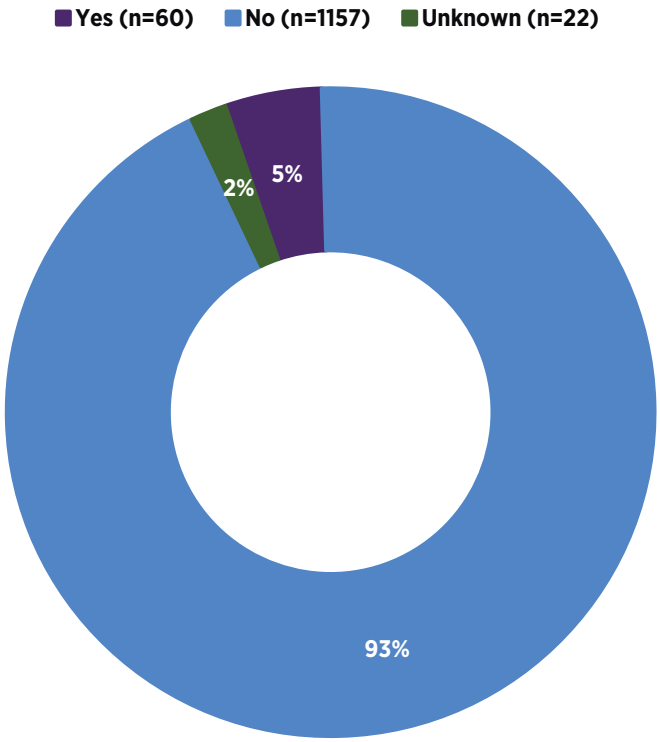

FIGURE 8.18: SPEECH AND LANGUAGE THERAPY ENTERAL FEEDING ON DISCHARGE (n=1239)

SLT: ONWARD REFERRAL

Following speech and language assessment, 54% (n=665) of patients with a stroke were referred for further speech and language therapy. Sixteen percent (n=200) of patients were referred to community SLT, a reduction from 21% (n=210) in 2019. Twenty percent (n=247) were referred for inpatient rehabilitation (Figure 8.19). The proportion of patients with a stroke seen by a speech and language therapist who were referred to ESD increased from 4% (n=43) in 2019 to 7% (n=92) in 2020. While it is positive that the provision of ESD increased in 2020, it is also true that community rehabilitation teams were suspended as staff were redeployed to support COVID-19 interventions, thus reducing access to community rehabilitation in areas without access to ESD teams.

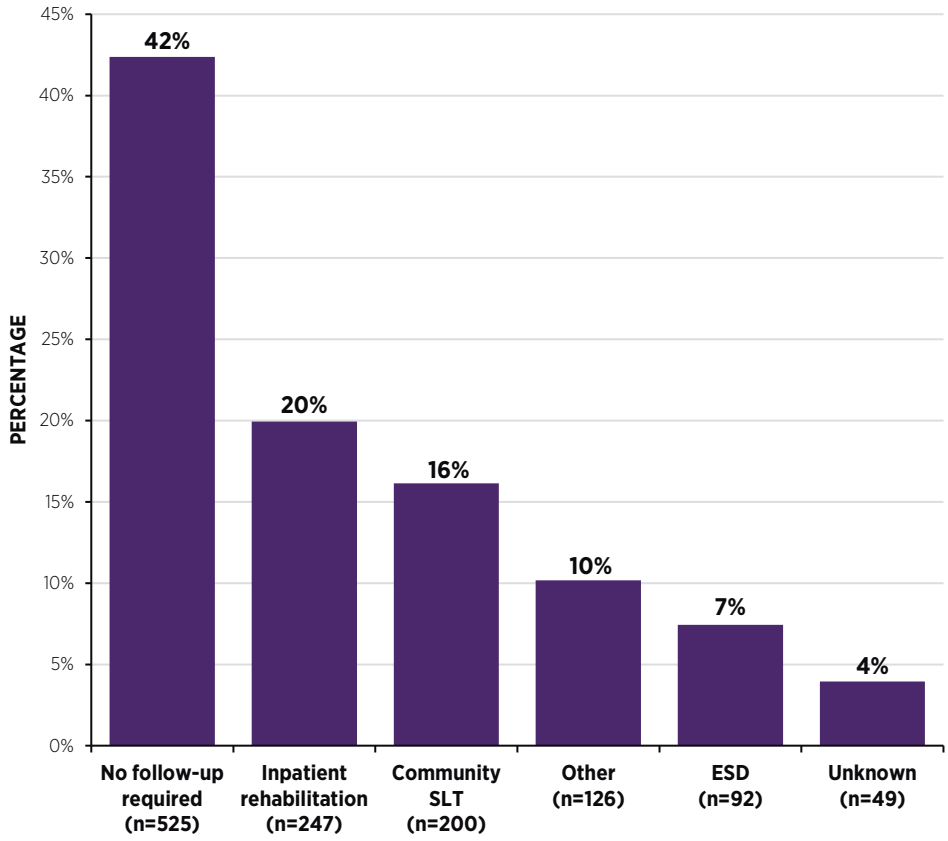

FIGURE 8.19: SPEECH AND LANGUAGE THERAPY ONWARD REFERRAL DESTINATION (n=1239)

KEY FINDINGS FROM CHAPTER 8

- In 2020, 15 hospitals had additional data recorded for patients who were seen by a HSCP – a reduction from 2019 (n=17) – and 9 hospitals had all three HSCP disciplines reporting to the audit, a decrease from 11 hospitals in 2019.

- Improvements were seen in 2020 across the HSCP disciplines in seeing patients with a stroke on the day of or the day after hospital arrival. One-half (53%, n=968) of patients with a stroke who were seen by a PT, almost one-half (44%, n=404) who were seen by an OT, and 60% (n=747) who were seen by an SLT were seen on the day of or the day after hospital arrival.

- In 2020, all therapists reported that a larger proportion of patients with a stroke had sufficient therapy compared to 2019. Physiotherapists reported that 56% (n=1016) of patients with a stroke received sufficient therapy compared to 47% in 2019. Occupational therapists reported that 39% (n=362) of patients with a stroke received sufficient therapy compared to 33% in 2019, and speech and language therapists reported that 45% (n=559) of patients with a stroke received sufficient therapy compared to 43% in 2019 (Figure 8.3).

- About one-quarter of patients with a stroke who were assessed by a physiotherapist (29%, n=529) (Figure 8.6) or an occupational therapist (26%, n=242) (Figure 8.11) within the HSCP dataset were physically dependent following their stroke, requiring the simultaneous assistance of two therapists for rehabilitation.

- For patients with a stroke who were assessed by an SLT in 2020, 83% (n=1026) had a swallowing or communication difficulty diagnosed (Figure 8.13).

- Within the HSCP dataset, PTs reported that 8% (n=144) of patients with a stroke who were seen by a PT required a full hoist for transfer on hospital discharge (Figure 8.5), and OTs reported that 12% (n=99) of patients with a stroke who were seen by an OT required full care with ADLs on hospital discharge (Figure 8.8). SLTs reported that 5% (n=60) of patients with a stroke who were seen by an SLT required enteral feeding on hospital discharge, down from 7% in 2019 (Figure 8.18). More than one-third (35%, n=952) of cases seen by one of the three HSCP participating disciplines were discharged from hospital to another care setting (Figure 8.4).

- Within the HSCP dataset, all therapists reported an increased proportion of patients with a stroke who were referred to ESD in 2020 compared to 2019:
  - PT – 2020: 9% (n=169) versus 2019: 4% (n=70)
  - OT – 2020: 27% (n=124) versus 2019: 21% (n=126)
  - SLT – 2020: 7% (n=92) versus 2019: 4% (n=43).

- There was a reduction in the proportion of patients with a stroke who were referred to OT and SLT community services in 2020 compared to 2019:
  - OT – 2020: 14% (n=65) versus 2019: 25% (n=152)
  - SLT – 2020: 16% (n=200) versus 2019: 21% (n=210).

CHAPTER 9
COVID-19

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CHAPTER 9: **COVID-19**

This chapter compares stroke activity, casemix and processes of care for patients with a stroke who were admitted to hospital during the defined pre-COVID-19 and COVID-19 periods and who had additional data submitted to the stroke portal. It uses aggregate INAS data from the hospitals that were reported on in the *Irish National Audit of Stroke National Report 2019* (NOCA, 2020) compared to the same hospitals in 2020 (n=19).[45]

The hospitals included in this analysis are:

- Bantry General Hospital
- Beaumont Hospital
- Cavan General Hospital
- Connolly Hospital
- Cork University Hospital
- Letterkenny University Hospital
- Mater Misericordiae University Hospital
- Mayo University Hospital
- Mercy University Hospital
- Naas General Hospital
- Our Lady of Lourdes Hospital Drogheda
- Sligo University Hospital
- South Tipperary General Hospital
- St James's Hospital
- St Vincent's University Hospital
- Tallaght University Hospital
- University Hospital Limerick
- University Hospital Waterford
- Wexford General Hospital

The pre-COVID-19 period is defined as 4 March 2019 (calendar week 10) to 29 December 2019 (calendar week 52), and the COVID-19 period as 2 March 2020 (calendar week 10) to 27 December 2020 (calendar week 52). Calendar weeks 10 to 52 were used to display the pre-COVID-19 and COVID-19 time periods as this allowed a direct comparison between those two time periods. Throughout this analysis, week 52 (Christmas week) shows a drop in activity and in length of stay metrics; this is seen in both periods and is not related to the pandemic.

[45] Our Lady's Hospital, Navan was reported on in 2019 but not in 2020 and is excluded from this analysis.

STROKE ACTIVITY

In the pre-COVID-19 period, 3,250 patients with a stroke were admitted to hospital; this rose to 3,486 patients during the COVID-19 period. The coverage of cases submitted to the stroke portal was higher during the COVID-19 period (92%, 4698/5085) compared to the pre-COVID-19 period (90%, 4275/4776), which may account for some of the increase in cases in the COVID-19 period. The mean number of admissions per week increased from 76 admissions in the pre-COVID-19 period to 81 admissions in the COVID-19 period (Figure 9.1). There was a decrease in admissions between calendar weeks 12 and 14 in 2020 (mean: 72) when compared to the same weeks in 2019 (mean: 90), possibly due to the first wave of COVID-19. This difference is most prominent in cases of ischaemic stroke (see Figure 9.2). The mean number of weekly admissions with ischaemic stroke in the pre-COVID-19 period was 65, and in the COVID-19 period the mean number of weekly admissions was 69. There was a smaller variation in the mean number of weekly admissions with a haemorrhagic stroke, which averaged 11 admissions per week in the pre-COVID-19 period and 12 admissions per week in the COVID-19 period (Figure 9.2).

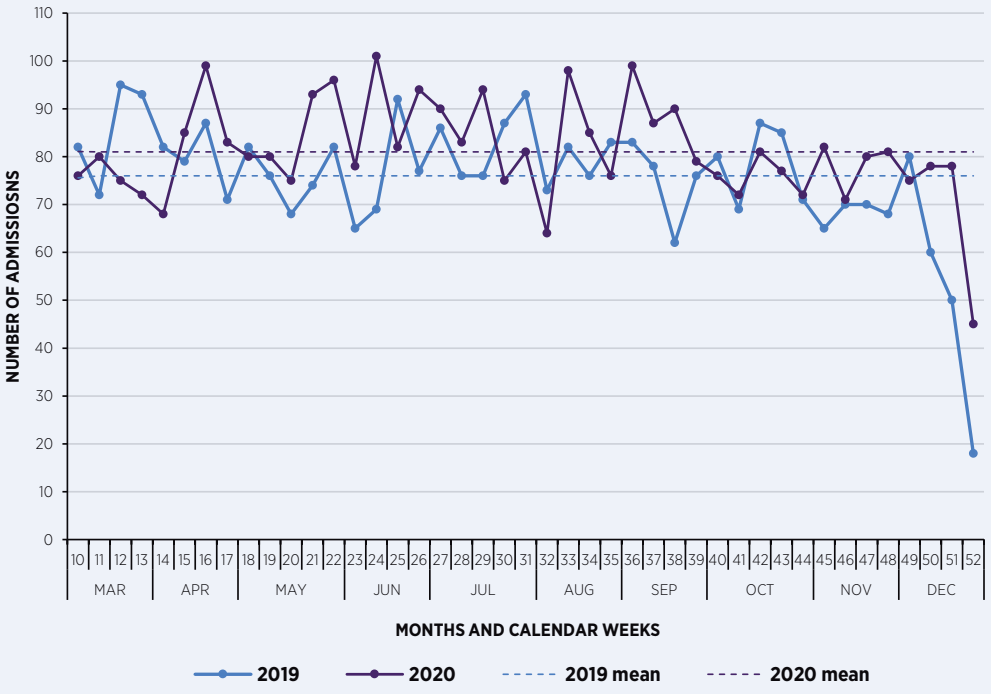

FIGURE 9.1: MONTHLY AND WEEKLY STROKE ACTIVITY BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (N=6736)

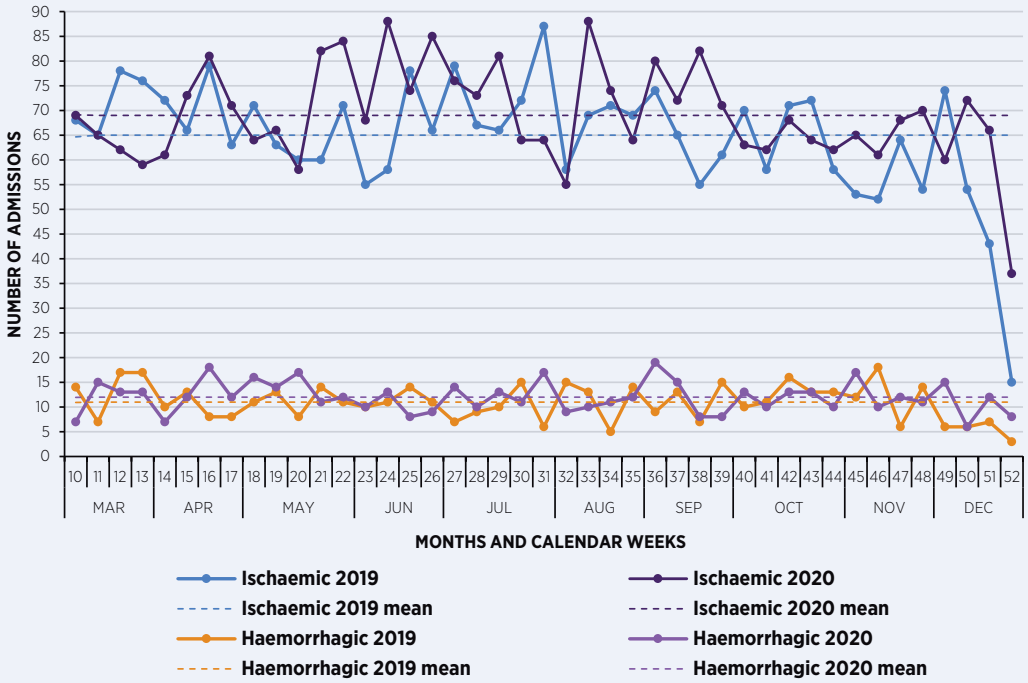

FIGURE 9.2: MONTHLY AND WEEKLY ISCHAEMIC AND HAEMORRHAGIC STROKE ACTIVITY BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (N=6736)

SEX AND AGE

Tables 9.1 and 9.2 show the number and percentage of patients with a stroke admitted between the two time periods under analysis, broken down by sex and by age group. The mean age of patients with a stroke was 72 years for both time periods. Fifty-seven percent of patients with a stroke were male during both time periods, and a similar proportion of admissions were aged 65 years and over during the pre-COVID-19 (74%, n=2408) and COVID-19 (73%, n=2562) periods.

TABLE 9.1 PATIENTS WITH A STROKE ADMITTED TO HOSPITAL FROM MARCH TO DECEMBER 2019 AND 2020, BY SEX (N=6736)

	Pre-COVID-19 (2019)		COVID-19 (2020)	
	N	%	N	%
Male	1844	57%	1992	57%
Female	1406	43%	1494	43%
Total	**3250**	**100%**	**3486**	**100%**

TABLE 9.2 PATIENTS WITH A STROKE ADMITTED TO FROM MARCH TO DECEMBER 2019 AND 2020, BY AGE GROUP (N=6736)

	Pre-COVID-19 (2019)		COVID-19 (2020)	
	N	%	N	%
17–64 years	842	26%	924	27%
65–79 years	1336	41%	1423	41%
80+ years	1072	33%	1139	33%
Total	**3250**	**100%**	**3486**	**100%**

SOURCE OF ADMISSION

Figure 9.3 displays the source of admission to hospital of patients with a stroke for the pre-COVID-19 and COVID-19 periods. There was a slightly larger proportion of patients with a stroke admitted from home during the COVID-19 period (89%, n=3117) compared to the pre-COVID-19 period (87%, n=2840); this was accompanied by a slightly smaller proportion of patients with a stroke who were transferred to the hospital from another healthcare facility during the COVID-19 period (10%, n=360) compared to the COVID-19 period (12%, n=382).

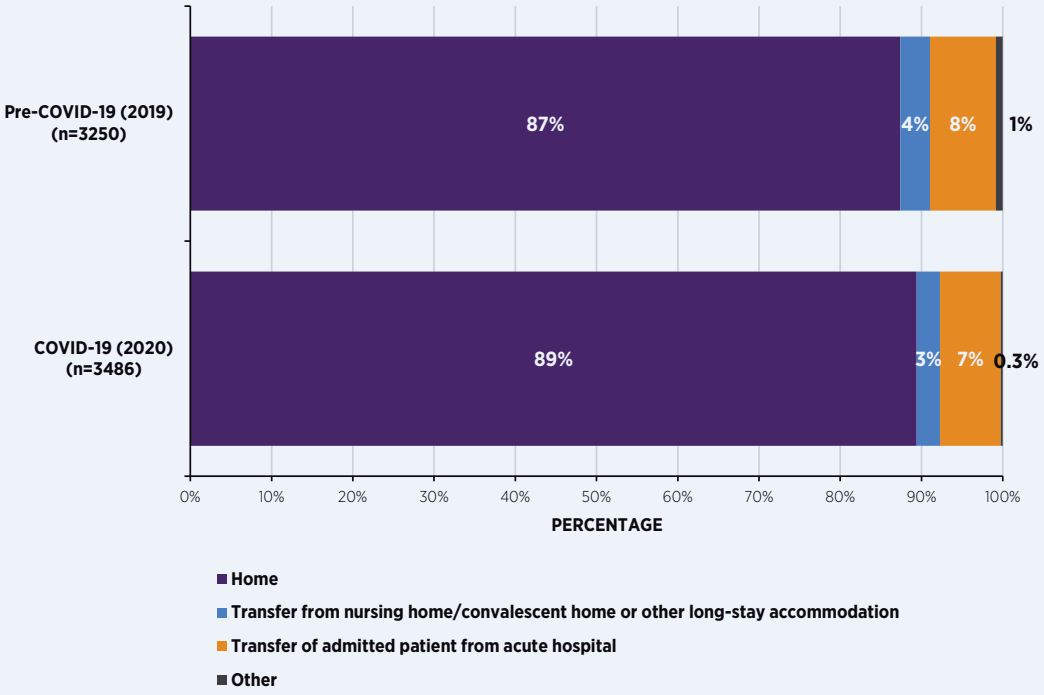

FIGURE 9.3: ADMISSION SOURCE BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (N=6736)

KEY PERFORMANCE INDICATORS

In 2012, the National Stroke Programme agreed on three national key performance indicators (KPIs) to support the implementation of the Stroke Model of Care (HSE, 2012a). These KPIs inform the HSE's *National Service Plan 2021* (HSE, 2021).

KPI 1. THE PERCENTAGE OF ACUTE PATIENTS WITH STROKE* WHO SPENT ALL OR SOME OF THEIR HOSPITAL STAY IN A STROKE UNIT

The percentage of acute patients with a stroke who spent all or some of their hospital stay in a stroke unit is presented by month and calendar week in Figure 9.4. The proportion of patients with a stroke who spent all or some of their hospital stay in a stroke unit was 72% (n=2347) during the pre-COVID-19 period and 71% (n=2470) during the COVID-19 period. There was, however, a decline in the month of April 2020 (calendar weeks 15 and 16) when the first wave of COVID-19 was at its peak; this may have been because stroke units were closed or stroke unit beds were allocated as general beds.

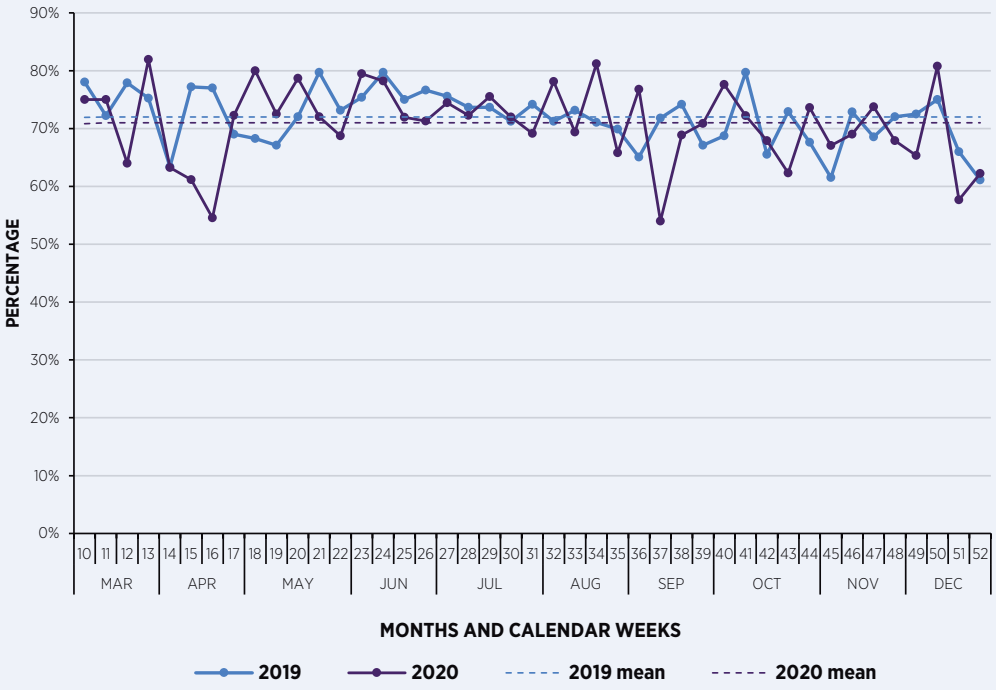

FIGURE 9.4: PERCENTAGE OF ACUTE PATIENTS WITH A STROKE WHO SPENT ALL OR SOME OF THEIR HOSPITAL STAY IN A STROKE UNIT, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (N=6736)

* Denotes wording used in the National Service Plan 2021 (HSE, 2021)

KPI 2. FOR PATIENTS WITH ACUTE STROKE ADMITTED TO AN ACUTE STROKE UNIT, THE PERCENTAGE OF THEIR HOSPITAL STAY SPENT IN THE STROKE UNIT

When a patient with a stroke is admitted to a stroke unit, it is recommended that they spend at least 90% of their hospital stay in the stroke unit. The average proportion of hospital stay spent in a stroke unit per week for both time periods was 78%. During the months of March, April and May (calendar weeks 10 to 22), a larger proportion of patients' time in hospital was spent in a stroke unit during the COVID-19 period (on average 78% per week) compared to the same calendar weeks during the pre-COVID-19 period (on average 70% per week) (Figure 9.5). This suggests that during those months in 2020, patients admitted with a stroke were more likely to receive stroke unit care for a larger proportion of their total hospital stay when compared to the same months in 2019.

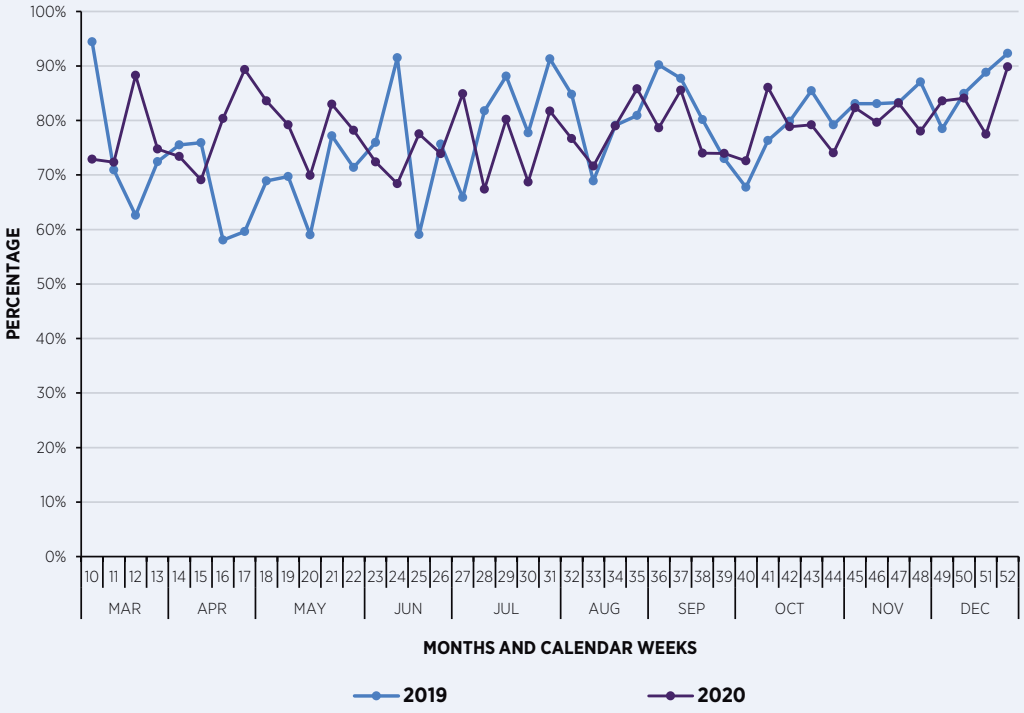

FIGURE 9.5: PERCENTAGE OF BED DAYS IN STROKE UNIT, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=74047)[46]

[46] Cases that did not have time information recorded or for which it was recorded incorrectly were excluded from Figure 9.5 (n=129).

Figure 9.6 presents the median length of stay (LOS) of patients with a stroke in hospital, and Figure 9.6A presents their median LOS in a stroke unit. In the pre-COVID-19 period, the median LOS in hospital was 10 days, while the median LOS was 8 days in the COVID-19 period. For patients with a stroke who were admitted to a stroke unit in the pre-COVID-19 period, the median LOS in the stroke unit was 8 days, while the median LOS in the stroke unit was 7 days for the COVID-19 period.

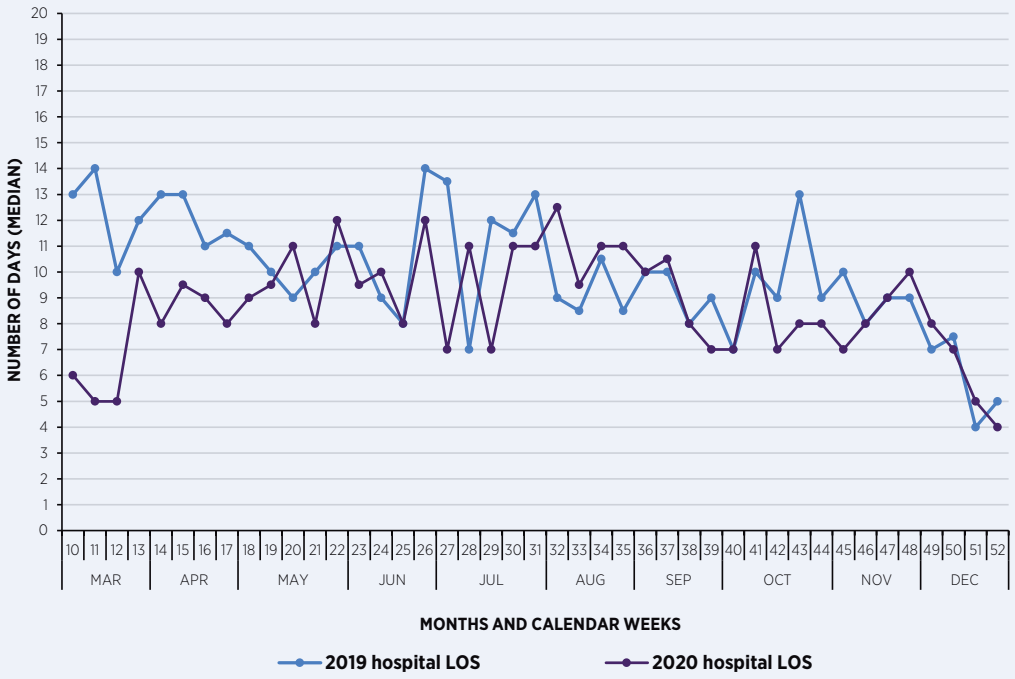

FIGURE 9.6: MEDIAN HOSPITAL LENGTH OF STAY OF PATIENTS WITH A STROKE BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=74047)[47]

[47] Cases that did not have time information recorded or for which it was recorded incorrectly were excluded from Figure 9.6 (n=129).

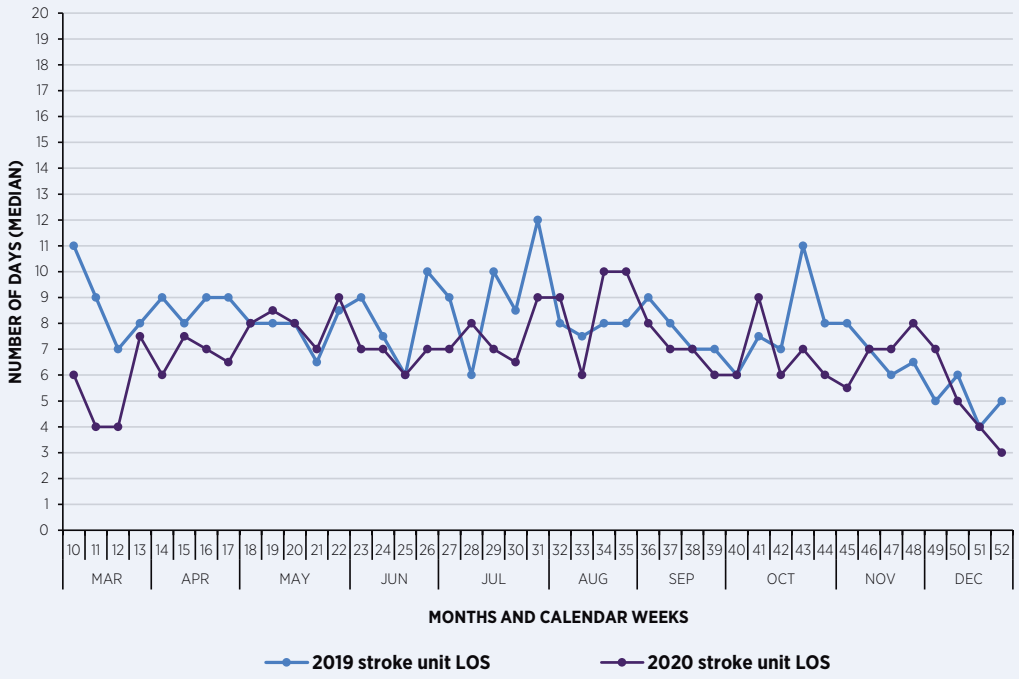

FIGURE 9.6A: MEDIAN STROKE UNIT LENGTH OF STAY OF PATIENTS WITH A STROKE BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=56972)[48]

[48] Cases that did not have time information recorded or for which it was recorded incorrectly were excluded from Figure 9.6A (n=129).

KPI 3. THE PERCENTAGE OF PATIENTS WITH CONFIRMED ACUTE ISCHAEMIC STROKE WHO RECEIVED THROMBOLYSIS

The proportion of patients with ischaemic stroke who received thrombolysis treatment is presented in Figure 9.7. The rate of thrombolysis was 10.6% during the pre-COVID-19 period and 10.4% during the COVID-19 period. However, during the months of March, April and May (calendar weeks 10 to 22), the rate of thrombolysis in 2020 was higher (13%, n=120) when compared to the same weeks in 2019 (11%, n=95).

Interestingly, the rate of thrombolysis increased to a high of 21% in the first week of April 2020. In this period there was a reduction in ischaemic stroke admissions (Figure 9.2), so it is likely that it was predominantly severe stroke cases that came to hospital during this time, of whom a higher proportion were more likely to be eligible for thrombolysis.

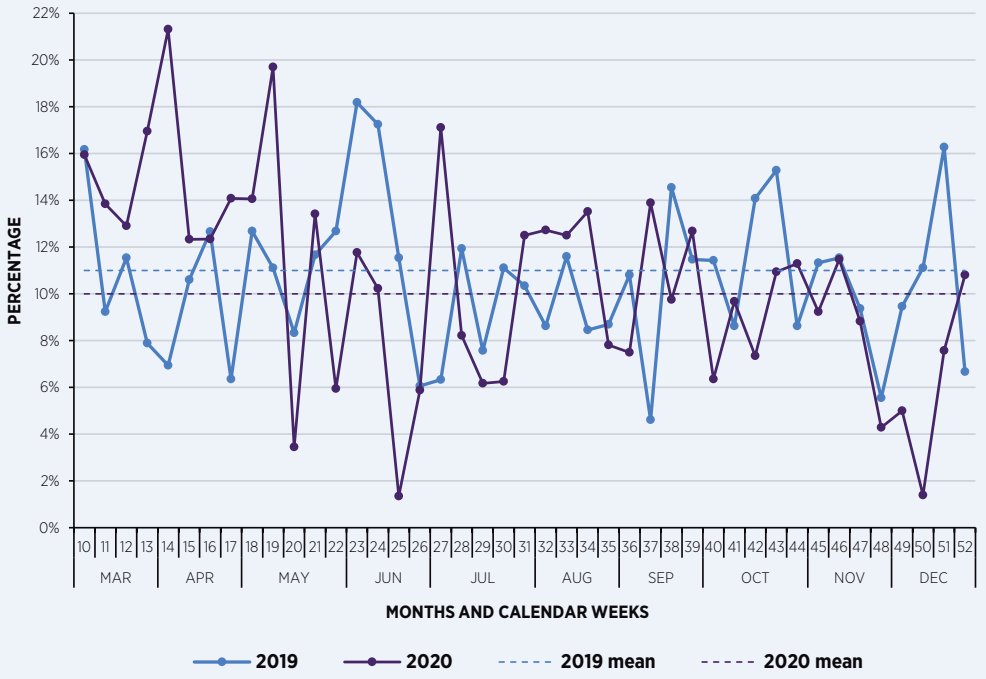

FIGURE 9.7: KEY PERFORMANCE INDICATOR 3: PERCENTAGE OF ISCHAEMIC STROKE CASES WHO RECEIVED THROMBOLYSIS TREATMENT BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=5752)

EMERGENCY CARE PROCESSES

In 2012, the National Stroke Programme agreed on three national key performance indicators (KPIs) to support the implementation of the Stroke Model of Care (HSE, 2012a). These KPIs inform the HSE's *National Service Plan 2021* (HSE, 2021).

TIME BETWEEN HOSPITAL ARRIVAL AND TIME REVIEWED BY MEDICAL TEAM

For patients with a stroke, early review by the medical team ensures that the patient has an initial stroke assessment and a brain scan completed as soon as possible. This facilitates prompt treatment, thus reducing brain cell death (Saver *et al*., 2016). The time and date of hospital arrival and the time and date of review by the medical team were available and recorded correctly for 79% (n=5073) of cases. In the pre-COVID-19 period, 67% (n=1547) of these were seen by the medical team within 1 hour of hospital arrival. In the COVID-19 period, this increased to 72% (n=1989) (Figure 9.8).

Furthermore, the overall median time from hospital arrival to review by a medical team was 16 minutes (interquartile range [IQR]: 0–129 minutes) in the pre-COVID-19 period, compared to 12 minutes (IQR: 0–75 minutes) in the COVID-19 period. Recent quality improvement initiatives have also improved this aspect of care since 2018–2019.

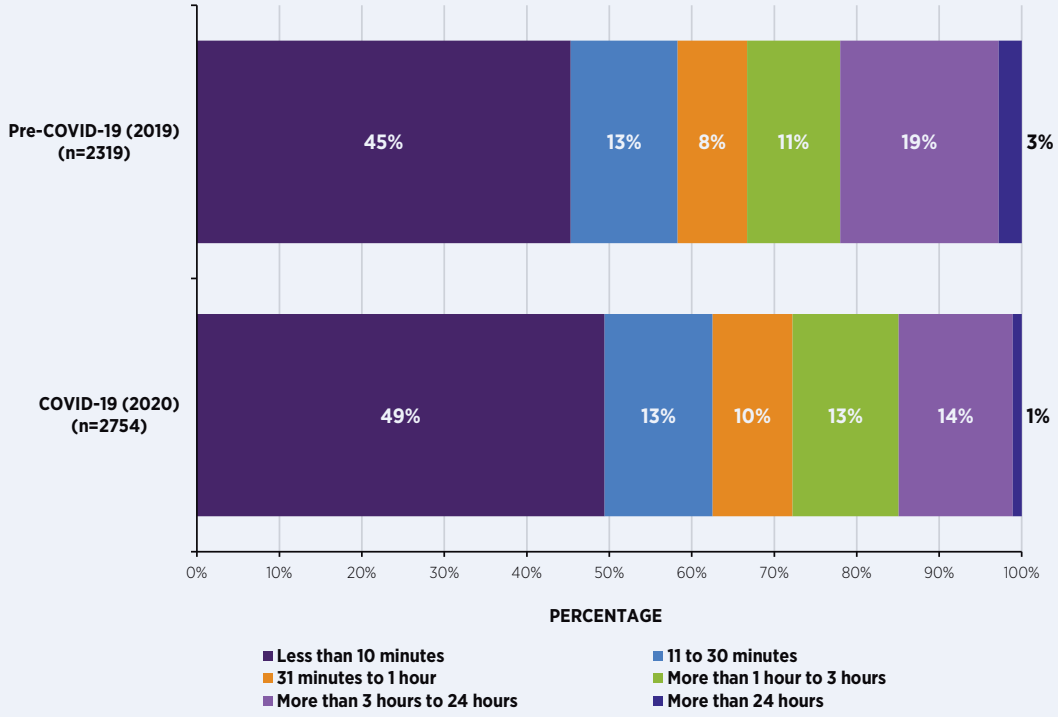

FIGURE 9.8: TIME BETWEEN HOSPITAL ARRIVAL AND TIME REVIEWED BY MEDICAL TEAM, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=5073)[49]

[49] Cases recorded as inpatient strokes (n=274) and cases that did not have time information recorded or had time information recorded incorrectly (n=1389) were excluded from Figure 9.8.

DOOR TO IMAGING

'Door to imaging' (DTI) is a term used to indicate the time between the arrival of the patient at the hospital and the time of the first brain scan. Once the patient has a brain scan, the decision about treatment can be made. Cases with suspected acute stroke should receive brain imaging urgently – at the latest within 1 hour of arrival at hospital (Royal College of Physicians, 2016).

In the pre-COVID-19 period, the DTI time was 60 minutes or less for 44% (n=1224) of cases, with a median of 79 minutes, and during the COVID-19 period, 47% of patients (n=1443) received their first brain scan within this time frame, and the median for this time period was 67 minutes (Figure 9.9). Access to imaging may have been better during the COVID-19 period as there was less pressure on scanners due to a reduction in elective work and a general reduction in emergency department attendance (Brick, *et al*., 2020).

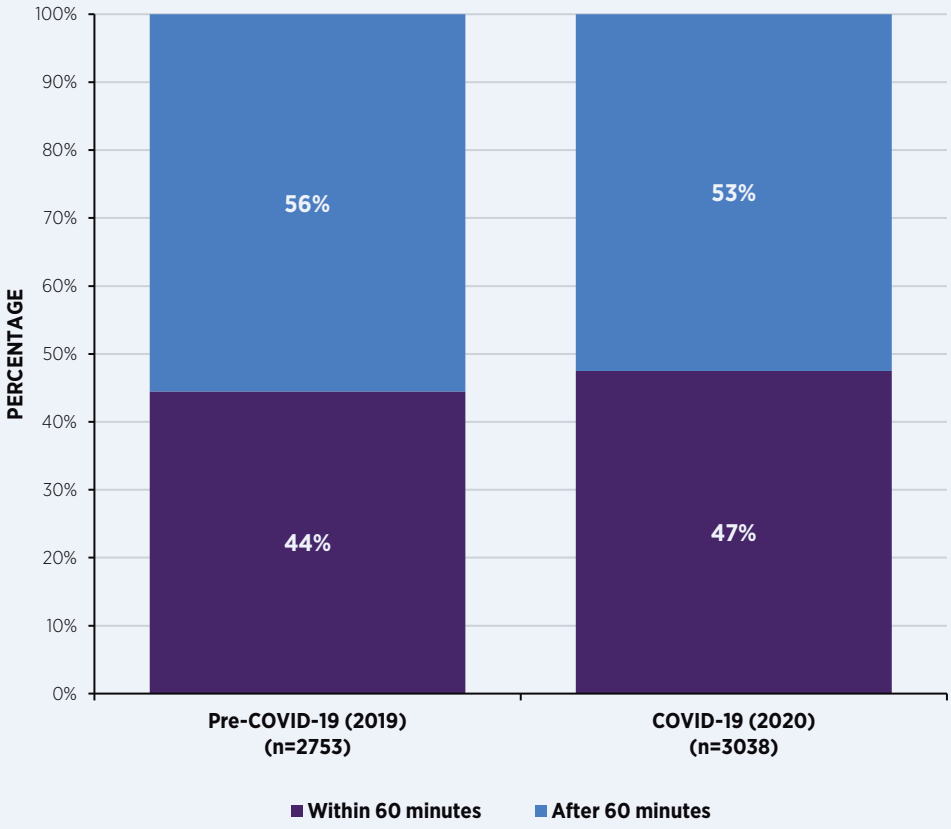

FIGURE 9.9: DOOR TO IMAGING TIME, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=5791)[50]

[50] Cases recorded as inpatient strokes (n=195) and cases that did not have time information or had time information recorded incorrectly (n=247) were excluded from Figure 9.9.

DOOR TO NEEDLE

'Door to needle' (DTN) is a term used to indicate the time between the arrival of the patient at the hospital and the time of thrombolysis treatment. The median DTN time in the pre-COVID-19 period was 54 minutes (Figure 9.10), while in the COVID-19 period the median DTN time was 58 minutes. Due to the small number of patients who were thrombolysed each week (an average of 10 per week in 2019 and 11 per week in 2020), caution should be applied when interpreting median DTN times; for instance, the rise in the median DTN time in December 2020 (calendar weeks 49 to 52) was calculated based on fewer than 5 cases per week.

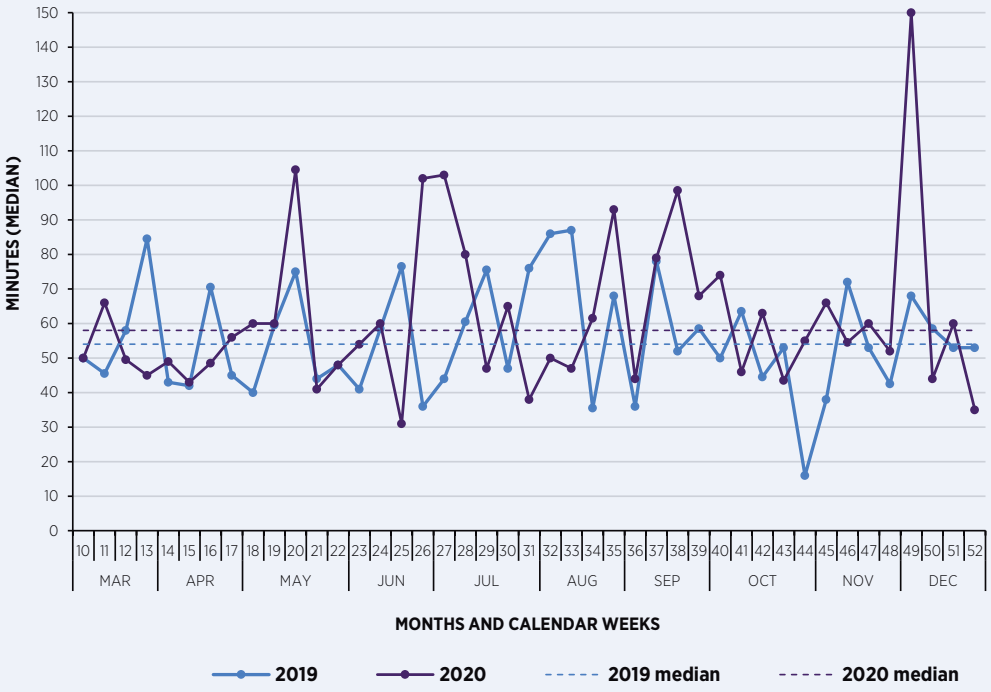

FIGURE 9.10: DOOR TO NEEDLE TIME, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=559)[51]

[51] Cases that did not have time information recorded or had time information recorded incorrectly (n=45) were excluded from Figure 9.10.

THROMBECTOMY

The availability of thrombectomy is increasing annually for patients with a stroke in Ireland. In 2020, the rate of thrombectomy among patients with ischaemic stroke was 9% (n=370) (Chapter 5). In the pre-COVID-19 period, 301 patients with a stroke had a thrombectomy, while during the COVID-19 period 303 patients had a thrombectomy. The rate of thrombectomy in the pre-COVID-19 period was 9.1% (n=244), and in the COVID-19 period it was 8.7% (n=250)[52]. A larger proportion of patients were admitted directly to an endovascular thrombectomy (EVT) stroke centre during the COVID-19 period (27%, n=83) compared to the pre-COVID-19 period (19%, n=57) (Table 9.3).

TABLE 9.3: PERCENTAGE OF PATIENTS ADMITTED DIRECTLY OR TRANSFERRED TO AN ENDOVASCULAR THROMBECTOMY STROKE CENTRE, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=604)

	2019		2020	
	N	%	N	%
Admitted directly to EVT stroke centre	57	19%	83	27%
Transferred from primary hospital to EVT stroke centre	244	81%	220	73%
Total	**301**	**100%**	**303**	**100%**

There was an increase in the median time between the onset of stroke symptoms to computed tomography (CT) scan, from 100 minutes during the pre-COVID-19 period to 126 minutes during the COVID-19 period. It must be noted that this time interval includes the time between the onset of stroke symptoms to arrival to the hospital. The most prominent difference was in the month of March, when the median time to CT scan was 100 minutes pre-COVID-19 and 164 minutes during COVID-19 (Table 9.4).

TABLE 9.4: TIME FROM ONSET OF STROKE SYMPTOMS TO COMPUTED TOMOGRAPHY SCAN FOR THROMBECTOMY CASES, MEDIAN AND INTERQUARTILE RANGE BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH (n=326)[53]

	2019				2020			
		IQR				IQR		
	Patients (n)	Median (days)	Percentile 25 (days)	Percentile 75 (days)	Patients (n)	Median (days)	Percentile 25 (days)	Percentile 75 (days)
March	19	100	75	173	10	164	139	294
April	20	108	77	197	12	127	85	216
May	15	107	80	219	22	132	98	198
June	22	96	70	164	18	134	83	177
July	19	98	57	163	17	143	109	223
August	9	86	73	99	14	122	84	203
September	17	97	50	140	20	108	82	173
October	17	94	60	134	20	124	84	202
November	17	106	80	145	10	100	50	133
December	18	114	70	144	10	98	82	137
Total	**173**	**100**	**72**	**150**	**153**	**126**	**85**	**191**

[52] There was no information about ischaemic stroke for 110 cases that received thrombectomy
[53] 278 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Table 9.4.

A computed tomography angiogram (CTA) is a scan that shows if there is an occlusion in the large arteries in the brain. Measuring the time between CTA and decision to transfer the patient to an EVT stroke centre reflects the efficiency of radiology review, communication with the stroke team and contact with the EVT stroke centre. There was a small increase in median time from CTA to decision to transfer the patient to an EVT stroke centre from 26 minutes during the pre-COVID-19 period to 30 minutes during the COVID-19 period (Table 9.5).

TABLE 9.5: TIME FROM COMPUTED TOMOGRAPHY ANGIOGRAM TO DECISION TO TRANSFER PATIENT TO ENDOVASCULAR THROMBECTOMY STROKE CENTRE FOR THROMBECTOMY CASES, MEDIAN AND INTERQUARTILE RANGE, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH (n=367)[54]

	2019				2020			
			IQR				IQR	
	Patients (n)	Median (mins)	Percentile 25 (mins)	Percentile 75 (mins)	Patients (n)	Median (mins)	Percentile 25 (mins)	Percentile 75 (mins)
March	19	24	16	50	12	25	17	44
April	23	34	14	49	12	26	16	33
May	18	25	18	53	19	41	16	48
June	19	24	14	45	19	30	22	43
July	22	30	16	48	21	32	23	46
August	9	27	18	48	13	29	22	55
September	20	33	18	63	20	27	16	45
October	21	21	13	37	23	27	16	55
November	19	27	15	41	13	30	25	50
December	24	29	14	45	21	34	13	43
Total	**194**	**26**	**16**	**47**	**173**	**30**	**18**	**46**

[54] Table 9.5 refers to patients transferred to an EVT stroke centre. 97 cases did not have time information known or recorded, or it was recorded incorrectly. These cases were excluded from Table 9.5.

Recanalisation is the term used to describe when a blood clot is removed and blood flow is restored. Time to recanalisation reflects the time from onset of stroke symptoms to arrival in the EVT stroke centre and also includes the time to prepare for and perform the thrombectomy[55]. The median time from onset of stroke symptoms to recanalisation for thrombectomy patients was higher during the COVID-19 period (median: 287 minutes; IQR: 214–415 minutes) compared to the pre-COVID-19 period (median: 264 minutes; IQR: 191–389 minutes). The most prominent difference was in the month of October, when the median time to recanalisation was 198 minutes pre-COVID-19 and 378 minutes during COVID-19 (Table 9.6).

TABLE 9.6: TIME FROM ONSET OF STROKE SYMPTOMS TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH (n=316)[56]

	2019				2020			
			IQR				IQR	
	Patients (n)	Median (mins)	Percentile 25 (mins)	Percentile 75 (mins)	Patients (n)	Median (mins)	Percentile 25 (mins)	Percentile 75 (mins)
March	17	240	181	393	13	312	269	472
April	18	338	238	510	11	285	193	344
May	15	307	199	423	20	288	225	439
June	21	271	220	345	18	287	234	320
July	18	301	182	406	17	345	282	449
August	12	191	158	280	14	217	171	318
September	18	218	198	337	18	252	185	377
October	15	198	152	358	19	378	231	472
November	15	291	201	417	11	230	173	768
December	16	239	197	401	10	269	222	359
Total	**165**	**264**	**191**	**389**	**151**	**287**	**214**	**415**

[55] This is a different metric to the 'time to recanalisation' metric reported in chapter 5 as in 2019 the time of arrival at the first hospital was not available.
[56] 288 cases did not have time information recorded or it was recorded incorrectly. These cases were excluded from Table 9.6.

The distribution of National Institutes of Health Stroke Scale (NIHSS) scores pre-thrombectomy and 24 hours post-thrombectomy for the two time periods is displayed in Figure 9.11. During the COVID-19 period, there was a smaller proportion of patients with moderate to severe stroke symptoms pre-thrombectomy (NIHSS scores of 16 to 20) (22%, n=53) compared to during the pre-COVID-19 period (29%, n=79). Additionally, during the COVID-19 period there was a larger proportion of patients with severe stroke symptoms pre-thrombectomy (NIHSS scores of 21 to 42) (20%, n=48) compared to the pre-COVID-19 period (17%, n=47).

An NIHSS score of ≤8 measured at 24 hours post-thrombectomy is highly predictive of long-term functional outcome for anterior circulation stroke (Meyer *et al.*, 2020). During the COVID-19 period, 53% (n=127) of patients with a stroke had an NIHSS score of ≤8 at 24 hours post-thrombectomy, and during the pre-COVID-19 period, 57% (n=154) of patients with a stroke had an NIHSS score of ≤8 at 24 hours post-thrombectomy.

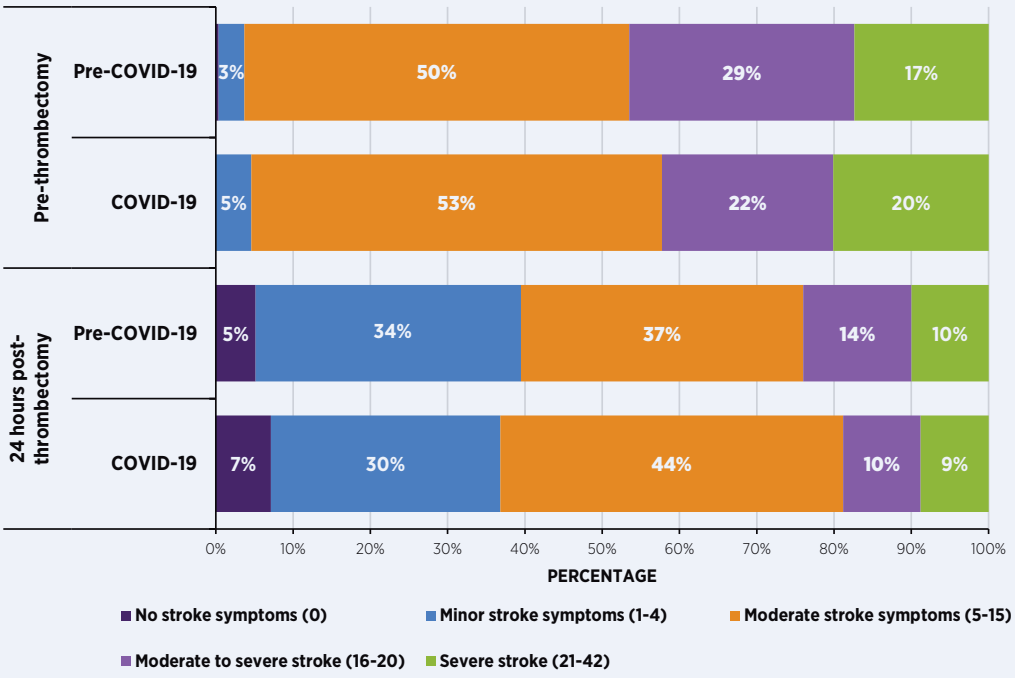

FIGURE 9.11: INTERVENTION OUTCOMES – NATIONAL INSTITUTES OF HEALTH STROKE SCALE SCORES, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=510)[57]

[57] 94 cases did not have an NIHSS score recorded. These cases have been excluded from Figure 9.11.

STROKE CARE PROCESSES

SWALLOW SCREENING

During the pre-COVID-19 period, 2,200 (68%) patients with a stroke had a swallow screen performed; out of those, 44% (n=961) had it performed within 4 hours of presentation to hospital. During the COVID-19 period, 2,394 (69%) patients with a stroke had a swallow screen performed, and of those, 41% (n=993) had it performed within 4 hours of presentation to hospital (Figure 9.12).

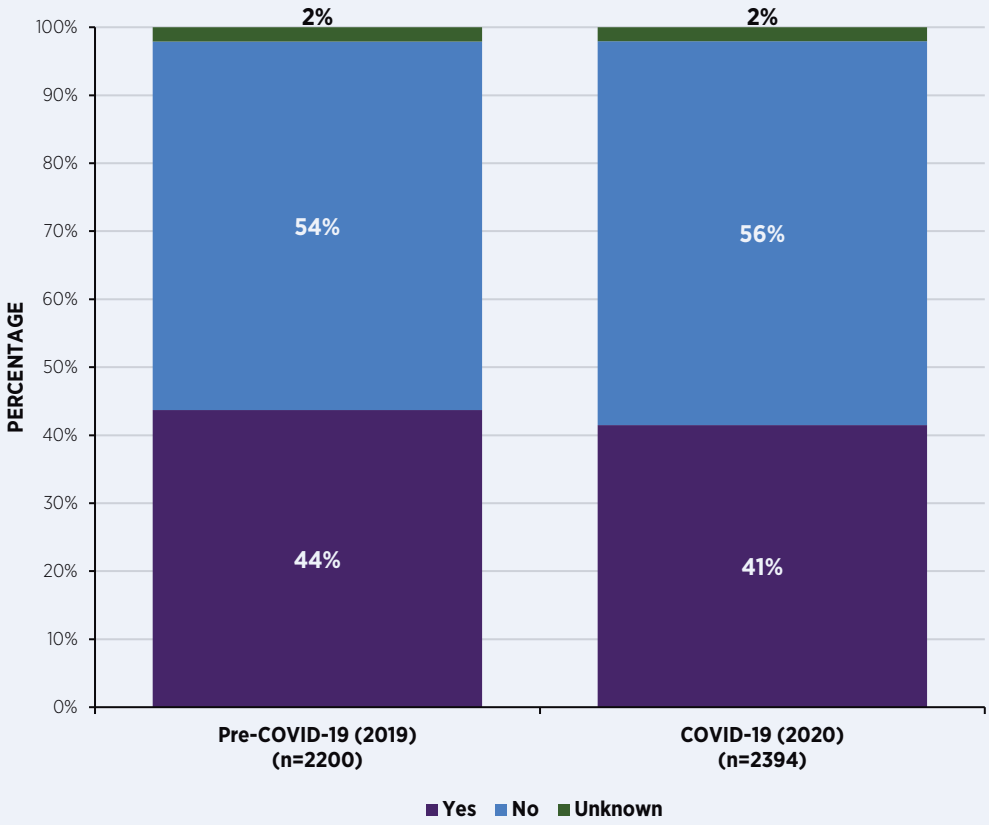

FIGURE 9.12: SWALLOW SCREENING WITHIN 4 HOURS OF PRESENTATION TO HOSPITAL, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020)(n=4594)[58]

[58] Figure 9.12 displays only cases that had a swallow screen performed.

ASSESSMENT BY A CLINICAL NURSE SPECIALIST

Most patients with a stroke are generally assessed by a clinical nurse specialist (CNS) after their admission to hospital. In the pre-COVID-19 period, 83% (n=2713) of patients with a stroke were assessed by a CNS; this fell to 78% (n=2729) during the COVID-19 period. The largest difference in the proportion of patients assessed by a CNS was observed during calendar weeks 12 to 19, when the average proportion of patients with a stroke who were assessed by a CNS was 87% per week during the pre-COVID-19 period and 65% during the COVID-19 period (Figure 9.13). This was most likely due to the redeployment of some CNSs and advanced nurse practitioners (ANPs) to other roles during the pandemic. Thirteen percent of CNSs/ANPs were redeployed at some point during the first wave of COVID-19.

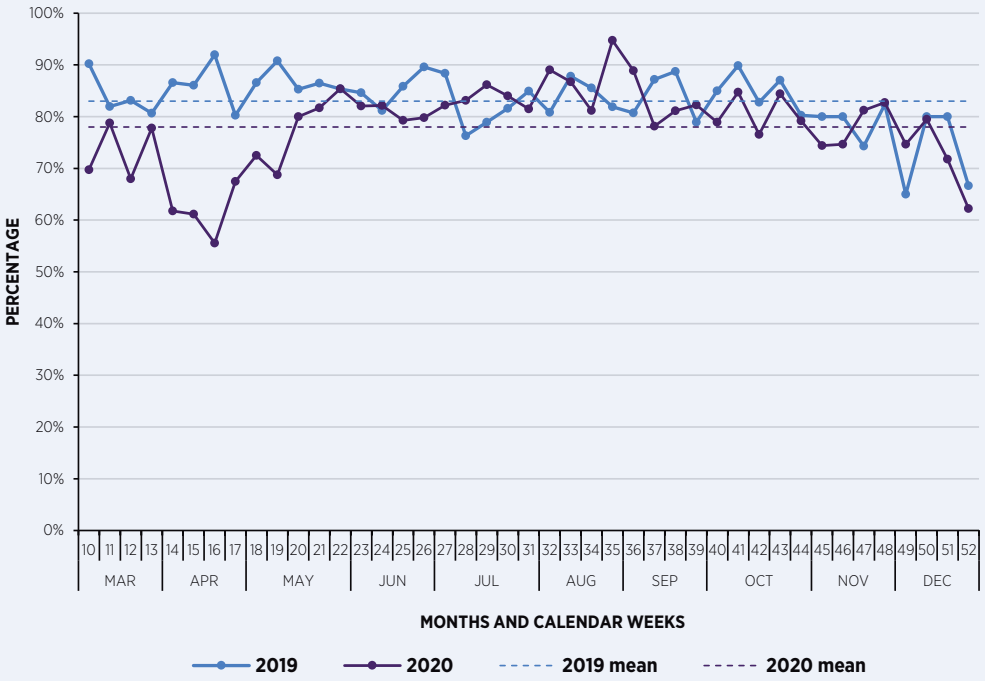

FIGURE 9.13: ASSESSED BY A CLINICAL NURSE SPECIALIST, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (N=6736)

MULTIDISCIPLINARY TEAM MEETINGS

Figure 9.14 indicates whether the care of patients with a stroke was discussed at multidisciplinary team meetings. In the pre-COVID-19 period, 83% (n=2590) of patients with a stroke had their care discussed at these meetings; this declined to 73% (n=2464) in the COVID-19 period.

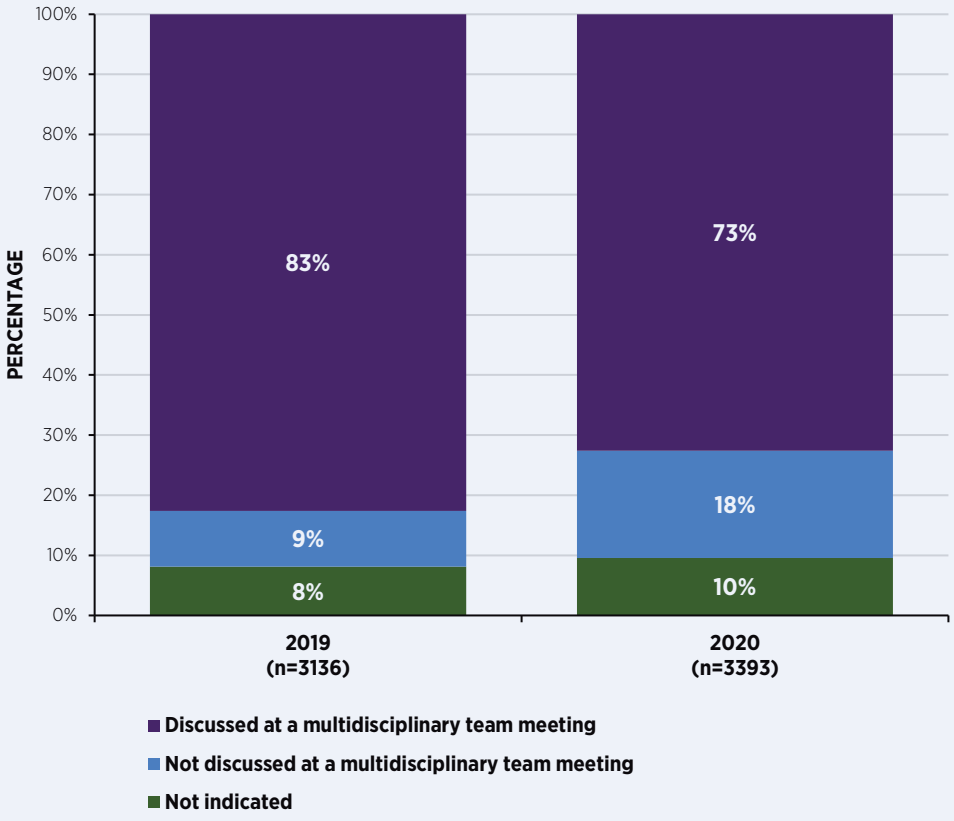

FIGURE 9.14: CARE OF PATIENTS WITH A STROKE DISCUSSED AT A MULTIDISCIPLINARY TEAM MEETING, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=6529)[59]

[59] Cases that did not have information recorded or for which it was recorded incorrectly (n=207) were excluded from Figure 9.14.

DISCHARGE DESTINATION

There was no difference in the proportion of patients with a stroke who were discharged home between the two reporting periods. Discharge to long-term care decreased from 6% (n=209) in the pre-COVID-19 period to 5% (n=166) in the COVID-19 period. In the pre-COVID-19 period, 7% (n=35) of patients with haemorrhagic stroke were discharged to long-term care compared to 4% (n=21) during the COVID-19 period (Table 9.7).

The proportion of patients with a stroke who were discharged home with Early Supported Discharge (ESD) increased during the COVID-19 period (8%, n=277) compared to the pre-COVID-19 period (5%, n=166) (Figure 9.15). This was most likely due to the increase of tele-rehabilitation (which was utilised early in the pandemic to support patients with a stroke in the home) and an increased number of ESD teams available nationally in 2020. In addition, St Vincent's University Hospital commenced an ESD service in September 2020.

TABLE 9.7: DISCHARGE DESTINATION OF PATIENTS WITH A STROKE, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020)

N		2019		2020	
		%	N	%	N
Ischaemic stroke	Home	1557	56%	1663	56%
	Patient died	228	8%	228	8%
	Discharge to long-term care	174	6%	145	5%
	Discharge to off-site rehabilitation	374	13%	368	12%
	Transfer	233	8%	222	7%
	Home with ESD	144	5%	244	8%
	Other/unknown	70	3%	102	3%
	Total	**2780**	**100.0%**	**2972**	**100.0%**
Haemorrhagic stroke	Home	136	29%	154	30%
	Patient died	151	32%	166	32%
	Discharge to long-term care	35	7%	21	4%
	Discharge to off-site rehabilitation	75	16%	83	16%
	Transfer	41	9%	37	7%
	Home with ESD	22	5%	33	6%
	Other/unknown	10	2%	20	4%
	Total	**470**	**100.0%**	**514**	**100.0%**
Total	Home	1693	52%	1817	52%
	Patient died	379	12%	394	11%
	Discharge to long-term care	209	6%	166	5%
	Discharge to off-site rehabilitation	449	14%	451	13%
	Transfer	274	8%	259	7%
	Home with ESD	166	5%	277	8%
	Other/unknown	80	2%	122	3%
	Total	**3250**	**100.0%**	**3486**	**100.0%**

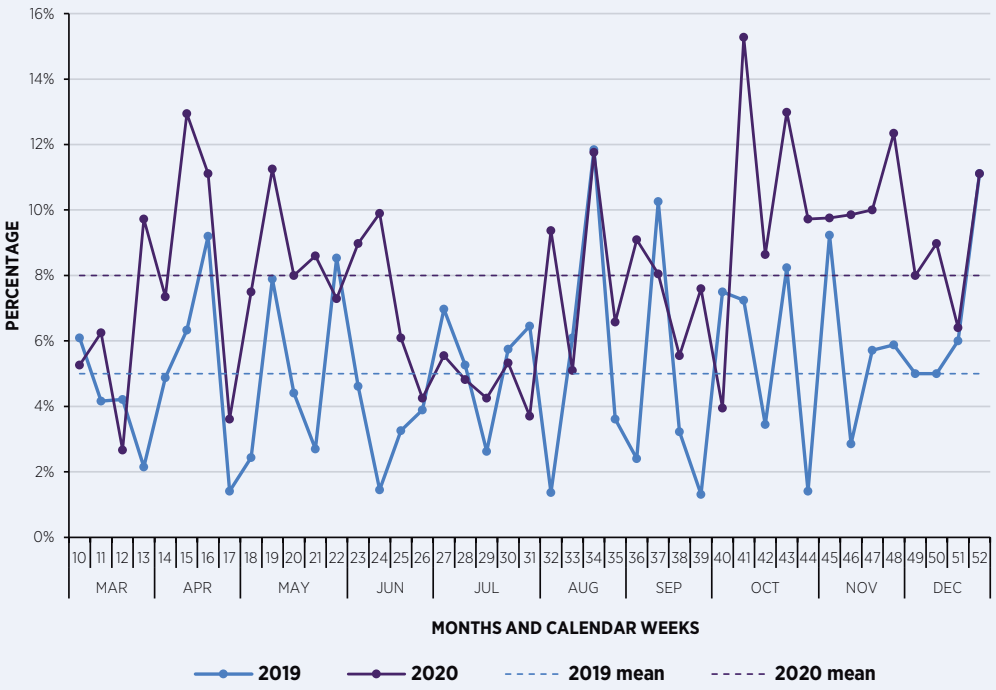

FIGURE 9.15: PROPORTION OF PATIENTS WITH A STROKE WHO WERE DISCHARGED HOME WITH EARLY SUPPORTED DISCHARGE, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (N=6736)

KEY FINDINGS FROM CHAPTER 9

- There was no substantial change in stroke activity between the pre-COVID-19 and COVID-19 periods. In the pre-COVID-19 period, 3,250 patients with a stroke were admitted to hospital; this rose to 3,486 patients during the COVID-19 period. The coverage of cases submitted to the stroke portal was higher during the COVID-19 period (92%, 4698/5085) compared to the pre-COVID-19 period (90%, 4275/4776), which may account for some of the increase in cases in the COVID-19 period.

- Some acute care processes improved during the COVID-19 period:
  - The median time from arrival at hospital to review by a medical team decreased from 16 minutes (IQR: 0–129 minutes) in the pre-COVID-19 period to 12 minutes (IQR: 0–75 minutes) in the COVID-19 period.
  - The DTI time was 60 minutes or less for 44% (n=1224) of patients in the pre-COVID-19 period; this increased to 47% (n=1443) of patients in the COVID-19 period.
  - The median DTI time decreased from 79 minutes in the pre-COVID-19 period to 67 minutes in the COVID-19 period.
  - The proportion of patients with a stroke who were discharged home with ESD increased in the COVID-19 period (8%, n=277) compared to the pre-COVID-19 period (5%, n=166) (Figure 9.15).

- Some acute care processes declined during the COVID-19 period:
  - The median DTN time in the pre-COVID-19 period was 54 minutes, and this increased to 58 minutes in the COVID-19 period (Figure 9.10).
  - During the pre-COVID-19 period, 44% (n=961) of patients with a stroke who had swallow screening performed had it performed within 4 hours of presentation to hospital; this decreased to 41% (n=993) in the COVID-19 period (Figure 9.12).
  - In the pre-COVID-19 period, 83% (n=2713) of patients with a stroke were assessed by a CNS; this fell to 78% (n=2729) in the COVID-19 period.
  - In the pre-COVID-19 period, 83% (n=2590) of patients with a stroke had their care discussed at multidisciplinary team meetings; this declined to 73% (n=2464) in the COVID-19 period (Figure 9.14).

- The median length of stay was shorter during the COVID-19 period compared to the pre-COVID-19 period for both total hospital stay (median: 8 days versus 10 days) and stroke unit stay (median: 7 days versus 8 days) (Figures 9.6 and 9.6A).

CHAPTER 10
AUDIT UPDATE

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CHAPTER 10: **AUDIT UPDATE**

UPDATE ON RECOMMENDATIONS FROM 2019 IRISH NATIONAL AUDIT OF STROKE (INAS) ANNUAL REPORT

Recommendations	Status
RECOMMENDATIONS FOR NOCA	
All hospitals providing acute stroke care should fully participate in the INAS.	**In 2019, 25 hospitals provided acute stroke care; however, 5 of these were excluded from the analysis as they did not submit sufficient data to the stroke portal. In 2020, 24 hospitals provided acute stroke care. Our Lady's Hospital, Navan no longer provides acute stroke care, and all INAS participating hospitals but one – Portiuncula University Hospital – are included in the 2020 INAS annual report. The Clinical Lead from Portiuncula University Hospital has performed an internal root cause analysis into the issues in relation to stroke data submission and, in collaboration with hospital management, is committed to improving data quality in 2021.** **The ongoing process of embedding data collection into the health and social care professional (HSCP) dataset was challenged in 2020, most likely due to COVID-19 restrictions. The number of hospitals that submitted data to the HSCP dataset fell from 17 in 2019 to 15 in 2020, although the total number of cases reported on increased from 2,483 in 2019 to 2,609 in 2020. Increasing communication with the participating HSCP bodies through the HSE's National Health and Social Care Professions Office is a recommendation in this report.**
Complete an organisational audit of stroke units in order to review the availability and accessibility of stroke unit beds, the availability of the appropriate number of trained stroke staff, and the accessibility of diagnostic tests and investigations.	**The INAS is in the process of completing the organisational audit, which is due to be published on the NOCA website in Q1 2022.**
Complete an audit of ESD services nationally.	**The INAS is in the process of completing the audit of ESD services, which is due to be published on the NOCA website in Q1 2022.**

RECOMMENDATIONS FOR THE NATIONAL STROKE PROGRAMME	
Develop a stroke awareness campaign.	**In 2020, the Irish Heart Foundation (IHF) delivered its Act F.A.S.T campaign, with the support of the Department of Health and the HSE and its National Stroke Programme (NSP) on radio and social media. The campaign was jointly funded by the Government of Ireland and the IHF. The NSP has completed costing for another national stroke awareness campaign and has submitted this to the HSE estimates process.**
Pilot a large vessel occlusion ambulance bypass to the EVT stroke centres in Dublin and Cork.	**This recommendation from the 2019 INAS report proposed a timeline for this pilot to be introduced in 2021. A working group has been established through the NSP in order to review the feasibility of a pilot ambulance bypass for patients with large vessel occlusion to the EVT stroke centres in Dublin and Cork. This recommendation remains the same in the 2020 INAS annual report.**
RECOMMENDATIONS FOR HOSPITAL MANAGERS, CLINICIANS AND AUDIT COORDINATORS	
Improve the level of swallow screening for patients with a stroke.	**All INAS participating hospitals now provide a swallow screening service; however, the majority (74%, n=17) are providing this service to less than 80% of their patients with a stroke. There was a slight improvement in the rate of swallow screening from 67% (n=2850) in 2019 to 68% (n=3507) in 2020. More hospitals performed above the national average rate of 68% in 2020 than the number of hospitals that performed above the national average rate of 67% in 2019. Accessing timely swallow screening (within 4 hours of hospital admission) remains low, however, at 43% (n=1507). Increasing access to stroke unit care would have an immediate impact on the prevalence of swallow screening, as patients with a stroke who are admitted to a stroke unit are almost twice as likely to have swallow screening than those who are not admitted to a stroke unit. In addition, the NSP is looking at ways to develop a quality improvement programme in order to improve the rate of swallow screening.** **The INAS has identified timely swallow screening as a key quality indicator, and this will be measured as part of the INAS quarterly reporting system to be implemented in Q4 2021.** **Improving the level of swallow screening for patients with a stroke remains a recommendation in this report.**
All stroke services should have access to a clinical neuropsychologist/ psychologist as part of a specialist multidisciplinary team providing care to patients with a stroke.	**Access to a clinical neuropsychologist /psychologist remains low, at 5% (n=241), a small increase from 2019 (4%, n=141). The 2021 organisational audit will identify the gaps in the provision of clinical neuropsychologist /psychologist positions nationally in order to further develop this recommendation.**

VALUE OF AUDIT

The INAS remains committed to a culture of quality improvement and audit in stroke care as a core aspect of service delivery in our health service. It has taken many years to embed the capture of high-quality data into practice and in 2020 there is additional clinical information available on 93% (5,422 cases out of 5,824 recorded by the Hospital In-Patient Enquiry [HIPE] system) (Table 3.2 of all patients with a stroke admitted to acute stroke services. This is an increase of 10 percentage points from the 83% reported in 2019 (4,444 cases out of 5,346 recorded by HIPE). Increasing the visibility of the quality of stroke care in hospitals in Ireland through the publication of the 2019 INAS annual report and its recommendations has led to increased hospital participation and improved data quality.

In December 2020, the virtual launch of NOCA's first INAS annual report was attended by more than 200 participants. The report was also presented at the IHF's 24th Annual Stroke Conference in April 2021.

The INAS data inform the NSP's KPIs, which in turn inform the HSE's *National Service Plan 2021* (HSE, 2021). Other key quality indicator results will drive further quality improvement initiatives as we work alongside the NSP to develop its National Stroke Strategy 2021–2026.

If implemented, the recommendations within the audit will lead to improved outcomes for patients by increasing stroke awareness in the population, thereby ensuring that more patients with a stroke attend hospital in time for acute treatments; reducing the incidence of stroke through improved primary prevention of stroke; and increasing the availability of stroke unit beds in order to ensure that patients receive evidence-based quality care.

As the INAS can provide validated and published data, it is now in a position to make the anonymised data available for research and service evaluation projects following NOCA policies and procedures. In 2020, one data request for research was approved by the INAS Governance Committee and we look forward to seeing the published results.

AUDIT DEVELOPMENTS/IMPROVEMENTS

TRAINING, EDUCATION AND SUPPORT

Due to COVID-19, 2020 brought many challenges to the health service, including limiting the opportunity to visit hospitals for additional training and education. Virtual audit coordinator meetings were held every 2 months to support the audit coordinators through new processes such as the data validation reporting system, to monitor the impact of COVID-19 restrictions on the INAS and to enhance communication between the INAS and the audit coordinators.

DATA QUALITY INITIATIVES

Data Validation Report

The implementation of Data Validation Reports (DVRs), along with quarterly coverage reports, was a new process to improve data coverage and completeness. The use of DVRs was piloted in 2019 and roll-out to all hospitals began in 2020. In order to minimise the work for audit coordinators during the COVID-19 pandemic, however, full roll-out of the DVRs was suspended but recommenced in 2021.

The DVR will be updated to include a validation to correct any anomalies in relation to the recording of inpatient stroke.

Data dictionary

The INAS data dictionary was updated in accordance with Health Information and Quality Authority (HIQA) data dictionary standards. A Health Research Board Applied Partnership award was granted in 2019 in order to review the current INAS dataset in relation to international stroke datasets. The research project is called Maximising the Quality of Stroke Care in Ireland – Development of a National Stroke Audit. The first output of this research was the development of a dataset for acute stroke care. Any change to the current dataset will require the approval of the INAS Governance Committee. The INAS training manual will be updated based on any agreed changes.

Quarterly reports

In 2020, the NOCA quarterly reports, which are disseminated to the Hospital Group managers, presented the results of the three national KPIs. NOCA is also in the process of developing an interactive dashboard-style reporting system in order to enhance access to audit results at hospital, Hospital Group and national level. The INAS Governance Committee has approved a series of Key Quality Indicators which have informed the development of the INAS dashboard; these key quality indicators are:

- percentage of cases admitted to a stroke unit
- percentage of time patients with a stroke spend in a stroke unit
- percentage of patients with ischaemic stroke who receive thrombolysis
- median time between hospital arrival time and brain imaging time
- median time between hospital arrival time and thrombolysis time
- percentage of cases that have a swallow screen completed
- percentage of cases that have a swallow screen completed within 4 hours of hospital arrival.

The dashboard is due to go live for the INAS in Q1 2022. Training and support will be provided by NOCA.

Dataset amendments in 2020

Following engagement with the National Thrombectomy Service (NTS), an additional variable was added to the thrombectomy dataset in 2020. Further amendments to this dataset took place in 2021 in order to ensure alignment with data collected by the NTS.

Working with the Healthcare Pricing Office

The Healthcare Pricing Office (HPO) is introducing a 'Discharge Mode' variable to the HIPE database on a test basis for patients discharged on or after 1 January 2022. This 'Discharge Mode' variable will complement the existing 'Discharge Code' variable (which identifies the discharge destination) and will provide information on the type of care the patient is moving to if transferred to another healthcare area or facility. Options will include discharge for 'Rehabilitation Care' and 'Geriatric Evaluation and Management Care'. Further information will be available in the *2022 HIPE Instruction Manual*, which will be available on www.hpo.ie in early 2022.

CHAPTER 11
RECOMMENDATIONS

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CHAPTER 11: **RECOMMENDATIONS**

RECOMMENDATIONS FOR NOCA

RECOMMENDATION 1

Complete a study in order to explore the factors contributing to stroke in patients prescribed anticoagulation therapy.

Rationale
• Atrial fibrillation (AF) is the rapid, irregular beating of the heart resulting in a slow flow of blood through the heart. As the blood slows down it pools, and this can result in the formation of blood clots. If a clot leaves the heart and travels to the brain, it can cause a stroke by blocking the flow of blood through cerebral arteries. AF is treated with medications that prevent the formation of blood clots in the heart. Anticoagulation with warfarin decreases the risk of stroke by 50–80% (Garkina *et al*., 2016) and the 2020 European Society of Cardiology guidelines for the diagnosis and management of AF recommend the use of direct oral anticoagulants (DOACs) for patients with AF (Hindricks *et al*., 2021). In 2020, 17% (n=891) of all patients with a stroke had a diagnosis of AF pre-stroke. Treatment with anticoagulant medication pre-stroke was reported in 85% (n=756) of these cases: direct oral anticoagulant (DOAC) treatment was reported in 71% (n=540) of cases, warfarin treatment was reported in 12% (n=94) of cases and in 16% (n=122) other antiplatelet and/or anticoagulant were prescribed. Understanding why strokes are occurring in patients on anticoagulant medication is likely to be multifactorial and requires detailed study of issues such as medication type, medication dosage and patient compliance.
What action should be taken?
• A study of patients with AF who have a stroke while prescribed anticoagulation therapy should be undertaken. The aim of the study would be to identify how well the patient is anticoagulated prior to the stroke event (e.g. assess the patient's medication levels) and to assess how well the patient complies in taking the medication, in addition to investigating reasons for discontinuation of therapy.
Evidence that the action will be effective
• A variety of factors have been described that may contribute to stroke despite anticoagulation, including medication type and dosage, as well as patient compliance (Garkina *et al*., 2016). Camm *et al*. (2020) found that the majority of patients (72.9%) received the recommended dosage; however, 23.2% were underdosed and 3.8% were overdosed. Further research will allow us to determine the contributory factors to stroke despite anticoagulation in the Irish context.
Who will benefit from the recommendation?
• Patients with AF diagnosed pre-stroke will benefit from the reduction of stroke events. Primary and secondary care teams will also benefit from an improved understanding of the factors that contribute to stroke despite anticoagulation. Care pathways can be reviewed and enhanced based on the results of the study.
Who is responsible for implementation?
• The INAS will lead on the study.
When should this be implemented?
The study of patients with AF who have a stroke while prescribed anticoagulation therapy should be conducted from 2021 to 2023.

RECOMMENDATION 2

Increase the participation of HSCPs in the HSCP dataset within the Irish National Audit of Stroke (INAS).

Rationale

- Clinical audit is designed to measure and improve the quality of patient care. In 2018, the HSCP dataset (collecting additional data from physiotherapy, occupational therapy, and speech and language therapy) was added to the INAS. The collection of HSCP data remains in the implementation phase. In 2020, 15 hospitals had additional data recorded for patients who were seen by a physiotherapist, occupational therapist or a speech and language therapist; this was a reduction from 2019 (n=17). In 2020, 9 hospitals had all three included disciplines reporting to the audit, which was a decrease from 11 hospitals in 2019.

What action should be taken?

- The INAS, with the assistance of the National Health and Social Care Professions Office, will work to improve communications with physiotherapists, occupational therapists, and speech and language therapists in order to encourage increased participation in the INAS. The INAS will also develop links with the quality improvement departments in all hospitals. Active engagement between quality improvement departments in hospitals and the participating HSCPs may help to increase the volume and quality of data collection.

Evidence that the action will be effective

- The Commission on Patient Safety and Quality Assurance, established by the Department of Health, recognised clinical audit as a key component of clinical governance, stating that it "constitutes the single most important method which any healthcare organisation can use to understand and ensure the quality of the service that it provides" (Department of Health, 2008, p151). Increasing sophistication of clinical audits has been accompanied by significant improvements in the care of patients, and, although not entirely attributable to the audits, the provision of high-quality comparative data has been a real stimulus for improvement (Stewart *et al.*, 2016).

Who will benefit from the recommendation?

- All patients with a stroke will benefit from care provision that views quality improvement as an important aspect of patient-centred care, which should result from the increased participation of HSCPs within the INAS.

Who is responsible for implementation?

- The INAS is responsible for implementation and will work in collaboration with the National Health and Social Care Professions Office to improve communication with the participating HSCPs.

When should this be implemented?

Implementation is an ongoing process.

RECOMMENDATIONS FOR THE NATIONAL STROKE PROGRAMME

RECOMMENDATION 3

Develop a stroke awareness campaign.

Rationale

- The INAS continues to highlight the need to increase public awareness of the symptoms of stroke and the importance of seeking immediate emergency care. People often do not recognise stroke symptoms and cannot identify when the symptoms began. In almost one-half (42%, n=2073) of patients with a stroke in 2020, excluding inpatients diagnosed with a stroke, the date and time of onset of stroke symptoms was not known. The main reason for this is that the patient or family member cannot identify the time of symptom onset. Among patients who could identify the date and time of onset of stroke symptoms in 2020, 40% (n=1123) arrived to hospital at least 4.5 hours after onset of stroke symptoms (Figure 4.3), thus excluding them from treatment with thrombolysis and limiting their access to further acute treatment such as thrombectomy.

What action should be taken?

- In 2020, the IHF delivered its Act F.A.S.T campaign, with the support of the Department of Health and the HSE and its NSP on radio and social media. The campaign was jointly funded by the Government of Ireland and the IHF. The costing for another national stroke awareness campaign has been completed by the NSP as part of its National Stroke Strategy 2021–2026. The INAS recommends funding this campaign as a priority in order to ensure that patients access care as quickly as possible in the event of a stroke.

Evidence that the action will be effective

- 'Time is Brain' is the phrase used to indicate that the shorter the time to treatment, the more brain can be saved, with reductions in the rate of disability (Saver, 2005). For patients with a severe stroke, every minute saved for a patient undergoing thrombectomy results in an additional week of independent living (Meretoja *et al*., 2017). In 2010–2011, a TV and radio Act F.A.S.T. campaign was run, which saw an increase in stroke awareness in the population and in hospital attendance, but this trend reversed when the campaign ended (Hickey *et al*., 2018).

Who will benefit from the recommendation?

- All citizens will benefit from increased stroke awareness for themselves and for their families, friends and colleagues. In addition, individuals who suffer a stroke will benefit from a reduction in disability after stroke if treated early.

Who is responsible for implementation?

- The NSP will lead in the development of a stroke awareness campaign in collaboration with key stakeholders in the Department of Health and the HSE.

When should this be implemented?

The next stroke awareness campaign should be implemented by the end of 2022

RECOMMENDATION 4

Pilot a large vessel occlusion ambulance bypass for patients with a large vessel occlusion to the EVT stroke centres in Dublin and Cork.

Rationale

- As in 2019, we continue to recommend piloting a large vessel occlusion bypass model that would enable patients with a stroke to be redirected to the EVT stroke centres in Dublin and Cork. Again in 2020, as in 2019, the majority of thrombectomy cases (72%, n=275) were transferred to an EVT stroke centre from another hospital rather than being admitted directly to an EVT stroke centre (Figure 5.3). The median time from onset of stroke symptoms to arrival at an EVT stroke centre was 1 hour and 34 minutes for patients who were admitted directly to an EVT stroke centre, and 4 hours and 23 minutes for those who were transferred to an EVT stroke centre from another hospital; this median time from symptom onset to arrival at an EVT stroke centre for those who were transferred represents a 23-minute increase from the median time in 2019. The median time from onset of stroke symptoms to recanalisation was shorter for thrombectomy patients who were admitted directly to an EVT stroke centre (3 hours and 39 minutes) than for thrombectomy patients who were transferred from another hospital (5 hours and 12 minutes). Again, this is an increase of 33 minutes, from 4 hours and 39 minutes in 2019.

  Currently, all patients with a stroke are brought to the nearest hospital for initial assessment and are then referred to an EVT stroke centre when thrombectomy is indicated. Early recanalisation is key to recovery from stroke. If patients with large vessel occlusion could be transferred directly to an EVT stroke centre without first going to a primary hospital, a considerable amount of time would be saved, which should result in improved outcomes. However, in some cases, it may be better to attend the nearest hospital if other acute treatments can also be provided there within a certain time frame (Holodinsky *et al.*, 2018).

  Identification of patients with a large vessel occlusion could be achieved through the use of a screening tool by trained personnel in the ambulance service. The NTS, in conjunction with the NSP and the National Ambulance Service, has identified a scale for use by the National Ambulance Service for the identification of patients with likely large vessel occlusion, to be combined with making a phone call to the EVT stroke centre for confirmation of suitability for transfer. Training material for this screening tool has been prepared. Once this has been agreed, such patients should then go directly to the EVT stroke centre, undergo EVT if appropriate and, at a suitable time, get transferred to the hospital they otherwise would have attended. This could be modelled on the HSE's existing Acute Coronary Syndromes Programme Model of Care (HSE, 2012b).

What action should be taken?

- A large vessel occlusion bypass model should be piloted that would enable patients within the catchment area of specified Dublin and Munster hospitals to be redirected from their nearest hospital directly to the EVT stroke centres in Beaumont Hospital or Cork University Hospital. The NSP should lead on the establishment of a working group, to assess the feasibility of a large vessel occlusion ambulance bypass, which should examine the complex operational issues involved in such a model of care.

Evidence that the action will be effective
• Thrombectomy is most commonly indicated for patients who have the most severe kind of stroke. There is a large body of evidence in the literature indicating that early recanalisation is associated with better outcomes (Jahan *et al.*, 2019; HIQA, 2017b; Saver *et al.*, 2016). For patients with severe stroke, the earliest possible intervention with thrombectomy greatly improves their chances of survival and of returning to independent living.
Who will benefit from the recommendation?
• All patients with severe stroke who were not severely frail pre-stroke will benefit from the piloting of a large vessel occlusion bypass model that could lead to earlier intervention at an EVT stroke centre.
Who is responsible for implementation?
• The NSP will lead on the implementation of the pilot, facilitated by the Office of the Chief Clinical Officer HSE and in conjunction with the NTS and the National Ambulance Service
When should this be implemented?
The NSP and related stakeholders are recommended to commence implementing the pilot in 2022.

RECOMMENDATION 5

Improve the level of swallow screening for patients with a stroke.

Rationale

- All patients with acute stroke should have their swallow screened by a trained healthcare professional, using a validated screening tool, within 4 hours of arrival at hospital and before any oral intake (NSP, 2017). All hospitals providing stroke services provide a swallow screening service; however, the majority (74%, n=17) are providing this service to less than 80% of their patients with a stroke. In 2020, 68% (n=3507) of patients with a stroke had a swallow screen performed (Figure 6.3), with less than one-half (43%, n=1507) of those patients having the swallow screen completed within 4 hours of arrival at hospital. This remains largely unchanged from 2019. The INAS has identified timely swallow screening as a key quality indicator; this will be measured and reported on as part of the INAS quarterly reporting system due to be implemented in Q1 2022.

What action should be taken?

- All stroke services should ensure that enough staff are trained in swallow screening in order to enable adequate provision 24 hours a day, 7 days a week. A quality improvement process should be undertaken to identify new processes and any barriers to implementation in order to ensure timely swallow screening. The INAS quarterly reports, which will be available in Q1 2022, should be monitored at individual hospital and Hospital Group level to measure the effectiveness of any new initiatives.

Evidence that the action will be effective

- Swallowing difficulties are common in patients with a stroke, and this can lead to food, fluid, and/or saliva entering the airway. This increases the risk of pneumonia and therefore poor outcomes, including a longer hospital stay and a higher risk of disability and death (Martino *et al*., 2009). Early swallow screening is recommended in both the IHF's *National Clinical Guidelines and Recommendations for the Care of People with Stroke and Transient Ischaemic Attack* (2010) and the Royal College of Physicians' *National clinical guideline for stroke* (2016). Bray *et al*. (2017) found that delays in screening for swallow difficulties after stroke are associated with an increased risk of stroke-related pneumonia.

Who will benefit from the recommendation?

- This will benefit all patients with a stroke by ensuring that they are not kept without food or fluids unnecessarily, and by ensuring that swallow assessment by a speech and language therapist can be prioritised for patients who require urgent evaluation.

Who is responsible for implementation?

- Each individual hospital and Hospital Group providing stroke services is responsible for the provision of a swallow screening service 24 hours a day, 7 days a week. The NSP is responsible for the development of a national quality improvement project to support the delivery of timely swallow screening.

When should this be implemented?

Provision of a swallow screening service 24 hours a day, 7 days a week should be implemented in all hospitals providing acute stroke services by 2022.

RECOMMENDATION 6

All stroke services should have access to a clinical neuropsychologist/psychologist as part of a specialist multidisciplinary team providing care to patients with a stroke.

Rationale

- The INAS continues to highlight the large deficit in the provision of psychology services to patients with a stroke in all hospitals. In 2020, only 5% (n=241) of patients with a stroke were assessed by a psychologist, and only 29% (n=1488) had a mood screen performed. The National Stroke Audit 2015, found that 19% of hospitals in Ireland had access to psychology services and that only 4% of patients with a stroke were referred to a psychologist (McElwaine *et al.,* 2015). This suggests that access to psychology services has not improved in the intervening years. Stroke unit care must be underpinned by a comprehensive specialist multidisciplinary team that includes a clinical psychologist (Royal College of Physicians, 2016; IHF, 2010).

What action should be taken?

- The National Stroke Programme (NSP) should publish an evidence-based guidance document on assessment of mood for patients with a stroke. All hospitals offering a stroke service should provide psychology services. A well-resourced psychology service can address the needs of patients at acute, post-acute and long-term stages of care, both in the hospital and at home. As with the rest of the stroke multidisciplinary team, resourcing of psychologists should be aligned with stroke staffing guidelines (Royal College of Physicians, 2016).

Evidence that the action will be effective

- Mood disturbance after stroke is common: 30% of patients with a stroke will suffer from depression at some point post-stroke, and a considerable proportion of these remain undiagnosed or inadequately treated (Hackett and Pickles, 2014). Psychological mood disturbance is associated with higher rates of mortality, long-term disability, hospital readmission, suicide, and utilisation of outpatient services if untreated (Gillham and Clark, 2011).

Who will benefit from the recommendation?

- All patients with a stroke and their families/carers will benefit from increased psychology services to support them during the different stages of recovery. The availability of a guidance document on mood assessment in stroke will assist the stroke teams caring for patients with a stroke to deliver holistic, evidenced based care. Stroke multidisciplinary teams will benefit from the expertise of a psychologist as part of the team through increased opportunities for education and training.

Who is responsible for implementation?

- The NSP should publish an evidence-based guidance document on assessment of mood for patients with a stroke. The NSP has identified the requirements of a fully resourced psychology service for each stroke service and resourcing should form part of the implementation of the forthcoming National Stroke Strategy 2021-2026.

When should this be implemented?

The completion of a guidance document on the assessment of mood for patients with stroke should be completed in 2022. The provision of a psychology service for each stroke service in Ireland should be implemented by the end of 2026.

CONSIDERATION/LEARNING POINT

The stroke care pathway has become more complex due to advancing technologies such as EVT and neurosurgical interventions. These interventions are carried out in designated centres, which requires the transfer of patients from one hospital to another. In addition, inpatient rehabilitation can be provided in a different hospital or care setting than the hospital providing the acute stroke care. As a result, without a way to uniquely identify each patient no matter the care setting, capturing data reflective of the total patient pathway is challenging and can impact on results such as hospital length of stay and number of hospital admissions. While every effort is made to account for such variation through the inclusion and exclusion criteria within this audit, it is very difficult to accurately quantify activity within each stroke service, and the record of care ends on discharge from the acute care setting. The burden of data collection is huge and inefficient, with duplication of effort in each stroke service. The INAS advocates for the development of technology that would streamline data collection, and would value the implementation of a national individual health identifier in all healthcare settings in order to ensure that the full stroke care pathway from onset of stroke symptoms through to care in the community is reflected in audit activity.

CHAPTER 12
CONCLUSION

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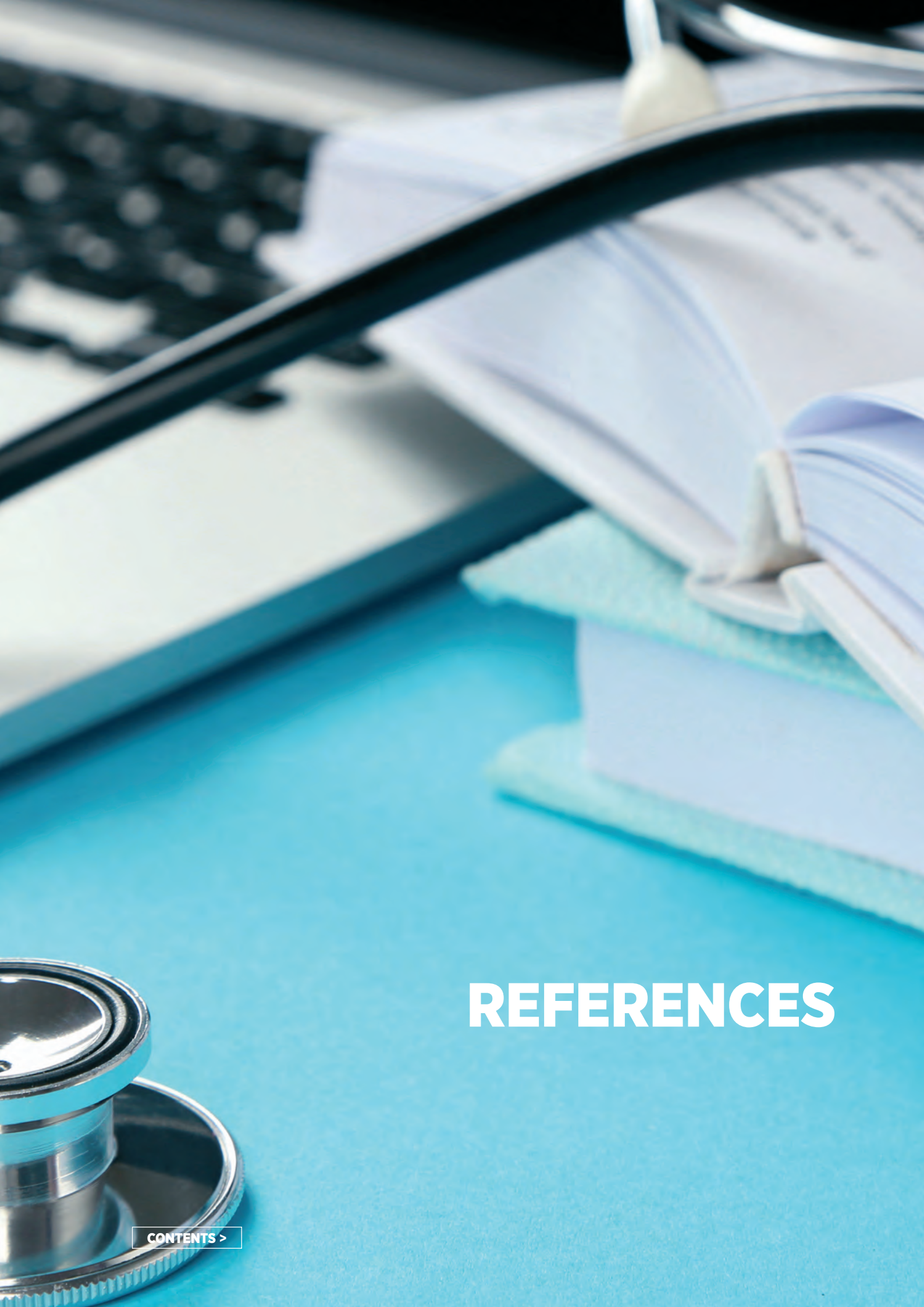
CHAPTER 12: **CONCLUSION**

This year's INAS report was compiled from data collected throughout the COVID-19 pandemic, and the authors would like to congratulate all participating staff for their dedication to achieving a higher level of completeness than previously reached by the INAS. This report demonstrates that stroke services across Ireland remained functional and effective throughout a most difficult year. It shows that stroke care remained effective and of high quality across a range of variables, although it also identified important shortcomings that have been evident and resistant to improvement over a number of years. It is hoped that increased awareness and vigilance with respect to these problems, and identification of areas of care that lack important elements of resource provision or organisation, will help stroke services to continue to improve the quality of their care.

We are aware that some of the shortcomings in performance relate to organisational and structural issues. The NSP has recently submitted a strategy document proposing solutions for improvement of stroke services and the INAS strongly support this proposed strategy's objectives. As recommended in 2019, and in support of this strategy, the INAS is undertaking the first organisational audit of Irish stroke services since 2015. The NSP will use the findings from this audit to inform the implementation of the forthcoming National Stroke Strategy 2021-2026. We intend that such organisational audits will be conducted on a biannual or annual basis in future, as a means of assessing the development of stroke services against local and international standards.



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APPENDICES

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APPENDIX 1: INAS GOVERNANCE COMMITTEE

NAME	TITLE
Dr Tim Cassidy	Chairperson of Irish National Audit of Stroke Governance Committee Consultant in Medicine for the Elderly and Stroke Physician, St Vincent's University Hospital
Prof. Joe Harbison	Clinical Lead – Irish National Audit of Stroke Consultant Geriatrician and Stroke Physician, St James's Hospital
Joan McCormack	Cardiovascular Programme Audit Manager, National Office of Clinical Audit
Martin Quinn	Public and Patient Interest Representative, Irish National Audit of Stroke Governance Committee Stroke Survivor and Advocate, Irish Heart Foundation
Dr Marcia Ward	Public and Patient Interest Representative, Irish National Audit of Stroke Governance Committee Senior Clinical Neuropsychologist, Headway
Ann Dalton	Deputy Chief Executive Officer/Chief Operations Officer, St James's Hospital
Dr Margaret O'Connor	Consultant in Geriatric Medicine, University Hospital Limerick
Prof. Rónán Collins	Clinical Lead, National Clinical Programme for Stroke Consultant in Geriatric and Stroke Medicine, Tallaght University Hospital
Prof. John Thornton	Consultant Neuroradiologist, Beaumont Hospital Director, National Thrombectomy Service
Dr Eugene Wallace	Consultant in Rehabilitation Medicine, National Rehabilitation Hospital
Una Moffatt	Advanced Nurse Practitioner in Stroke Care, Sligo University Hospital
Glen Arrigan	Clinical Nurse Specialist in Stroke, Cork University Hospital
Claire Prendergast	Clinical Specialist Physiotherapist in Stroke, Our Lady of Lourdes Hospital Drogheda
Dr Breda Smyth	Director of Public Health, HSE West
Paul Gallagher	Chief Director of Nursing & Midwifery, Ireland East Hospital Group
Deirdre Murphy	Head of Hospital In-Patient Enquiry, Healthcare Pricing Office

APPENDIX 2: INAS DATASET

Stroke audit portal variables

CORE CLINICAL DATASET	
Question	**Options**
1A. Why was the patient transferred?	1) Thrombolysis; 2) Thrombectomy; 3) Neurosurgery; 8) Other
1B. If other transfer reason, please specify.	Free text
1C. If other transfer hospital, please specify.	Free text
2. Date of onset of stroke symptoms	
3. Time of onset of stroke symptoms	
3A. If time of onset of stroke symptoms is unknown, what date was the patient last known to be well?	
3B. If time of onset of stroke symptoms is unknown, what time was the patient last known to be well?	
4. Did the stroke occur while the patient was in hospital for treatment of another condition?	1) Yes; 2) No; 9) Unknown
4A. If no, date of presentation to hospital	
4B. If no, time of presentation to hospital	
4C. If presentation time is unknown, was presentation to hospital within 4.5 hours of onset of stroke symptoms?	1) Yes; 2) No; 9) Unknown
5. Medical assessment date	
5A. Medical assessment time	
6. Was brain CT or MRI performed?	1) Yes; 2) No; 3) Performed pre-admission/hospital transfer; 9) Unknown
6A. If yes, first brain imaging date	
6B. If yes, first brain imaging time	
7. Did the patient receive intravenous (IV) thrombolysis?	1) Yes; 2) No; 5) Contraindicated
7A. If yes, enter date.	
7B. If yes, enter time.	
7C. If yes, was intracerebral bleed seen on scan within 36 hours?	1) Yes; 2) No; 9) Unknown

APPENDIX 2: INAS DATASET

Stroke audit portal variables

Question	Options
7D. If intracerebral bleed, was neurological deterioration associated with it?	1) Yes; 2) No; 9) Unknown
9. Was a swallow screen completed?	1) Yes; 2) No; 9) Unknown
9A. If yes, was a swallow screen completed within 4 hours of presentation?	1) Yes; 2) No; 9) Unknown
10. Modified Rankin Scale score pre-stroke	0) 0; 1) 1; 2) 2; 3) 3; 4) 4; 5) 5; 6) 6; 9) Unknown
11. Admitted to stroke unit (key performance indicator)	1) Yes; 2) No
11A. If yes, date admitted to stroke unit (key performance indicator)	
11B. If yes, date discharged from stroke unit (key performance indicator)	
11C. If no, give reason why.	1) No stroke unit; 2) Bed not available; 5) Infection control risk; 8) Other
11C2. If other reason, please specify.	Free text
12. Allied health professional (AHP) assessment	1) Yes; 2) No
12A. If yes, physiotherapist	1) Yes; 2) No; 3) Not indicated; 9) Unknown
12B. If yes, occupational therapist	1) Yes; 2) No; 3) Not indicated; 9) Unknown
12C. If yes, speech and language therapist	1) Yes; 2) No; 3) Not indicated; 9) Unknown
12D. If yes, dietitian	1) Yes; 2) No; 3) Not indicated; 9) Unknown
12E. If yes, medical social worker	1) Yes; 2) No; 3) Not indicated; 9) Unknown
12F. If yes, psychologist	1) Yes; 2) No; 3) Not indicated; 9) Unknown
13. Was the patient assessed by a stroke nurse specialist?	1) Yes; 2) No; 9) Unknown
13A. If no, give reason why.	Free text
14. Multidisciplinary meeting case assessment?	1) Yes; 2) No; 3) Not indicated; 9) Unknown
14A. Was an assessment of mood completed and documented by a member of the multidisciplinary team?	1) Yes; 2) No; 3) Not indicated; 9) Unknown
15. Does the patient have symptomatic carotid stenosis?	1) Yes; 2) No; 9) Unknown
15A. If symptomatic carotid stenosis, was the patient referred for carotid endarterectomy?	1) Yes; 2) No; 9) Unknown

APPENDIX 2: INAS DATASET

Stroke audit portal variables

Question	Options
15B. If symptomatic carotid stenosis, was the patient referred for carotid stenting?	1) Yes; 2) No; 9) Unknown
16. Was new or altered antithrombotic therapy prescribed for acute treatment?	1) Yes; 2) No; 3) Contraindicated; 9) Unknown
16A. If yes, give antiplatelet or anticoagulant (for acute treatment) start date.	
17. Does the patient have atrial fibrillation?	1) Yes; 2) No; 4) Results pending; 9) Unknown
17A. If atrial fibrillation, was atrial fibrillation known prior to stroke onset?	1) Yes; 2) No; 9) Unknown
17B. If atrial fibrillation known prior to stroke onset, was antiplatelet and/or anticoagulant prescribed prior to stroke onset?	1) Yes; 2) No; 9) Unknown
17B(I). If yes, please specify antiplatelet/ anticoagulant prior to stroke.	0) NOAC; 1) Warfarin; 5) Aspirin; 6) Clopidogrel; 7) Other antiplatelet; 8) Dual antiplatelet therapy; 9) Antiplatelet and anticoagulant
17C. If atrial fibrillation known prior to stroke onset, and on warfarin, was the international normalised ratio (INR) 2–3 at stroke onset?	1) Yes; 2) No; 9) Unknown
17D. If atrial fibrillation, was anticoagulation prescribed for secondary prevention?	1) Yes; 2) No; 9) Unknown
17D(I). If yes, please specify antiplatelet/ anticoagulant on discharge.	0) NOAC; 1) Warfarin; 5) Aspirin; 6) Clopidogrel; 7) Other antiplatelet; 8) Dual antiplatelet therapy; 9) Antiplatelet and anticoagulant
17D(II). If no, please enter reason documented.	1) No reason documented; 2) Major bleeding (prior history); 3) Severe illness (e.g. cancer, dementia); 4) Poor compliance (known or suspected); 5) Patient refused anticoagulant; 6) Alcohol excess; 7) Falls; 8) Extreme frailty; 9) Liver disease
18. Modified Rankin Scale score on discharg	0) 0; 1) 1; 2) 2; 3) 3; 4) 4; 5) 5; 6) 6; 9) Unknown
19. Discharge destination	1) Home; 2) Patient died; 3) Discharge to long-term care; 4) Discharge to off-site rehabilitation; 5) Transfer to referring hospital; 6) Transfer to other hospital for ongoing stroke care; 7) Home with ESD; 8) Other; 9) Unknown
20. Case complete	1) Yes; 2) No; 9) Unknown

APPENDIX 2: INAS DATASET

THROMBECTOMY DATASET	
Question	**Options**
8. Did the patient have thrombectomy in this hospital (Beaumont Hospital/Cork University Hospital only)?	1) Yes; 2) No
8A. National Institutes of Health Stroke Scale (NIHSS) score pre-thrombectomy	
8B(I). Date of performance of non-contrast CT scan	
8B(II). Time of performance of non-contrast CT scan	
8C(I). Date of performance of non-contrast CTA	
8C(II). Time of performance of non-contrast CTA	
8D(II). Date of contact with the endovascular stroke centre	
8D(II). Time of contact with the endovascular stroke centre	
8E(I). Date of decision to transfer patient	
8E(II). Time of decision to transfer patient	
8F(I). Date of arrival at the endovascular stroke centre	
8F(II). Time of arrival at the endovascular stroke centre	
8G(I). Did the patient have repeat non-invasive imaging in the endovascular stroke centre	1) Yes; 2) No; 9) Unknown
8G(II). If yes, please specify	1) Non-contrast CT scan; 2) CTA; 3) Perfusion CT scan; 4) MRI
8H. Site of most proximal occlusion	1) MCA 1; 2) MCA 2; 3) Basilar; 4) ICA carotid T/L; 5) ICA cervical segment; 6) PCA; 7) Vertebrobasilar
8J. Second occlusion site	
8K. Associated carotid stenosis greater than 50%	1) Yes; 2) No; 9) Unknown
8L(II). Thrombolysis in cerebral infarction (TICI) pre-thrombectomy	
8L(III). TICI post-thrombectomy	
8M(I). Date of groin puncture	

APPENDIX 2: INAS DATASET

Question	Options
8M(II). Time of groin puncture	
8N(I). Date of first pass	
8N(II). Time of first pass	
8P(I). Date of first reperfusion	
8P(II). Time of first reperfusion	
8Q(I). Date of final angiogram	
8Q(II). Time of final angiogram	
8R. Immediate complications	0) n/a; 1) Haemorrhage; 2) Embolus into separate vascular territory; 3) Dissection; 8) Other; 9) Unknown
8S. National Institutes of Health Stroke Scale (NIHSS) score 24 hours post-thrombectomy	
8T(II). Following the procedure, was the patient transferred immediately back to primary receiving hospital?	1) Yes; 2) No; 9) Unknown
8T(II). If no, when was the patient admitted to the endovascular stroke centre?	1) 0–3 hours; 2) 3–12 hours; 3) 12–24 hours; 4) 24+ hours
8U1. Was the patient transferred from another hospital?	1) Yes; 2) No; 9) Unknown
8U2. If yes, what date did the patient arrive at the referring/first hospital?	
8U3. If yes, what time did the patient arrive at the referring/first hospital?	

APPENDIX 2: INAS DATASET

HEALTH AND SOCIAL CARE PROFESSIONAL DATASET	
Question	**Options**
21. Was the patient referred to a physiotherapist?	1) Yes; 2) No; 3) Unknown
21A. If yes, please provide date of referral.	
22. Was the patient seen by a physiotherapist?	1) Yes; 2) No; 3) Discharged before seen; 9) Unknown
22A. If yes, date of initial contact by physiotherapist	
23. Indoor mobility pre-admission	1) Independent, no aid; 2) Independent, with an aid; 3) Supervision or assistance of one person +/- aid; 4) Transfer only with assistance +/- aid; 5) Hoist transfer; 9) Unknown
24. Were standardised outcome measures used?	1) Yes; 2) No; 3) Unknown
25. Was the intensity of physiotherapy sufficient?	1) Yes 80–100%; 2) Moderate 50–79%; 3) No 0–49%; 9) Unknown
25A. Was intensity calculated on minutes of therapy?	1) Yes; 2) No; 3) Unknown
26. Did the patient require more than one therapist/physiotherapist assistant for more than half of their treatment sessions?	1) Yes; 2) No; 3) Unknown
27. Indoor mobility on discharge	0) n/a (died); 1) Independent, no aid; 2) Independent, with an aid; 3) Supervision or assistance of one person +/- aid; 4) Transfer only with assistance +/- aid; 5) Hoist transfer; 9) Unknown
28. Onward physiotherapy referral to	0) n/a (died); 1) Inpatient rehabilitation; 2) Community physiotherapy; 3) ESD physiotherapy; 4) Stroke-specific outpatient physiotherapy; 5) Day hospital; 8) Other; 9) Unknown
29. Was the patient referred to an occupational therapist?	1) Yes; 2) No; 3) Unknown
29A. If yes, please provide date of referral.	
30. Was the patient seen by an occupational therapist?	1) Yes; 2) No; 3) Discharged before seen; 9) Unknown
30A. If yes, date of initial assessment by an occupational therapist	
31. Prior to admission, which would best describe the patient's ability to attend to their personal activities of daily living?	1) Independent; 2) Independent, with cues/aids; 3) Required supervision or set-up; 4) Required assistance; 5) Dependent/full care; 6) Unknown
32. Was the patient a driver prior to admission?	1) Yes; 2) No; 3) Unknown
32A. If yes, was the patient advised prior to discharge about driving limitations post-stroke?	1) Yes; 2) No; 3) Unknown
33. Did the patient work in paid employment prior to admission?	1) Yes; 2) No; 3) Unknown

APPENDIX 2: INAS DATASET

Question	Options
33A. If yes, was the person advised about return to work prior to discharge?	1) Yes; 2) No; 3) Onward referral made; 4) Unknown
34. Was the intensity of occupational therapy input sufficient?	1) Yes 80–100%; 2) Moderate 50–79%; 3) No 0–49%; 9) Unknown
34A. Was intensity calculated on minutes of therapy?	1) Yes; 2) No; 3) Unknown
35. Did the patient require more than one therapist/therapy assistant for more than half of their treatment sessions?	1) Yes; 2) No; 3) Unknown
36. Were visual fields assessed during the admission?	1) Yes, using confrontation testing; 2) Yes, using perimetry testing; 3) Yes, using both confrontation and perimetry testing; 4) Attempted, but unable due to patient factors; 5) No; 6) Unknown
37. Was screening for cognitive impairment completed, using a valid screening measure?	1) Yes; 2) No; 3) Unable to complete due to patient factors; 4) Unknown
38. On discharge, which would best describe the patient's ability to attend to their personal activities of daily living?	0) n/a (died); 1) Independent; 2) Independent, with cues/aids; 3) Required supervision or set-up; 4) Required assistance; 5) Dependent /full care; 9) Unknown
39. Was an onward referral made for further occupational therapy intervention?	0) n/a (died); 1) Yes; 2) No; 9) Unknown
39A. If yes, to what service?	1) Inpatient rehabilitation (off-site); 2) Community occupational therapy; 3) ESD occupational therapy; 4) Other
40. Was the patient referred to a speech and language therapist?	1) Yes; 2) No; 3) Unknown
40A. If yes, please provide date of referral.	
41. Was the patient seen by a speech and language therapist?	1) Yes; 2) No; 3) Discharged before seen; 9) Unknown
41A. If yes, date of initial contact by speech and language therapist	
42. Functional communication ability prior to admission	1) No difficulties; 2) Mild: effective communication >80% – occasional breakdown in conversation; 3) Moderate: effective communication 50–79% – frequent breakdown in conversation; 4) Severe: less than half (10–49%) of communication attempts are successful; 5) Profound: no, or occasional (<10%) communication attempts are successful; 9) Unknown
43. Modified diet recommended prior to admission	1) Yes; 2) No; 3) Unknown
44. Modified fluids recommended prior to admission	1) Yes; 2) No; 3) Unknown
45. Speech and language therapist initial assessment diagnosis	1) Difficulties identified; 2) No issues identified
45A. Does the patient have swallowing difficulty?	1) Yes; 2) No; 3) Unknown
45B. Does the patient have dysarthria?	1) Yes; 2) No; 3) Unknown
45C. Does the patient have dyspraxia?	1) Yes; 2) No; 3) Unknown

APPENDIX 2: INAS DATASET

Question	Options
45d. Does the patient have aphasia?	1) Yes; 2) No; 3) Unknown
45e. Does the patient have cognitive linguistic communication disorder?	1) Yes; 2) No; 3) Unknown
45f. Does the patient have voice difficulties?	1) Yes; 2) No; 3) Unknown
45g. Other difficulties, please specify	Free text
46. Was the patient nil by mouth pending swallow assessment?	1) Yes; 2) No; 3) Unknown
47. Was videofluoroscopy completed during episode?	1) Yes; 2) No; 3) Indicated but not available; 9) Unknown
48. Was flexible endoscopic evaluation of swallowing (FEES) completed during episode?	1) Yes; 2) No; 3) Indicated but not available; 9) Unknown
49. Was the intensity of speech and language therapy sufficient?	1) Yes 80–100%; 2) Moderate 50–79%; 3) No 0–49%; 9) Unknown
49a. Was intensity calculated on minutes of contact?	1) Yes; 2) No; 3) Unknown
50. New enteral feeding required on discharge	0) n/a (died); 1) Yes; 2) No; 9) Unknown
51. Newly modified diet recommended at discharge	0) n/a (died); 1) Yes; 2) No; 9) Unknown
52. Newly modified fluids recommended at discharge	0) n/a (died); 1) Yes; 2) No; 9) Unknown
53. Functional communication ability at discharge	0) n/a (died); 1) No difficulties; 2) Mild: effective communication >80% – occasional breakdown in conversation; 3) Moderate: effective communication 50–79% – frequent breakdown in conversation; 4) Severe: less than half (10–49%) of communication attempts are successful; 5) Profound: no, or occasional (<10%) communication attempts are successful; 9) Unknown
54. Further speech and language therapy requirements	0) None indicated; 1) Communication; 2) Swallow
55. Onward speech and language therapy referral to	0) n/a (died); 1) Inpatient rehabilitation; 2) Community speech and language therapist; 3) ESD speech and language therapist; 7) None; 8) Other

APPENDIX 3: FREQUENCY TABLES

FIGURE 4.1: PERCENTAGE OF PATIENTS WITH A STROKE, BY SEX AND AGE GROUP (N=5153)

	Male		Female		Total	
	N	**%**	**N**	**%**	**N**	**%**
17–64 years	890	66.8%	443	33.2%	1333	100.0%
65–79 years	1308	62.1%	799	37.9%	2107	100.0%
80+ years	746	43.5%	967	56.5%	1713	100.0%
Total	**2944**	**57.1%**	**2209**	**42.9%**	**5153**	**100.0%**

FIGURE 4.2: ADMISSION SOURCE (N=5153)

	N	%
Home	4588	89.0%
Transfer from nursing home/convalescent home or other long-stay accommodation	156	3.0%
Transfer of admitted patient from acute hospital	389	7.5%
Other	20	0.4%
Total	**5153**	**100.0%**

FIGURE 4.3: DISTRIBUTION OF TIME FROM STROKE SYMPTOM ONSET TO HOSPITAL ARRIVAL (n=2825)

	N	%
Between 0 and 3 hours	1400	49.6%
Between 3 hours and 4 hours 30 minutes	302	10.7%
Between 4 hours and 30 minutes and 12 hours	523	18.5%
More than 12 hours	600	21.2%
Total	**2825**	**100.0%**

FIGURE 4.4: DISTRIBUTION OF DAY AND TIME OF HOSPITAL ARRIVAL (n=4906)

	00.00–08.59		09.00–16.59		17.00–23.59		Total	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Monday	87	11.2%	467	60.0%	224	28.8%	778	100.0%
Tuesday	101	13.3%	430	56.6%	229	30.1%	760	100.0%
Wednesday	88	12.2%	406	56.2%	229	31.7%	723	100.0%
Thursday	86	12.2%	418	59.3%	201	28.5%	705	100.0%
Friday	82	11.6%	411	58.3%	212	30.1%	705	100.0%
Saturday	90	14.3%	355	56.5%	183	29.1%	628	100.0%
Sunday	80	13.2%	335	55.2%	192	31.6%	607	100.0%
Total	**614**	**12.5%**	**2822**	**57.5%**	**1470**	**30.0%**	**4906**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 4.5: TIME BETWEEN HOSPITAL ARRIVAL AND TIME REVIEWED BY MEDICAL TEAM (n=4127)

	N	%
Less than 10 minutes	2049	49.6%
11 to 30 minutes	494	12.0%
31 minutes to 1 hour	368	8.9%
More than 1 hour to 3 hours	481	11.7%
More than 3 hours to 24 hours	652	15.8%
More than 24 hours	83	2.0%
Total	**4127**	**100.0%**

FIGURE 4.6: PROPORTION OF PATIENTS WHO RECEIVED BRAIN IMAGING WITHIN 1 HOUR OF HOSPITAL ARRIVAL (n=4518)

	Within 60 minutes		After 60 minutes		Total	
	N	%	N	%	N	%
Bantry General Hospital	38	53.5%	33	46.5%	71	100.0%
Beaumont Hospital	188	54.2%	159	45.8%	347	100.0%
Cavan General Hospital	28	26.7%	77	73.3%	105	100.0%
Connolly Hospital	41	26.8%	112	73.2%	153	100.0%
Cork University Hospital	305	65.9%	158	34.1%	463	100.0%
Letterkenny University Hospital	42	24.6%	129	75.4%	171	100.0%
Mater Misericordiae University Hospital	191	68.5%	88	31.5%	279	100.0%
Mayo University Hospital	59	31.7%	127	68.3%	186	100.0%
Mercy University Hospital	31	36.5%	54	63.5%	85	100.0%
Naas General Hospital	100	62.9%	59	37.1%	159	100.0%
Our Lady of Lourdes Hospital Drogheda	94	44.5%	117	55.5%	211	100.0%
Regional Hospital Mullingar	97	65.5%	51	34.5%	148	100.0%
Sligo University Hospital	59	34.5%	112	65.5%	171	100.0%
South Tipperary General Hospital	40	48.2%	43	51.8%	83	100.0%
St James's Hospital	87	41.8%	121	58.2%	208	100.0%
St Luke's General Hospital, Carlow/Kilkenny	66	53.2%	58	46.8%	124	100.0%
St Vincent's University Hospital	207	54.2%	175	45.8%	382	100.0%
Tallaght University Hospital	103	42.2%	141	57.8%	244	100.0%
University Hospital Galway	119	55.6%	95	44.4%	214	100.0%
University Hospital Kerry	68	51.9%	63	48.1%	131	100.0%
University Hospital Limerick	146	44.1%	185	55.9%	331	100.0%
University Hospital Waterford	70	50.4%	69	49.6%	139	100.0%
Wexford General Hospital	27	23.9%	86	76.1%	113	100.0%
National	**2206**	**48.8%**	**2312**	**51.2%**	**4518**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 4.6A: DOOR TO IMAGING TIME, MEDIAN AND INTERQUARTILE RANGE, BY HOSPITAL, IN MINUTES (n=4518)

	N	Median	Percentile 25	Percentile 75
Bantry General Hospital	71	60	17	101
Beaumont Hospital	347	43	22	200
Cavan General Hospital	105	190	57	1043
Connolly Hospital	153	180	52	841
Cork University Hospital	463	36	22	113
Letterkenny University Hospital	171	143	61	1006
Mater Misericordiae University Hospital	279	30	19	108
Mayo University Hospital	186	102	49	773
Mercy University Hospital	85	90	40	176
Naas General Hospital	159	38	17	206
Our Lady of Lourdes Hospital Drogheda	211	71	35	218
Regional Hospital Mullingar	148	34	21	102
Sligo University Hospital	171	114	47	312
South Tipperary General Hospital	83	67	26	893
St James's Hospital	208	85	35	220
St Luke's General Hospital, Carlow/Kilkenny	124	57	32	243
St Vincent's University Hospital	382	53	27	171
Tallaght University Hospital	244	103	21	294
University Hospital Galway	214	49	20	255
University Hospital Kerry	131	44	16	235
University Hospital Limerick	331	82	35	328
University Hospital Waterford	139	60	29	167
Wexford General Hospital	113	166	62	1115
National	**4518**	**63**	**27**	**238**

FIGURE 4.7: PERCENTAGE OF PATIENTS WITH A STROKE, BY STROKE TYPE (N=5153)

	N	%
Ischaemic stroke	4379	85.0%
Haemorrhagic stroke	774	15.0%
Total	**5153**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 4.8: PERCENTAGE OF ISCHAEMIC STROKE CASES TO RECEIVE THROMBOLYSIS, BY HOSPITAL (n=4379)

	Yes		No		Contraindicated		Unknown		Total	
	N	%	N	%	N	%	N	%	N	%
Bantry General Hospital	~	*	51	79.7%	*	*	0	0.0%	64	100.0%
Beaumont Hospital	55	12.6%	21	4.8%	360	82.6%	0	0.0%	436	100.0%
Cavan General Hospital	*	*	107	90.7%	~	*	0	0.0%	118	100.0%
Connolly Hospital	*	*	~	*	181	92.3%	0	0.0%	196	100.0%
Cork University Hospital	35	8.6%	26	6.4%	347	85.0%	0	0.0%	408	100.0%
Letterkenny University Hospital	12	7.3%	~	*	145	88.4%	~	*	164	100.0%
Mater Misericordiae University Hospital	47	18.7%	47	18.7%	157	62.5%	0	0.0%	251	100.0%
Mayo University Hospital	7	3.7%	~	*	180	95.2%	~	*	189	100.0%
Mercy University Hospital	8	9.8%	0	0.0%	74	90.2%	0	0.0%	82	100.0%
Naas General Hospital	16	10.3%	129	83.2%	9	5.8%	~	*	155	100.0%
Our Lady of Lourdes Hospital Drogheda	31	14.0%	~	*	188	85.1%	0	0.0%	221	100.0%
Regional Hospital Mullingar	30	22.2%	94	69.6%	7	5.2%	~	*	135	100.0%
Sligo University Hospital	6	3.8%	~	*	151	95.0%	0	0.0%	159	100.0%
South Tipperary General Hospital	*	*	69	89.6%	~	*	0	0.0%	77	100.0%
St James's Hospital	24	12.4%	151	78.2%	18	9.3%	0	0.0%	193	100.0%
St Luke's General Hospital, Carlow/ Kilkenny	10	8.8%	68	59.6%	36	31.6%	0	0.0%	114	100.0%
St Vincent's University Hospital	32	9.7%	~	*	297	89.7%	0	0.0%	331	100.0%
Tallaght University Hospital	21	9.1%	~	*	209	90.5%	0	0.0%	231	100.0%
University Hospital Galway	17	8.9%	137	71.7%	37	19.4%	0	0.0%	191	100.0%
University Hospital Kerry	8	6.6%	114	93.4%	0	0.0%	0	0.0%	122	100.0%
University Hospital Limerick	44	14.0%	9	2.9%	261	83.1%	0	0.0%	314	100.0%
University Hospital Waterford	14	10.8%	8	6.2%	108	83.1%	0	0.0%	130	100.0%
Wexford General Hospital	14	14.3%	60	61.2%	24	24.5%	0	0.0%	98	100.0%
National	**466**	**10.6%**	**1105**	**25.2%**	**2800**	**64.0%**	**8**	**0.2%**	**4379**	**100.0%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 4.9: DISTRIBUTION OF TIME BETWEEN HOSPITAL ARRIVAL AND TIME OF THROMBOLYSIS, BY HOSPITAL (n=427)

	Less than 45 minutes		46 to 60 minutes		More than 60 minutes		Total	
	N	%	N	%	N	%	N	%
Bantry General Hospital	~	*	~	*	~	*	~	100.0%
Beaumont Hospital	26	48.1%	11	20.4%	17	31.5%	54	100.0%
Cavan General Hospital	~	*	~	*	~	*	6	100.0%
Connolly Hospital	~	*	~	*	6	46.2%	13	100.0%
Cork University Hospital	14	40.0%	9	25.7%	12	34.3%	35	100.0%
Letterkenny University Hospital	~	*	0	0.0%	*	*	12	100.0%
Mater Misericordiae University Hospital	*	*	~	*	20	46.5%	43	100.0%
Mayo University Hospital	0	0.0%	~	*	~	71.4%	7	100.0%
Mercy University Hospital	~	*	0	0.0%	~	*	7	100.0%
Naas General Hospital	7	43.8%	~	*	6	37.5%	16	100.0%
Our Lady of Lourdes Hospital Drogheda	10	38.5%	6	23.1%	10	38.5%	26	100.0%
Regional Hospital Mullingar	*	*	~	*	10	40.0%	25	100.0%
Sligo University Hospital	0	0.0%	~	*	~	*	~	100.0%
South Tipperary General Hospital	~	*	0	0.0%	~	*	6	100.0%
St James's Hospital	~	*	~	*	13	61.9%	21	100.0%
St Luke's General Hospital, Carlow/Kilkenny	7	70.0%	~	*	~	*	10	100.0%
St Vincent's University Hospital	11	36.7%	10	33.3%	9	30.0%	30	100.0%
Tallaght University Hospital	10	47.6%	~	*	8	38.1%	21	100.0%
University Hospital Galway	10	66.7%	~	*	~	20.0%	15	100.0%
University Hospital Kerry	~	*	~	*	~	*	6	100.0%
University Hospital Limerick	*	*	~	*	25	62.5%	40	100.0%
University Hospital Waterford	~	*	~	*	~	*	12	100.0%
Wexford General Hospital	~	*	~	15.4%	6	46.2%	13	100.0%
National	**163**	**38.2%**	**80**	**18.7%**	**184**	**43.1%**	**427**	**100.0%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 4.9A: DOOR TO NEEDLE TIME, MEDIAN AND INTERQUARTILE RANGE, BY HOSPITAL, IN MINUTES (n=427)

	N	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
Bantry General Hospital	~	63	28	84
Beaumont Hospital	54	47	32	66
Cavan General Hospital	6	81	53	112
Connolly Hospital	13	57	32	68
Cork University Hospital	35	52	36	70
Letterkenny University Hospital	12	81	70	95
Mater Misericordiae University Hospital	43	58	37	88
Mayo University Hospital	7	67	58	80
Mercy University Hospital	7	45	33	118
Naas General Hospital	16	51	25	71
Our Lady of Lourdes Hospital Drogheda	26	54	36	77
Regional Hospital Mullingar	25	52	36	80
Sligo University Hospital	~	63	47	64
South Tipperary General Hospital	6	96	41	119
St James's Hospital	21	78	58	95
St Luke's General Hospital, Carlow/ Kilkenny	10	36	31	46
St Vincent's University Hospital	30	53	38	69
Tallaght University Hospital	21	50	25	93
University Hospital Galway	15	38	32	53
University Hospital Kerry	6	78	55	97
University Hospital Limerick	40	75	42	117
University Hospital Waterford	12	53	32	63
Wexford General Hospital	13	54	40	71
National	**427**	**55**	**36**	**83**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 5.2: TIME FROM ARRIVAL TO HOSPITAL TO COMPUTED TOMOGRAPHY SCAN FOR THROMBECTOMY CASES, MEDIAN AND INTERQUARTILE RANGE, BY HOSPITAL (n=289)

	N	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
Beaumont Hospital	44	19	14	27
Cavan General Hospital	~	33	16	62
Connolly Hospital	~	34	19	79
Cork University Hospital	53	23	16	33
Letterkenny University Hospital	~	357	30	683
Mater Misericordiae University Hospital	36	19	13	28
Mayo University Hospital	8	45	29	167
Naas General Hospital	9	17	15	21
Our Lady of Lourdes Hospital Drogheda	9	24	16	29
Portiuncula University Hospital	~	185	185	185
Regional Hospital Mullingar	16	30	15	47
Sligo University Hospital	~	14	9	15
South Tipperary General Hospital	~	59	43	62
St James's Hospital	13	25	15	34
St Luke's General Hospital, Carlow/Kilkenny	7	30	18	40
St Vincent's University Hospital	21	27	14	36
Tallaght University Hospital	15	24	15	38
University Hospital Galway	16	21	13	27
University Hospital Limerick	11	28	14	52
University Hospital Waterford	~	18	10	26
Wexford General Hospital	10	50	30	92
Other	~	30	30	72
National	**289**	**23**	**16**	**35**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 5.3: PERCENTAGE OF PATIENTS TRANSFERRED TO ENDOVASCULAR THROMBECTOMY STROKE CENTRE (N=380)

	N	%
Admitted directly to an EVT stroke centre	105	27.6%
Transferred to an EVT stroke centre	275	72.4%
Total	**380**	**100.0%**

FIGURE 5.4: TIME FROM COMPUTED TOMOGRAPHY ANGIOGRAM TO DECISION TO TRANSFER TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE FOR THROMBECTOMY CASES, MEDIAN AND INTERQUARTILE RANGE, BY HOSPITAL (N=214)

	N	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
Bantry General Hospital	~	59	59	59
Cavan General Hospital	~	119	43	194
Connolly Hospital	~	16	8	20
Letterkenny University Hospital	~	31	31	31
Mater Misericordiae University Hospital	41	30	23	44
Mayo University Hospital	10	46	40	53
Mercy University Hospital	~	43	43	43
Naas General Hospital	8	16	12	32
Our Lady of Lourdes Hospital Drogheda	10	38	17	60
Portiuncula University Hospital	~	236	236	236
Regional Hospital Mullingar	9	26	16	46
Sligo University Hospital	~	25	22	25
South Tipperary General Hospital	~	41	27	55
St James's Hospital	18	27	9	39
St Luke's General Hospital, Carlow/Kilkenny	8	20	14	24
St Vincent's University Hospital	22	29	15	41
Tallaght University Hospital	15	26	11	30
University Hospital Galway	19	34	25	46
University Hospital Limerick	17	51	39	84
University Hospital Waterford	~	55	27	85
Wexford General Hospital	9	21	17	25
Other	8	32	24	85
Total	**214**	**31**	**18**	**47**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 5.5: TIME FROM ARRIVAL AT PRIMARY HOSPITAL TO TIME OF ARRIVAL AT THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE, MEDIAN AND INTERQUARTILE RANGE, FOR THROMBECTOMY CASES THAT WERE TRANSFERRED TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (N=207)

	N	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
Bantry General Hospital	~	359	359	359
Cavan General Hospital	~	192	149	327
Connolly Hospital	~	104	101	240
Letterkenny University Hospital	~	237	234	240
Mater Misericordiae University Hospital	36	104	84	125
Mayo University Hospital	8	295	281	429
Naas General Hospital	9	90	78	126
Our Lady of Lourdes Hospital Drogheda	9	171	150	210
Portiuncula University Hospital	~	0	0	0
Regional Hospital Mullingar	15	180	147	243
Sligo University Hospital	~	213	180	219
South Tipperary General Hospital	~	300	290	337
St James's Hospital	14	123	110	140
St Luke's General Hospital, Carlow/Kilkenny	8	162	142	181
St Vincent's University Hospital	23	130	95	181
Tallaght University Hospital	15	138	103	210
University Hospital Galway	20	233	214	273
University Hospital Limerick	14	290	265	313
University Hospital Waterford	~	293	231	335
Wexford General Hospital	10	236	220	306
Other	~	99	90	175
National	**207**	**165**	**110**	**242**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 5.6: PROXIMAL OCCLUSION SITE (n=380)

	N	%
MCA 1	207	54.5%
MCA 2	74	19.5%
Basilar	21	5.5%
Internal carotid artery terminus	56	14.7%
Internal carotid artery cervical segment	17	4.5%
Vertebrobasilar	~	*
Unknown	~	*
Total	**380**	**100.0%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

FIGURE 5.7A: TIME FROM ARRIVAL AT ENDOVASCULAR THROMBECTOMY STROKE CENTRE TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, FOR PATIENTS ADMITTED DIRECTLY TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=86)

	N	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
Beaumont Hospital	41	95	67	129
Cork University Hospital	45	126	93	159
Total	**86**	**116**	**74**	**150**

APPENDIX 3: FREQUENCY TABLES

FIGURE 5.7B: TIME FROM ARRIVAL AT PRIMARY HOSPITAL TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, FOR PATIENTS TRANSFERRED TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=193)

	N	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
Bantry General Hospital	~	433	433	433
Cavan General Hospital	~	290	243	387
Connolly Hospital	~	135	127	310
Letterkenny University Hospital	~	283	274	292
Mater Misericordiae University Hospital	33	136	118	160
Mayo University Hospital	8	398	356	486
Naas General Hospital	9	158	120	163
Our Lady of Lourdes Hospital Drogheda	8	201	177	216
Regional Hospital Mullingar	14	203	194	248
Sligo University Hospital	~	242	225	273
South Tipperary General Hospital	~	401	318	402
St James's Hospital	13	155	141	173
St Luke's General Hospital, Carlow/Kilkenny	7	181	156	232
St Vincent's University Hospital	22	174	134	224
Tallaght University Hospital	15	170	135	218
University Hospital Galway	16	278	252	339
University Hospital Limerick	14	331	298	379
University Hospital Waterford	~	363	285	390
Wexford General Hospital	9	301	279	348
Other	~	128	119	235
Total	**193**	**204**	**143**	**298**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 5.8: INTERVENTION OUTCOMES – NATIONAL INSTITUTES OF HEALTH STROKE SCALE SCORES (n=295)

		N	%
24 hours post-thrombectomy	No stroke symptoms (0)	18	6.1%
	Minor stroke symptoms (1–4)	88	29.8%
	Moderate stroke symptoms (5–15)	131	44.4%
	Moderate to severe stroke symptoms (16–20)	30	10.2%
	Severe stroke (21–42)	28	9.5%
	Total	**295**	**100.0%**
Pre-thrombectomy	No stroke symptoms (0)	~	*
	Minor stroke symptoms (1–4)	*	*
	Moderate stroke symptoms (5–15)	153	51.9%
	Moderate to severe stroke symptoms (16–20)	68	23.1%
	Severe stroke (21–42)	60	20.3%
	Total	**295**	**100.0%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

FIGURE 5.9: PERCENTAGE OF THROMBECTOMY CASES TRANSFERRED IMMEDIATELY BACK TO REFERRING HOSPITAL (n=275)

	N	%
Yes	179	65.1%
No	95	34.5%
Unknown	1	0.4%
Total	**275**	**100.0%**

FIGURE 5.10: DISCHARGE DESTINATION FOR PATIENTS ADMITTED DIRECTLY TO THE ENDOVASCULAR THROMBECTOMY STROKE CENTRE (n=105)

	Cork University Hospital		Beaumont Hospital		Total	
	N	%	N	%	N	%
Home	37	62.7%	25	54.3%	62	59.0%
Nursing home, convalescent home or long-stay accommodation	~	*	*	*	12	11.4%
Transfer to acute hospital	*	*	~	*	12	11.4%
Transfer to rehabilitation facility (not in HIPE Hospital Listing)	0	0.0%	~	*	~	*
Died	10	16.9%	6	13.0%	16	15.2%
Total	**59**	**100.0%**	**46**	**100.0%**	**105**	**100.0%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 6.1: ADMISSION TO STROKE UNIT, BY HOSPITAL (N=5153)

	Yes		No		Total	
	N	%	N	%	N	%
Bantry General Hospital	61	78.2%	17	21.8%	78	100.0%
Beaumont Hospital	386	78.9%	103	21.1%	489	100.0%
Cavan General Hospital	62	45.6%	74	54.4%	136	100.0%
Connolly Hospital	126	58.3%	90	41.7%	216	100.0%
Cork University Hospital	392	79.4%	102	20.6%	494	100.0%
Letterkenny University Hospital	0	0.0%	182	100.0%	182	100.0%
Mater Misericordiae University Hospital	217	70.7%	90	29.3%	307	100.0%
Mayo University Hospital	199	93.4%	14	6.6%	213	100.0%
Mercy University Hospital	64	66.0%	33	34.0%	97	100.0%
Naas General Hospital	132	73.7%	47	26.3%	179	100.0%
Our Lady of Lourdes Hospital Drogheda	183	71.5%	73	28.5%	256	100.0%
Regional Hospital Mullingar	49	30.8%	110	69.2%	159	100.0%
Sligo University Hospital	175	95.6%	8	4.4%	183	100.0%
South Tipperary General Hospital	58	67.4%	28	32.6%	86	100.0%
St James's Hospital	185	79.1%	49	20.9%	234	100.0%
St Luke's General Hospital, Carlow/Kilkenny	112	82.4%	24	17.6%	136	100.0%
St Vincent's University Hospital	276	65.4%	146	34.6%	422	100.0%
Tallaght University Hospital	212	81.2%	49	18.8%	261	100.0%
University Hospital Galway	180	78.6%	49	21.4%	229	100.0%
University Hospital Kerry	126	81.3%	29	18.7%	155	100.0%
University Hospital Limerick	301	82.2%	65	17.8%	366	100.0%
University Hospital Waterford	104	67.5%	50	32.5%	154	100.0%
Wexford General Hospital	49	40.5%	72	59.5%	121	100.0%
National	**3649**	**71.0%**	**1504**	**29.0%**	**5153**	**100.0%**

FIGURE 6.2A: REASON FOR NON-ADMISSION TO A STROKE UNIT (n=1504)

	N	%
No stroke unit	184	12.2%
Bed not available	587	39.0%
Infection control risk	195	13.0%
Other	532	35.4%
Unknown	6	0.4%
Total	**1504**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 6.2B: OTHER REASONS FOR NON-ADMISSION TO A STROKE UNIT (n=532)

	N	%
Palliative care	81	15.2%
Safety concerns	17	3.2%
Intensive care unit	71	13.3%
High dependency bed/Coronary Care Unit	42	7.9%
No stroke service referral	91	17.1%
Transfer to another hospital	*	*
No bed	~	*
Too well/no rehabilitation needs	80	15.0%
Unknown	128	24.1%
Total	**532**	**100.0%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 6.3: SWALLOW SCREENING, BY HOSPITAL (N=5153)

	Yes		No		Unknown		Total	
	N	%	N	%	N	%	N	%
Bantry General Hospital	53	67.9%	25	32.1%	0	0.0%	78	100.0%
Beaumont Hospital	429	87.7%	58	11.9%	~	*	489	100.0%
Cavan General Hospital	19	14.0%	114	83.8%	~	*	136	100.0%
Connolly Hospital	*	*	~	*	0	0.0%	216	100.0%
Cork University Hospital	435	88.1%	59	11.9%	0	0.0%	494	100.0%
Letterkenny University Hospital	44	24.2%	134	73.6%	~	*	182	100.0%
Mater Misericordiae University Hospital	237	77.2%	30	9.8%	40	13.0%	307	100.0%
Mayo University Hospital	76	35.7%	108	50.7%	29	13.6%	213	100.0%
Mercy University Hospital	55	56.7%	42	43.3%	0	0.0%	97	100.0%
Naas General Hospital	61	34.1%	111	62.0%	7	3.9%	179	100.0%
Our Lady of Lourdes Hospital Drogheda	125	48.8%	102	39.8%	29	11.3%	256	100.0%
Regional Hospital Mullingar	100	62.9%	52	32.7%	7	4.4%	159	100.0%
Sligo University Hospital	169	92.3%	14	7.7%	0	0.0%	183	100.0%
South Tipperary General Hospital	79	91.9%	*	*	0	0.0%	86	100.0%
St James's Hospital	180	76.9%	53	22.6%	~	*	234	100.0%
St Luke's General Hospital, Carlow/Kilkenny	*	*	83	61.0%	~	*	136	100.0%
St Vincent's University Hospital	228	54.0%	185	43.8%	9	2.1%	422	100.0%
Tallaght University Hospital	234	89.7%	27	10.3%	0	0.0%	261	100.0%
University Hospital Galway	161	70.3%	23	10.0%	45	19.7%	229	100.0%
University Hospital Kerry	112	72.3%	42	27.1%	~	*	155	100.0%
University Hospital Limerick	234	63.9%	119	32.5%	13	3.6%	366	100.0%
University Hospital Waterford	114	74.0%	40	26.0%	0	0.0%	154	100.0%
Wexford General Hospital	95	78.5%	26	21.5%	0	0.0%	121	100.0%
National	**3507**	**68.1%**	**1455**	**28.2%**	**191**	**3.7%**	**5153**	**100.0%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

FIGURE 6.4: MOOD SCREENING (N=5153)

	N	%
Yes	1488	28.9%
No	1578	30.6%
Not indicated	1811	35.1%
Unknown	276	5.4%
Total	**5153**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 6.5A: HEALTH AND SOCIAL CARE PROFESSIONAL ASSESSMENT (n=4537)

		N	%
Physiotherapist	Yes	4247	93.6%
	No	138	3.0%
	Not indicated	135	3.0%
	Unknown	17	0.4%
	Total	**4537**	**100.0%**
Occupational therapist	Yes	4043	89.1%
	No	254	5.6%
	Not indicated	210	4.6%
	Unknown	30	0.7%
	Total	**4537**	**100.0%**
Speech and language therapist	Yes	3085	68.0%
	No	563	12.4%
	Not indicated	827	18.2%
	Unknown	62	1.4%
	Total	**4537**	**100.0%**
Dietitian	Yes	1456	32.1%
	No	1267	27.9%
	Not indicated	1729	38.1%
	Unknown	85	1.9%
	Total	**4537**	**100.0%**
Medical social worker	Yes	1124	24.8%
	No	1796	39.6%
	Not indicated	1517	33.4%
	Unknown	100	2.2%
	Total	**4537**	**100.0%**
Psychologist	Yes	241	5.3%
	No	2713	59.8%
	Not indicated	1445	31.8%
	Unknown	138	3.0%
	Total	**4537**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 6.5B: ASSESSED BY A CLINICAL NURSE SPECIALIST (N=5153)

	N	%
Yes	4093	79.4%
No	1022	19.8%
Unknown	38	0.7%
Total	**5153**	**100.0%**

FIGURE 6.6: START TIMES FOR ANTITHROMBOTICS (n=3721)

	N	%
Same day	2288	61.5%
Next day	1076	28.9%
2–7 days	302	8.1%
More than 8 days	55	1.5%
Total	**3721**	**100.0%**

FIGURE 6.8: SECONDARY PREVENTION TREATMENT FOR ATRIAL FIBRILLATION IN PATIENTS WITH ISCHAEMIC STROKE (n=1117)

	N	%
Yes	956	86%
No	118	11%
Unknown	43	4%
Total	**1117**	**100.0%**

FIGURE 6.10: PATIENTS WITH A STROKE DIAGNOSED WITH SYMPTOMATIC CAROTID STENOSIS (N=5153)

	N	%
Yes	316	6%
No	4358	85%
Unknown	479	9%
Total	**5153**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 7.1A: MODIFIED RANKIN SCALE SCORES IN PATIENTS WITH ISCHAEMIC STROKE, PRE-STROKE AND ON DISCHARGE (n=3902)

		N	%
Pre-stroke	No disability (0)	2457	63.0%
	Mild disability (1, 2)	819	21.0%
	Moderate to severe disability (3, 4, 5)	626	16.0%
	Total	**3902**	**100.0%**
On discharge	No disability (0)	817	20.9%
	Mild disability (1, 2)	1351	34.6%
	Moderate to severe disability (3, 4, 5)	1430	36.6%
	Died (6)	304	7.8%
	Total	**3902**	**100.0%**

FIGURE 7.1B: MODIFIED RANKIN SCALE SCORES IN PATIENTS WITH HAEMORRHAGIC STROKE, PRE-STROKE AND ON DISCHARGE (n=686)

		N	%
Pre-stroke	No disability (0)	415	60.5%
	Mild disability (1, 2)	147	21.4%
	Moderate to severe disability (3, 4, 5)	124	18.1%
	Total	**686**	**100.0%**
On discharge	No disability (0)	67	9.8%
	Mild disability (1, 2)	152	22.2%
	Moderate to severe disability (3, 4, 5)	261	38.0%
	Died (6)	206	30.0%
	Total	**686**	**100.0%**

FIGURE 7.2: PRE-STROKE MODIFIED RANKIN SCALE SCORES, BY AGE GROUP (N=5153)

	17–64 years		**65–79 years**		**80+ years**		**Total**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**
No disability (0)	1043	78.2%	1305	61.9%	594	34.7%	2942	57.1%
Mild disability (1, 2)	145	10.9%	373	17.7%	462	27.0%	980	19.0%
Moderate to severe disability (3, 4, 5)	41	3.1%	244	11.6%	471	27.5%	756	14.7%
Unknown	104	7.8%	185	8.8%	186	10.9%	475	9.2%
Total	**1333**	**100.0%**	**2107**	**100.0%**	**1713**	**100.0%**	**5153**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 7.3: MEDIAN BED DAYS IN STROKE UNIT, BY HOSPITAL (n=3499)

	N	Median (days)	Percentile 25 (days)	Percentile 75 (days)
Bantry General Hospital	59	7	2	25
Beaumont Hospital	374	5	3	10
Cavan General Hospital	61	8	6	13
Connolly Hospital	121	5	3	14
Cork University Hospital	382	8	4	21
Mater Misericordiae University Hospital	210	7	3	14
Mayo University Hospital	194	9	6	14
Mercy University Hospital	64	5	3	10
Naas General Hospital	131	12	5	25
Our Lady of Lourdes Hospital Drogheda	171	8	5	15
Regional Hospital Mullingar	48	7	4	13
Sligo University Hospital	169	7	4	11
South Tipperary General Hospital	55	12	6	17
St James's Hospital	178	4	2	7
St Luke's General Hospital, Carlow/Kilkenny	108	6	4	9
St Vincent's University Hospital	265	10	6	19
Tallaght University Hospital	204	5	4	9
University Hospital Galway	171	6	3	10
University Hospital Kerry	110	3	2	6
University Hospital Limerick	282	10	6	18
University Hospital Waterford	94	9	6	19
Wexford General Hospital	48	9	4	16
National	**3499**	**7**	**4**	**14**

APPENDIX 3: FREQUENCY TABLES

FIGURE 7.4: PERCENTAGE OF BED DAYS SPENT IN STROKE UNIT, FOR PATIENTS WHO SPENT SOME OR ALL OF THEIR HOSPITAL STAY IN A DEDICATED STROKE UNIT, BY HOSPITAL (n=56536)

	Patients	Hospital stay (days)	Stroke unit stay (days)	
	(n)	N	N	%
Bantry General Hospital	59	1730	1449	83.8%
Beaumont Hospital	374	5445	3799	69.8%
Cavan General Hospital	61	939	743	79.1%
Connolly Hospital	121	2509	1713	68.3%
Cork University Hospital	382	7412	6980	94.2%
Mater Misericordiae University Hospital	210	3944	2398	60.8%
Mayo University Hospital	194	2494	2304	92.4%
Mercy University Hospital	64	737	551	74.8%
Naas General Hospital	131	2824	2452	86.8%
Our Lady of Lourdes Hospital Drogheda	171	2730	2287	83.8%
Regional Hospital Mullingar	48	622	487	78.3%
Sligo University Hospital	169	1657	1573	94.9%
South Tipperary General Hospital	55	898	741	82.5%
St James's Hospital	178	1453	948	65.2%
St Luke's General Hospital, Carlow/Kilkenny	108	1492	850	57.0%
St Vincent's University Hospital	265	4922	4047	82.2%
Tallaght University Hospital	204	2918	1464	50.2%
University Hospital Galway	171	3588	1304	36.3%
University Hospital Kerry	110	1035	474	45.8%
University Hospital Limerick	282	4609	3829	83.1%
University Hospital Waterford	94	1693	1329	78.5%
Wexford General Hospital	48	885	563	63.6%
National	**3499**	**56 536**	**42 285**	**74.8%**

FIGURE 7.5: DISCHARGE DESTINATION OF PATIENTS WITH A STROKE (N=5153)

	N	%
Home	2682	52.0%
Patient died	586	11.4%
Discharge to long-term care	323	6.3%
Discharge to off-site rehabilitation	667	12.9%
Transfer to referring hospital	164	3.2%
Transfer to other hospital for ongoing stroke care	218	4.2%
Home with ESD	335	6.5%
Other	116	2.3%
Unknown	62	1.2%
Total	**5153**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 7.6: STROKE CASES DISCHARGED HOME WITH EARLY SUPPORTED DISCHARGE, BY HOSPITAL (n=2899)

	Number of cases	Early Supported Discharge	
		N	%
Beaumont Hospital	489	78	16.0%
University Hospital Limerick	366	76	20.8%
Mater Misericordiae University Hospital	307	56	18.2%
Tallaght University Hospital/St James's Hospital	495	39	7.9%
Cork University Hospital/Mercy University Hospital	591	50	8.5%
St Vincent's University Hospital	422	25	5.9%
University Hospital Galway	229	11	4.8%
Total	**2899**	**335**	**12.0%**

FIGURE 8.2: TIME FROM HOSPITAL ARRIVAL TO THERAPY ASSESSMENT, BY DISCIPLINE (N=2609)

	Physiotherapy		Occupational therapy		Speech and language therapy	
	N	%	N	%	N	%
Same day	319	17.5%	87	9.5%	295	23.8%
Next day	649	35.5%	317	34.6%	452	36.5%
2 days	300	16.4%	181	19.7%	158	12.8%
3–7 days	403	22.0%	244	26.6%	209	16.9%
8 days or more	33	1.8%	22	2.4%	40	3.2%
Unknown	124	6.8%	66	7.2%	85	6.9%
Total	**1828**	**100.0%**	**917**	**100.0%**	**1239**	**100.0%**

FIGURE 8.3: INTENSITY OF THERAPY, BY DISCIPLINE (N=2609)

	Physiotherapy		Occupational therapy		Speech and language therapy	
	N	%	N	%	N	%
Sufficient amount of therapy (80–100% of daily target)	1016	56%	362	39%	559	45%
Moderate amount of therapy (50–79% of daily target)	534	29%	403	44%	443	36%
Insufficient amount of therapy (≤49% of daily target)	238	13%	115	13%	209	17%
Unknown	40	2%	37	4%	28	2%
Total	**1828**	**100%**	**917**	**100%**	**1239**	**100%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 8.4: DISCHARGE DESTINATION, BY DISCIPLINE (N=2609)

	Physiotherapy		Occupational therapy		Speech and language therapy	
	N	%	N	%	N	%
Home	1047	57.3%	546	59.5%	606	48.9%
Nursing home, convalescent home or long-stay accommodation	356	19.5%	146	15.9%	194	15.7%
Transferred	298	16.3%	174	19.0%	313	25.3%
Other	18	1.0%	6	0.7%	19	1.5%
Died	109	6.0%	45	4.9%	107	8.6%
Total	**1828**	**100.0%**	**917**	**100.0%**	**1239**	**100.0%**

FIGURE 8.5: PHYSIOTHERAPY MOBILITY OUTCOMES (n=1705)

		N	%
Pre-stroke	Independent, with no aid	1310	76.8%
	Independent, with aid	270	15.8%
	Supervision or assistance of one person, with or without aid	84	4.9%
	Transfer only with assistance	27	1.6%
	Hoist transfer	14	0.8%
	Total	**1705**	**100.0%**
On discharge from acute services	Independent, with no aid	800	46.9%
	Independent, with aid	237	13.9%
	Supervision or assistance of one person, with or without aid	310	18.2%
	Transfer only with assistance	119	7.0%
	Hoist transfer	144	8.4%
	Died	95	5.6%
	Total	**1705**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 8.6: PHYSIOTHERAPY CASES REQUIRING THE ASSISTANCE OF MORE THAN ONE THERAPIST/THERAPY ASSISTANT (n=1828)

	N	%
Yes	529	29%
No	1237	68%
Unknown	62	3%
Total	**1828**	**100.0%**

FIGURE 8.7: PHYSIOTHERAPY ONWARD REFERRAL DESTINATION (n=1828)

	N	%
Inpatient rehabilitation	355	19.4%
Community PT	172	9.4%
ESD	169	9.2%
Stroke-specific outpatient department PT	20	1.1%
Day hospital	7	0.4%
Other	232	12.7%
No follow-up required	804	44.0%
Unknown	69	3.8%
Total	**1828**	**100.0%**

FIGURE 8.8: OCCUPATIONAL THERAPY ACTIVITIES OF DAILY LIVING PRE- AND POST-STROKE (n=859)

		N	%
Pre-stroke	Independent	674	78.5%
	Independent, with cues/aids	38	4.4%
	Required supervision or set-up	41	4.8%
	Required assistance	86	10.0%
	Dependent/full care	20	2.3%
	Total	**859**	**100.0%**
On discharge from acute services	Independent	358	41.7%
	Independent, with cues/aids	55	6.4%
	Required supervision or set-up	99	11.5%
	Required assistance	207	24.1%
	Dependent/full care	102	11.9%
	Died	38	4.4%
	Total	**859**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 8.9: OCCUPATIONAL THERAPY VISUAL FIELD ASSESSMENT (n=917)

	N	%
Yes, using confrontation testing	570	62.2%
Yes, using both confrontation and perimetry testing	98	10.7%
Yes, using perimetry testing	26	2.8%
Attempted assessment but unable due to patient factors	134	14.6%
No	61	6.7%
Unknown	28	3.1%
Total	**917**	**100.0%**

FIGURE 8.10: OCCUPATIONAL THERAPY PATIENT EDUCATION ON RETURNING TO WORK AND DRIVING (n=443)

		N	%
Advice on driving	Yes	358	85.4%
	No	30	7.2%
	Unknown	31	7.4%
	Total	**419**	**100.0%**
Advised about return to work	Yes	128	62.1%
	No	30	14.6%
	Onward referral made	27	13.1%
	Unknown	21	10.2%
	Total	**206**	**100.0%**

FIGURE 8.11: OCCUPATIONAL THERAPY CASES REQUIRING THE ASSISTANCE OF MORE THAN ONE THERAPIST/THERAPY ASSISTANT (n=917)

	N	%
Yes	242	26%
No	597	65%
Unknown	78	9%
Total	**917**	**100.0%**

FIGURE 8.12: OCCUPATIONAL THERAPY ONWARD REFERRAL DESTINATION (n=451)

	N	%
Inpatient rehabilitation (off-site)	176	39.0%
ESD	124	27.5%
Other	86	19.1%
Community OT	65	14.4%
Total	**451**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 8.13: COMMUNICATION AND SWALLOW DIFFICULTIES IDENTIFIED BY SPEECH AND LANGUAGE THERAPISTS (n=1026)

		N	%
Swallow difficulty	Yes	654	63.7%
	No	370	36.1%
	Unknown	2	0.2%
	Total	**1026**	**100.0%**
Dysarthria	Yes	575	56.0%
	No	379	36.9%
	Unknown	72	7.0%
	Total	**1026**	**100.0%**
Dyspraxia	Yes	78	7.6%
	No	828	80.7%
	Unknown	120	11.7%
	Total	**1026**	**100.0%**
Aphasia	Yes	409	39.9%
	No	540	52.6%
	Unknown	77	7.5%
	Total	**1026**	**100.0%**
Cognitive linguistic communication disorder	Yes	254	24.8%
	No	563	54.9%
	Unknown	209	20.4%
	Total	**1026**	**100.0%**
Voice difficulties	Yes	120	11.7%
	No	825	80.4%
	Unknown	81	7.9%
	Total	**1026**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 8.14: SPEECH AND LANGUAGE THERAPY PRE- AND POST-STROKE COMMUNICATION ABILITY (n=1136)

		N	%
Pre-stroke	No difficulties	892	78.5%
	Mild: >80% effective communication; occasional breakdown in conversation	185	16.3%
	Moderate: 50–79% effective communication; frequent breakdown in conversation	42	3.7%
	Severe: Less than half (10–49%) of communication attempts are successful	10	0.9%
	Profound: No, or occasional (<10%), communication attempts are successful	7	0.6%
	Total	**1136**	**100.0%**
On discharge from acute services	No difficulties	322	28.3%
	Mild: >80% effective communication; occasional breakdown in conversation	372	32.7%
	Moderate: 50–79% effective communication; frequent breakdown in conversation	204	18.0%
	Severe: Less than half (10–49%) of communication attempts are successful	114	10.0%
	Profound: No, or occasional (<10%), communication attempts are successful	37	3.3%
	Died	87	7.7%
	Total	**1136**	**100.0%**

FIGURE 8.15: SPEECH AND LANGUAGE THERAPY SWALLOW INVESTIGATIONS (n=1239)

		N	%
Videofluoroscopy	Yes	97	7.8%
	No	1115	90.0%
	Indicated but not available	13	1.0%
	Unknown	14	1.1%
	Total	**1239**	**100.0%**
FEES	Yes	35	2.8%
	No	1155	93.2%
	Indicated but not available	37	3.0%
	Unknown	12	1.0%
	Total	**1293**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 8.16: SPEECH AND LANGUAGE THERAPY PRE- AND POST-STROKE MODIFIED DIET (n=1189)

		N	%
Pre-stroke	Yes	64	5.4%
	No	1125	94.6%
	Total	**1189**	**100.0%**
On discharge from acute services	Yes	330	27.8%
	No	859	72.2%
	Total	**1189**	**100.0%**

FIGURE 8.17: SPEECH AND LANGUAGE THERAPY PRE- AND POST-STROKE MODIFIED FLUIDS (n=1188)

		N	%
Pre-stroke	Yes	20	1.7%
	No	1168	98.3%
	Total	**1188**	**100.0%**
On discharge from acute services	Yes	213	17.9%
	No	975	82.1%
	Total	**1188**	**100.0%**

FIGURE 8.18: SPEECH AND LANGUAGE THERAPY ENTERAL FEEDING ON DISCHARGE (n=1239)

	N	%
Yes	60	4.8%
No	1157	93.4%
Unknown	22	1.8%
Total	**1239**	**100.0%**

FIGURE 8.19: SPEECH AND LANGUAGE THERAPY ONWARD REFERRAL DESTINATION (n=1239)

	N	%
Inpatient rehabilitation	247	19.9%
Community SLT	200	16.1%
ESD	92	7.4%
No follow-up required	525	42.4%
Other	126	10.2%
Unknown	49	4.0%
Total	**1239**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.1: MONTHLY AND WEEKLY STROKE ACTIVITY BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (N=6736)

Month	Week No.	2019	2020	2019 mean	2020 mean
MAR	10	82	76	76	81
	11	72	80	76	81
	12	95	75	76	81
	13	93	72	76	81
APR	14	82	68	76	81
	15	79	85	76	81
	16	87	99	76	81
	17	71	83	76	81
MAY	18	82	80	76	81
	19	76	80	76	81
	20	68	75	76	81
	21	74	93	76	81
	22	82	96	76	81
JUN	23	65	78	76	81
	24	69	101	76	81
	25	92	82	76	81
	26	77	94	76	81
JUL	27	86	90	76	81
	28	76	83	76	81
	29	76	94	76	81
	30	87	75	76	81
	31	93	81	76	81
AUG	32	73	64	76	81
	33	82	98	76	81
	34	76	85	76	81
	35	83	76	76	81
SEP	36	83	99	76	81
	37	78	87	76	81
	38	62	90	76	81
	39	76	79	76	81
OCT	40	80	76	76	81
	41	69	72	76	81
	42	87	81	76	81
	43	85	77	76	81
	44	71	72	76	81
NOV	45	65	82	76	81
	46	70	71	76	81
	47	70	80	76	81
	48	68	81	76	81
DEC	49	80	75	76	81
	50	60	78	76	81
	51	50	78	76	81
	52	18	45	76	81

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.2: MONTHLY AND WEEKLY ISCHAEMIC AND HAEMORRHAGIC STROKE ACTIVITY BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (N=6736)

Month	Week No.	Ischaemic 2019	Ischaemic 2020	Ischaemic 2019 mean	Ischaemic 2020 mean	Haemorrhagic 2019	Haemorrhagic 2020	Haemorrhagic 2019 mean	Haemorrhagic 2020 mean
MAR	10	68	69	65	69	14	7	11	12
	11	65	65	65	69	7	15	11	12
	12	78	62	65	69	17	13	11	12
	13	76	59	65	69	17	13	11	12
APR	14	72	61	65	69	10	7	11	12
	15	66	73	65	69	13	12	11	12
	16	79	81	65	69	8	18	11	12
	17	63	71	65	69	8	12	11	12
MAY	18	71	64	65	69	11	16	11	12
	19	63	66	65	69	13	14	11	12
	20	60	58	65	69	8	17	11	12
	21	60	82	65	69	14	11	11	12
	22	71	84	65	69	11	12	11	12
JUN	23	55	68	65	69	10	10	11	12
	24	58	88	65	69	11	13	11	12
	25	78	74	65	69	14	8	11	12
	26	66	85	65	69	11	9	11	12
JUL	27	79	76	65	69	7	14	11	12
	28	67	73	65	69	9	10	11	12
	29	66	81	65	69	10	13	11	12
	30	72	64	65	69	15	11	11	12
	31	87	64	65	69	6	17	11	12
AUG	32	58	55	65	69	15	9	11	12
	33	69	88	65	69	13	10	11	12
	34	71	74	65	69	~	11	11	12
	35	69	64	65	69	14	12	11	12
SEP	36	74	80	65	69	9	19	11	12
	37	65	72	65	69	13	15	11	12
	38	55	82	65	69	7	8	11	12
	39	61	71	65	69	15	8	11	12
OCT	40	70	63	65	69	10	13	11	12
	41	58	62	65	69	11	10	11	12
	42	71	68	65	69	16	13	11	12
	43	72	64	65	69	13	13	11	12
	44	58	62	65	69	13	10	11	12
NOV	45	53	65	65	69	12	17	11	12
	46	52	61	65	69	18	10	11	12
	47	64	68	65	69	6	12	11	12
	48	54	70	65	69	14	11	11	12
DEC	49	74	60	65	69	6	15	11	12
	50	54	72	65	69	6	6	11	12
	51	43	66	65	69	7	12	11	12
	52	15	37	65	69	~	8	11	12

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.3: ADMISSION SOURCE BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (N=6736)

	Pre-COVID-19 (2019)		COVID-19 (2020)	
	N	**%**	**N**	**%**
Home	2840	87.4%	3117	89.4%
Transfer from nursing home/convalescent home or other long-stay accommodation	119	3.7%	100	2.9%
Transfer of admitted patient from acute hospital	263	8.1%	260	7.5%
Other	28	0.9%	9	0.3%
Total	**3250**	**100.0%**	**3486**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.4: PERCENTAGE OF ACUTE PATIENTS WITH A STROKE WHO SPENT ALL OR SOME OF THEIR HOSPITAL STAY IN A STROKE UNIT, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (N=6736)

Month	Week number	2019				
		Yes		No		Total
		N	%	N	%	N
MAR	10	64	78.0%	18	22.0%	82
	11	52	72.2%	20	27.8%	72
	12	74	77.9%	21	22.1%	95
	13	70	75.3%	23	24.7%	93
APR	14	52	63.4%	30	36.6%	82
	15	61	77.2%	18	22.8%	79
	16	67	77.0%	20	23.0%	87
	17	49	69.0%	22	31.0%	71
MAY	18	56	68.3%	26	31.7%	82
	19	51	67.1%	25	32.9%	76
	20	49	72.1%	19	27.9%	68
	21	59	79.7%	15	20.3%	74
	22	60	73.2%	22	26.8%	82
JUN	23	49	75.4%	16	24.6%	65
	24	55	79.7%	14	20.3%	69
	25	69	75.0%	23	25.0%	92
	26	59	76.6%	18	23.4%	77
JUL	27	65	75.6%	21	24.4%	86
	28	56	73.7%	20	26.3%	76
	29	56	73.7%	20	26.3%	76
	30	62	71.3%	25	28.7%	87
	31	69	74.2%	24	25.8%	93
AUG	32	52	71.2%	21	28.8%	73
	33	60	73.2%	22	26.8%	82
	34	54	71.1%	22	28.9%	76
	35	58	69.9%	25	30.1%	83
SEP	36	54	65.1%	29	34.9%	83
	37	56	71.8%	22	28.2%	78
	38	46	74.2%	16	25.8%	62
	39	51	67.1%	25	32.9%	76
OCT	40	55	68.8%	25	31.3%	80
	41	55	79.7%	14	20.3%	69
	42	57	65.5%	30	34.5%	87
	43	62	72.9%	23	27.1%	85
	44	48	67.6%	23	32.4%	71
NOV	45	40	61.5%	25	38.5%	65
	46	51	72.9%	19	27.1%	70
	47	48	68.6%	22	31.4%	70
	48	49	72.1%	19	27.9%	68
DEC	49	58	72.5%	22	27.5%	80
	50	45	75.0%	15	25.0%	60
	51	33	66.0%	17	34.0%	50
	52	11	61.1%	7	38.9%	18
Total		**2347**	**72.0%**	**903**	**28.0%**	**3250**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

Month	Week number	2020				
		Yes		No		Total
		N	%	N	%	N
MAR	10	57	75.0%	19	25.0%	76
	11	60	75.0%	20	25.0%	80
	12	48	64.0%	27	36.0%	75
	13	59	81.9%	13	18.1%	72
APR	14	43	63.2%	25	36.8%	68
	15	52	61.2%	33	38.8%	85
	16	54	54.5%	45	45.5%	99
	17	60	72.3%	23	27.7%	83
MAY	18	64	80.0%	16	20.0%	80
	19	58	72.5%	22	27.5%	80
	20	59	78.7%	16	21.3%	75
	21	67	72.0%	26	28.0%	93
	22	66	68.8%	30	31.3%	96
JUN	23	62	79.5%	16	20.5%	78
	24	79	78.2%	22	21.8%	101
	25	59	72.0%	23	28.0%	82
	26	67	71.3%	27	28.7%	94
JUL	27	67	74.4%	23	25.6%	90
	28	60	72.3%	23	27.7%	83
	29	71	75.5%	23	24.5%	94
	30	54	72.0%	21	28.0%	75
	31	56	69.1%	25	30.9%	81
AUG	32	50	78.1%	14	21.9%	64
	33	68	69.4%	30	30.6%	98
	34	69	81.2%	16	18.8%	85
	35	50	65.8%	26	34.2%	76
SEP	36	76	76.8%	23	23.2%	99
	37	47	54.0%	40	46.0%	87
	38	62	68.9%	28	31.1%	90
	39	56	70.9%	23	29.1%	79
OCT	40	59	77.6%	17	22.4%	76
	41	52	72.2%	20	27.8%	72
	42	55	67.9%	26	32.1%	81
	43	48	62.3%	29	37.7%	77
	44	53	73.6%	19	26.4%	72
NOV	45	55	67.1%	27	32.9%	82
	46	49	69.0%	22	31.0%	71
	47	59	73.8%	21	26.3%	80
	48	55	67.9%	26	32.1%	81
DEC	49	49	65.3%	26	34.7%	75
	50	63	80.8%	15	19.2%	78
	51	45	57.7%	33	42.3%	78
	52	28	62.2%	17	37.8%	45
Total		**2470**	**71.0%**	**1016**	**29.0%**	**3486**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.5: PERCENTAGE OF BED DAYS IN STROKE UNIT, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=74047)

Month	Week number	2019					2020				
		LOS in hospital		LOS in stroke unit			LOS in hospital		LOS in stroke unit		
		Patients (n)	LOS (days)	Patients (n)	LOS (days)	%	Patients (n)	LOS (days)	Patients (n)	LOS (days)	%
MAR	10	62	1620	62	1530	94%	56	790	56	576	73%
	11	52	1136	52	806	71%	59	499	59	361	72%
	12	71	1398	71	875	63%	48	684	48	604	88%
	13	65	1328	65	962	72%	56	864	56	646	75%
APR	14	50	1108	50	837	76%	43	511	43	375	73%
	15	61	1280	61	972	76%	52	985	52	681	69%
	16	64	1476	64	857	58%	54	739	54	594	80%
	17	48	978	48	583	60%	56	994	56	888	89%
MAY	18	54	856	54	590	69%	63	840	63	702	84%
	19	50	1060	50	739	70%	56	870	56	689	79%
	20	47	796	47	470	59%	56	1058	56	740	70%
	21	56	1082	56	835	77%	65	941	65	781	83%
	22	60	1021	60	729	71%	64	1142	64	893	78%
JUN	23	48	937	48	712	76%	62	946	62	685	72%
	24	54	1200	54	1098	92%	77	1171	77	801	68%
	25	68	1088	68	643	59%	59	770	59	597	78%
	26	55	1192	55	902	76%	67	1188	67	878	74%
JUL	27	64	1663	64	1096	66%	63	894	63	759	85%
	28	54	861	54	704	82%	57	1165	57	785	67%
	29	55	1138	55	1003	88%	70	798	70	640	80%
	30	62	1212	62	942	78%	50	780	50	536	69%
	31	68	1322	68	1207	91%	55	1082	55	884	82%
AUG	32	48	736	48	624	85%	50	964	50	739	77%
	33	54	1043	54	719	69%	64	1044	64	748	72%
	34	54	905	54	716	79%	69	1180	69	932	79%
	35	58	855	58	692	81%	47	838	47	719	86%
SEP	36	54	991	54	894	90%	76	1087	76	855	79%
	37	55	800	55	702	88%	46	637	46	545	86%
	38	45	570	45	457	80%	61	897	61	664	74%
	39	51	774	51	565	73%	53	576	53	426	74%
OCT	40	54	782	54	530	68%	54	773	54	561	73%
	41	54	854	54	652	76%	50	817	50	703	86%
	42	57	795	57	635	80%	55	856	55	675	79%
	43	61	950	61	812	85%	47	572	47	453	79%
	44	47	529	47	419	79%	50	701	50	519	74%
NOV	45	37	508	37	422	83%	54	713	54	587	82%
	46	51	627	51	521	83%	45	526	45	419	80%
	47	47	521	47	434	83%	57	618	57	514	83%
	48	48	525	48	457	87%	53	637	53	497	78%
DEC	49	57	507	57	398	79%	48	463	48	387	84%
	50	44	352	44	299	85%	62	459	62	386	84%
	51	32	170	32	151	89%	45	262	45	203	77%
	52	11	52	11	48	92%	27	118	27	106	90%
TOTAL		**2287**	**39 598**	**2287**	**30 239**	**76%**	**2401**	**34 449**	**2401**	**26 733**	**78%**

- Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.6: MEDIAN HOSPITAL LENGTH OF STAY OF PATIENTS WITH A STROKE BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=74047)

Month	Week No.	2019 hospital median LOS (days)	2020 hospital median LOS (days)
MAR	10	13	6
	11	14	5
	12	10	5
	13	12	10
APR	14	13	8
	15	13	10
	16	11	9
	17	12	8
MAY	18	11	9
	19	10	10
	20	9	11
	21	10	8
	22	11	12
JUN	23	11	10
	24	9	10
	25	8	8
	26	14	12
JUL	27	14	7
	28	7	11
	29	12	7
	30	12	11
	31	13	11
AUG	32	9	13
	33	9	10
	34	11	11
	35	9	11
SEP	36	10	10
	37	10	11
	38	8	8
	39	9	7
OCT	40	7	7
	41	10	11
	42	9	7
	43	13	8
	44	9	8
NOV	45	10	7
	46	8	8
	47	9	9
	48	9	10
DEC	49	7	8
	50	8	7
	51	4	5
	52	5	4

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.6A: MEDIAN STROKE UNIT LENGTH OF STAY OF PATIENTS WITH A STROKE BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=56972)

Month	Week No.	2019 stroke unit median LOS (days)	2020 stroke unit median LOS (days)
MAR	10	11	6
	11	9	4
	12	7	4
	13	8	8
APR	14	9	6
	15	8	8
	16	9	7
	17	9	7
MAY	18	8	8
	19	8	9
	20	8	8
	21	7	7
	22	9	9
JUN	23	9	7
	24	8	7
	25	6	6
	26	10	7
JUL	27	9	7
	28	6	8
	29	10	7
	30	9	7
	31	12	9
AUG	32	8	9
	33	8	6
	34	8	10
	35	8	10
SEP	36	9	8
	37	8	7
	38	7	7
	39	7	6
OCT	40	6	6
	41	8	9
	42	7	6
	43	11	7
	44	8	6
NOV	45	8	6
	46	7	7
	47	6	7
	48	7	8
DEC	49	5	7
	50	6	5
	51	4	4
	52	5	3

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.7: KEY PERFORMANCE INDICATOR 3: PERCENTAGE OF ISCHAEMIC STROKE CASES TO RECEIVED THROMBOLYSIS TREATMENT BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020), BY MONTH AND CALENDAR WEEK (n=5752)

Month	Week number	2019									
		Yes		No		Contraindicated		Unknown		Total	
		N	%	N	%	N	%	N	%	N	%
MAR	10	11	16%	13	19%	44	65%	0	0%	68	100%
	11	6	9%	10	15%	49	75%	0	0%	65	100%
	12	9	12%	18	23%	51	65%	0	0%	78	100%
	13	6	8%	19	25%	51	67%	0	0%	76	100%
APR	14	~	*	*	*	49	68%	0	0%	72	100%
	15	7	11%	18	27%	40	61%	~	*	66	100%
	16	10	13%	17	22%	52	66%	0	0%	79	100%
	17	~	*	12	19%	46	73%	*	*	63	100%
MAY	18	9	13%	12	17%	50	70%	0	0%	71	100%
	19	7	11%	6	10%	50	79%	0	0%	63	100%
	20	~	*	*	*	42	70%	0	0%	60	100%
	21	7	12%	14	23%	39	65%	0	0%	60	100%
	22	9	13%	18	25%	44	62%	0	0%	71	100%
JUN	23	10	18%	9	16%	36	65%	0	0%	55	100%
	24	10	17%	8	14%	39	67%	~	*	58	100%
	25	9	12%	15	19%	52	67%	~	*	78	100%
	26	~	*	11	17%	50	76%	*	*	66	100%
JUL	27	~	*	*	*	54	68%	0	0%	79	100%
	28	8	12%	17	25%	41	61%	~	*	67	100%
	29	~	*	*	*	50	76%	0	0%	66	100%
	30	8	11%	14	19%	50	69%	0	0%	72	100%
	31	9	10%	19	22%	59	68%	0	0%	87	100%
AUG	32	~	*	*	*	43	74%	0	0%	58	100%
	33	8	12%	13	19%	47	68%	~	*	69	100%
	34	6	8%	11	15%	53	75%	~	*	71	100%
	35	6	9%	10	14%	52	75%	~	*	69	100%
SEP	36	8	11%	15	20%	51	69%	0	0%	74	100%
	37	3	5%	13	20%	49	75%	0	0%	65	100%
	38	8	15%	10	18%	37	67%	0	0%	55	100%
	39	7	11%	16	26%	38	62%	0	0%	61	100%
OCT	40	8	11%	8	11%	54	77%	0	0%	70	100%
	41	~	*	15	26%	37	64%	*	*	58	100%
	42	10	14%	9	13%	52	73%	0	0%	71	100%
	43	11	15%	11	15%	50	69%	0	0%	72	100%
	44	~	*	11	19%	41	71%	*	*	58	100%
NOV	45	6	11%	9	17%	38	72%	0	0%	53	100%
	46	6	12%	14	27%	32	62%	0	0%	52	100%
	47	6	9%	13	20%	45	70%	0	0%	64	100%
	48	~	*	6	11%	43	80%	*	*	54	100%
DEC	49	7	9%	17	23%	50	68%	0	0%	74	100%
	50	6	11%	7	13%	40	74%	~	*	54	100%
	51	7	16%	6	14%	30	70%	0	0%	43	100%
	52	~	*	~	*	9	60%	*	*	15	100%
TOTAL		**295**	**11%**	**540**	**19%**	**1929**	**69%**	**16**	**1%**	**2780**	**100%**

~ Denotes five cases or fewer

APPENDIX 3: FREQUENCY TABLES

Month	Week number	2020									
		Yes		No		Contraindicated		Unknown		Total	
		N	%	N	%	N	%	N	%	N	%
MAR	10	11	16%	11	16%	47	68%	0	0%	69	100%
	11	9	14%	14	22%	42	65%	0	0%	65	100%
	12	8	13%	13	21%	41	66%	0	0%	62	100%
	13	10	17%	6	10%	43	73%	0	0%	59	100%
APR	14	13	21%	9	15%	39	64%	0	0%	61	100%
	15	9	12%	11	15%	53	73%	0	0%	73	100%
	16	10	12%	10	12%	61	75%	0	0%	81	100%
	17	10	14%	18	25%	43	61%	0	0%	71	100%
MAY	18	9	14%	14	22%	41	64%	0	0%	64	100%
	19	13	20%	14	21%	39	59%	0	0%	66	100%
	20	~	*	*	*	43	74%	0	0%	58	100%
	21	11	13%	13	16%	58	71%	0	0%	82	100%
	22	~	*	*	*	66	79%	0	0%	84	100%
JUN	23	8	12%	16	24%	44	65%	0	0%	68	100%
	24	9	10%	18	20%	60	68%	~	*	88	100%
	25	~	*	*	*	59	80%	0	0%	74	100%
	26	~	*	*	*	64	75%	0	0%	85	100%
JUL	27	13	17%	17	22%	46	61%	0	0%	76	100%
	28	6	8%	11	15%	56	77%	0	0%	73	100%
	29	~	*	15	19%	61	75%	0	0%	81	100%
	30	~	*	*	*	48	75%	0	0%	64	100%
	31	8	13%	17	27%	39	61%	0	0%	64	100%
AUG	32	7	13%	19	35%	29	53%	0	0%	55	100%
	33	11	13%	16	18%	61	69%	0	0%	88	100%
	34	10	14%	9	12%	55	74%	0	0%	74	100%
	35	~	*	*	*	49	77%	0	0%	64	100%
SEP	36	6	8%	16	20%	58	73%	0	0%	80	100%
	37	10	14%	19	26%	42	58%	~	*	72	100%
	38	8	10%	22	27%	52	63%	0	0%	82	100%
	39	9	13%	9	13%	53	75%	0	0%	71	100%
OCT	40	~	*	*	*	45	71%	0	0%	63	100%
	41	6	10%	17	27%	39	63%	0	0%	62	100%
	42	~	*	13	19%	50	74%	0	0%	68	100%
	43	7	11%	14	22%	43	67%	0	0%	64	100%
	44	7	11%	11	18%	44	71%	0	0%	62	100%
NOV	45	6	9%	8	12%	51	78%	0	0%	65	100%
	46	7	11%	8	13%	46	75%	0	0%	61	100%
	47	6	9%	9	13%	53	78%	0	0%	68	100%
	48	~	*	*	*	*	80%	0	0%	70	100%
DEC	49	~	*	11	18%	45	75%	*	*	60	100%
	50	~	*	*	*	*	83%	0	0%	72	100%
	51	~	*	*	*	*	67%	0	0%	66	100%
	52	~	*	*	*	*	68%	0	0%	37	100%
TOTAL		**309**	**10%**	**567**	**19%**	**2093**	**70%**	**~**	*****	**2972**	**100%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.8: TIME BETWEEN HOSPITAL ARRIVAL AND TIME REVIEWED BY MEDICAL TEAM, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=5073)

	Pre-COVID-19 (2019)		COVID-19 (2020)	
	N	**%**	**N**	**%**
Less than 10 minutes	1051	45.3%	1361	49.4%
11 to 30 minutes	301	13.0%	361	13.1%
31 minutes to 1 hour	195	8.4%	267	9.7%
More than 1 hour to 3 hours	262	11.3%	354	12.9%
More than 3 hours to 24 hours	445	19.2%	381	13.8%
More than 24 hours	65	2.8%	30	1.1%
Total	**2319**	**100.0%**	**2754**	**100.0%**

FIGURE 9.9: DOOR TO IMAGING TIME, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=5791)

	Within 60 minutes		After 60 minutes		Total	
	N	**%**	**N**	**%**	**N**	**%**
Pre-COVID-19 (2019)	1224	44.5%	1529	55.5%	2753	100.0%
COVID-19 (2020)	1443	47.5%	1595	52.5%	3038	100.0%
Total	**2667**	**46.1%**	**3124**	**53.9%**	**5791**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.10: DOOR TO NEEDLE TIME, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=559)

Month	Week number	2019				
		Patients (n)	Mean	Median	Percentile 25	Percentile 75
MAR	10	11	61	50	42	76
	11	*	53	46	26	78
	12	8	66	58	36	88
	13	~	78	85	52	105
	Total	29	63	50	42	78
APR	14	~	51	43	35	75
	15	7	44	42	32	56
	16	8	83	71	52	107
	17	~	86	45	28	144
	Total	24	65	51	38	78
MAY	18	9	54	40	32	56
	19	6	60	60	47	70
	20	~	64	75	40	82
	21	~	45	44	30	64
	22	8	69	48	29	117
	Total	33	59	47	33	75
JUN	23	9	56	41	32	76
	24	10	70	59	50	91
	25	*	81	77	61	87
	26	~	41	36	22	65
	Total	30	66	59	41	80
JUL	27	~	55	44	28	81
	28	8	73	61	35	97
	29	~	81	76	53	109
	30	8	70	47	39	100
	31	9	76	76	45	108
	Total	33	72	62	38	105
AUG	32	~	66	86	35	88
	33	7	134	87	53	297
	34	6	36	36	20	39
	35	~	63	68	30	72
	Total	23	78	64	31	88
SEP	36	8	49	36	19	64
	37	~	78	78	69	87
	38	7	51	52	38	71
	39	*	68	59	51	85
	Total	23	57	52	33	75
OCT	40	7	142	50	24	85
	41	~	79	64	47	112
	42	8	62	45	30	87
	43	10	68	53	45	73
	44	~	21	16	15	22
	Total	34	76	49	27	73
NOV	45	~	50	38	33	69
	46	6	77	72	37	128
	47	6	63	53	31	88
	48	~	43	43	23	62
	Total	19	62	62	31	88
DEC	49	7	83	68	46	134
	50	*	63	59	46	72
	51	7	56	53	23	75
	52	~	53	53	53	53
	Total	21	67	59	46	75
Total		**269**	**67**	**54**	**35**	**82**

APPENDIX 3: FREQUENCY TABLES

Month	Week number	2020				
		Patients (n)	Mean	Median	Percentile 25	Percentile 75
MAR	10	11	57	50	38	66
	11	9	60	66	28	83
	12	8	60	50	27	77
	13	9	45	45	32	60
	Total	37	55	50	33	66
APR	14	12	61	49	35	82
	15	9	48	43	31	50
	16	10	64	49	30	90
	17	8	65	56	42	87
	Total	39	60	45	31	86
MAY	18	9	77	60	55	104
	19	13	78	60	51	107
	20	~	105	105	90	119
	21	10	48	41	30	67
	22	~	68	48	46	73
	Total	39	70	57	44	90
JUN	23	8	51	54	19	78
	24	9	57	60	42	65
	25	~	31	31	31	31
	26	~	104	102	100	133
	Total	23	64	60	31	95
JUL	27	12	86	103	55	113
	28	6	87	80	79	102
	29	~	51	47	42	74
	30	~	68	65	44	93
	31	7	47	38	32	59
	Total	34	71	70	38	102
AUG	32	~	46	50	30	59
	33	9	59	47	32	56
	34	10	63	62	31	82
	35	~	85	93	75	98
	Total	29	63	56	32	75
SEP	36	~	86	44	44	93
	37	10	67	79	30	92
	38	8	171	99	25	246
	39	*	68	68	58	87
	Total	30	98	73	33	100
OCT	40	~	78	74	44	113
	41	~	43	46	36	51
	42	~	52	63	30	67
	43	6	44	44	41	61
	44	7	80	55	37	145
	Total	27	60	53	36	68
NOV	45	6	81	66	52	118
	46	6	62	55	45	85
	47	6	82	60	25	120
	48	~	53	52	32	74
	Total	21	72	58	45	85
DEC	49	~	493	150	87	1241
	50	~	44	44	44	44
	51	~	46	60	13	66
	52	~	40	35	29	52
	Total	11	166	60	32	87
Total		**290**	**71**	**58**	**37**	**86**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.11: INTERVENTION OUTCOMES – NATIONAL INSTITUTES OF HEALTH STROKE SCALE SCORES, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=510)

		2019		2020	
		N	%	N	%
Pre-thrombectomy	No stroke symptoms (0)	~	*	0	0%
	Minor stroke symptoms (1–4)	*	*	11	5%
	Moderate stroke (5–15)	135	50%	127	53%
	Moderate to severe stroke (16–20)	79	29%	53	22%
	Severe stroke (21–42)	47	17%	48	20%
	Total	**271**	**100%**	**239**	**100%**
24 hours post-thrombectomy	No stroke symptoms (0)	14	5%	17	7%
	Minor stroke (1–4)	93	34%	71	30%
	Moderate stroke (5–15)	99	37%	106	44%
	Moderate to severe stroke (16–20)	38	14%	24	10%
	Severe stroke (21–42)	27	10%	21	9%
	Total	**271**	**100%**	**239**	**100%**

~ Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

FIGURE 9.12: SWALLOW SCREENING WITHIN 4 HOURS OF PRESENTATION TO HOSPITAL, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=4594)

	Pre-COVID-19 (2019)		COVID-19 (2020)	
	N	%	N	%
Yes	961	43.7%	993	41.5%
No	1193	54.2%	1352	56.5%
Unknown	46	2.1%	49	2.0%
Total	**2200**	**100.0%**	**2394**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.13: ASSESSED BY A CLINICAL NURSE SPECIALIST, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (N=6736)

Month	Week number	2019							
		Yes		No		Unknown		Total	
		N	%	N	%	N	%	N	%
MAR	10	74	90.2%	8	9.8%	0	0.0%	82	100.0%
	11	59	81.9%	11	15.3%	-	*	72	100.0%
	12	79	83.2%	15	15.8%	-	*	95	100.0%
	13	75	80.6%	17	18.3%	-	*	93	100.0%
	Total	287	83.9%	51	14.9%	-	*	342	100.0%
APR	14	71	86.6%	9	11.0%	-	*	82	100.0%
	15	68	86.1%	11	13.9%	0	0.0%	79	100.0%
	16	80	92.0%	7	8.0%	0	0.0%	87	100.0%
	17	57	80.3%	11	15.5%	-	*	71	100.0%
	Total	276	86.5%	38	11.9%	-	*	319	100.0%
MAY	18	71	86.6%	8	9.8%	-	*	82	100.0%
	19	69	90.8%	7	9.2%	0	0.0%	76	100.0%
	20	58	85.3%	9	13.2%	-	*	68	100.0%
	21	64	86.5%	10	13.5%	0	0.0%	74	100.0%
	22	70	85.4%	11	13.4%	-	*	82	100.0%
	Total	332	86.9%	45	11.8%	-	*	382	100.0%
JUN	23	55	84.6%	10	15.4%	0	0.0%	65	100.0%
	24	56	81.2%	12	17.4%	-	*	69	100.0%
	25	79	85.9%	12	13.0%	-	*	92	100.0%
	26	69	89.6%	7	9.1%	-	*	77	100.0%
	Total	259	85.5%	41	13.5%	-	*	303	100.0%
JUL	27	76	88.4%	9	10.5%	-	*	86	100.0%
	28	58	76.3%	17	22.4%	-	*	76	100.0%
	29	60	78.9%	14	18.4%	-	*	76	100.0%
	30	71	81.6%	14	16.1%	-	*	87	100.0%
	31	79	84.9%	13	14.0%	-	*	93	100.0%
	Total	344	82.3%	67	16.0%	7	1.7%	418	100.0%
AUG	32	59	80.8%	12	16.4%	-	*	73	100.0%
	33	72	87.8%	10	12.2%	0	0.0%	82	100.0%
	34	65	85.5%	10	13.2%	-	*	76	100.0%
	35	68	81.9%	14	16.9%	-	*	83	100.0%
	Total	264	84.1%	46	14.6%	-	*	314	100.0%
SEP	36	67	80.7%	16	19.3%	0	0.0%	83	100.0%
	37	68	87.2%	10	12.8%	0	0.0%	78	100.0%
	38	55	88.7%	7	11.3%	0	0.0%	62	100.0%
	39	60	78.9%	15	19.7%	-	*	76	100.0%
	Total	250	83.6%	48	16.1%	-	*	299	100.0%
OCT	40	68	85.0%	11	13.8%	-	*	80	100.0%
	41	62	89.9%	6	8.7%	-	*	69	100.0%
	42	72	82.8%	15	17.2%	0	0.0%	87	100.0%
	43	74	87.1%	11	12.9%	0	0.0%	85	100.0%
	44	57	80.3%	13	18.3%	-	*	71	100.0%
	Total	333	84.9%	56	14.3%	-	*	392	100.0%
NOV	45	52	80.0%	9	13.8%	-	*	65	100.0%
	46	56	80.0%	11	15.7%	-	*	70	100.0%
	47	52	74.3%	16	22.9%	-	*	70	100.0%
	48	56	82.4%	9	13.2%	-	*	68	100.0%
	Total	216	79.1%	45	16.5%	12	4.4%	273	100.0%
DEC	49	52	65.0%	23	28.8%	-	*	80	100.0%
	50	48	80.0%	12	20.0%	0	0.0%	60	100.0%
	51	40	80.0%	*	*	-	*	50	100.0%
	52	12	66.7%	-	*	*	*	18	100.0%
	Total	152	73.1%	48	23.1%	8	3.8%	208	100.0%
Total		**2713**	**83.5%**	**485**	**14.9%**	**52**	**1.6%**	**3250**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

Month	Week number	2020							
		Yes		No		Unknown		Total	
		N	%	N	%	N	%	N	%
MAR	10	53	69.7%	23	30.3%	0	0.0%	76	100.0%
	11	63	78.8%	17	21.3%	0	0.0%	80	100.0%
	12	51	68.0%	24	32.0%	0	0.0%	75	100.0%
	13	56	77.8%	15	20.8%	-	*	72	100.0%
	Total	223	73.6%	79	26.1%	-	*	303	100.0%
APR	14	42	61.8%	26	38.2%	0	0.0%	68	100.0%
	15	52	61.2%	32	37.6%	-	*	85	100.0%
	16	55	55.6%	44	44.4%	0	0.0%	99	100.0%
	17	56	67.5%	27	32.5%	0	0.0%	83	100.0%
	Total	205	61.2%	129	38.5%	-	*	335	100.0%
MAY	18	58	72.5%	22	27.5%	0	0.0%	80	100.0%
	19	55	68.8%	25	31.3%	0	0.0%	80	100.0%
	20	60	80.0%	15	20.0%	0	0.0%	75	100.0%
	21	76	81.7%	17	18.3%	0	0.0%	93	100.0%
	22	82	85.4%	14	14.6%	0	0.0%	96	100.0%
	Total	331	78.1%	93	21.9%	0	0.0%	424	100.0%
JUN	23	64	82.1%	14	17.9%	0	0.0%	78	100.0%
	24	83	82.2%	18	17.8%	0	0.0%	101	100.0%
	25	65	79.3%	17	20.7%	0	0.0%	82	100.0%
	26	75	79.8%	19	20.2%	0	0.0%	94	100.0%
	Total	287	80.8%	68	19.2%	0	0.0%	355	100.0%
JUL	27	74	82.2%	16	17.8%	0	0.0%	90	100.0%
	28	69	83.1%	13	15.7%	-	*	83	100.0%
	29	81	86.2%	13	13.8%	0	0.0%	94	100.0%
	30	63	84.0%	12	16.0%	0	0.0%	75	100.0%
	31	66	81.5%	15	18.5%	0	0.0%	81	100.0%
	Total	353	83.5%	69	16.3%	-	*	423	100.0%
AUG	32	57	89.1%	*	*	0	0.0%	64	100.0%
	33	85	86.7%	10	10.2%	3	3.1%	98	100.0%
	34	69	81.2%	15	17.6%	-	*	85	100.0%
	35	*	*	-	*	0	0.0%	76	100.0%
	Total	283	87.6%	36	11.1%	-	*	323	100.0%
SEP	36	88	88.9%	11	11.1%	0	0.0%	99	100.0%
	37	68	78.2%	17	19.5%	-	*	87	100.0%
	38	73	81.1%	15	16.7%	-	*	90	100.0%
	39	65	82.3%	13	16.5%	-	*	79	100.0%
	Total	294	82.8%	56	15.8%	-	*	355	100.0%
OCT	40	60	78.9%	15	19.7%	-	*	76	100.0%
	41	61	84.7%	11	15.3%	0	0.0%	72	100.0%
	42	62	76.5%	19	23.5%	0	0.0%	81	100.0%
	43	65	84.4%	11	14.3%	-	*	77	100.0%
	44	57	79.2%	14	19.4%	-	*	72	100.0%
	Total	305	80.7%	70	18.5%	-	*	378	100.0%
NOV	45	61	74.4%	21	25.6%	0	0.0%	82	100.0%
	46	53	74.6%	17	23.9%	-	*	71	100.0%
	47	65	81.3%	15	18.8%	0	0.0%	80	100.0%
	48	67	82.7%	13	16.0%	-	*	81	100.0%
	Total	246	78.3%	66	21.0%	-	*	314	100.0%
DEC	49	56	74.7%	19	25.3%	0	0.0%	75	100.0%
	50	62	79.5%	15	19.2%	-	*	78	100.0%
	51	56	71.8%	22	28.2%	0	0.0%	78	100.0%
	52	28	62.2%	17	37.8%	0	0.0%	45	100.0%
	Total	202	73.2%	73	26.4%	-	*	276	100.0%
Total		**2729**	**78.3%**	**739**	**21.2%**	**18**	**0.5%**	**3486**	**100.0%**

- Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.14: CARE OF PATIENTS WITH A STROKE DISCUSSED AT A MULTIDISCIPLINARY TEAM MEETING, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (n=6529)

	Pre-COVID-19 (2019)		COVID-19 (2020)	
	N	%	N	%
Discussed at a multidisciplinary team meeting	2590	82.6%	2464	72.6%
Not discussed at a multidisciplinary team meeting	291	9.3%	604	17.8%
Not indicated	255	8.1%	325	9.6%
Total	3136	100.0%	3393	100.0%

APPENDIX 3: FREQUENCY TABLES

FIGURE 9.15: SHARE OF PATIENTS WITH A STROKE WHO WERE DISCHARGED HOME WITH EARLY SUPPORTED DISCHARGE, BASED ON ADMISSION DATE (MARCH TO DECEMBER 2019 AND 2020) (N=6736)

Month	Week number	2019					
		Home with ESD		Other/unknown		Total	
		N	%	N	%	N	%
MAR	10	~	*	*	*	82	100.0%
	11	~	*	*	*	72	100.0%
	12	~	*	*	*	95	100.0%
	13	~	*	*	*	93	100.0%
	Total	14	4.1%	328	95.9%	342	100.0%
APR	14	~	*	*	*	82	100.0%
	15	~	*	*	*	79	100.0%
	16	8	9.2%	*	*	87	100.0%
	17	~	*	70	98.6%	71	100.0%
	Total	18	5.6%	301	94.4%	319	100.0%
MAY	18	~	*	*	*	82	100.0%
	19	6	7.9%	70	92.1%	76	100.0%
	20	~	*	*	*	68	100.0%
	21	~	*	*	*	74	100.0%
	22	7	8.5%	75	91.5%	82	100.0%
	Total	20	5.2%	362	94.8%	382	100.0%
JUN	23	~	*	*	*	65	100.0%
	24	~	*	*	*	69	100.0%
	25	~	*	*	*	92	100.0%
	26	~	*	*	*	77	100.0%
	Total	10	3.3%	293	96.7%	303	100.0%
JUL	27	6	7.0%	80	93.0%	86	100.0%
	28	~	*	*	*	76	100.0%
	29	~	*	*	*	76	100.0%
	30	~	*	*	*	87	100.0%
	31	6	6.5%	87	93.5%	93	100.0%
	Total	23	5.5%	395	94.5%	418	100.0%
AUG	32	~	*	*	*	73	100.0%
	33	~	*	*	*	82	100.0%
	34	9	12.0%	*	*	76	100.0%
	35	~	*	*	*	83	100.0%
	Total	18	6.0%	296	94.3%	314	100.0%
SEP	36	~	*	*	*	83	100.0%
	37	8	10.0%	70	89.7%	78	100.0%
	38	~	*	*	*	62	100.0%
	39	~	*	*	*	76	100.0%
	Total	13	4.0%	286	95.7%	299	100.0%
OCT	40	6	8.0%	74	92.5%	80	100.0%
	41	~	*	*	*	69	100.0%
	42	~	*	*	*	87	100.0%
	43	7	8.0%	78	91.8%	85	100.0%
	44	~	*	*	*	71	100.0%
	Total	22	6.0%	370	94.4%	392	100.0%
NOV	45	6	9.0%	59	90.8%	65	100.0%
	46	~	*	*	*	70	100.0%
	47	~	*	*	*	70	100.0%
	48	~	*	*	*	68	100.0%
	Total	16	6.0%	257	94.1%	273	100.0%
DEC	49	~	*	*	*	80	100.0%
	50	~	*	*	*	60	100.0%
	51	~	*	*	*	50	100.0%
	52	~	*	*	*	18	100.0%
	Total	12	6.0%	196	94.2%	208	100.0%
Total		**166**	**5.0%**	**3084**	**94.9%**	**3250**	**100.0%**

APPENDIX 3: FREQUENCY TABLES

Month	Week number	2020					
		Home with ESD		Other/unknown		Total	
		N	%	N	%	N	%
MAR	10	-	*	*	*	76	100.0%
	11	-	*	*	*	80	100.0%
	12	-	*	*	*	75	100.0%
	13	7	9.7%	65	90.3%	72	100.0%
	Total	18	5.9%	285	94.1%	303	100.0%
APR	14	-	*	*	*	68	100.0%
	15	11	12.9%	74	87.1%	85	100.0%
	16	11	11.1%	88	88.9%	99	100.0%
	17	-	*	*	*	83	100.0%
	Total	30	9.0%	305	91.0%	335	100.0%
MAY	18	6	7.5%	74	92.5%	80	100.0%
	19	9	11.3%	71	88.8%	80	100.0%
	20	6	8.0%	69	92.0%	75	100.0%
	21	8	8.6%	85	91.4%	93	100.0%
	22	7	7.3%	89	92.7%	96	100.0%
	Total	36	8.5%	388	91.5%	424	100.0%
JUN	23	7	9.0%	71	91.0%	78	100.0%
	24	10	9.9%	91	90.1%	101	100.0%
	25	-	*	*	*	82	100.0%
	26	-	*	*	*	94	100.0%
	Total	26	7.3%	329	92.7%	355	100.0%
JUL	27	-	*	*	*	90	100.0%
	28	-	*	*	*	83	100.0%
	29	-	*	*	*	94	100.0%
	30	-	*	*	*	75	100.0%
	31	-	*	*	*	81	100.0%
	Total	20	4.7%	403	95.3%	423	100.0%
AUG	32	6	9.4%	58	90.6%	64	100.0%
	33	-	*	*	*	98	100.0%
	34	10	11.8%	75	88.2%	85	100.0%
	35	-	*	*	*	76	100.0%
	Total	26	8.0%	297	92.0%	323	100.0%
SEP	36	9	9.1%	90	90.9%	99	100.0%
	37	7	8.0%	80	92.0%	87	100.0%
	38	-	*	*	*	90	100.0%
	39	6	7.6%	73	92.4%	79	100.0%
	Total	27	7.6%	328	92.4%	355	100.0%
OCT	40	-	*	*	*	76	100.0%
	41	11	15.3%	61	84.7%	72	100.0%
	42	7	8.6%	74	91.4%	81	100.0%
	43	10	13.0%	67	87.0%	77	100.0%
	44	7	9.7%	65	90.3%	72	100.0%
	Total	38	10.1%	340	89.9%	378	100.0%
NOV	45	8	9.8%	74	90.2%	82	100.0%
	46	7	9.9%	64	90.1%	71	100.0%
	47	8	10.0%	72	90.0%	80	100.0%
	48	10	12.3%	71	87.7%	81	100.0%
	Total	33	10.5%	281	89.5%	314	100.0%
DEC	49	6	8.0%	69	92.0%	75	100.0%
	50	7	9.0%	71	91.0%	78	100.0%
	51	-	*	*	*	78	100.0%
	52	-	*	*	*	45	100.0%
	Total	23	8.3%	253	91.7%	276	100.0%
Total		**277**	**7.9%**	**3209**	**92.1%**	**3486**	**100.0%**

- Denotes five cases or fewer
* Further suppression required to prevent disclosure of five cases or fewer

APPENDIX 4: INAS GOVERNANCE COMMITTEE MEETING ATTENDANCE RECORD, 2020

Representative	Name	*30.03 2020	15.06 2020	29.09 2020	15.12 2020	Total 2020
Healthcare Professional Expert – Clinical Nurse Specialist in Stroke (Model 4 Hospital)	Glen Arrigan	N/A	✗	✓	✓	2/3
Chairperson of Irish National Audit of Stroke Governance Committee	Dr Tim Cassidy	N/A	CHAIR	CHAIR	CHAIR	3/3
Clinical Expert – Clinical Lead, National Clinical Programme for Stroke	Prof. Rónán Collins	N/A	✗	✓	✓	2/3
Senior Accountable Healthcare Manager representative	Ann Dalton	N/A	✓	✗	✗	1/3
Hospital Group Director of Nursing representative	Paul Gallagher	N/A	✓	✓	✗	2/3
Clinical Lead – Irish National Audit of Stroke	Prof. Joe Harbison	N/A	✓	✓	✓	3/3
Cardiovascular Programme Audit Manager	Joan McCormack	N/A	✓	✓	✓	3/3
Healthcare Professional Expert – Advanced Nurse Practitioner in Stroke (Model 3 Hospital)	Una Moffat	N/A	✓	✗	✓	2/3
Healthcare Pricing Office	Deirdre Murphy	N/A	✓	✓	✓	3/3
Clinical Expert – Clinical Advisory Group – Stroke	Dr Margaret O'Connor	N/A	✓	✓	✓	3/3
Healthcare Professional Expert – National Health and Social Care Professions Office	Claire Prendergast	N/A	✓	✓	✓	3/3
Public and Patient Interest Representative – Irish Heart Foundation	Martin Quinn	N/A	✓	✓	✓	3/3
Public Health Specialist	Dr Breda Smyth	N/A	✗	✓	✗	1/3
Clinical Expert – Director, National Thrombectomy Service	Prof. John Thornton	N/A	✗	✓	✓	2/3
Clinical Expert – Rehabilitation Specialist	Dr Eugene Wallace	N/A	✓	✗	✓	2/3
Public and Patient Interest Representative – Headway	Dr Marcia Ward	N/A	✓	✓	✓	3/3
Programme Manager, National Stroke Programme	Edina O'Driscoll	N/A	✓	✓	✓	3/3

* Meeting on 30 March 2020 was cancelled due to the COVID-19 pandemic

✓ = Attended
✗ = Did not attend
N/A = Not applicable

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