NOCA National Office of Clinical Audit

INAS Irish National Audit of Stroke

IRISH NATIONAL AUDIT OF STROKE

A critical review of national stroke data for Ireland from 2013 to 2021

MINUTES CAN SAVE INDEPENDENCE

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NATIONAL OFFICE OF CLINICAL AUDIT (NOCA)

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RCSI

HSE

ROYAL COLLEGE OF PHYSICIANS OF IRELAND

STROKE

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DESIGNED BY SWERVE

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INAS Irish National Audit of Stroke

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A critical review of national stroke data for Ireland from 2013 to 2021

National Office of Clinical Audit

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31 October, 2022

Dear Prof Harbison,

I wish to acknowledge receipt of the *Irish National Audit of Stroke: A critical review of national stroke data for Ireland from 2013 to 2021.*

Following review of this report by NOCA, I am delighted to endorse this report on behalf of the NOCA Governance Board.

I wish to congratulate you, Audit Manager Joan McCormack, Data Analyst Olga Brych, and the INAS Governance Committee on the development of this report, which is a valuable quality improvement initiative.

Please accept this as formal endorsement from the NOCA Governance Board of the *Irish National Audit of Stroke: A critical review of national stroke data for Ireland from 2013 to 2021* and of your ongoing commitment to driving improvement in stroke care in Ireland.

Yours sincerely,

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FOREWORD

It is truly a pleasure to welcome this report.

The authors aimed to examine the quality of the stroke audit data from its inception as the National Stroke Register established by the National Stroke Programme in 2013 to the publication by the National Office of Clinical Audit (NOCA) of the Irish National Audit of Stroke (INAS) report for 2021. Trends in patient and care characteristics are reported, along with trends in Key Performance and Key Quality Indicators. The authors have fully delivered what they set out to accomplish.

Just one caveat about the exercise. Because the main focus is to validate the data and to make recommendations for improvements to the quality of the data set and of services, there is a danger of missing the very positive messages from this report. There was one stroke unit in Ireland when a comprehensive audit of services was carried out in 2007. That prompted the development of stroke units and now there is one in every hospital which delivers acute stroke care. While there will always be a need for more resources and better patient care, it is important to take a moment to acknowledge all that has been achieved.

A declaration of interest at this point! As a public health specialist in the HSE, I was part of the research team for the 2007 organisational audit and for some years I was Public Health Lead for the National Stroke Programme. I also Chaired the Stroke Register Steering Group for a number of years. So, I admit to potential bias in my declaration that service developments are a credit to all involved.

While some of the progress may be attributed to financial resources, much has been achieved by the persistent advocacy of professional leaders and the collaboration, teamwork and innovation of health care staff, for example, to provide 24/7 hyperacute care, early supported discharge and a thrombectomy service, as well as supplying data for the national audit. Is there a need for more resources and further improvements? Absolutely, but no doubt the dedication which has resulted in so many improvements to date will lead to ongoing progress to enhance outcomes for patients.

Prior to the transfer of the audit to NOCA, resources only allowed for basic checks of the data. The team at NOCA has developed a validation scheme consistent with internationally agreed dimensions of data quality. Fortunately, due to the high quality of data input by Audit Coordinators since its inception, the retrospective validation of pre-NOCA data has concluded that they are of acceptable quality to be used for research on trends from 2013 onwards.

The findings are set in the context of audits of the organisation of stroke care. The 2015 audit identified improvements compared to the 2007 audit. However, the findings of this analysis are consistent with those of the organisational audit published in 2022 that, despite the increase in stroke unit beds from 150 (in 2015) to 239, additional stroke unit beds are needed to meet the key performance indicator that patients who are admitted to a stroke unit after an acute event would spend 90% of their in-patient stay in the unit. Annual performance peaked at 73% in 2018 and decreased to 70% in 2021.

Another key performance indicator is the percentage of patients with an acute ischaemic stroke who receive thrombolysis, a ‘clot busting’ injection. The overall rate from 2013 to 2021 was 11.2% but the annual rate decreased to 10% in 2021. Possible reasons include delayed presentation to the stroke centre or an increase in patients in whom the treatment is contraindicated. The authors recommend a spotlight audit on thrombolysis. It is noted that raising public awareness of stroke symptoms as a medical emergency is a priority for the National Stroke Programme, working with the HSE and the Irish Heart Foundation.

The audit of the National Thrombectomy Service in Beaumont Hospital, Dublin and Cork University Hospital started in 2016. For patients whose ischaemic stroke is due to a blockage caused by a clot in a large blood vessel, there is strong evidence of benefit from this emergency intervention by neuroradiologists to remove the clot. There has been an ongoing increase in the number of patients treated, with an annual rate of over 9% of patients with an ischaemic stroke for 2019 to 2021. This compares to a rate of 2% reported by the Sentinel Stroke National Audit Programme in 2020 / 2021 in England, Wales and Northern Ireland.

The 2022 organisational audit identified shortfalls in recommended staffing levels and, though not yet in place in all hospitals providing acute stroke care, the Health and Social Care Professional audit found that less than half of all patients received the quantity of care considered appropriate to meet their needs. The reporting of changes in patients' abilities compared to their independence prior to their stroke is a stark reminder and powerful motivator to continue to advocate for the highest quality of stroke care.

Those who experience a stroke will be engaging with health services for the remainder of their lives. There has long been a call for the use of Individual Health Identifiers (IHIs) to track patient care in Ireland, to allow safe data sharing across healthcare settings and support service planning. Irish health information systems make it difficult to estimate health status thirty days after an acute event, a measure of outcome in use internationally. The National Thrombectomy Service is a good example of how an IHI would enable efficient sharing of information between the hospitals and improve patient safety.

This analysis will inform the data quality improvement plan for INAS in 2023. It also identifies priorities to improve patient care. It describes some research projects which are already underway and identifies other topics which warrant investigation. The validated audit data set and other sources of information on patients and their care in Ireland provide a high quality resource for economic evaluation to make the case for investment in stroke services.

I congratulate the authors of this report for their detailed and careful analysis, and for setting the findings in the context of audits of the organisation of care. It will be of interest to the entire stroke community, including the many professionals who have contributed to the audits of care and to the development of improved services for patients.

Prof Emer Shelley
Specialist in Public Health Medicine,
Health Service Executive (retired) and Chair Irish Heart Foundation.

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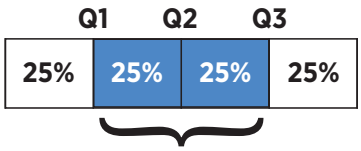
GLOSSARY OF TERMS AND DEFINITIONS

ACRONYM	FULL TERM
ABF	Activity Based Funding
ADLs	activities of daily living
AF	atrial fibrillation
aphasia	A disorder that affects the ability to speak, read, write, and understand language.
BPT	Best Practice Tariff
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.
CT	computed tomography – this is a scanning technique that uses X-rays to take highly detailed images of the body/brain.
CTA	computed tomography angiography
DOAC	direct oral anticoagulant
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
ESD	Early Supported Discharge
EVT	endovascular thrombectomy
EVT stroke centre	A hospital that can provide a thrombectomy service.
F.A.S.T.	face, arm, speech, time
FEES	fiberoptic endoscopic evaluation of swallowing
HADx	hospital acquired diagnosis
haemorrhagic stroke	Haemorrhagic stroke occurs when a blood vessel in the brain leaks or ruptures.
HIPE	Hospital In-Patient Enquiry
HPO	Healthcare Pricing Office
HSCP	health and social care professional
HSE	Health Service Executive

ACRONYM	FULL TERM
ICD-10-AM	International Classification of Diseases, Tenth Revision, Australian Modification
IHF	Irish Heart Foundation
IHI	individual health identifier
INAS	Irish National Audit of Stroke
INR	international normalised ratio
IQR	 Interquartile range = Q3–Q1 interquartile range – this 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
KQI	key quality indicator
LOS	length of stay
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
NIHSS	National Institutes of Health Stroke Scale
NOCA	National Office of Clinical Audit
NSP	National Stroke Programme
NSR	National Stroke Register
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
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
QI	Quality improvement

ACRONYM	FULL TERM
RCSI	Royal College of Surgeons in Ireland
recanalisation	The term used to describe when blood flow in the occluded blood vessel is restored.
SLT	speech and language therapist
SPSS	Statistical Package for the Social Sciences
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.
TIA	transient ischaemic attack
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.
UHL	University Hospital Limerick
UK	United Kingdom

EXECUTIVE SUMMARY

In the European Union (EU) stroke is the second most common cause of death and a leading cause of adult disability. As populations continue to grow and live to an older age, stroke and the long-term sequelae, along with the corresponding costs, are expected to increase dramatically (The Stroke Alliance for Europe, 2020; Bennett *et al*., 2014). Treatment for stroke has advanced greatly since the 1990s, and there is strong evidence that stroke unit care with multidisciplinary team input will reduce disability and mortality and will benefit all patients with a stroke. Patients with ischaemic stroke who present early after symptom onset will benefit from emergency treatments such as thrombolysis and thrombectomy (Organisation for Economic Co-operation and Development, 2015).

From its inception in 2011 until 2019, the National Stroke Register (NSR), under the governance of the National Stroke Programme (NSP), collected stroke data in hospitals providing acute stroke care; in 2019, governance was transferred to the National Office of Clinical Audit (NOCA) and the NSR was renamed the Irish National Audit of Stroke (INAS). This is the third national report from the INAS and it is an overview of the quality of the data and key trends in stroke care from 2013 to 2021. It presents data on 34,630 cases and includes patients aged 17 years and over who were treated in public hospitals that provide acute stroke care and admitted more than 25 patients with a stroke annually from 2013 to 2021. The dataset has evolved during the 9-year reporting period, and therefore not all results can be presented for the full 9 years. In addition, this report presents data from the health and social care professional (HSCP) dataset for 2021, which includes data from 19 hospitals – an increase from 15 hospitals in 2020.

As expected, there has been an incremental increase in the number of patients with a stroke admitted to hospital over the reporting period, from 4,727 in 2013 to 5,789 in 2021. The quantity of data submitted to the stroke audit portal within the Hospital In-Patient Enquiry (HIPE) system and which is thus available to monitor trends and audit the quality of care provided has also increased, from 2,790 cases (64% coverage) in 2013 to 5,239 cases (95% coverage) in 2021.

This report indicates some important trends, such as the reduction in median total hospital length of stay from 11 days in 2013 to 8 days in 2021; however, key targets in relation to admission to, and length of stay in, a stroke unit are not being met. Emergency care processes have improved considerably during the reporting period, ensuring appropriate patient selection for timely thrombolysis and thrombectomy. Mortality for patients with ischaemic stroke has decreased by 29%. Monitoring trends and improving the quality of care provided to patients with a stroke should remain a high priority in all stroke services.

KEY FINDINGS

DEMOGRAPHICS

Throughout the reporting period, the age and sex profile of patients with a stroke has remained consistent. More than one-half (56%, 19,550) of all patients with a stroke were male. Females were older, with a median age of 78 years (interquartile range (IQR): 68–85 years); the median age for males was 72 years (IQR: 62–80 years). There was a slight increase in the proportion of patients with a stroke in the younger age group (aged 17–64 years), from 24% (n=669) in 2013 to 27% (n=1402) in 2021.

EMERGENCY CARE PROCESSES

There has been a decreasing trend in patients arriving at hospital within 3 hours of symptom onset, from 59% (n=591) in 2013 to 46% (n=1429) in 2021, which limits access to time-sensitive treatments such as thrombolysis and thrombectomy.

Once a patient arrives at hospital, the processes involved in accessing timely treatment with thrombolysis and thrombectomy have improved considerably over the reporting period. The proportion of patients with a stroke who were seen by a medical team within 10 minutes of hospital arrival more than doubled between 2016 and 2021, from 23% (n=398) to 48% (n=2126). In addition, the proportion who had brain imaging within 1 hour of hospital arrival increased from 20% (n=532) in 2013 to 48% (n=2341) in 2021.

EMERGENCY TREATMENTS

There has been a gradual decrease in the thrombolysis rate, from 12% in 2015 to 10% in 2021. The thrombolysis rate for patients with an ischaemic stroke who arrive at hospital within the time frame for thrombolysis has also decreased, from 34% (n=205) in 2013 to 24% (n=335) in 2021. However, for those who were treated with thrombolysis, the proportion who received it within 60 minutes of arrival at hospital increased considerably, from 25% (n=68) in 2013 to 56% (n=243) in 2021. The number of patients who received thrombectomy increased from 157 in 2016 to 422 in 2021. Between 2016 and 2021, he overall rate of thrombectomy was 8.4%. Monitoring and improving the rate and timeliness of thrombolysis should remain a high priority in all stroke services.

HOSPITAL AND STROKE UNIT ADMISSIONS AND LENGTH OF STAY

The median total hospital length of stay decreased from 11 days in 2013 to 8 days in 2021. Despite a gradual increase in the proportion of patients with a stroke who were admitted to a stroke unit, from 65% in 2013 to 70% in 2021, there has been a consistent failure to meet the target of 90% of patients with a stroke being admitted to a stroke unit. Lack of stroke unit bed availability was the main factor for non-admission to a stroke unit throughout the reporting period. There was also an increase in the proportion of the total hospital stay spent in a stroke unit, from 57% in 2013 to 68% in 2021; however, this too remains far below the 90% target.

KEY FINDINGS

STROKE CARE UNIT

Between 2017 and 2021, the proportion of patients with a stroke who received swallow screening increased from 58% to 68%, but only 40% (n=5911) of those patients had it completed within the recommended 4 hours of presentation to hospital. On average, between 2017 and 2021, only 26% of patients with a stroke received a mood assessment. Importantly, admission to a stroke unit increased the likelihood of a patient having a mood and swallow screen completed.

According to the 2021 findings from the health and social care professional (HSCP) dataset, physiotherapists reported that only 51% (n=1046) of patients with a stroke received sufficient therapy, occupational therapists reported that only 38% (n=512) received sufficient therapy, and speech and language therapists reported that only 46% (n=720) received sufficient therapy. In line with findings in the *Irish National Audit of Stroke Organisational Audit Report 2021* (National Office of Clinical Audit, 2022b), there are significant deficits in HSCP staffing across acute stroke units, which impacts on the optimal delivery of care. Speech and language therapists reported a low rate of instrumental assessment of swallow, with only 7% of patients with a stroke receiving videofluoroscopy and 4% receiving a fiberoptic endoscopic evaluation of swallowing (FEES). This warrants closer attention by speech and language therapists, especially as instrumental assessment was considered indicated (but was not available) in only 2% of cases.

ATRIAL FIBRILLATION

In total, the prevalence of atrial fibrillation (AF) among all patients with a stroke over the reporting period was 29% (n=10016). Out of the total population of patients with a stroke over the reporting period (N=34630), 18% (n=6313) had known AF before the onset of stroke (ischaemic: n=5491, 18%; haemorrhagic: n=822, 18%). Treatment with anticoagulant medication pre-stroke was reported in 81% (n=5122) of these cases.

OUTCOMES

The crude in-hospital mortality rate for patients with ischaemic stroke decreased by 29%, from 10.1% in 2013 to 7.2% in 2021. For patients with haemorrhagic stroke, the overall in-hospital mortality rate was 30.1% (n=1402), ranging from 27.0% (n=113) in 2014 to 36.4% (n=164) in 2017. There was an increase in the proportion of patients discharged home with Early Supported Discharge, from 2% (n=61) in 2017 to 10% (n=530) in 2021, but this is still well below the 46% reported in the United Kingdom (Sentinel Stroke National Audit Programme, 2021).

KEY FINDINGS

KEY FINDINGS 2013-2021

EMERGENCY CARE TRENDS

The proportion of patients who saw a doctor within 10 minutes **increased** from 23% in 2016* to 48% in 2021

2021 **48%**
2016 **23%**

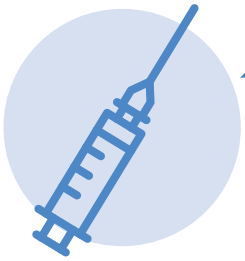
The proportion of patients who had brain scan within 1 hour increased from 20% in 2013 to 48% in 2021

2021 **48%**
2013 **20%**

EMERGENCY TREATMENTS

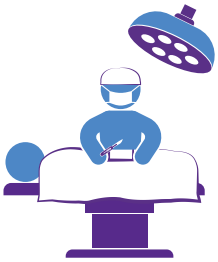
2013 **11%**
2021 **10%**

IV thrombolysis rate - 11% in 2013 **decreased** to 10% in 2021 - Target 12%



2021 **56%**
2013 **25%**

The proportion of patients who received thrombolysis within 1 hour **increased** from 25% in 2013 to 56% in 2021



2021 **9.5%**
2016 **4.8%**

Thrombectomy rate - 4.8% in 2016* **increased** to 9.5% in 2021

STROKE UNIT CARE

2021 **70%**
2013 **65%**

There was an **increase** in the proportion of patients with a stroke admitted to a stroke unit from 65% in 2013 to 70% in 2021 - Target 90%

2021 **68%**
2013 **57%**

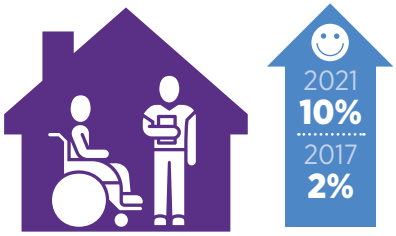
For patients with a stroke who were admitted to a stroke unit there was an **increase** in the proportion of their total hospital stay spent in a stroke unit from 57% in 2013 to 68% in 2021 -Target 90%

2021 **68%**
2017 **58%**

The proportion of patients with a stroke who received swallow screening **increased** from 58% in 2017** to 68% in 2021

OUTCOMES

The median*** hospital length of stay has **reduced** from 11 days in 2013, to 8 days in 2021



There was an **increase** in the proportion of patients discharged home with Early Supported Discharge (ESD) from 2% in 2017** to 10% in 2021

Mortality for ischaemic stroke has **reduced** from 10.1% in 2013 to 7.2% in 2021 = 29% reduction.

THE HEALTH AND SOCIAL CARE PROFESSIONAL (HSCP) DATASET 2021

The HSCP dataset represents additional rehabilitation information from physiotherapists (2013 cases), occupational therapists (1344 cases) and speech and language therapists (1239 cases) from 19 hospitals.

PHYSIOTHERAPISTS

Physiotherapists reported that only 51% of patients with a stroke received sufficient therapy.

51%

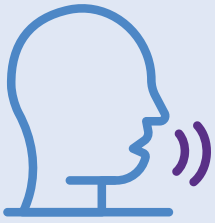
OCCUPATIONAL THERAPISTS

Occupational therapists reported that only 38% of patients with a stroke received sufficient therapy.

38%

SPEECH AND LANGUAGE THERAPISTS

Speech and language therapists reported that only 46% of patients with a stroke received sufficient therapy.



46%

* Data only available from 2016 for this information.
** Data only available from 2017 for this information
*** The median is the middle number in list of numbers

KEY RECOMMENDATIONS

RECOMMENDATION 1

The number of stroke unit beds should be increased so that at least 90% of patients with a stroke are cared for in a stroke unit.

RECOMMENDATION 2

Increase the thrombolysis rates in all hospitals providing acute stroke care.

RECOMMENDATION 3

All hospitals providing acute stroke care should have an active stroke governance committee.

RECOMMENDATION 4

Increase the number of Early Supported Discharge teams.

RECOMMENDATION 5

Expand the use of the individual health identifier in order to increase follow-up for patients on discharge or transfer to another hospital.

RECOMMENDATION 6

Develop a Best Practice Tariff for acute stroke care.

THE PATIENT PERSPECTIVE

NOCA is committed to putting the patient voice at the centre of national clinical audit, providing a broader picture of quality and safety and patient's experience of healthcare. Here is Bobby's story as told in his own voice.

BOBBY'S STORY

My name is Bobby. I am 69 years old, and I live with my family in Tallaght, Dublin. I had a stroke in September 2021; this is my story.

ACCESSING STROKE SERVICES

On the day of my stroke in September 2021, I woke up around 6.30am. I felt fine, but as I attempted to get up to go to the loo, I slid from the bed – no sudden fall, no pain, I just slid out of the bed. I tried to get up but I could not use my left leg or arm; I had no power, there was nothing there at all. I realised that I needed help. I called out, but when I heard my voice it sounded all distorted. My daughter came in and asked me to lift my arms; when I couldn't, she called an ambulance immediately, as she knew it was a stroke, and she made sure the ambulance service knew that too. The ambulance arrived quickly and blue lighted me to Tallaght Hospital. My brain was still working and I could hear the ambulance crew speaking on the radio to Tallaght Hospital; the sirens were going and I knew I was in trouble. I knew I was having a stroke because of my arm and speech, and it was scary. I arrived at the hospital quickly and the stroke team met me at the door of accident and emergency. I couldn't ask for anything better than that.

"MY BRAIN WAS STILL WORKING AND I COULD HEAR THE AMBULANCE CREW SPEAKING ON THE RADIO TO TALLAGHT HOSPITAL; THE SIRENS WERE GOING AND I KNEW I WAS IN TROUBLE".

EMERGENCY CARE

The stroke team asked me questions and examined me, and I went straight into the CT scanner. The doctor confirmed that I had had a stroke, that there was a clot, and that he wanted to thrombolyse me (administer a drug that helps break up blood clots). He explained that there was a risk with this, that it could cause bleeding. No one was with me, as this was during COVID-19, but the staff kept my family informed at all times. I got the thrombolysis, and then the staff said that they were going to send me to Beaumont Hospital to get the clot removed. My first reaction to that was 'brain surgery' – I had no idea how far medicine had progressed; my thought was that someone would be drilling into my brain and that would be it for me. They quickly put my mind at ease and explained that the doctor in Beaumont Hospital would go in through the vein in the groin and go up into the brain to remove the blood clot (thrombectomy). The staff made sure I was being fully informed of everything that was happening and every decision that was being made. The ambulance crew was still with me, and the stroke nurse and doctor from Tallaght Hospital were also coming with me to Beaumont Hospital. I thought, "You're not coming with me for the ride, I'm in real trouble here, they don't send a doctor and a nurse with you unless you are in serious trouble." They spoke to me through the whole journey but I was frustrated, as I knew what was coming out of my mouth was not what I was trying to say; it was gobbledygook. My brain was working but my speech wasn't. That journey to Beaumont Hospital was interesting – hair-raising, you could say; I had one good hand and I was hanging on to the stretcher for dear life. I never felt I was in any danger, but I knew we were tearing along the M50, sirens blaring.

"I WAS FRUSTRATED, AS I KNEW WHAT WAS COMING OUT OF MY MOUTH WAS NOT WHAT I WAS TRYING TO SAY; IT WAS GOBBLEDYGOOK. MY BRAIN WAS WORKING BUT MY SPEECH WASN'T".

THROMBECTOMY

When we arrived at Beaumont Hospital, I was brought straight to the radiology department. The doctor introduced himself and said he would give me a local anaesthetic in the groin and then he would remove the clot. With that, the machine came right down, almost on top of my face, so I couldn't see anything but I could hear everything. At that stage, I just had to put my trust in the guy, just like you put your trust in the pilot on a plane. He was telling me what he was doing and every time he took out a bit of the clot, I got a really severe pain in my head and saw stars in front of my eyes. He said, "We're nearly there, this will be the last one," and almost instantly, it was as if someone had pulled a plug and I could feel the blood rushing to a certain part of my brain. Almost immediately, I could feel things start to improve; they took me straight off the table and put me back on the ambulance trolley, and they brought me back to Tallaght Hospital in a much more sedate fashion. My speech had improved and I was moving my arm, but I was lying down and couldn't move my leg. I stayed in a room on my own until I got a negative COVID-19 test a few hours later, and then I went to a bed in the high dependency unit.

"HE SAID, 'WE'RE NEARLY THERE, THIS WILL BE THE LAST ONE,' AND ALMOST INSTANTLY, IT WAS AS IF SOMEONE HAD PULLED A PLUG AND I COULD FEEL THE BLOOD RUSHING TO A CERTAIN PART OF MY BRAIN".

HOSPITAL CARE

The next morning, the staff got me up and I could do everything they asked me to do. I was visited by the physiotherapist, the occupational therapist, and the speech and language therapist, who all said they would be around if I needed them but that they did not need to do anything with me. I just needed to build up my own strength and confidence. The stroke really affected my confidence; however, I had a massive heart attack in 1994 and that experience stood to me. After my heart attack, I had to learn how to integrate back into society normally; this time, I wasn't as scared or reluctant as I might have been because I had already gone through that, I had survived it, I had done cardiac rehab and it left me with a positive attitude that "I'm fine".

They had to do tests on me to try to find out why the stroke happened, and it was important that I had those tests before I left hospital, as otherwise I would be on a long waiting list, especially during COVID-19.

They were not sure what exactly caused the stroke, but thought that possibly a clot had formed and broken off. I am now on some medication to try to prevent it happening again. I certainly got a good MOT: I got an MRI, blood tests, X-rays, echo on my heart – everything.

The hard part was COVID-19; I had very little contact with the outside world. I was not good at using the phone for video calls; in fact, I had only one video call in the 2 weeks I was in hospital.

"THE STROKE REALLY AFFECTED MY CONFIDENCE".

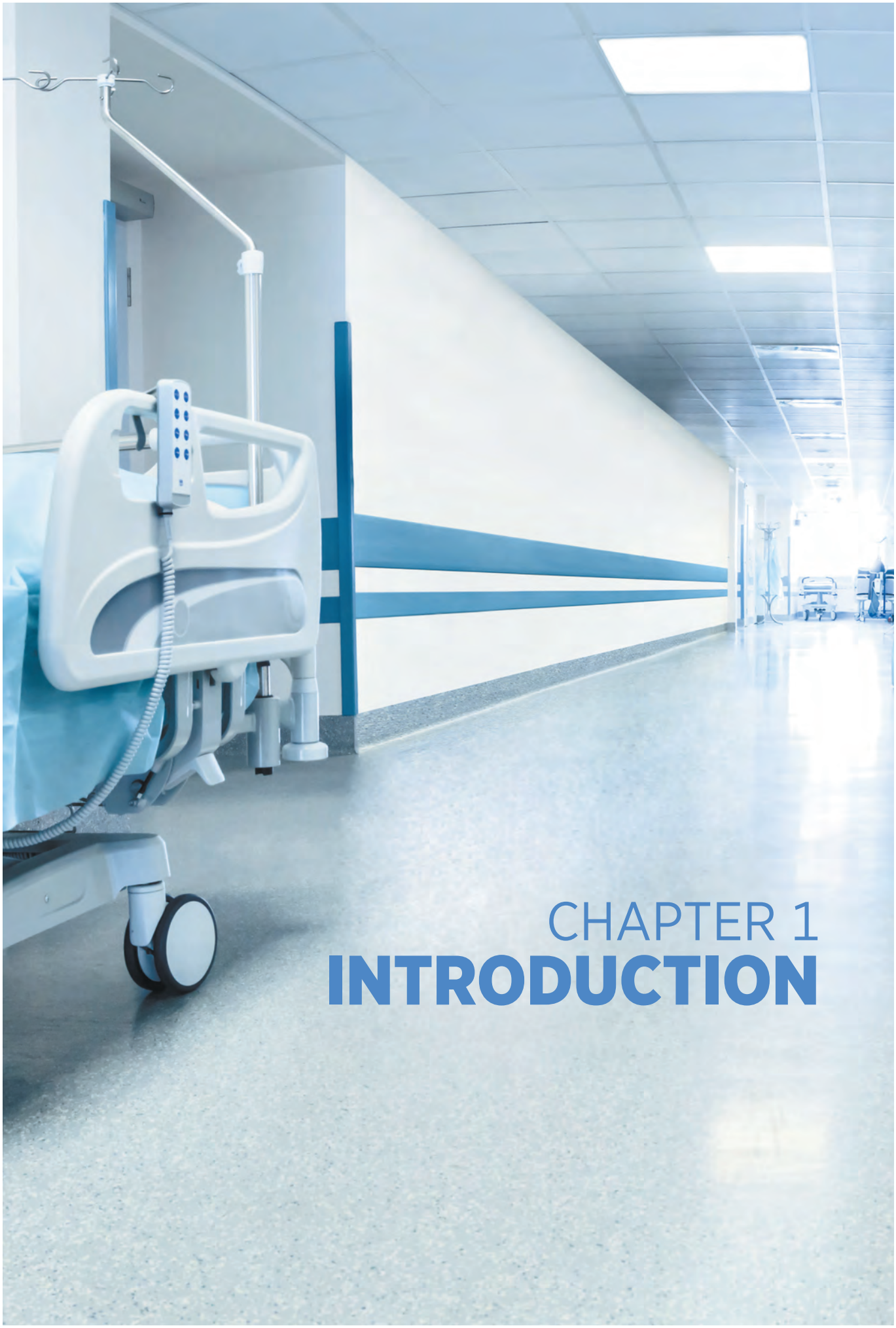
GOING HOME

After 2 weeks I was discharged home, and as I was walking up the long corridor to leave, I saw the doctor who had come to Beaumont Hospital with me. I was able to say a proper thank you and he could see he had done everything well and that I was now fully recovered and going home. None of them could have done any more.

The only thing that could have made going home easier would have been if the hospital staff had told my family to treat me as normal, because they were nervous. They did get lots of updates from the hospital staff, but they did not get to see the different doctors or nurses as you would normally, and I think that made them more nervous when I was going home. They 'wrapped me in cotton wool' for a good while – they were terrified; they had seen it happen and it took them a long time to have trust in me that I was alright. It took a bit of stubbornness from me to get back to normal life. It was the same outside of the home; I do stewarding at football matches and I have my own gate here in Tallaght Stadium, but after the stroke, the people in Tallaght Stadium told me that they would prefer that I not do that anymore, that they needed to keep an eye on me, but I said no, I needed to get back to normal – and sure enough, I'm now back on my gate. People had to learn to trust me again, and that I can look after myself. For my part, I had to trust the doctors and the nurses – you've got to. I am now back to living my normal life; I'm helping my son move house and I drop my grandson to work every day.

FINAL MESSAGE

The main message I have for anyone reading this is to remember that if you have symptoms of a stroke, you should get to the hospital quickly, and get medical advice as quickly as possible. The one thing that saved me was getting there quickly; I'm lucky, but no matter where you live, get help quickly.



CHAPTER 1
INTRODUCTION

CHAPTER 1: **INTRODUCTION**

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. Early action can reduce brain damage and other complications. The effects of stroke vary from person to person based on the type, severity, location, and number of strokes. The brain is very complex; each area of the brain is responsible for a specific function or ability. When an area of the brain is damaged from a stroke, the loss of normal function of part of the body may occur. This may result in death or disability.

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

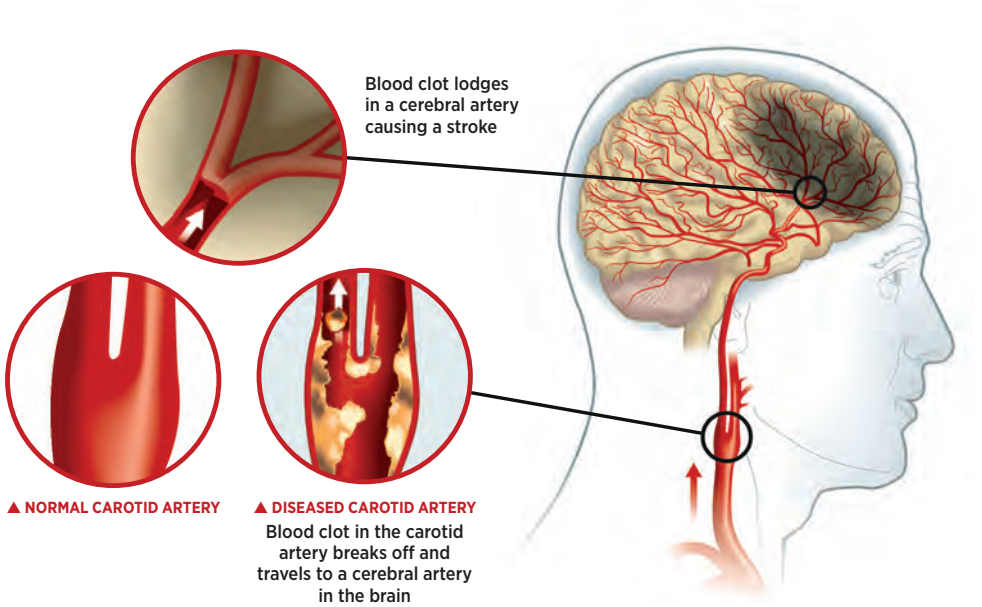


FIGURE 1.1: ISCHAEMIC STROKE

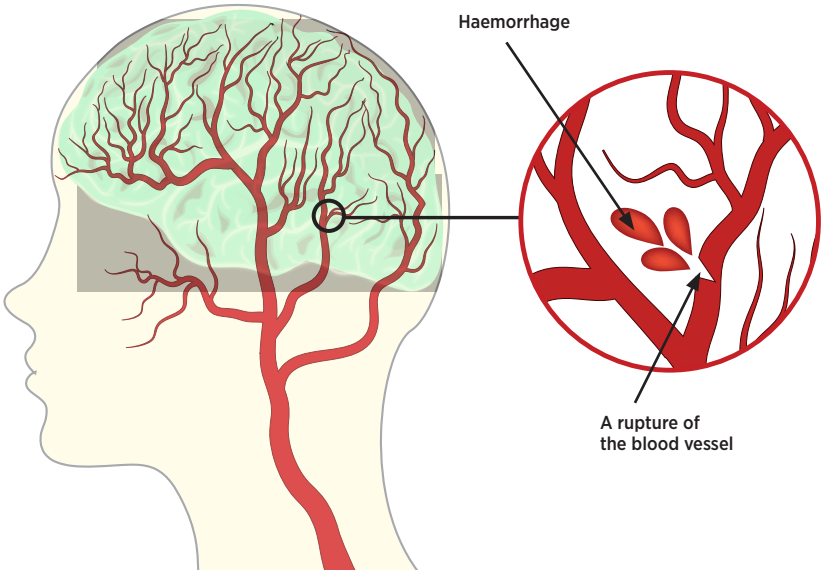


FIGURE 1.2: HAEMORRHAGIC STROKE

WHAT IS THE BURDEN OF STROKE?

In the European Union (EU) stroke is the second most common cause of death and a leading cause of adult disability, and the cost associated with stroke was estimated at €45 billion per year (Wilkins *et al.*, 2017). In Ireland, more than 6,000 people are admitted to hospitals with a diagnosis of stroke each year, accounting for approximately 4% of total health expenditure annually (Health Information and Quality Authority, 2017). As populations continue to grow and live to an older age, stroke events and their long-term sequelae, along with the corresponding costs, are expected to increase dramatically (Bennett *et al*., 2014).

HOW ARE PEOPLE WHO HAVE A STROKE TREATED IN IRELAND?

In 2012, the National Stroke Programme (NSP) published the *Stroke Model of Care* (Health Service Executive, 2012) with the aim of improving the delivery of care through better use of resources. The *Irish National Audit of Stroke Organisational Audit Report 2021* (National Office of Clinical Audit, 2022b) described how stroke services were organised in all hospitals providing acute stroke services in 2021. The report found that all such hospitals have a clinical lead for stroke and provide multidisciplinary stroke care, but that there is variation between hospitals in the composition of teams.

Treatment for stroke has advanced greatly since the 1990s; evidence exists that organised stroke (i.e. stroke unit) care with multidisciplinary team input will reduce disability and mortality and will benefit all patients with a stroke. People with ischaemic stroke who present early after symptom onset will benefit from hyperacute treatments such as thrombolysis and thrombectomy (Organisation for Economic Co-operation and Development, 2015).

Just like heart attack, stroke is a medical emergency, and prompt treatment is crucial. The earlier patients with a stroke receive thrombolysis and thrombectomy, the more effective the treatment will be. On average, every minute after the onset of stroke, 2 million brain cells die. So every minute does actually count.

THROMBOLYSIS

Thrombolysis is an emergency treatment which dissolves blood clots and restores blood flow to the brain. Thrombolysis treatment is available 24 hours a day, 7 days a week in all but one acute hospital providing acute stroke services in Ireland (National Office of Clinical Audit, 2022b). This treatment should be administered within 4.5 hours of the onset of stroke symptoms, although it can be given beyond this time in certain cases. It is therefore important that patients who have symptoms of a stroke call 999/112 immediately in order to ensure that they have the best chance to receive this treatment.

THROMBECTOMY

Thrombectomy is the mechanical removal of a blood clot in a large blood vessel in the brain (Figure 1.3) and is performed in two endovascular thrombectomy (EVT) stroke centres in Ireland – Beaumont Hospital and Cork University Hospital – 24 hours a day, 7 days a week. Patients suitable for thrombectomy following initial assessment in the primary hospital are transferred to the EVT stroke centre for treatment and are transferred back to the primary hospital when stable. In addition to providing a National Thrombectomy Service, the team in Beaumont Hospital has also led out on a national quality improvement project, called Door to Decision in 30!, which has been key to improving the timeliness of brain imaging and of delivering acute stroke treatments such as thrombolysis and thrombectomy (National Office of Clinical Audit, 2022a).

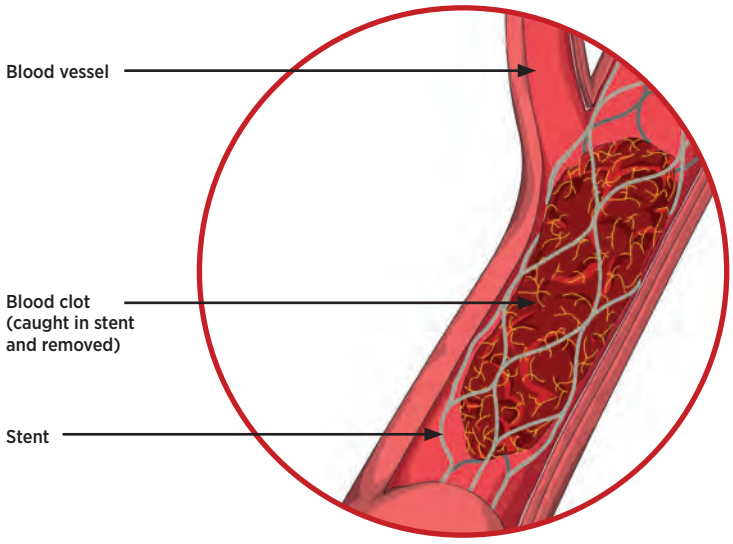


FIGURE 1.3: THROMBECTOMY

STROKE UNIT

A stroke unit is 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. It is recommended that all patients with a stroke be admitted to a stroke unit unless stroke is not the predominant clinical problem, and that they should spend 90% of their total hospital stay in the stroke unit.

EARLY SUPPORTED DISCHARGE

The *Stroke Model of Care* also recommended the establishment of Early Supported Discharge (ESD) teams. ESD allows patients who have had a stroke to get an early discharge from hospital by providing rehabilitation in the home, under the care of specialist therapists. Appropriately resourced ESD teams can reduce long-term dependency and admission to institutional care, as well as reduce the length of hospital stay (Langhorne *et al*., 2017).

AIM OF THIS REPORT

This report aims to describe the quality of stroke care provided between 2013 and 2021 using data from the National Stroke Register (NSR) and the Irish National Audit of Stroke (INAS), and to compare the quality of care provided against best practice standards and key quality indicators (KQIs) in order to inform recommendations for improvement. Prior to 2020 there were no formal data validation processes, and this report aims to review the quality of the historical data and to present any data quality issues that might impact on the findings within the report.

In 2022, the National Office of Clinical Audit (NOCA) published the *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b), which includes 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 results were compared against the *Irish Heart Foundation National Audit of Stroke Care* (Horgan *et al*., 2008) and the *Irish Heart Foundation/HSE National Stroke Audit 2015* (McElwaine *et al*., 2015). Information from the *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) and the findings from this analysis of the data from 2013 to 2021 will inform the recommendations in this report.

This report describes the methodology and data quality in Chapters 2 and 3. Chapters 4, 5, 6 and 7 present the findings from the analysis. Chapter 8 presents the value of the audit and the quality improvement initiatives that are being undertaken with the aim of improving the quality of care received by patients with a stroke. The final chapters present the recommendations and conclusions from the analysis.

THE IRISH NATIONAL AUDIT OF STROKE

The INAS is a clinically led, web-based audit that measures the care provided in hospital to patients with a stroke against Irish (Irish Heart Foundation, 2015, 2010) and United Kingdom (UK) (Royal College of Physicians, 2016) guidelines.

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.**

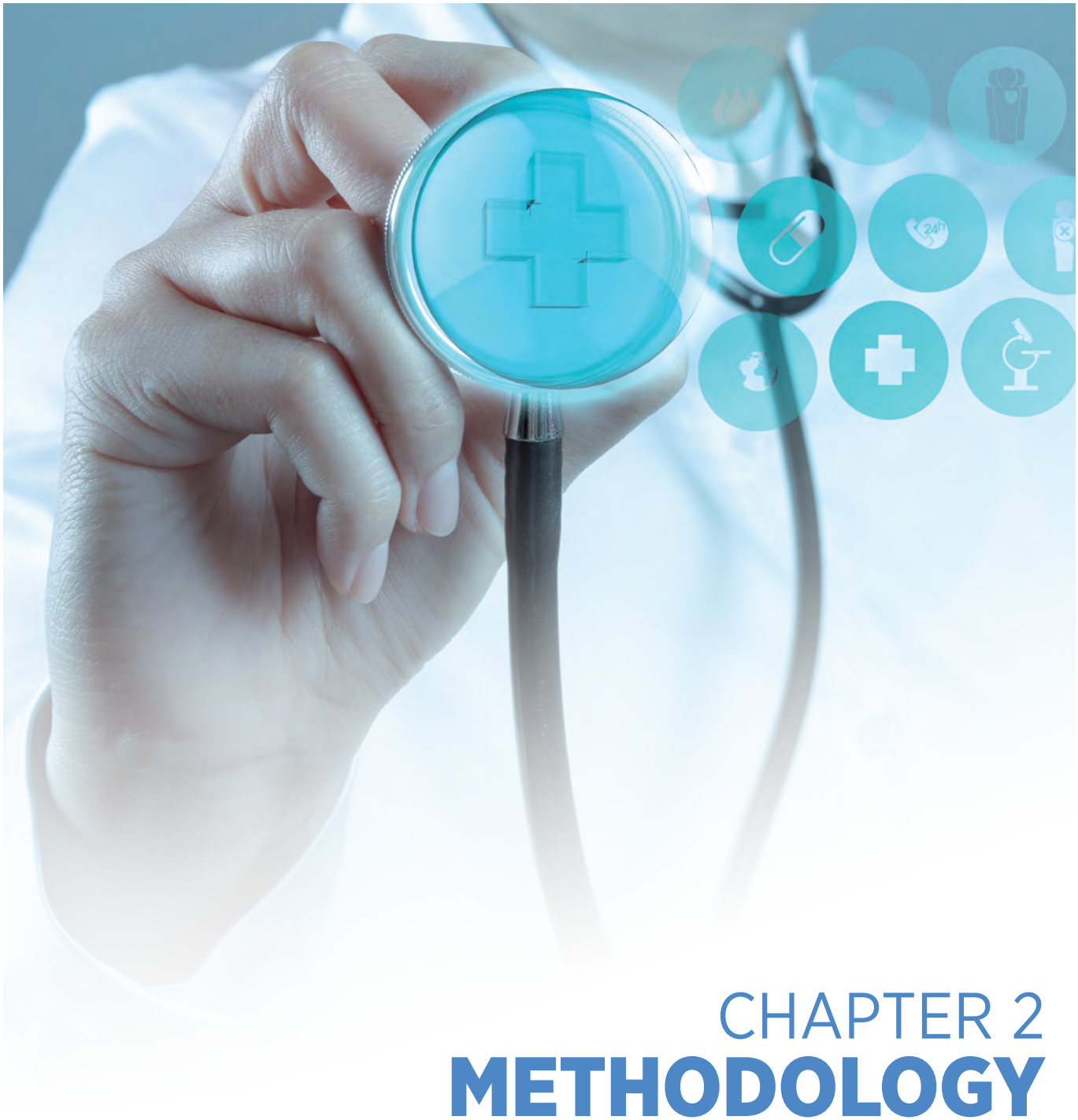
WHO IS THIS REPORT AIMED AT?

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: A critical review of national stroke data for Ireland from 2013 to 2021* presents the key findings of the INAS regarding case mix, patient pathway and outcomes.
2. The *Irish National Audit of Stroke: A critical review of national stroke data for Ireland from 2013 to 2021: Summary Report* will be of particular interest to patients, patient organisations and the public.



CHAPTER 2
METHODOLOGY

CHAPTER 2: **METHODOLOGY**

BACKGROUND

In 2012, the NSP developed the 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* (Health Service Executive, 2012). The NSR was governed by the NSR Steering Group. In 2019, governance of the NSR was transferred to NOCA and it was renamed the INAS. During the reporting period (2013–2021), the NSR/INAS evolved to include data collection on thrombectomy and on discipline-specific rehabilitation metrics (Figure 2.1). From 2013 to 2019 there was no formal data validation process in operation, and a review of the historical data is one of the aims of this report. Data collected and validated between 2013 and 2021 are reported. All of the findings in this report are preceded by a table and commentary indicating the quality of the data reported on.

All patients with ischaemic and haemorrhagic stroke who were treated in public hospitals that provide acute stroke care and that admitted more than 25 patients with a stroke annually over the reporting period are included in this audit.

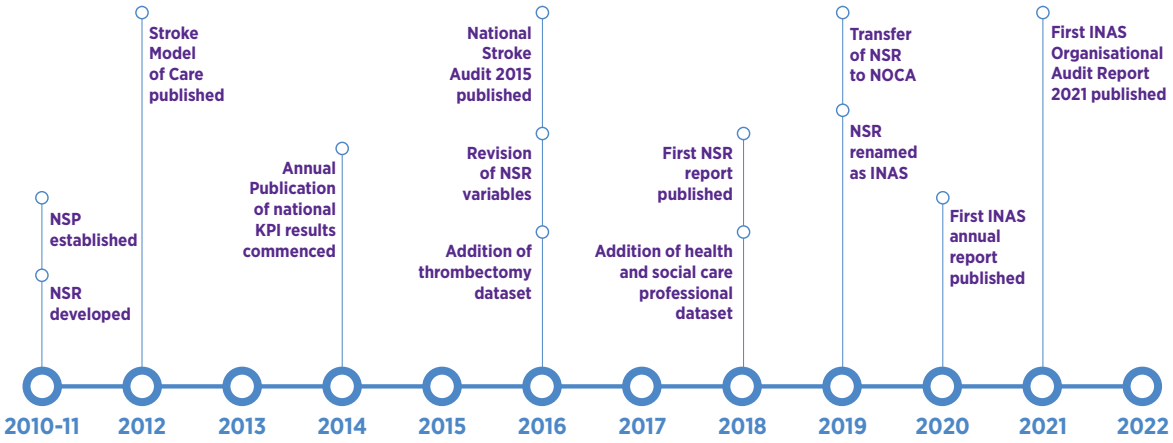


FIGURE 2.1: EVOLUTION OF STROKE DATA COLLECTION

DATA SOURCE

Data were sourced via the Hospital In-Patient Enquiry (HIPE) system. HIPE is the principal source of national data on discharges from acute hospitals in Ireland. It collects demographic, clinical and administrative data on discharges from, and deaths in, acute public hospitals nationally. Additional stroke-specific data (the INAS dataset (Appendix 2)) were collected on patients with a stroke and were submitted from each hospital to the HIPE system via the stroke audit portal. The HIPE data and the INAS data were merged within HIPE to form a final dataset.

The INAS dataset comprises clinical data collected on all patients with a stroke; these are known as core clinical data. These data have been collected since 2013 and have evolved, with amendments in 2016, 2020 and 2021. In 2016, additional thrombectomy data collected on patients who receive a thrombectomy in an EVT stroke centre were added to the INAS dataset. In 2018, additional discipline-specific data on health and social care professionals (HSCPs) were also added.

DATA COLLECTION

DATA COLLECTION: CORE CLINICAL DATASET

Each hospital has an audit coordinator and a clinical lead who lead on stroke service governance within the hospital. The audit coordinator, usually an experienced nurse specialising in stroke care, collects the core clinical data and submits them to the stroke audit portal. A list of cases eligible for inclusion can be identified by running a HIPE Discharge Report within the stroke audit portal. Additional cases may be identified manually. Most data are entered retrospectively.

DATA COLLECTION: THROMBECTOMY DATASET

The thrombectomy dataset was added to the INAS dataset in 2016 and data are collected on all patients who receive a thrombectomy in an EVT stroke centre. Core clinical data and additional thrombectomy data are entered by the audit coordinators for each patient with a stroke who receives a thrombectomy in either of the two EVT stroke centres (Beaumont Hospital or Cork University Hospital).

DATA COLLECTION: HSCP DATASET

The HSCP dataset was developed by the NSP in collaboration with the professional bodies for physiotherapy, occupational therapy, and speech and language therapy. At the time of formation of the dataset, the professional bodies for both dietetics and medical social work could not commit to the collection of data due to low staff numbers in the area of acute stroke. It is hoped that the HSCP dataset will grow to represent many more HSCP groups, and the INAS welcomes their participation. The dataset was piloted in 2017 and the first publication of the data was in 2018 (NSP, 2019). The dataset remains in the implementation phase; therefore, a trend report is not appropriate at this time, and only 2021 data are included in this report for the HSCP dataset. Data are collected by therapists in each hospital and are presented in aggregate form. The HSCP dataset includes data from one hospital that is not eligible to participate in the core clinical dataset, as it provides rehabilitation services (not acute stroke care) to patients with a stroke. Further information can be found in the data quality statement in Chapter 3.

The INAS data dictionary is available in Appendix 2.

DATA VALIDATION

In 2019, the NOCA Data Analytics and Research team developed a data validation process for the INAS, as follows:

1. The HPO issues monthly coverage reports and data extracts to NOCA.
2. The data analyst produces a Data Validation Report (DVR) quarterly of any missing information within the data and any data anomalies.
3. The DVR is sent to the audit coordinators, who amend the record.

In order to minimise the demands on the audit coordinators, many of whom were redeployed to other clinical roles due to the impact of coronavirus disease 2019 (COVID-19), no DVRs were sent to hospitals in 2020. In 2021, DVRs were sent to hospitals quarterly in order to reduce missing data and data anomalies, thus improving data quality.

DATA EXTRACTION

HIPE data and INAS data were merged to form an anonymised stroke extract. The HPO sent two extracts to NOCA: a core clinical data extract which includes thrombectomy data, and a HSCP data extract. Data from the HIPE/core clinical dataset were extracted by the NOCA analyst to form two separate datasets: the core clinical dataset and the thrombectomy dataset. The inclusion and exclusion criteria for all three datasets are presented below.

CORE CLINICAL DATASET

The core clinical dataset comprises data that were collected on all patients with a stroke from 2013 to 2021. This dataset informs the findings in Chapters 4, 5 and 6, excluding findings on thrombectomy[1] in Chapter 4.

Inclusion criterion IV and exclusion criteria III and IV refer to patients who had a stroke while already an inpatient with another condition (e.g. a stroke event following surgery); this is called 'in-hospital' stroke. The INAS dataset includes the collection of data on patients with in-hospital stroke, but these cases are not included in this report. These cases can be identified if the 'in-hospital stroke' field is populated as 'yes', but only those cases for which this field was populated with 'no' are included in this report. These in-hospital stroke cases can also be identified if a hospital acquired diagnosis (HADx) flag for stroke has been attached to the 'secondary diagnosis' field. These cases are also excluded from the core clinical dataset for this report.

Exclusion criterion IV refers to patients with a stroke who are transferred to an EVT stroke centre[2] for thrombectomy and are then immediately transferred back to the referring hospital. These cases are excluded from the final denominator in the EVT stroke centre within the core clinical dataset, as this would negatively affect the results of the key quality indicators (KQIs) in the EVT stroke centre. For example, these cases would not be included in the analysis of the percentage of cases admitted to a stroke unit because they would not be expected to be admitted to the EVT stroke centre's stroke unit, as they were transferred back to the referring hospital immediately following thrombectomy.

In 2018, the HSCP dataset was added to the INAS dataset. Inclusion criterion V refers to cases where HSCP data were submitted with no associated core clinical data. This may occur if the audit coordinator did not submit data on a case or there was no audit coordinator due to a resourcing issue. From 2018 to 2021, in order to exclude these missing data from the core clinical dataset, any case that had no response in the 'admission to stroke unit' field was excluded.

[1] Thrombectomy findings are based on the thrombectomy dataset.
[2] An EVT stroke centre is a hospital that performs thrombectomy. Patients can be admitted directly to an EVT stroke centre or transferred from another hospital. Patients who have a thrombectomy may be transferred back to the referring hospital immediately after the procedure if stable or admitted to the EVT stroke centre.

This methodology was chosen because the 'admission to stroke unit' variable had a 99.9% completeness rate within the core clinical dataset, and if it was not completed, it was because only HSCP data were submitted for that case.

The core clinical dataset inclusion criteria, 2013–2021 are:

I. patients discharged between 1 January 2013 and 31 December 2021, inclusive
II. cases reported on HIPE, using the International Classification of Diseases, Tenth Revision, Australian Modification (ICD-10-AM) codes I61, I63 or I64 as a principal diagnosis[3] (Independent Hospital Pricing Authority, 2017)
III. patients aged 17 years and over
IV. all cases with the 'in-hospital stroke' field populated with '2=No' within the stroke audit portal.

The core clinical dataset inclusion criterion, 2018–2021 also includes:

V. all cases with the 'admission to stroke unit' field populated with either '1=Yes' or '2=No' within the stroke audit portal.

Core clinical dataset exclusion criteria, 2013–2021 are:

I. patients aged 16 years and under
II. patients with a HADx stroke code of I61, I63 or I64
III. patients where the stroke occurred while in hospital with another condition.

Core clinical dataset exclusion criterion, 2015–2021 also includes:

I. patients who had a thrombectomy in Beaumont Hospital or Cork University Hospital and were transferred back to the referring hospital on the same day.

After applying the inclusion and exclusion criteria, the final core clinical dataset includes 34,630 cases (Table 2.1). Appendix 3 provides the number of cases by hospital and year. In 2015 and 2016, Mater Misericordiae University Hospital only collected data for the three key performance indicators (KPIs). Therefore, Mater Misericordiae University Hospital is excluded from the majority of analyses in this report for those 2 years; however, it is included in the analysis of the three KPIs.

TABLE 2.1: TOTAL NUMBER OF CASES, BY YEAR (N=34630)

Year	Number of Cases
2013	2790
2014	3259
2015	3326[4]
2016	3569[5]
2017	3502

Year	Number of Cases
2018	3730
2019	4426
2020	4989
2021	5239
TOTAL	**34 630**

[3] 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" (Australian Consortium for Classification Development, 2017, p.1).
[4] Does not include Mater Misericordiae University Hospital (n=344).
[5] Does not include Mater Misericordiae University Hospital (n=267).

THROMBECTOMY DATASET

The thrombectomy dataset is extracted from the HIPE/core clinical dataset by filtering for all cases who had a thrombectomy and are aged 17 years and over.

Thrombectomy dataset inclusion criteria, 2016–2021 are:

I. all cases with the 'thrombectomy' field populated with '1=Yes' within the stroke audit portal
II. patients aged 17 years and over.

Thrombectomy dataset exclusion criterion, 2016–2021 is:

I. patients aged 16 years and under.

After applying the inclusion and exclusion criteria, the final thrombectomy dataset used to report on thrombectomy comprised 1,840 cases.

HSCP DATASET

All cases who have data submitted by one or more HSCPs and are aged 17 years and over are included.

HSCP dataset inclusion criteria, 2021 are::

I. all cases with '1=Yes' populated for the 'seen by physiotherapist', 'seen by occupational therapist', and/or 'seen by speech and language therapist' fields within the stroke audit portal
II. patients aged 17 years and over.

HSCP dataset exclusion criterion, 2021 is:

I. patients aged 16 years and under.

After applying the inclusion and exclusion criteria, the final HSCP dataset used to report on HSCP data from 2021 comprised 3,092 cases.

DATA ANALYSIS OF HISTORICAL DATA

NOCA received the full stroke audit portal data extracts for 2013–2020 from the HPO on 31 January 2022, and the 2021 data extract on 12 June 2022. The 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. Appendix 4 describes the metadata for composite variables.

COVERAGE ANALYSIS

The final annual coverage is reported by the HPO at the close of the HIPE file.[6] Historical coverage reports were requested from the HPO to inform this report. Hospital-level reporting is not published unless a hospital has at least 80% coverage; however, all hospitals are included in the national figures throughout this report.

Coverage for the thrombectomy dataset was measured by comparing the number of thrombectomy cases reported in the National Thrombectomy Service reports against the number of cases with thrombectomy data submitted to the stroke audit portal. Coverage for the HSCP dataset is not reported, as this dataset remains in the implementation phase; thus, these results are reported in aggregated format.

[6] Further information on coverage is described in the data quality statement in Chapter 3.

COMPLETENESS ANALYSIS

Analysis for this report was performed using three datasets: the core clinical dataset, the thrombectomy dataset and the HSCP dataset.

As part of the analysis, data completion was analysed for each variable and each year. Table 2.2 displays the number of variables from each dataset collected in each year. A table of each variable and the year it was recorded is provided in Appendix 5.

Core clinical dataset

During the 2013–2021 reporting period, there were 107 core clinical variables. Some variables were discontinued through the years, and some were included later based on review of the dataset by the NSP. During the reporting period, 36 variables were collected in all 9 years, 37 were discontinued, and 34 were included in later years. In November 2021, 14 additional variables focusing on atrial fibrillation were introduced to the core clinical dataset for a defined period of 14 months to support a spotlight audit on atrial fibrillation. Hospitals were not expected to report on these variables until 1 January 2022, but they were available to the hospitals to begin this data collection. These data will be reported on in 2023. These additional atrial fibrillation variables are not included in the completeness analysis for this report.

Thrombectomy dataset

The thrombectomy dataset was introduced in 2016 for the two national EVT stroke centres. Initially, 31 thrombectomy-specific variables were collected; an additional 3 variables were added in 2020, and another 2 variables were included in 2021.

HSCP dataset

Fifty-four HSCP discipline-specific variables were introduced in 2018. There has been no change in the number of variables collected through the years, and the collection of these data remains in the implementation phase. Because of this, completeness analysis was performed for 2021 only, and aggregate data for 2021 are presented in this report.

TABLE 2.2: TOTAL NUMBER OF IRISH NATIONAL AUDIT OF STROKE VARIABLES COLLECTED, BY YEAR

Year	Core clinical dataset	Thrombectomy dataset	HSCP dataset	Total
2013	73			**73**
2014	70			**70**
2015	60			**60**
2016	56	31		**87**
2017	56	31		**87**
2018	56	31	54	**141**
2019	56	31	54	**141**
2020	56	34	54	**144**
2021	70[7]	36	54	**160**

[7] Includes an additional 14 variables focusing on atrial fibrillation. They were introduced to the core clinical dataset for a defined period of 14 months to support a spotlight audit on atrial fibrillation. These data will be reported on in 2023.

VARIABLES EXCLUDED FROM THE COMPLETENESS ANALYSIS

When analysing completeness, some variables had logical rules applied. For example, the completeness of variable 16 'Brain image date' was only analysed if 'yes' was selected for variable 15 'Brain scan – was a brain scan performed?'. There were 77[8] such variables. Sixty-two[9] variables did not have logical rules, and it was a simple calculation of the proportion of cases that had any information recorded versus no information recorded.

The following variables were not included in the completeness analysis of the core clinical dataset:

- '1 Transfer hospital': Analysing completeness for this variable is not possible, as the system auto-populates the data input field with 'N/A', meaning that the patient was not transferred from another hospital. Therefore, if a record shows no data entered in the '1 Transfer hospital – what hospital patient was transferred from' variable, it is because the case was not a transfer, and not because the record for that variable was incomplete. A blank record is justifiable in this field.
- '9 In-hospital stroke' and '26 Admitted to stroke unit': These variables were used in inclusion criteria IV and V of the core clinical dataset prior to analysing for completeness; therefore, all cases in the core clinical dataset have these variables recorded.

The following variables were not included in completeness analysis of the thrombectomy dataset:

- '108 Thrombectomy': This variable was used in inclusion criterion V of the thrombectomy dataset prior to analysing for completeness; therefore, all cases in the thrombectomy dataset had this variable recorded.
- '123 Second occlusion site': It is clinically appropriate not to populate this variable; therefore, completeness analysis was not possible.

STATISTICAL PROCESS CONTROL CHARTS

The statistical process control (SPC) technique is a good tool for highlighting unexpected variation in a process over a period of time. The mean in the charts is based on the overall average over the 9-year reporting period. The control limits in the charts are calculated from the mean of each reporting quarter. These control limits are calculated according to statistical formulas and represent three standard deviations (99.7% probability) above and below the mean. When a point falls outside the limits or forms a particular pattern, this may suggest the presence of a special cause of variation deserving further examination.

DATA REPORTING

There are internationally validated and widely accepted quality indicators for benchmarking the process and quality of treatment of patients with a stroke. This report identifies standards based on the following guidelines:

1. the Irish Heart Foundation (IHF) Council for Stroke's *National Clinical Guidelines and Recommendations for the Care of People with Stroke and Transient Ischaemic Attack* (IHF, 2010)
2. the IHF Council for Stroke's *Stroke Thrombolysis Guidelines Version 2.0* (IHF, 2015)
3. the Royal College of Physicians' *National clinical guideline for stroke* (Royal College of Physicians, 2016).

[8] 71 in the core clinical dataset and 6 in the thrombectomy dataset.
[9] 34 in the core clinical dataset and 28 in the thrombectomy dataset.

INDICATORS OF CARE

In 2021, the INAS Governance Committee agreed on seven KQIs to be reported via the NOCA dashboard:

1. percentage of cases admitted to a stroke unit (target: 90%)
2. percentage of time patients with a stroke spend in a stroke unit (target: 90%)
3. percentage of patients with ischaemic stroke who receive thrombolysis (target: 12%)
4. median time between hospital arrival time and brain imaging time (minutes) (target: 1 hour)
5. median time between hospital arrival time and time of thrombolysis (minutes) (target: 1 hour)
6. percentage of cases who have a swallow screen completed (target: 100%)
7. percentage of cases who have a swallow screen completed within 4 hours of hospital arrival (target: 100%).

The metadata for each KQI is available in Appendix 4, and the result of each KQI for 2021 is reported within the findings.

Each figure within this report is presented as a national result. A table indicating the completeness of each variable used to analyse the result precedes each figure. Some variables, such as key time stamps, can be difficult to record if not known or not documented in the medical record, and caution is advised where completeness is low. The completeness tables also include the final validated[10] proportion of cases used to analyse the result for each year. If the figure relates to one of the seven KQIs, the result for 2021 follows the figure.

Frequency tables for each figure are available in Appendix 6, and hospital-level results are available in Appendix 7; however, if a hospital had less than 80% coverage, the result for that year was redacted. In addition, as mortality is unadjusted for age, sex or stroke severity, it is not reported at hospital level. Information on hospital-level stroke mortality is available in the *National Audit of Hospital Mortality Annual Report 2020* (NOCA, 2022c) and the *National Healthcare Quality Reporting System Annual Report 2020* (Department of Health, 2020).

EVIDENCE SYNTHESIS AND RECOMMENDATION FORMATION

A writing group – comprising the INAS Clinical Lead, the INAS Chairperson, one medical consultant with stroke expertise, one neuroradiologist, one HSCP, the INAS Audit Manager and the INAS Data Analyst – was established to plan and write this report. Following data analysis, the Data Analyst provided the INAS writing group with the figures and analytical commentary, the Audit Manager provided additional clinical commentary, and meetings were held to review, edit and interpret the results. The key findings were agreed by the writing group and recommendations were developed by consensus. Once recommendations were agreed, owners were identified and contacted in order to aid implementation of each recommendation. The two public and patient interest representatives from the INAS Governance Committee were provided with a final draft of the report and, in collaboration with the Audit Manager and the writing group, they agreed on the findings to be highlighted in the summary report.

HOW DOES THIS ANALYSIS INFORM THE INAS?

Completing a validation of historical data will ensure that the data available for service evaluation, quality improvement and research projects are of good quality with the ability to identify important caveats when needed.

WHO 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.

[10] This includes missing cases or cases that did not have date/time information recorded, or for whom it was recorded incorrectly.

HOSPITALS AND PEOPLE WE WORK WITH 2021

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 Luke's General Hospital Carlow-Kilkenny
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
Tipperary University 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 UNIVERSITY HOSPITAL
CLINICAL LEAD: Dr Niamh Hannon
AUDIT COORDINATOR: Mary Diskin

UNIVERSITY HOSPITAL GALWAY
CLINICAL LEAD: Dr Niamh Hannon
AUDIT COORDINATOR: Trish Galvin

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

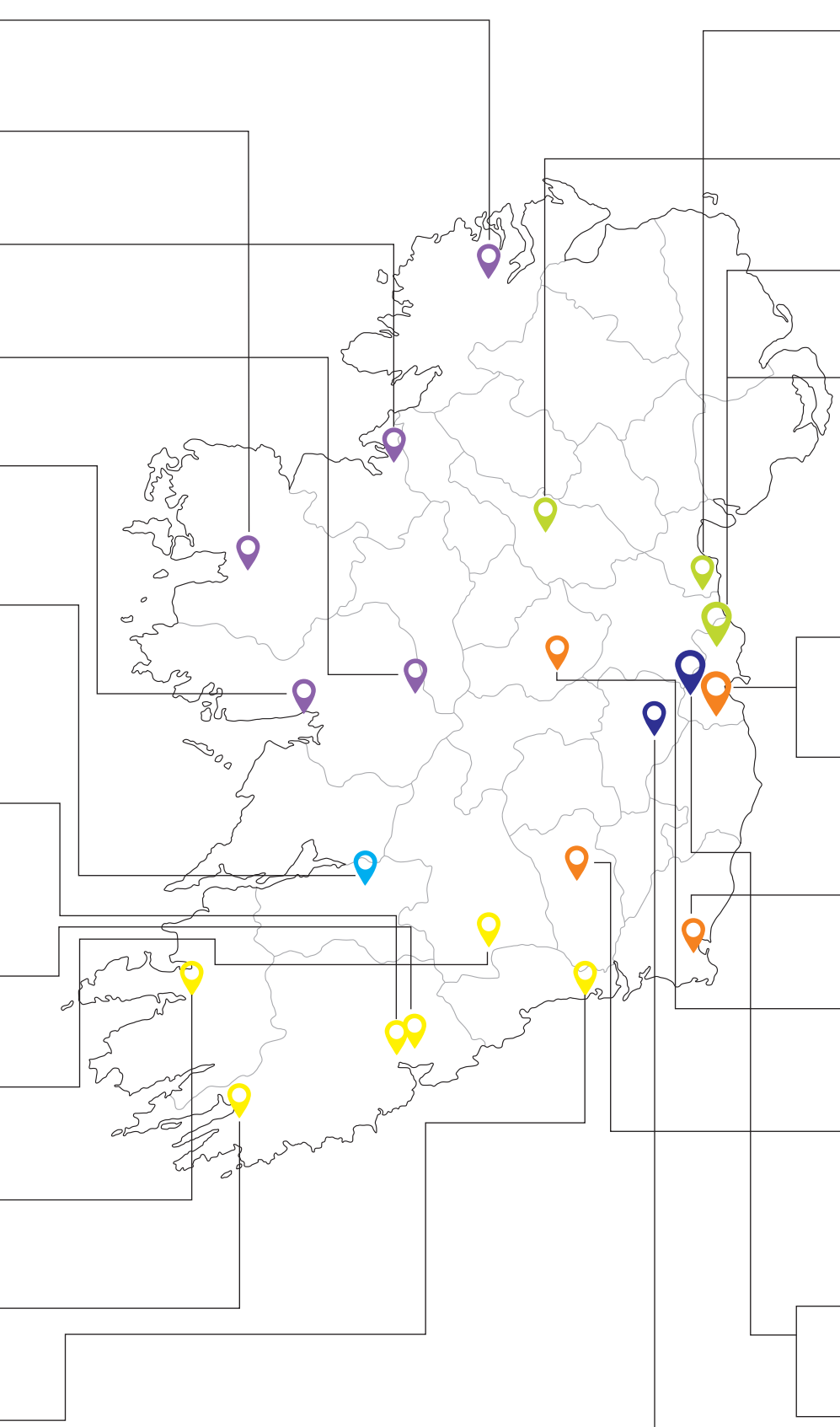
MERCY UNIVERSITY HOSPITAL
CLINICAL LEAD: Dr Catherine O'Sullivan
AUDIT COORDINATOR: Inês Saramago

TIPPERARY UNIVERSITY 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: Sarah 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 Michael Murnane
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 STATEMENT

Coverage of Data Release

Completeness of Data Release

Accuracy of Data Release

CHAPTER 3: **DATA QUALITY STATEMENT**

This chapter provides an assessment of the quality of the INAS data in this report using internationally agreed dimensions of data quality (Health Information and Quality Authority, 2018). Table 3.1 describes the context of the data quality statement, Table 3.2 outlines the characteristics of the data quality within this report and Table 3.3 provides an overall assessment of the quality of the data.

TABLE 3.1: CONTEXT OF DATA QUALITY STATEMENT

SCOPE	This data quality statement provides an assessment of the data released for this report. This statement solely focuses on the data quality dimension of 'accuracy and reliability', and specifically on the following characteristics: • coverage of data release • completeness of data release • accuracy of data release. This can be used in conjunction with an assessment of the characteristics of the INAS dataset, available at www.noca.ie.
PURPOSE	The data quality statement will help the reader decide whether the data are fit for the user's specific purpose.
DATA SOURCE	Data for this report have been extracted from the HIPE system, which includes data submitted to the stroke audit portal within HIPE.
TIMEFRAME OF DATA RELEASE	The data released in this report are based on data reported between 1 January 2013 and 31 December 2021.
TYPE OF DATA	Final

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY

Coverage of data release

The stroke audit portal has three distinct datasets:

- core clinical dataset
- thrombectomy dataset
- HSCP dataset.

The core clinical dataset was assessed for coverage and completeness for the whole reporting period. The thrombectomy dataset was assessed for coverage and completeness from 2016 to 2021. The HSCP dataset was assessed for completeness for 2021 only, as it remains in the implementation phase; additionally, only aggregate data for 2021 are presented.

CORE CLINICAL DATASET

The reference population for this report includes patients aged 17 years and over, with a principal diagnosis of ICD-10-AM[11] codes I61, I63 or I64 (and all their subsets) (Appendix 8), who were admitted to a public hospital that provided acute stroke services to more than 25 patients annually in Ireland. The number of hospitals that met these criteria changed during the reporting period (Table 3.2.1). In 2013, 23 hospitals participated in the INAS; this increased to 25 hospitals in 2018 with the addition of Connolly Hospital and University Hospital Kerry. In 2020, Our Lady's Hospital, Navan ceased to provide acute stroke care and is no longer participating in the audit. In 2021, 24 hospitals were participating in the INAS.

TABLE 3.2.1: NATIONAL HOSPITAL PARTICIPATION IN THE IRISH NATIONAL AUDIT OF STROKE

	2013	2014	2015	2016	2017	2018	2019	2020*	2021*
Number of participating hospitals	23	23	23	23	23	25	25	24	24
Number of participating hospitals with >80% coverage	9	12	18	19	18	18	20	23	24

*HADx included in coverage.

Coverage was defined as the proportion of cases with a principal diagnosis of stroke that had additional clinical data submitted to the stroke audit portal. National coverage generally increased throughout the reporting period (Figure 3.2.1).

HIPE also 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 (HPO, 2021). 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). If this is noted by the HIPE coder, the patient is assigned a HADx flag. This 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. Until 2020, only cases in the stroke audit portal with a principal diagnosis of stroke as coded

[11] During the reporting period, three editions (sixth, eighth and tenth) of the ICD-10-AM were utilised, and all codes remained unchanged over the 9-year reporting period.

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY *CONTINUED*

Coverage of data release

by the HIPE coder 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 and in the coverage reports. The HADx cases are included in the coverage report for 2020 and 2021 but only the principle diagnosis cases are reported on in this report. Further analysis of in-hospital stroke will be undertaken in 2022.

Hospital-level coverage is displayed by year in Appendix 3.

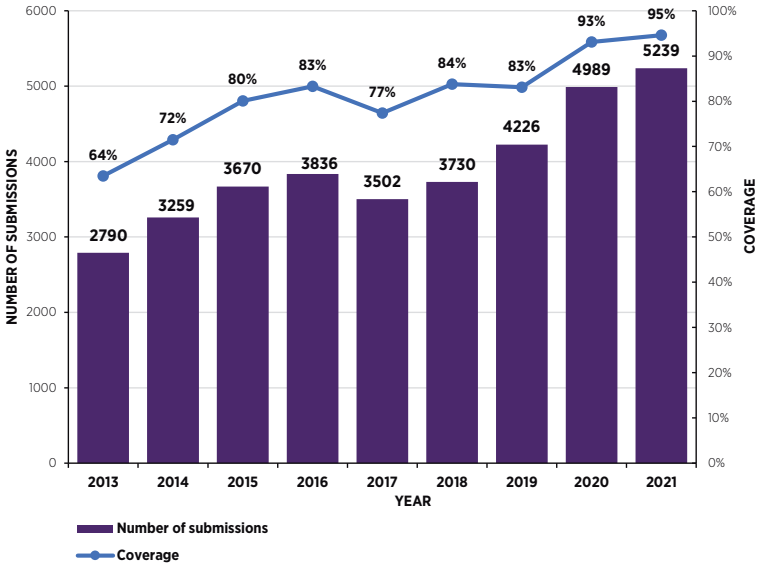


FIGURE 3.2.1: ANNUAL CASE SUBMISSIONS AND COVERAGE, BY YEAR (N=35241)[12]

[12] Includes additional cases for Mater Misericordiae University Hospital for 2015 and 2016.

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY *CONTINUED*

Coverage of data release

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 was measured against the number of cases reported in the National Thrombectomy Service annual reports for 2019, 2020 and 2021 (National Thrombectomy Service, 2022, 2021, 2020). Table 3.2.2 displays the coverage for the thrombectomy dataset.

TABLE 3.2.2: THROMBECTOMY DATASET COVERAGE

Year	Number of thrombectomy cases in the INAS	Number of National Thrombectomy Service report cases	Coverage
2016	157	N/A	N/A
2017	271	N/A	N/A
2018	249	N/A	N/A
2019	361	384	94%
2020	380	392	97%
2021	422	424	99%

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 INAS dataset.

In 2021, there was no effective way to calculate coverage for the HSCP dataset. Therapists from 19 hospitals submitted data to the HSCP dataset in 2021. This does not represent all of the physiotherapy, occupational therapy, or speech and language therapy activities in a named hospital, nor does it imply that there is no activity in hospitals that are not currently represented in this analysis. Because coverage cannot be described, there is a risk that the reported quality of care is biased, most likely positively. HSCPs who entered data may have been more motivated and aware of the need to improve the care they provide, and may as a result have been providing better care than those who did not enter data.

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY *CONTINUED*

Completeness of data release

Chapter 2: Methodology describes the completeness methodology undertaken for this report, and the data completeness report for all variables and datasets by year is available in Appendix 9.

Table 3.2.3 displays a summary of the improving level of variable completeness in the core clinical dataset during the reporting period. In 2013, 50% of variables were completed in at least 90% of cases; this increased to 89% in 2021. The percentage of variables with 79% or less completeness decreased from 42% in 2013 to 8% in 2021.

TABLE 3.2.3: SUMMARY OF VARIABLE COMPLETENESS IN THE CORE CLINICAL DATASET, 2013–2021

	At least 90% completeness		80-89% completeness		79% or less completeness		Total number of variables	
	N	%	N	%	N	%	N	%
2013	36	50%	6	8%	30	42%	72	100%
2014	34	59%	8	14%	16	28%	58	100%
2015	38	66%	4	7%	16	28%	58	100%
2016	29	56%	6	12%	17	33%	52	100%
2017	31	58%	12	23%	10	19%	53	100%
2018	34	64%	13	25%	6	11%	53	100%
2019	39	74%	8	15%	6	11%	53	100%
2020	45	85%	4	8%	4	8%	53	100%
2021	47	89%	2	4%	4	8%	53	100%

The DVR developed by the Data Analytics and Research team in 2020 has improved the quality of data and completeness, but for certain variables, the information can be both legitimately unknown and not recorded in the clinical record. This is a quality improvement opportunity for all hospitals.

Table 3.2.4 displays a summary of variable completeness in the thrombectomy dataset from 2016 to 2021.

TABLE 3.2.4: SUMMARY OF VARIABLE COMPLETENESS IN THE THROMBECTOMY DATASET, 2016–2021

	At least 90% completeness		80-89% completeness		79% or less completeness		Total number of variables	
	N	%	N	%	N	%	N	%
2016	1	3%	0	0%	31	97%	32	100%
2017	18	56%	5	16%	9	28%	32	100%
2018	20	63%	7	22%	5	16%	32	100%
2019	17	53%	10	31%	5	16%	32	100%
2020	17	53%	6	19%	9	28%	32	100%
2021	17	53%	11	34%	4	13%	32	100%

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY *CONTINUED*

Completeness of data release

Table 3.2.5 displays a summary of the completeness in the HSCP dataset for 2021 and indicates a high level of completeness: 100% for physiotherapy and occupational therapy, and 92% for speech and language therapy.

TABLE 3.2.5: SUMMARY OF VARIABLE COMPLETENESS IN THE HEALTH AND SOCIAL CARE PROFESSIONAL DATASET, 2021

	At least 90% completeness		80-89% completeness		79% or less completeness		Total number of variables	
	N	%	N	%	N	%	N	%
Physiotherapy	10	100%	0	0%	0	0%	10	100%
Occupational therapy	15	100%	1	0%	0	0%	16	100%
Speech and language therapy	23	92%	1	8%	0	0%	24	100%

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY *CONTINUED*

Accuracy of data release

During the reporting period, levels of coverage and completeness have changed and improved, as described in this data quality statement. Within the body of this report, each figure is based on the national total. Appendix 7 presents the results by hospital and year. To support accuracy, only hospitals that had at least 80% coverage in the reporting year have data displayed.

For each table and figure, accuracy in relation to completeness for each variable used for the analysis is presented. Variables where completeness is less than 80% are highlighted and caution is advised for the result.

The DVR process commenced in 2020; prior to that there were no data validations performed. A retrospective DVR, looking at the variables used to calculate the three national KPIs for the total reporting period, was produced in order to check for accuracy. Table 3.2.6 displays the proportion of cases excluded due to validations for KPI 2, and Table 3.2.7 displays it for KPI 3.[13]

The following are the three national KPIs reported to the HSE since 2014:

- KPI 1: percentage of patients with acute stroke who spent all or some of their hospital stay in a stroke unit
- KPI 2: for patients with acute stroke admitted to an acute stroke unit, the percentage of their hospital stay spent in the stroke unit
- KPI 3: percentage of patients with confirmed acute ischaemic stroke who received thrombolysis.

TABLE 3.2.6: DATA VALIDATIONS FOR KEY PERFORMANCE INDICATOR 2 – STROKE UNIT ADMISSION AND LENGTH OF STAY

	Total cases admitted to stroke unit	Cases excluded due to validations[14]	
		N	%
2013	1793	190	11%
2014	2219	225	10%
2015	2322	245	11%
2016	2603	189	7%
2017	2499	183	7%
2018	2710	143	5%
2019	3030	101	3%
2020	3534	124	4%
2021	3655	47	1%
TOTAL	**24 365**	**1447**	**6%**

[13] There was no data validation of the variable for KPI 1, as admission to a stroke unit was used in inclusion criterion IV of the core clinical dataset prior to the analysis; therefore, all cases in the core clinical dataset have this variable recorded.

[14] Validations included: 1) admission to and/or discharge from stroke unit date not recorded; 2) stroke unit admission date is after stroke unit discharge date; 3) admission to stroke unit date is before the hospital admission date; and 4) stroke unit discharge date is after hospital discharge date

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY *CONTINUED*

Accuracy of data release

TABLE 3.2.7: DATA VALIDATION FOR KEY PERFORMANCE INDICATOR 3 – PERCENTAGE OF PATIENTS WITH ISCHAEMIC STROKE WHO RECEIVED THROMBOLYSIS

	Total cases eligible for thrombolysis	Validation: Thrombolysis not known	
		N	%
2013	2496	14	1%
2014	2828	10	0%
2015	3160	26	1%
2016	3298	19	1%
2017	2998	32	1%
2018	3100	19	1%
2019	3473	12	0%
2020	4101	4	0%
2021	4334	1	0%
TOTAL	**24 365**	**1447**	**6%**

An area of concern in relation to accuracy is in the definitions of variables that require a time to be recorded; for example, the time of the brain scan. The exact time used by each hospital is not clearly defined. It is possible that one hospital may record the time the scan was completed, and another hospital may record the time the scan was reported. A researcher completing a PhD as part of the Improving Pathways for Acute STroke And Rehabilitation (iPASTAR) programme is completing a project that aims to:

1. identify if there are core data elements of the INAS data dictionary whose current definitions are potentially open to interpretation and therefore to variability in data collection and accuracy
2. gain insights into the challenges to data collection, interpretation and entry into the INAS stroke audit portal.

In addition, there is research under way aiming to develop a minimum set of questions (dataset) to be asked as part of the INAS (Bruen *et al*., 2021). The results of this research will inform a revised core dataset with clear definitions based on international review of other national stroke audits.

TABLE 3.3: ASSESSMENT

Strengths of data in this report	This report provides an overview of the quality of stroke care received by 34,630 patients during the 9-year reporting period. The dataset has evolved and matured in this time. The analysis of data completeness has indicated a good level of data quality in years where there were no data quality processes in place, and the validations for two national KPIs suggest that there was a high degree of data quality throughout the reporting period. The INAS now assesses data quality following the Health Information and Quality Authority's (HIQA's) *Guidance on a data quality framework for health and social care* (HIQA, 2018) and a data quality improvement plan is identified annually, and new processes (such as the development of a data validation process) work towards improving data quality in a timely fashion. The data in this report inform the three national KPIs and the INAS dashboard, which reports on seven KQIs and presents data from 2016 onwards. The dashboard is reported to all hospitals quarterly, 3 months in arrears, in order to enhance access to timely, high-quality data to inform local quality improvement initiatives and care processes.
Limitations of data in this report	This report has identified areas for improvement in data quality for some key variables, and this has informed the data quality improvement plan for 2023 (Chapter 9). The dataset has evolved during the reporting period and therefore not all results can be presented for the full 9 years (e.g. the thrombectomy dataset is only reported from 2016). The HSCP dataset remains in the implementation phase, and only 2021 data are covered in this report.

CHAPTER 4
EMERGENCY CARE

CHAPTER 4: **EMERGENCY CARE**

There has been an incremental increase in the number of patients with a stroke admitted to hospital annually over the reporting period (Figure 4.1), from 4,727 in 2013 to 5,789 in 2021.

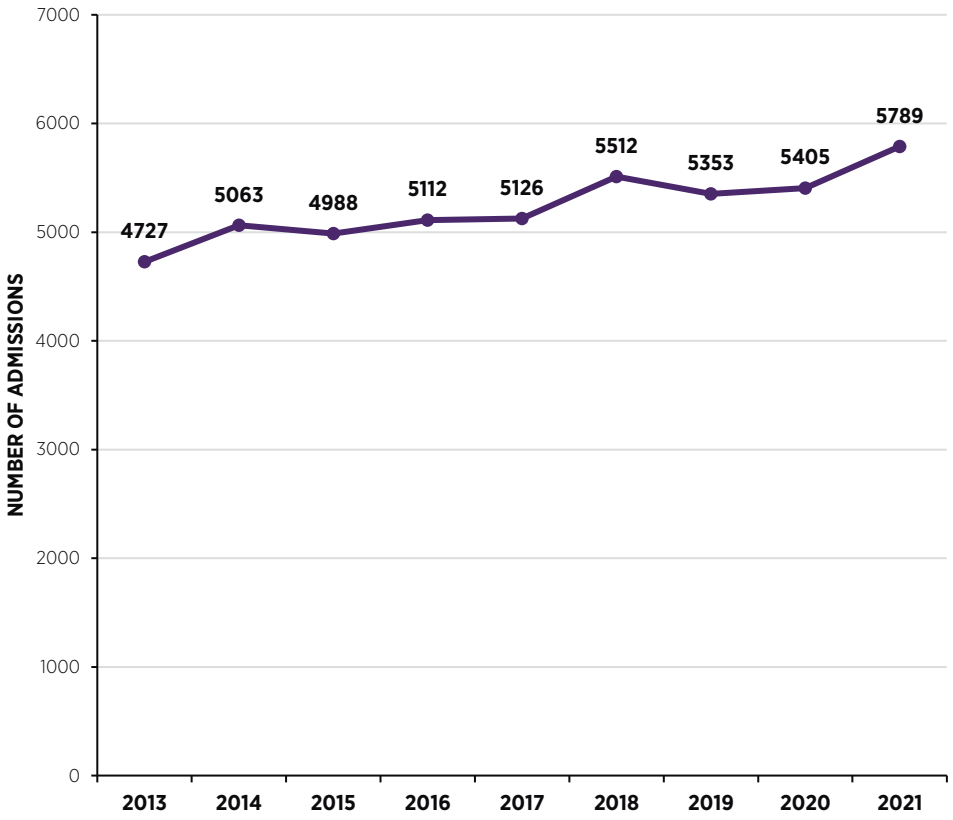


FIGURE 4.1: NUMBER OF HOSPITAL IN-PATIENT ENQUIRY STROKE ADMISSIONS IN PARTICIPATING HOSPITALS, BY YEAR (N=47075)

SEX AND AGE BAND

Data completeness

Sex and age data were recorded by HIPE, and there is 100% completeness for these variables.

Findings

Throughout the 9-year reporting period, more than one-half (n=19550, 56%) of all patients with a stroke were male (Figure 4.2).

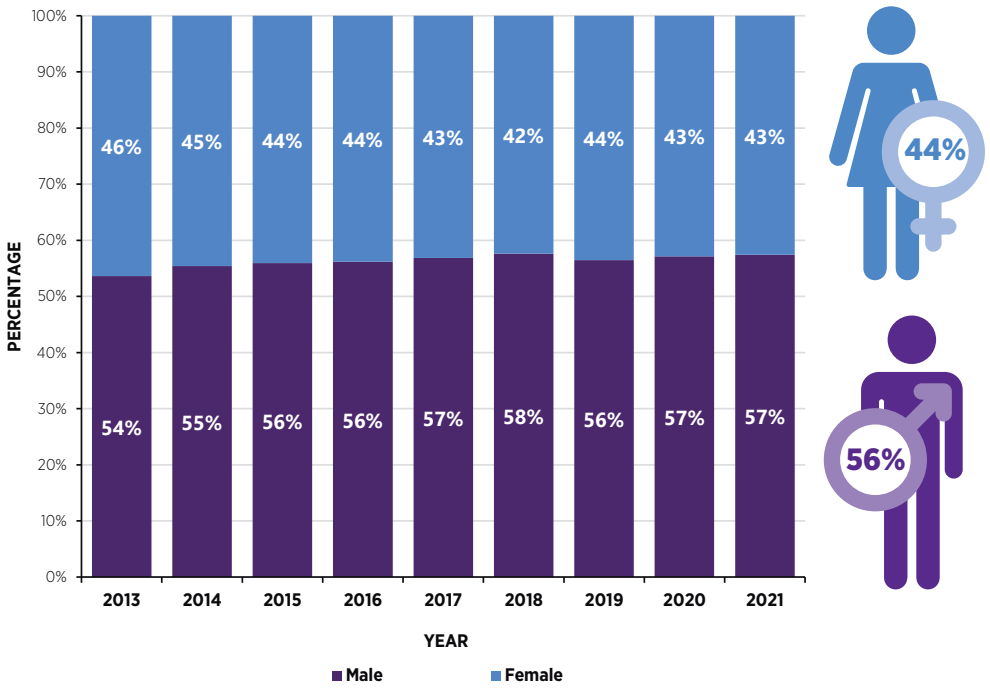


FIGURE 4.2: PERCENTAGE OF PATIENTS WITH A STROKE, BY SEX AND YEAR (N=34630)

The median age of patients with a stroke during the reporting period was 74 years (interquartile range (IQR): 65–82 years), and the mean age was 72 years. The median age for female patients was 78 years (IQR: 68–85 years), and for male patients it was 72 years (IQR: 62–80 years). These figures are consistent throughout the 9-year reporting period. There was a slight increase in patients with a stroke in the younger age group (aged 17–64 years), from 24% (n=669) in 2013 to 27% (n=1402) in 2021 (Figure 4.3).

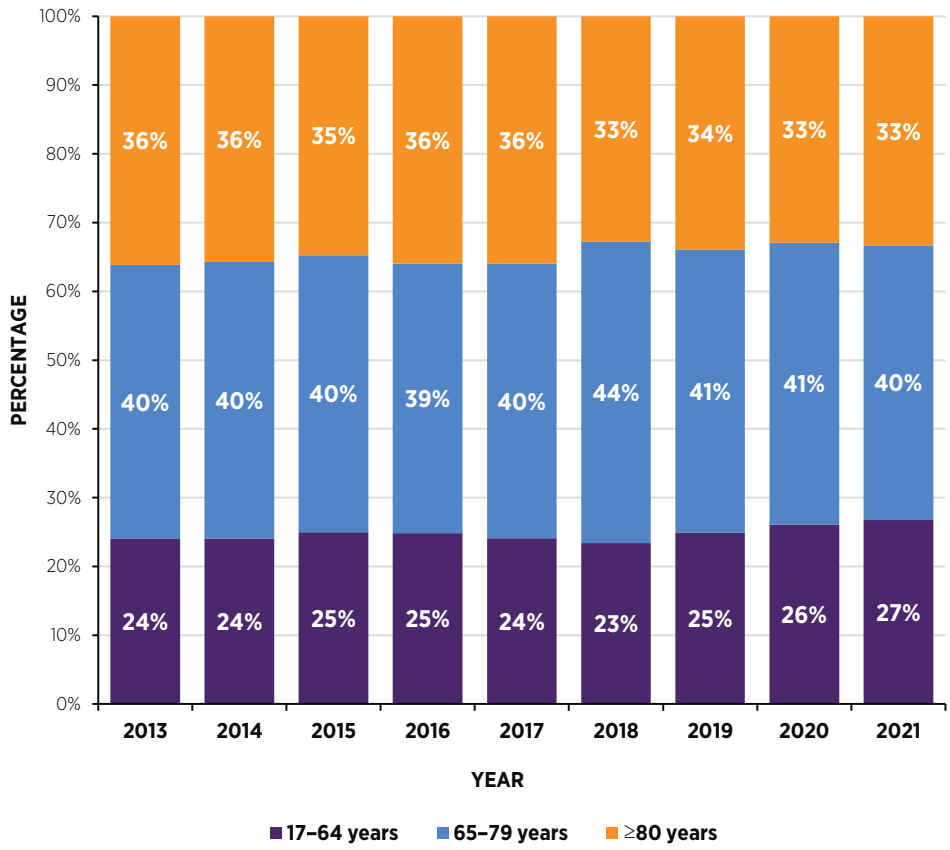


FIGURE 4.3: PERCENTAGE OF PATIENTS WITH A STROKE, BY AGE GROUP AND YEAR (N=34630)

ADMISSION SOURCE

Data completeness

The admission source data were recorded by HIPE, and there is 100% completeness for this variable.

Findings

The admission source data (Figure 4.4) show that the majority of patients with a stroke were living at home prior to their stroke. There was a gradual increase in the proportion of patients with a stroke who were transferred from one acute hospital to another, from 2% (n=50) in 2013 to 8% (n=428) in 2021. This was possibly due to the increased occurrence of interhospital transfers for thrombectomy since 2016 (Figure 4.11). Tracking the patient journey for these patients can be difficult due to the lack of an individual health identifier (IHI) in hospital records. Attaching the IHI to health records across different patient systems is a recommendation of this report.

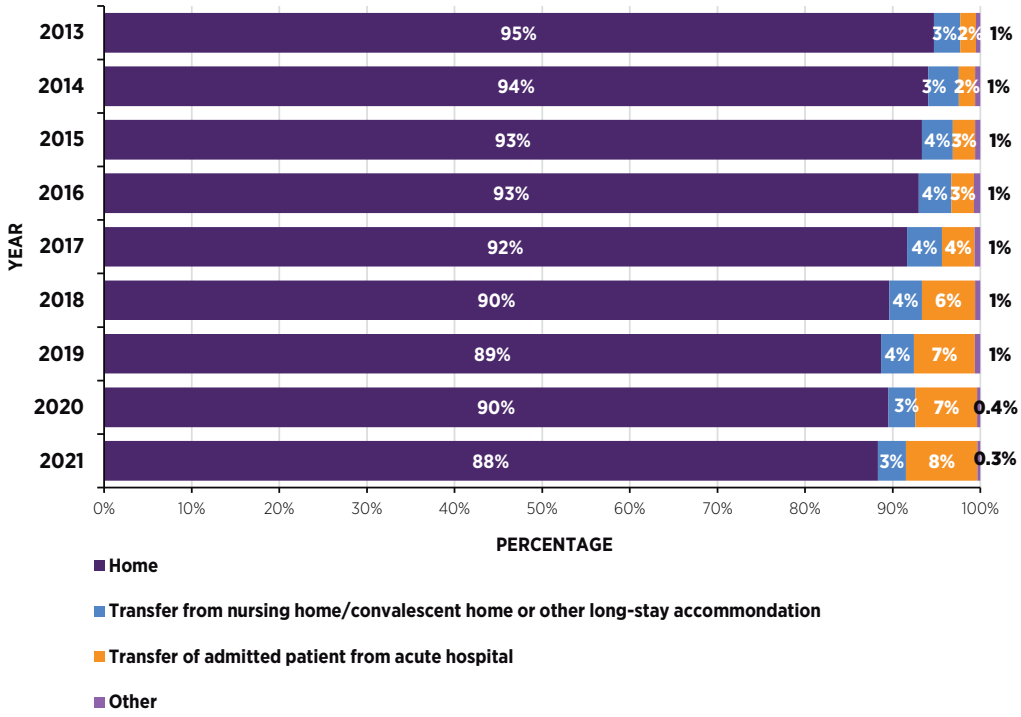


FIGURE 4.4: ADMISSION SOURCE, BY YEAR (N=34630)

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 with the phrase 'Time is Brain', implying that the shorter the time to the intervention, the more brain can be saved, with reductions in disability and handicap (Saver, 2005). On average, every minute after the onset of stroke, 2 million brain cells die. So every minute does actually count. The earlier patients receive thrombolysis and thrombectomy, the more effective the treatment will be.

Stroke teams are asked to record the date and time of onset of stroke symptoms and the date and time of hospital arrival. These data are 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'. However, determining the time of onset of stroke symptoms is difficult, as in many cases the stroke is unwitnessed (e.g. the patient may not know when symptoms began or be unable to speak, or the patient may wake up with symptoms). From 2016, if the time of onset of stroke symptoms was unknown, stroke teams were asked to record the time the patient was last seen well. The onset of symptoms or 'last seen well' date and time was available in 60% of cases across the 6-year reporting period.

Data completeness

Table 4.1 shows the proportion of cases that had the date and time of onset of stroke symptoms for patients with both witnessed and unwitnessed stroke recorded for each of the reporting years. In total, the date and time of onset of stroke symptoms and arrival at a hospital was specified in 51% (n=17814) of cases. Figure 4.5 displays the results of cases of witnessed stroke (known date and time of onset) only.

TABLE 4.1: DATA COMPLETENESS FOR ONSET OF SYMPTOMS AND HOSPITAL ARRIVAL VARIABLES, BY YEAR [15]

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Onset of stroke symptoms date	76%	90%	96%	97%	95%	94%	93%	92%	90%
Onset of stroke symptoms time	50%	48%	49%	52%	54%	56%	57%	58%	60%
Hospital arrival date	100%	100%	100%	100%	99%	100%	100%	100%	100%
Hospital arrival time	94%	94%	95%	96%	95%	96%	99%	99%	100%
Proportion of data used for the analysis	36%	42%	46%	50%	52%	54%	55%	57%	59%

[15] Time of onset of stroke symptoms can only be known in cases of witnessed stroke. The low proportion of recorded witnessed onset of symptoms date and time was associated with the difficulty of retrieving this information.

Findings

For those cases which had time from onset of stroke symptoms (witnessed stroke) to hospital arrival available, the median interval increased from 2 hours and 20 minutes in 2013 to 3 hours and 30 minutes in 2021. Figure 4.5 shows a gradual decrease in the proportion of patients with a stroke who arrived at a hospital within 3 hours of stroke symptom onset, from 59% (n=591) in 2013 to 46% (n=1429) in 2021. Caution should be applied as there was also an increase in the number of cases each year, which could have influenced the results in this figure (Figure 4.5).[16]

The proportion of patients who arrived at hospital within 3 hours of onset of stroke symptoms decreased

2013 **59%**
2021 **46%**

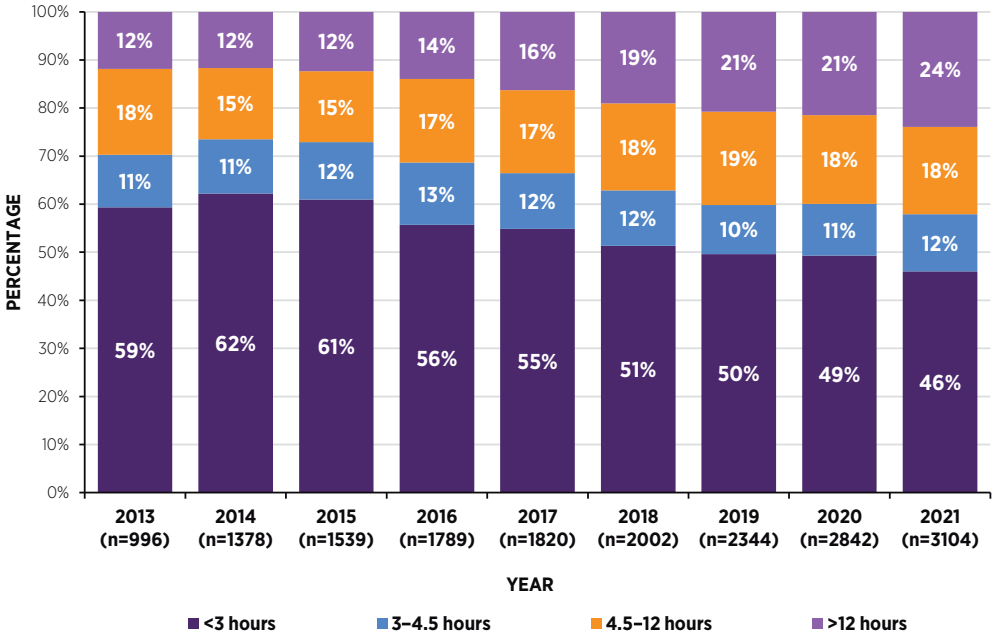


FIGURE 4.5: DISTRIBUTION OF TIME FROM WITNESSED STROKE SYMPTOM ONSET TO HOSPITAL ARRIVAL, BY YEAR (n=17814)[17]

[16] For a detailed description of how analysis for Figure 4.5 was performed, please see Appendix 4.
[17] 16,816 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 4.5.

TIME BETWEEN HOSPITAL ARRIVAL AND REVIEW BY MEDICAL TEAM

Early review by the medical team[18] 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).

Between 2013 and 2015, stroke teams were asked to record the date and time of stroke team assessment. This was defined as "assessment by stroke team consultant or stroke team registrar. May also include assessment by nursing or allied health professional members of the stroke team. Review by the on-call medical team without stroke expertise present is not assessment by acute stroke team" (Appendix 2). Following a revision of the dataset in 2016, stroke teams were asked to record the medical assessment date and time. This was defined as "the first date and time a doctor saw the patient as documented in the medical chart" (Appendix 2). This is an important change, as the majority of stroke teams do not provide service 24 hours a day, 7 days a week (NOCA, 2022b), and therefore the time seen by the stroke team is often longer than the time seen by the on-call medical team. As a result, there was a difference in the proportion of patients with a stroke who were seen within 30 minutes of the initial medical assessment from 2016 onwards (Figure 4.6).

Data completeness

Table 4.2 shows the proportion of cases that had the date and time of both stroke team/medical team assessment, and of arrival at hospital, recorded for each of the reporting years. Documentation of stroke team assessment time was low (average: 55%) between 2013 and 2015; documentation of medical team assessment time was higher (average: 74%) between 2016 and 2021.

TABLE 4.2: DATA COMPLETENESS FOR STROKE TEAM ASSESSMENT, MEDICAL TEAM ASSESSMENT AND HOSPITAL ARRIVAL TIME VARIABLES, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Seen by a stroke team	99%	99%	99%						
Stroke team assessment date	96%	97%	98%						
Stroke team assessment time	56%	57%	52%						
Medical team assessment date				85%	97%	98%	99%	100%	100%
Medical team assessment time				51%	71%	75%	77%	85%	85%
Hospital arrival date	100%	100%	100%	100%	99%	100%	100%	100%	100%
Hospital arrival time	94%	94%	95%	96%	95%	96%	99%	99%	100%
Proportion of data used for the analysis	49%	52%	49%	49%	67%	72%	75%	83%	84%

[18] The term 'medical team' here refers to the first doctor who sees the patient in the emergency department; this could be the emergency department/on-call doctor, the on-call medical team or a stroke team. The term 'stroke team' specifically refers to a team with stroke expertise (e.g. stroke consultant/stroke registrar).

2021 **48%**
2013 **23%**

The proportion of patients who were seen by a medical team within 10 minutes of hospital arrival more than doubled.

Findings

From 2016 to 2021, the proportion of patients with a stroke who were seen by a medical team within 10 minutes of hospital arrival more than doubled, from 23% (n=398) in 2016 to 48% (n=2126) in 2021 (Figure 4.6).[19] The median time to assessment decreased from 2 hours and 28 minutes in 2016 to 12 minutes in 2021.

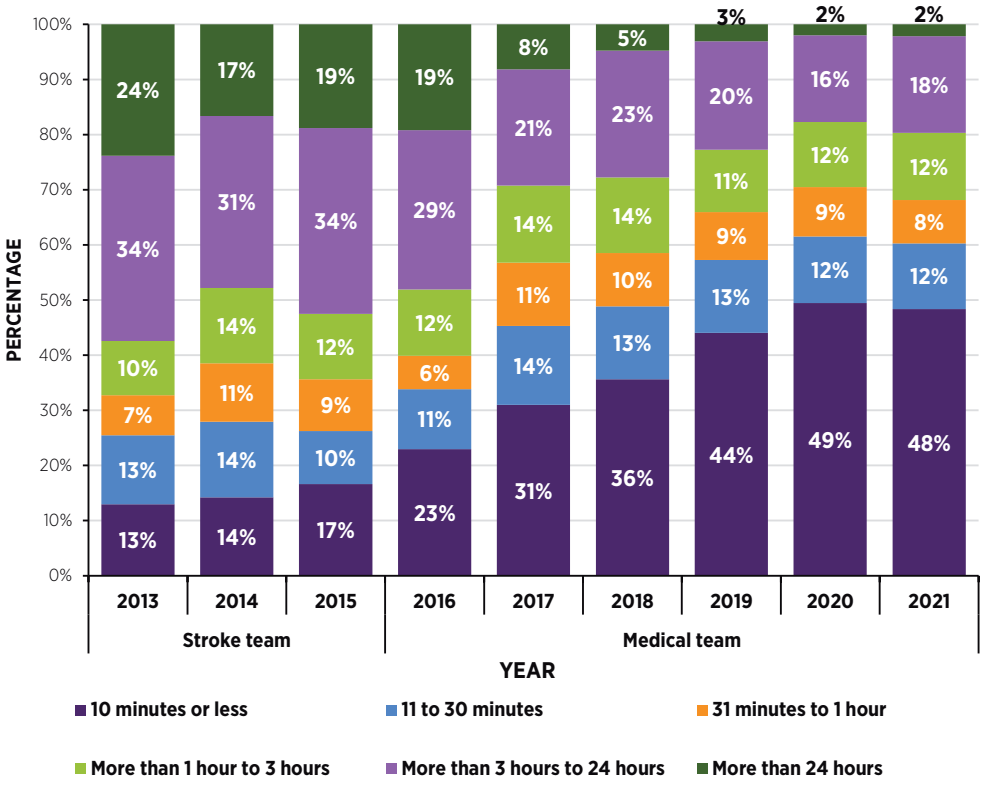


FIGURE 4.6: TIME BETWEEN HOSPITAL ARRIVAL AND TIME REVIEWED BY STROKE/ MEDICAL TEAM, BY YEAR (n=22598)[20,21]

[19] For a detailed description of how analysis for Figure 4.6 was performed, please see Appendix 4.
[20] Between 2013 and 2015, 1,158 cases were not reviewed by a stroke team; therefore, those cases were not included in Figure 4.6. Between 2013 and 2021, 10,874 cases did not have time information recorded or it was recorded incorrectly.
[21] 2016 was a transition year; thus, caution should be applied when interpreting results from this year.

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).

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. The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that all hospitals have access to computed tomography (CT) imaging for patients with a stroke in the emergency department, and that 18 (75%) hospitals can routinely get a CT scan performed on all patients with a suspected stroke within 3 hours of admission.

The clinical guidance related to initial brain imaging changed during the reporting period, reflecting changing evidence. This may affect results within this trend report. In 2012, the *National clinical guideline for stroke* (Royal College of Physicians, 2012) recommended that brain imaging be performed within 1 hour for suspected stroke in certain circumstances, such as in cases where thrombolysis was indicated; otherwise, imaging should be performed as soon as possible, but at most within 12 hours of admission. In 2016 (Royal College of Physicians, 2016), it was recommended that patients with suspected acute stroke should receive brain imaging urgently – at most within 1 hour of arrival at hospital.

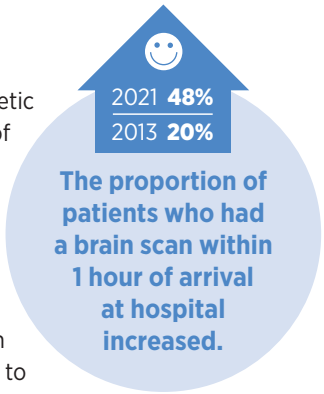
Data completeness

Completion of the variables required to analyse the 'door to imaging' metric has been high (greater than 90%) throughout the reporting period (Table 4.3).

TABLE 4.3: DATA COMPLETENESS FOR BRAIN SCAN AND HOSPITAL ARRIVAL VARIABLES, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Brain Scan	100%	100%	99%	100%	99%	99%	100%	100%	100%
Brain image date	99%	99%	99%	100%	99%	99%	100%	100%	100%
Brain image time	94%	95%	93%	95%	94%	95%	98%	100%	100%
Hospital arrival date	100%	100%	100%	100%	99%	100%	100%	100%	100%
Hospital arrival time	94%	94%	95%	96%	95%	96%	99%	99%	100%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings



In total, 96% (n=33073) of patients with a stroke had a CT or magnetic resonance imaging (MRI) scan after their stroke in their hospital of admission, with a further 4% (n=1290) of patients having a CT or MRI scan performed pre-admission or in a previous hospital, in cases of hospital transfer[22].

The proportion of all patients with a stroke who had a brain imaging scan within 1 hour of hospital arrival increased from 20% (n=532) in 2013 to 48% (n=2341) in 2021. The results align with changes in the clinical guidance in 2016 and the commencement of the Door to Decision in Under 30! quality improvement collaborative, led by Professor John Thornton, in 2018. Further information is presented in Chapter 8 and the *National Thrombectomy Service Annual Report 2021* (National Thrombectomy Service, 2022). There was also an improvement in the proportion of data recorded; in 2013, the 'door to imaging' time was unknown in 12% of cases, as there was insufficient information recorded; this decreased to 2% in 2021 (Figure 4.7).[23]

TABLE 4.4: "DOOR TO IMAGING' TIME, MEDIAN AND INTERQUARTILE RANGE, BY YEAR, IN MINUTES (n=33073)

YEAR	Patients (N)	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
2013	2720	185	67	885
2014	3183	170	59	784
2015	3236	135	51	471
2016	3468	139	53	479
2017	3377	106	43	347
2018	3550	91	37	308
2019	3974	79	30	304
2020	4698	64	27	240
2021	4867	63	26	257
Total	**33 073**	**102**	**37**	**364**

[22] An additional 107 (0.3%) patients did not receive a CT or MRI scan, and 160 (0.5%) did not have information recorded. Please note that percentages may not sum to 100% due to rounding.
[23] For a detailed description of how analysis for Table 4.4 and Figure 4.7 was performed, please see Appendix 4.

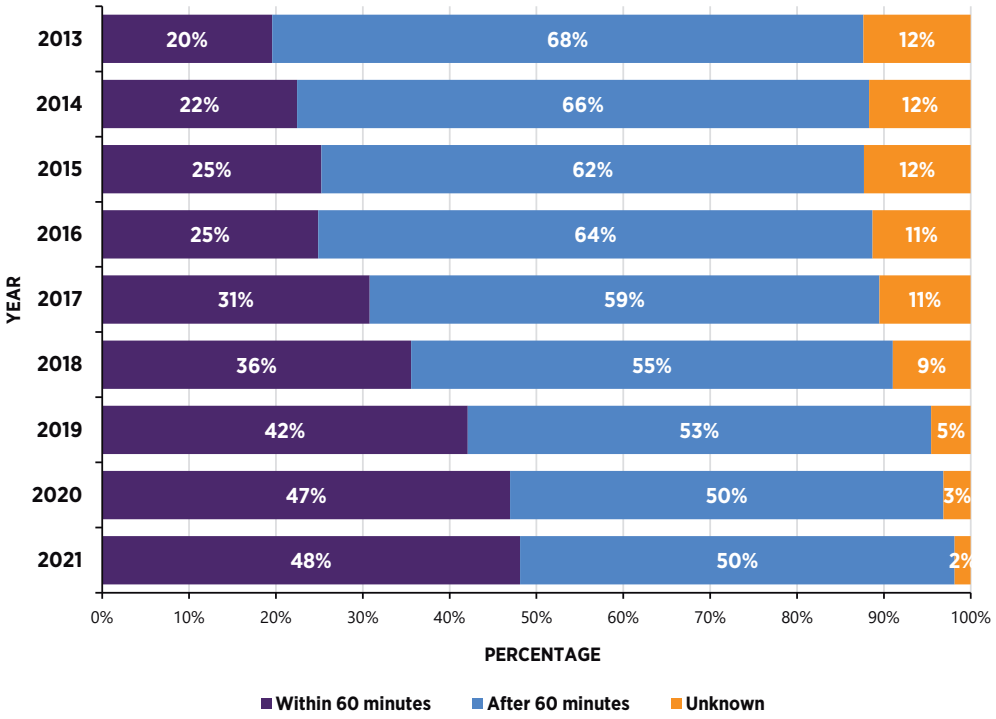


FIGURE 4.7: PROPORTION OF PATIENTS WHO RECEIVED BRAIN IMAGING WITHIN 1 HOUR OF HOSPITAL ARRIVAL, BY YEAR (n=33073)

KQI 4: Median time between hospital arrival time and brain imaging time (minutes) (target: 1 hour).

2021: 1 hour and 3 minutes

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).

Thrombolysis

Thrombolysis is an emergency treatment which dissolves blood clots and restores blood flow to the brain. Thrombolysis treatment is available 24 hours a day, 7 days a week in all but one acute hospital providing acute stroke services in Ireland (NOCA, 2022b). This treatment should be administered within 4.5 hours of the onset of stroke symptoms, although it can be given beyond this time in certain cases. It is therefore important that patients who have symptoms of a stroke call 999/112 immediately in order to ensure that they have the best chance of receiving this treatment.

Appropriate patient selection for thrombolysis and thrombectomy and timely treatment are crucial in acute stroke care. In 2021, the European Stroke Organisation (ESO) guidelines on intravenous thrombolysis for acute ischaemic stroke (Berge *et al*., 2021) found high-quality evidence to recommend intravenous thrombolysis in patients with acute ischaemic stroke on awakening from sleep, who were last seen well more than 4.5 hours earlier, who have MRI DWI-FLAIR[24] mismatch, and for whom mechanical thrombectomy is not planned. Advanced brain imaging (magnetic resonance or CT perfusion) should be used to select patients for treatment with alteplase if they present between 4.5 and 9.0 hours after the start of symptoms, or if a stroke is noticed upon waking from sleep (Berge *et al*., 2021). Advanced brain imaging is also beneficial in patient selection and timely decision-making for thrombectomy. The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that all hospitals had access to CT and computed tomography angiography (CTA), but only six hospitals had access to computed tomography perfusion (CTP). All hospitals had access to MRI, but only one hospital had access to MRI outside of normal working hours. Ensuring that all patients have access to advanced imaging is a recommendation of this report.

Data completeness

Completion of the variable required to analyse thrombolysis rates was high, at 99–100% throughout the reporting period (Table 4.5).

TABLE 4.5: DATA COMPLETENESS FOR THROMBOLYSIS VARIABLE, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Thrombolysis	99%	100%	99%	99%	99%	99%	100%	100%	100%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

[24] DWI-FLAIR = diffusion-weighted imaging - fluid-attenuated inversion recovery.

Findings

For patients with ischaemic stroke (n=29788) between 2013 and 2021, the intravenous thrombolysis rate was 11.2% (n=3351) (Figure 4.8)[25]. The thrombolysis rate had declined to 10% in 2021, possibly due to the reduction in the number of patients with a stroke who arrived at hospital within 3 hours (Figure 4.5), which limits access to emergency stroke treatment. The differentiation between the data entry options of 'no' and 'contraindicated' is unclear and may vary between sites. Understanding the reason for a 'contraindicated' or a 'no' response is an area for further audit, and a spotlight audit on thrombolysis is a recommendation of this report. Increasing public awareness of the need to identify stroke symptoms as a medical emergency is a priority for the National Stroke Programme, which is working with the Health Service Executive (HSE) and the Irish Heart Foundation (IHF) to increase the number of stroke awareness campaigns.

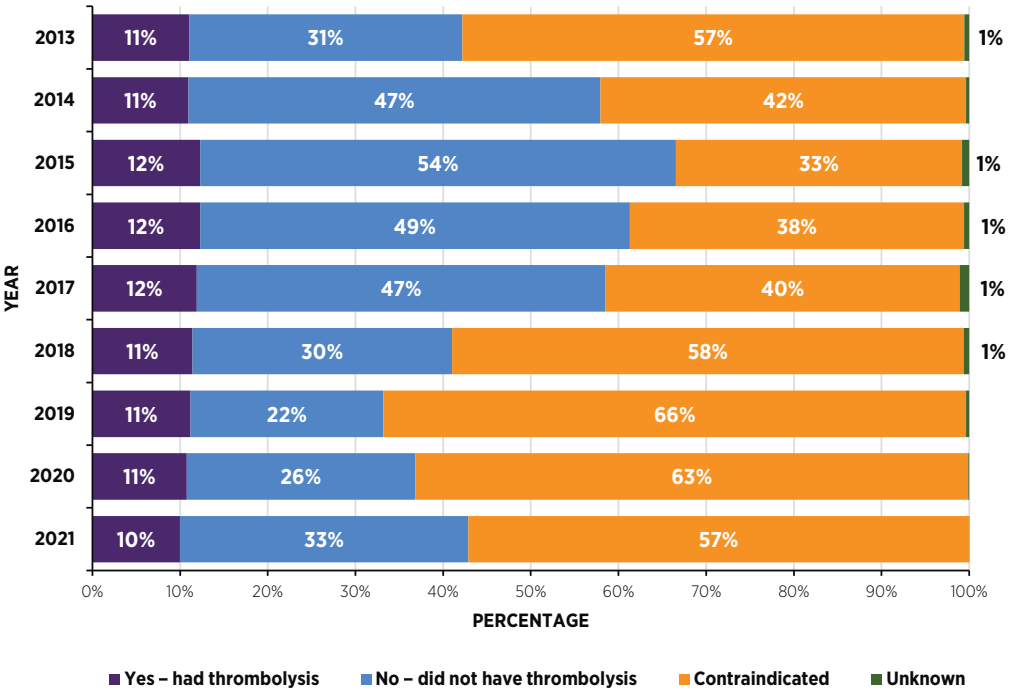


FIGURE 4.8: PERCENTAGE OF PATIENTS WITH ISCHAEMIC STROKE WHO RECEIVED THROMBOLYSIS, BY YEAR (n=29788)[26,27]

KQI 3: Percentage of patients with ischaemic stroke who receive thrombolysis (target: 12%).

2021: 10%

[25] For a detailed description of how analysis for Table 4.8 was performed, please see Appendix 4.
[26] Refers to ischaemic stroke only. Patients who were transferred to Beaumont Hospital or Cork University Hospital (n=724) were excluded from Figure 4.8.
[27] In 2015 and 2016, Mater Misericordiae University Hospital provided data to calculate the national KPI results only. Figure 4.8 includes additional Mater Misericordiae University Hospital data (n=538).

TIME BETWEEN HOSPITAL ARRIVAL AND TIME OF THROMBOLYSIS

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

Internationally, a 'door to needle' (DTN) target of 45 minutes is considered a good quality improvement goal (Xian *et al*., 2022), and the British and Irish Association of Stroke Physicians is currently in the process of developing a new stroke guideline which may recommend a change in the DTN target time.

Data completeness

Completion of the variables required to analyse the DTN times has been high throughout the reporting period (Table 4.6).

TABLE 4.6: DATA COMPLETENESS FOR HOSPITAL ARRIVAL TIME AND THROMBOLYSIS TIME VARIABLES, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Thrombolysis	99%	100%	99%	99%	99%	99%	100%	100%	100%
Thrombolysis date	99%	99%	99%	100%	100%	99%	100%	100%	100%
Thrombolysis time	95%	92%	95%	96%	96%	98%	98%	98%	100%
Hospital arrival date	100%	100%	100%	100%	99%	100%	100%	100%	100%
Hospital arrival time	94%	94%	95%	96%	95%	96%	99%	99%	100%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

For the 2013–2021 reporting period, the median DTN time was 64 minutes (Table 4.7);[28] the median DTN time has gradually decreased, from 76 minutes in 2013 to 53 minutes in 2021. This improvement is aligned with the aforementioned Door to Decision in Under 30! quality improvement collaborative.

TABLE 4.7: "DOOR TO NEEDLE' TIME, MEDIAN AND INTERQUARTILE RANGE, BY YEAR, IN MINUTES (n=3006)[29]

YEAR	Patients (N)	Median (minutes)	Percentile 25 (minutes)	Percentile 75 (minutes)
2013	238	76	60	100
2014	270	76	58	104
2015	292	72	55	100
2016	335	71	52	100
2017	322	61	42	90
2018	334	59	39	91
2019	372	57	36	88
2020	423	55	36	80
2021	420	53	37	80
Total	**3006**	**64**	**43**	**92**

[28] For a detailed description of how analysis for Table 4.7 was performed, please see Appendix 4.

[29] Refers to patients with ischaemic stroke who received thrombolysis only. Excludes Mater Misericordiae University Hospital in 2015 and 2016, as there were no data recorded for the relevant variables for those years. Cases that did not have date/time information recorded or for whom it was recorded incorrectly were excluded from calculation (n=238).

Figure 4.9[30] shows the distribution of time between hospital arrival and time of thrombolysis, by year. Between 2013 and 2021, the proportion of patients with a stroke who received thrombolysis within 60 minutes of arrival at hospital was 43% (n=1394), and this increased considerably over the reporting period, from 25% (n=68) in 2013 to 56% (n=243) in 2021. Similar improvements were seen for those receiving thrombolysis within 45 minutes of arrival at hospital, from 9% (n=25) in 2013 to 39% (n=170) in 2021. There was also an improvement in data quality over the reporting period, with the proportion of dates and times not recorded correctly decreasing from 14% in 2013 to 3% in 2021.

Monitoring and improving the timeliness of thrombolysis should remain a high priority in all stroke services, and the establishment of a stroke governance committee, in all hospitals, where the INAS data informs the agenda, is a recommendation of this report.

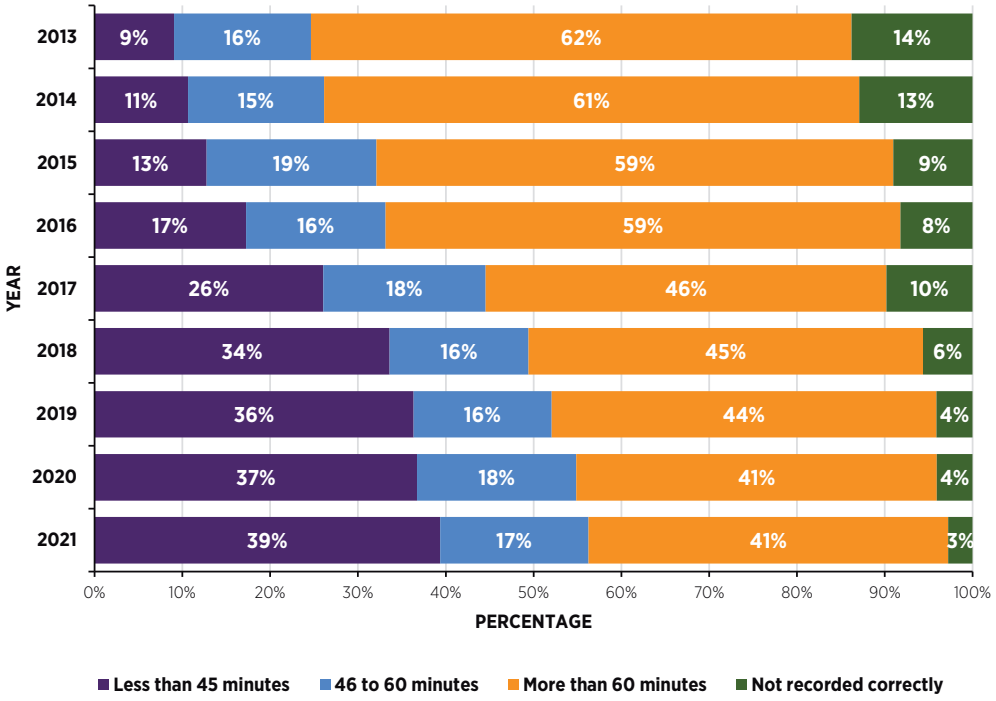


FIGURE 4.9: DISTRIBUTION OF TIME BETWEEN HOSPITAL ARRIVAL AND TIME OF THROMBOLYSIS, BY YEAR (n=3244)[31]

KQI 5: Median time between hospital arrival time and time of thrombolysis (minutes) (target: 1 hour).

2021: 53 minutes

[30] For a detailed description of how analysis for Figure 4.9 was performed, please see Appendix 4.
[31] Refers to patients with ischaemic stroke who received thrombolysis only. Excludes Mater Misericordiae University Hospital for 2015 and 2016, as there were no data recorded for the relevant variables for those years. Patients who were transferred to Beaumont Hospital or Cork University Hospital (n=27) were excluded from Figure 4.9.

THROMBOLYSIS IN PATIENTS WITH ISCHAEMIC STROKE WHO ARRIVE AT HOSPITAL WITHIN 4 HOURS OF ONSET OF STROKE SYMPTOMS

Delay in hospital arrival is the main reason for contraindication to thrombolysis. Reviewing the thrombolysis rates for patients who arrive at hospital in time for thrombolysis and do not receive thrombolysis may indicate issues with internal hospital processes, e.g. delay to brain scan, if there is variation.

Data completeness

Table 4.8 shows the proportion of cases that had the date and time of onset of stroke symptoms for patients with both witnessed and unwitnessed stroke recorded for each of the reporting years.

TABLE 4.8: DATA COMPLETENESS FOR TIME OF ONSET OF STROKE SYMPTOMS, HOSPITAL ARRIVAL TIME AND THROMBOLYSIS VARIABLES, BY YEAR[32]

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Onset of stroke symptoms date	76%	90%	96%	97%	95%	94%	93%	92%	90%
Onset of stroke symptoms time	50%	48%	49%	52%	54%	56%	57%	58%	60%
Hospital arrival date	100%	100%	100%	100%	99%	100%	100%	100%	100%
Hospital arrival time	94%	94%	95%	96%	95%	96%	99%	99%	100%
Thrombolysis	99%	100%	99%	99%	99%	99%	100%	100%	100%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

Between 2013 and 2021, there were 29,250[33] patients with ischaemic stroke. Of those, 9,176 arrived at a hospital within 4 hours of onset of stroke symptoms. Figure 4.10[34] shows the proportion of those 9,176 patients who received thrombolysis. The proportion of patients with ischaemic stroke who arrived at a hospital within the recommended time window of 4 hours for treatment with thrombolysis and who received thrombolysis has decreased over the reporting period, from 34% (n=205) in 2013 to 24% (n=334) in 2021. However, there has been an increase in the proportion of patients for whom thrombolysis treatment is contraindicated (Figure 4.10), which could be related to the increasing rate of direct oral anticoagulant (DOAC) prescription as presented in Chapter 6 (Figure 6.4A). This is an opportunity for further study and quality improvement initiatives in each stroke service.

[32] Time of onset of stroke symptoms can only be known in cases of witnessed stroke. The low proportion of recorded witnessed onset of symptoms date and time was associated with the difficulty of retrieving this information.
[33] Excludes Mater Misericordiae University Hospital for 2015 and 2016, as there were no data recorded for the relevant variables for those years. Patients who were transferred to Beaumont Hospital or Cork University Hospital (n=724) were also excluded.
[34] For a detailed description of how analysis for Figure 4.10 was performed, please see Appendix 4.

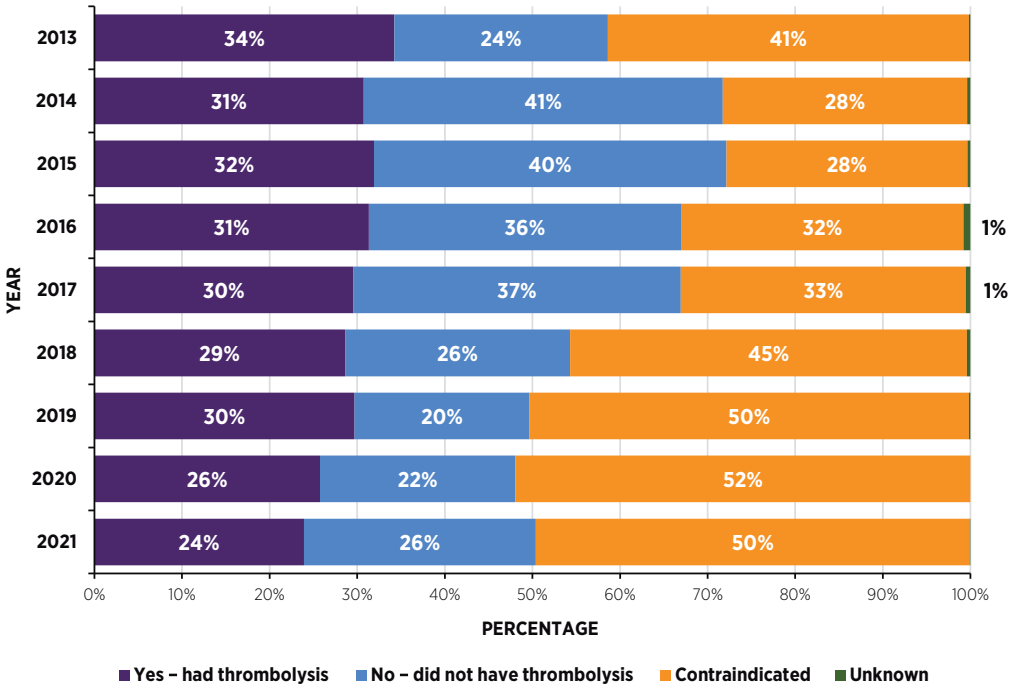


FIGURE 4.10: PROPORTION OF PATIENTS WITH ISCHAEMIC STROKE WHO ARRIVED AT HOSPITAL WITHIN 4 HOURS AND RECEIVED THROMBOLYSIS, BY YEAR (n=9176)[35]

[35] Patients who were transferred to Beaumont Hospital or Cork University Hospital (n=91) were excluded from Figure 4.10.

THROMBECTOMY IN ISCHAEMIC STROKE

Thrombectomy in stroke is the mechanical removal of a blood clot in a large blood vessel in the brain. The National Thrombectomy Service (NTS) has been developed in two hospitals since around 2010. Beaumont Hospital has provided a national service 24 hours a day, 7 days a week since 2010, while Cork University Hospital initially began providing an 8.00am–5.00pm service 5 days a week for its surrounding region in 2016, and began providing a service 24 hours a day, 7 days a week in 2021.

Data collection for thrombectomy via the stroke audit portal commenced in 2016 for Beaumont Hospital and in 2017 for Cork University Hospital. The reporting period for thrombectomy in this trend report is 2016–2021. Additional data on the NTS are available in the *National Thrombectomy Service Annual Report 2021* (NTS, 2022).

2021 **9.5%**
2016 **4.8%**

Thrombectomy rates have doubled since 2016.

Findings

Figure 4.11 shows the distribution of thrombectomy cases between 2016 and 2021 for the two endovascular thrombectomy (EVT) stroke centres. There was a gradual increase in the number of cases who received a thrombectomy in either Beaumont Hospital or Cork University Hospital, from 157 cases in 2016 to 422 in 2021.

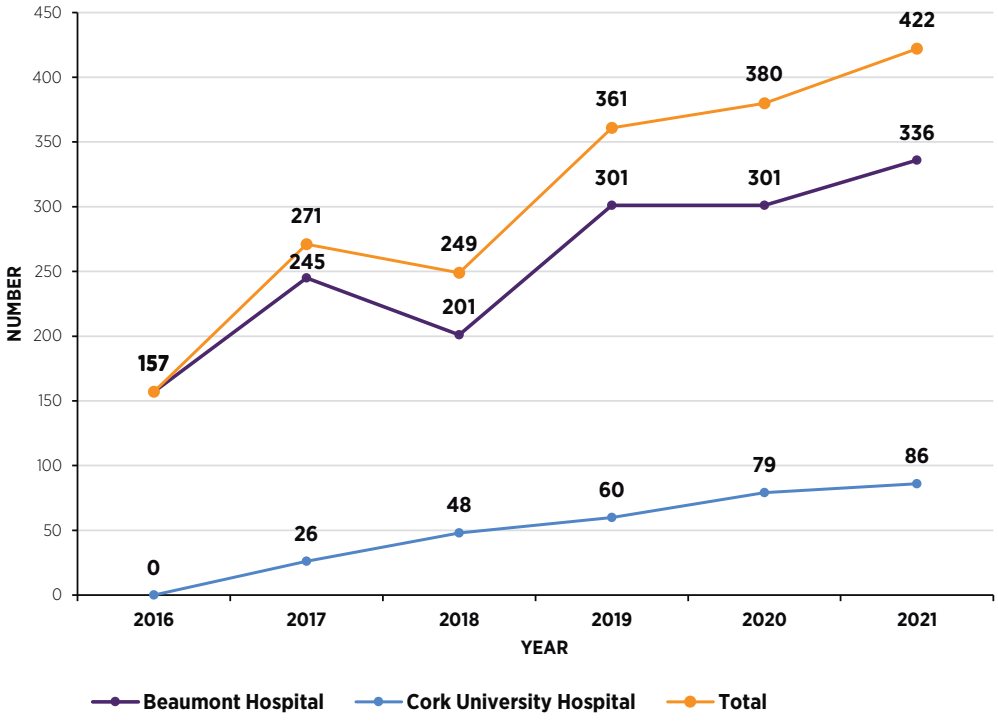


FIGURE 4.11: NUMBER OF CASES WHO RECEIVED A THROMBECTOMY, BY YEAR (n=1840)

Figure 4.12[36] shows the proportion of patients with ischaemic stroke[37] who had a thrombectomy[38] performed, by year. The overall rate of thrombectomy in patients with ischaemic stroke was 8.4%, with slight variance between the years. The results differ marginally from previous NOCA reports due to a change in the methodology, which in this report excludes in-hospital stroke as part of the final ischaemic stroke denominator. The Sentinel Stroke National Audit Programme (SSNAP) reported a thrombectomy rate of 2% in 2020–2021 (SSNAP, n.d.).

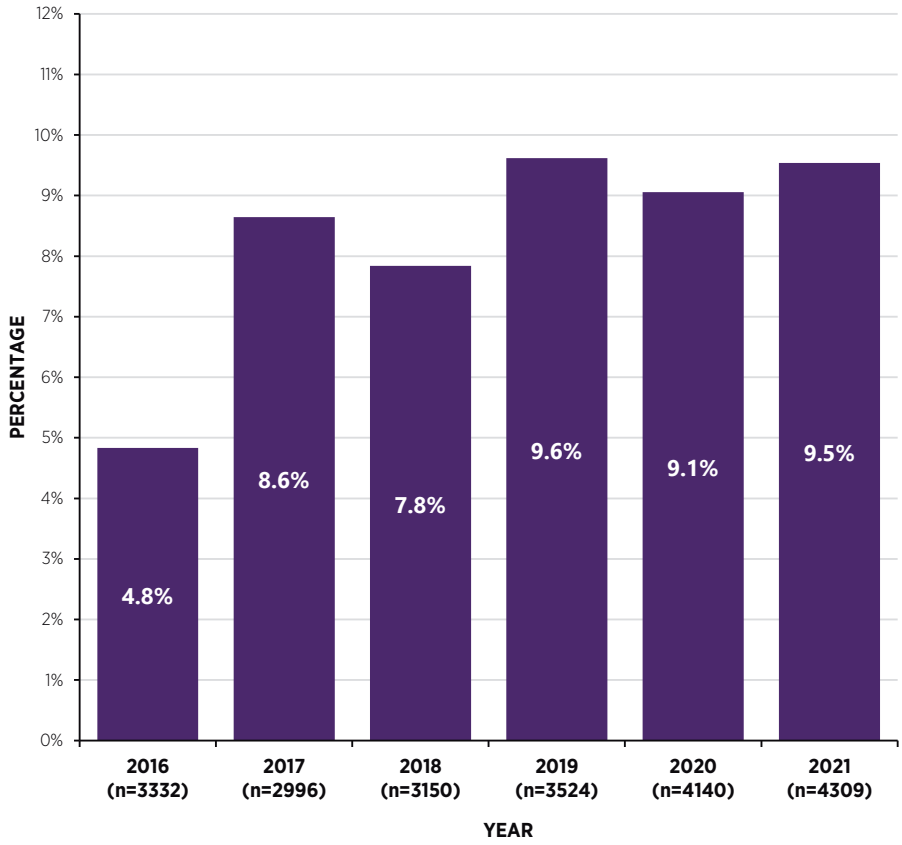


FIGURE 4.12: PERCENTAGE OF PATIENTS WITH ISCHAEMIC STROKE WHO HAD A THROMBECTOMY, BY YEAR (n=21451)

[36] For a detailed description of how analysis for Figure 4.12 was performed, please see Appendix 4.
[37] Excluding in-hospital stroke.
[38] May include in-hospital stroke within the total number of thrombectomies.

TRANSFER OF PATIENTS TO AND FROM THE EVT STROKE CENTRES

Thrombectomy is performed in two EVT stroke centres and, therefore, the majority of patients with ischaemic stroke who are suitable for thrombectomy will require transfer from the primary hospital to an EVT stroke centre.

Data completeness

Analysing completeness for the transfer variable is not possible; further details are available in Chapter 2.

Findings

Throughout the reporting period, the majority of thrombectomy cases were transferred to an EVT stroke centre from a referring hospital (Figure 4.13). The proportion of patients who were admitted directly to an EVT stroke centre varied from 8% (n=13) in 2016 to 30% (n=75) in 2018.

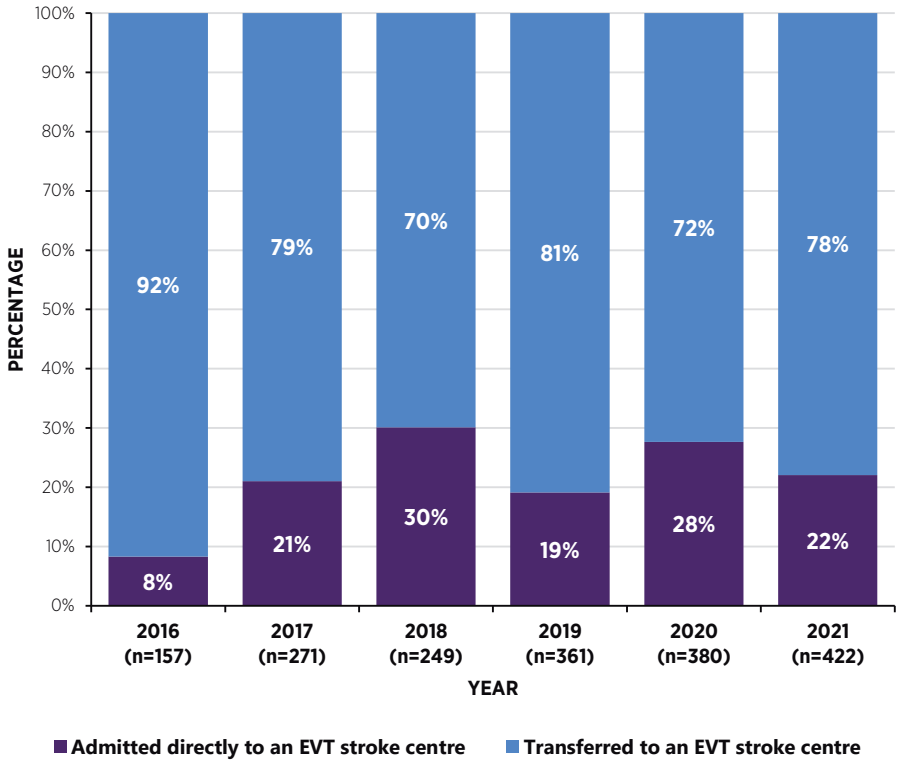


FIGURE 4.13: PERCENTAGE OF PATIENTS WHO RECEIVED A THROMBECTOMY WHO WERE ADMITTED DIRECTLY OR TRANSFERRED TO AN ENDOVASCULAR THROMBECTOMY STROKE CENTRE, BY YEAR (n=1840)

TIME TO RECANALISATION

Recanalisation is the term used to describe when a clot is removed and blood flow is restored. Time to recanalisation reflects the time from onset of stroke symptoms to recanalisation. For patients who are transferred to an EVT stroke centre, this includes the time spent in the referring hospital for initial diagnosis and decision to proceed to thrombectomy, the journey to the EVT stroke centre, and the procedure time. Most transferred patients go directly to the angiography laboratory for the procedure, as they would have already been evaluated in the referring hospital. Patients presenting directly to an EVT stroke centre require initial evaluation, diagnosis and decision prior to the procedure, along with time to prepare for and perform the thrombectomy. Typically, thrombectomy is considered up to 24 hours after onset of stroke symptoms in suitable cases (i.e. those who have had advanced imaging performed).

Data completeness

As for all patients with a stroke, the time of onset of stroke symptoms can only be known in cases of a witnessed stroke. Tables 4.9, 4.10 and 4.11 display the completeness of variables required to analyse the time to recanalisation for both witnessed and unwitnessed stroke. Between 2016 and 2021, within the thrombectomy dataset, the date and time of onset of stroke symptoms was known in 65% of cases. No data were available for first reperfusion time in 2016. Figures 4.14A, 4.14B and 4.14C refer to cases of witnessed stroke (known time of onset of stroke symptoms) only.

The proportion of data available for analysis of time to recanalisation for all patients (with both witnessed and unwitnessed stroke) admitted directly to an EVT stroke centre ranged from 41% to 61% (Table 4.9), and from 49% to 67% for all patients who were transferred to an EVT stroke centre (Table 4.10). Table 4.11 specifies those who were transferred to Beaumont Hospital; the data completeness for these cases ranged from 46% to 66%.

TABLE 4.9: DATA COMPLETENESS FOR TIME OF ONSET OF STROKE SYMPTOMS AND TIME OF FIRST REPERFUSION VARIABLES FOR PATIENTS ADMITTED DIRECTLY TO AN ENDOVASCULAR THROMBECTOMY STROKE CENTRE, BY YEAR[39]

	2016	2017	2018	2019	2020	2021
Onset of stroke symptoms date	92%	98%	99%	88%	87%	75%
Onset of stroke symptoms time	85%	75%	67%	68%	55%	48%
First reperfusion date	15%	84%	99%	97%	92%	90%
First reperfusion time	0%	77%	96%	93%	91%	89%
Proportion of data used for the analysis	0%	58%	59%	61%	49%	41%

[39] Time of onset of stroke symptoms can only be known in cases of witnessed stroke. The low proportion of recorded witnessed onset of symptoms date and time was associated with the difficulty of retrieving this information.

TABLE 4.10: DATA COMPLETENESS FOR TIME OF ONSET OF STROKE SYMPTOMS AND TIME OF FIRST REPERFUSION VARIABLES FOR PATIENTS TRANSFERRED FROM ANOTHER HOSPITAL TO AN ENDOVASCULAR THROMBECTOMY STROKE CENTRE, BY YEAR[40]

	2016	2017	2018	2019	2020	2021
Onset of stroke symptoms date	98%	95%	99%	87%	78%	74%
Onset of stroke symptoms time	95%	74%	76%	62%	55%	58%
First reperfusion date	1%	97%	99%	98%	97%	98%
First reperfusion time	0%	83%	91%	90%	91%	94%
Proportion of data used for the analysis	0%	63%	67%	55%	49%	53%

TABLE 4.11: DATA COMPLETENESS FOR TIME OF ONSET OF STROKE SYMPTOMS AND TIME OF FIRST REPERFUSION VARIABLES FOR PATIENTS ADMITTED DIRECTLY OR TRANSFERRED FROM ANOTHER HOSPITAL TO BEAUMONT HOSPITAL, BY YEAR[41]

	2016	2017	2018	2019	2020	2021
Onset of stroke symptoms date	97%	96%	99%	85%	75%	67%
Onset of stroke symptoms time	94%	77%	76%	62%	51%	54%
First reperfusion date	3%	97%	100%	99%	97%	99%
First reperfusion time	0%	84%	91%	91%	90%	94%
Proportion of data used for the analysis	0%	65%	66%	55%	46%	49%

[40] Time of onset of stroke symptoms can only be known in cases of witnessed stroke. The low proportion of recorded witnessed onset of symptoms date and time was associated with the difficulty of retrieving this information.

[41] Time of onset of stroke symptoms can only be known in cases of witnessed stroke. The low proportion of recorded witnessed onset of symptoms date and time was associated with the difficulty of retrieving this information.

RECANALISATION TIMES FOR PATIENTS ADMITTED DIRECTLY TO AN EVT STROKE CENTRE

The median time and interquartile range (IQR) from onset of stroke symptoms to recanalisation for patients who were admitted directly to an EVT stroke centre is displayed by year in Figure 4.14A.[42] Between 2017 and 2021, the median time to recanalisation for thrombectomy patients who were admitted directly to an EVT stroke centre was 3 hours and 17 minutes. For Beaumont Hospital, the recanalisation time for patients admitted directly to the EVT stroke centre for all reporting years was 2 hours and 45 minutes. This decreased from 3 hours and 31 minutes in 2018 to 2 hours and 22 minutes in 2021. For Cork University Hospital, this ranged from 4 hours and 8 minutes in 2019 to 3 hours and 24 minutes in 2018; however, the number of cases was small, and therefore caution should be applied when interpreting the results. In 2017, Cork University Hospital had fewer than five cases; therefore, the median and IQR are not displayed, 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 total median figure.

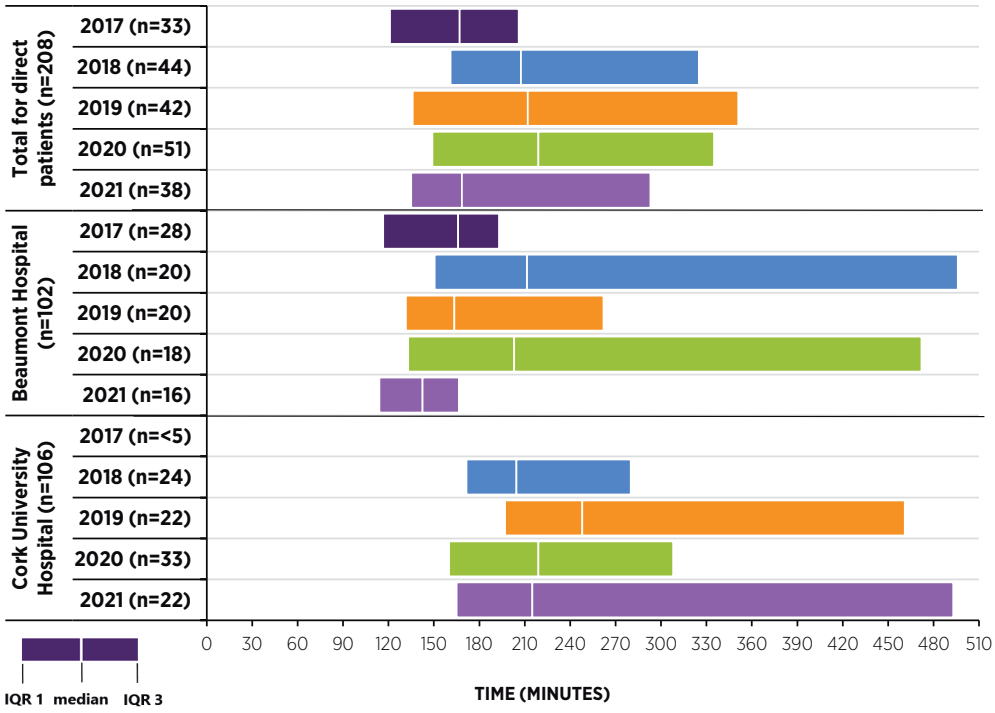


FIGURE 4.14A: TIME FROM WITNESSED ONSET OF STROKE SYMPTOMS TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, FOR PATIENTS ADMITTED DIRECTLY TO AN ENDOVASCULAR THROMBECTOMY STROKE CENTRE, BY YEAR (n=208)[43]

[42] For a detailed description of how analysis for Figure 4.14A was performed, please see Appendix 4.
[43] Figure 4.14A refers to patients who were admitted directly to an EVT stroke centre. There was limited date and time information recorded in 2016; therefore, this year is not included in Figure 4.14A. 204 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 4.14A.

RECANALISATION TIMES FOR PATIENTS TRANSFERRED TO AN EVT STROKE CENTRE

The median time and IQR from onset of stroke symptoms to recanalisation for patients who were transferred to an EVT stroke centre from another hospital is displayed in Figure 4.14B.[44]

In total, the median time to recanalisation for thrombectomy patients who were transferred to an EVT stroke centre was 4 hours and 55 minutes. For Beaumont Hospital, this time ranged from 4 hours and 44 minutes to 5 hours and 1 minute. In 2017 and 2018, Cork University Hospital had fewer than five cases; therefore, the median and IQR are not displayed, 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 total median figure. Between 2019 and 2021, the median for Cork University Hospital ranged from 4 hours and 19 minutes in 2019 to 6 hours and 15 minutes in 2021.

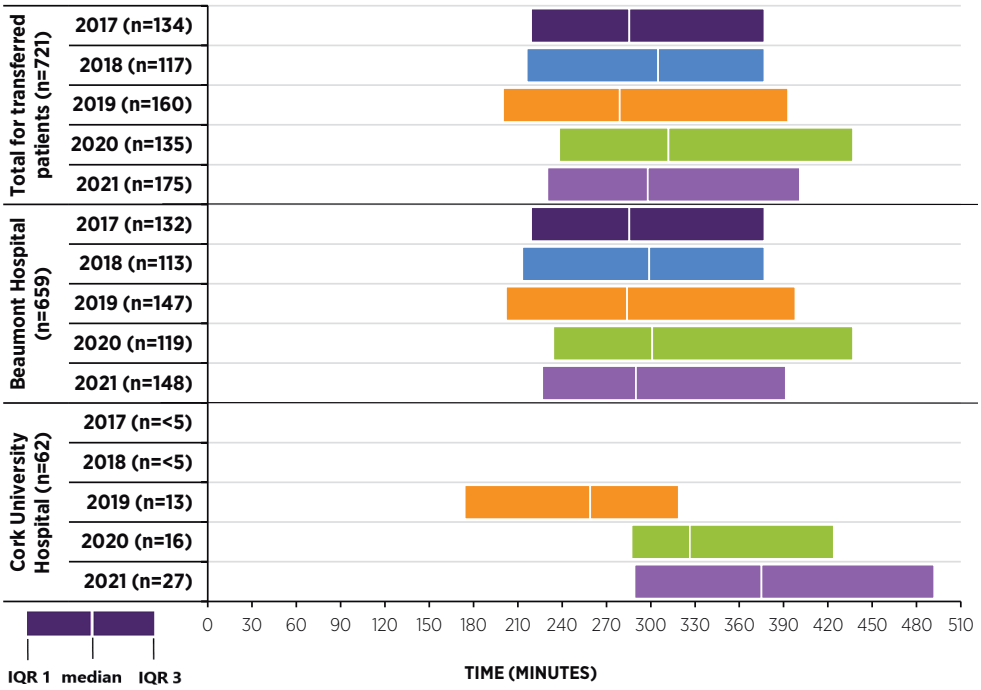


FIGURE 4.14B: TIME FROM WITNESSED ONSET OF STROKE SYMPTOMS TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, FOR PATIENTS TRANSFERRED FROM ANOTHER HOSPITAL TO AN ENDOVASCULAR THROMBECTOMY STROKE CENTRE, BY YEAR (n=721)[45]

[44] For a detailed description of how analysis for Figure 4.14B was performed, please see Appendix 4.

[45] Figure 4.14B refers to patients who were transferred from another hospital to an EVT stroke centre. There was limited date and time information recorded in 2016; therefore, this year is not included in Figure 4.14B. 707 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 4.14B.

Figure 4.14C displays the median time and IQR from onset of stroke symptoms to recanalisation for patients who were admitted directly or transferred to Beaumont Hospital from hospitals either within or outside of Dublin city.

The total median time to recanalisation for patients who were transferred to Beaumont Hospital for thrombectomy was 4 hours and 51 minutes. The total median time to recanalisation was shorter for thrombectomy patients who were transferred from a hospital within Dublin city (3 hours and 53 minutes) than for those who were transferred from a hospital outside of Dublin city (6 hours and 1 minute). Travel times to Beaumont Hospital need to be considered in this result.

Comparing the time to recanalisation for patients admitted directly to Beaumont Hospital with those who were transferred to Beaumont Hospital from a hospital within Dublin city could assist in policy decisions related to a bypass arrangement to Beaumont Hospital for patients with a large vessel occlusion. In total, for patients admitted directly to Beaumont Hospital, the time to recanalisation was 2 hours and 45 minutes (Figure 4.13A); this compares with 3 hours and 53 minutes for those who were transferred from a hospital within Dublin city (Figure 4.14C).[46]

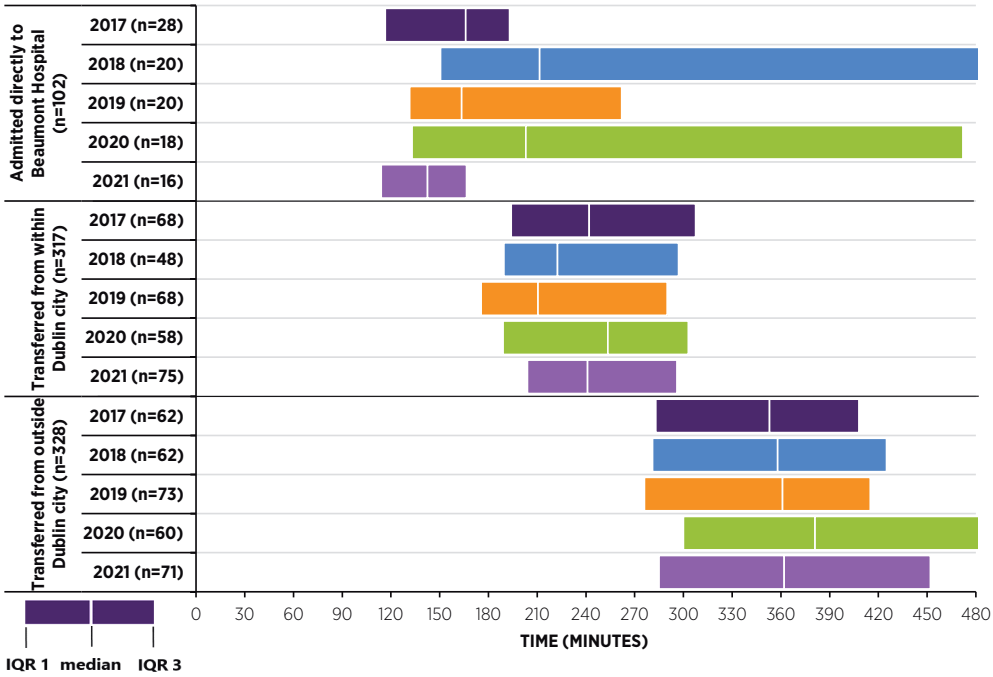


FIGURE 4.14C: TIME FROM WITNESSED ONSET OF STROKE SYMPTOMS TO RECANALISATION, MEDIAN AND INTERQUARTILE RANGE, FOR PATIENTS ADMITTED DIRECTLY OR TRANSFERRED FROM ANOTHER HOSPITAL TO BEAUMONT HOSPITAL, BY YEAR (n=761) [47,48,49]

[46] For a detailed description of how analysis for Figure 4.14C was performed, please see Appendix 4.
[47] 780 cases did not have time information recorded or it was recorded incorrectly. These cases have been excluded from Figure 4.14C.
[48] Hospitals within Dublin city: Connolly Hospital, Mater Misericordiae University Hospital, National Maternity Hospital, St James's Hospital, St Vincent's University Hospital, Tallaght University Hospital. Hospitals outside of Dublin city: Cavan General Hospital; Letterkenny University Hospital; Mayo University Hospital; Naas General Hospital; Our Lady of Lourdes Hospital Drogheda; Portiuncula University Hospital; Regional Hospital Mullingar; Sligo University Hospital; Tipperary University Hospital; St Luke's General Hospital, Carlow/Kilkenny; University Hospital Galway; University Hospital Kerry; University Hospital Limerick; University Hospital Waterford; Wexford General Hospital; Our Lady's Hospital, Navan.
[49] 14 cases did not have the name of the hospital recorded, and are therefore not displayed in Figure 4.14C; however, they were included in the total calculation.

KEY FINDINGS FROM CHAPTER 4

DEMOGRAPHICS
• There has been an incremental increase in the number of patients with a stroke admitted to hospital annually over the reporting period (Figure 4.1), from 4,727 in 2013 to 5,789 in 2021. The quantity of data submitted to the stroke audit portal within the Hospital In-Patient Enquiry (HIPE) system and which is thus available to monitor trends and audit the quality of care provided has also increased, from 2,790 cases (64% coverage) in 2013 to 5,239 cases (95% coverage) in 2021 (Figure 3.1).
• More than one-half (n=19550, 56%) of all patients with a stroke were male (Figure 4.2).
• The median age for female patients with a stroke was 78 years (IQR: 68–85 years), and for male patients it was 72 years (IQR: 62–80 years). These figures are consistent throughout the 9-year reporting period. There was a slight increase in patients with a stroke in the younger age group (aged 17–64 years), from 24% (n=669) in 2013 to 27% (n=1402) in 2021 (Figure 4.3).

EMERGENCY CARE PROCESSES
• There was a gradual increase in the proportion of patients with a stroke who were transferred from one acute hospital to another, from 2% (n=50) in 2013 to 8% (n=428) in 2021 (Figure 4.4). Tracking the patient journey through multiple hospitals can be difficult, and attaching an individual health identifier to health records across different patient systems would assist in the collection of accurate data.
• There has been a gradual decrease in the proportion of patients with a stroke who arrived at a hospital within 3 hours of stroke symptom onset, from 59% (n=591) in 2013 to 46% (n=1429) in 2021 (Figure 4.5).
• The proportion of patients with a stroke who were seen by a medical team within 10 minutes of hospital arrival more than doubled, from 23% (n=398) in 2016 to 48% (n=2126) in 2021 (Figure 4.6).
• The proportion of patients with a stroke who had a brain imaging scan within 1 hour of hospital arrival increased from 20% (n=532) in 2013 to 48% (n=2341) in 2021 (Figure 4.7).

EMERGENCY THERAPIES
• There has been a gradual decrease in the rate of thrombolysis, from 12% in 2015 to 10% in 2021 (Figure 4.8).
• The proportion of patients with a stroke who received thrombolysis within 60 minutes of arrival at hospital was 43% (n=1394) between 2013 and 2021, and this increased considerably over the reporting period, from 25% (n=68) in 2013 to 56% (n=243) in 2021.
• The rate of thrombolysis for those who arrived at hospital within 4 hours of symptom onset decreased over the reporting period, from 34% (n=205) in 2013 to 24% (n=334) in 2021 (Figure 4.10).
• The number of patients with ischaemic stroke who had a thrombectomy increased from 157 in 2016 to 422 in 2021. The overall rate of thrombectomy in patients with ischaemic stroke was 8.4% (Figure 4.12).
• The median time to recanalisation for thrombectomy patients who were admitted directly to an EVT stroke centre was 3 hours and 17 minutes (Figure 4.14A); this was 4 hours and 55 minutes for those who were transferred to an EVT stroke centre from another hospital (Figure 4.14B).

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

This chapter presents a review of the trends in emergency stroke care in Ireland from 2013 to 2021. Reviewing the data so comprehensively has highlighted the need to review definitions within the data dictionary, such as contraindication to thrombolysis and other areas discussed later in the report (e.g. mood assessment). The trends related to treatment with thrombolysis are deteriorating, and while public awareness campaigns may help in the identification of stroke as an emergency within the general population, there is an opportunity for further assessment as to the reasons for decreasing thrombolysis rates in patients who do present to hospital within the optimal time frame to receive thrombolysis.

CHAPTER 5

STROKE UNIT CARE

CHAPTER 5: **STROKE UNIT CARE**

ADMISSION TO A STROKE UNIT

Standard: People with a 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; Irish Heart Foundation, 2010).

Admission to a stroke unit is a KPI for the National Stroke Programme (NSP) with a target of 90%, and is reported quarterly as a KQI on the INAS dashboard. 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. The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that while all participating hospitals had a stroke unit, there was a lack of stroke unit bed capacity. In 2021, sixteen (67%) out of the 24 participating hospitals had more patients with a stroke in the hospital than designated stroke unit beds. Additionally, patients with a stroke 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. The INAS organisational audit found that only 67% of stroke unit beds had continuous physiological monitoring and that all stroke units operated below the recommended staffing ratios for all professions. The implementation of the *National Stroke Strategy 2022–2027* (NSP, 2022) will address many of the deficits identified in the INAS organisational audit, and the INAS Governance Committee recommends that it is fully implemented.

Data completeness

Table 5.1 displays the data completeness for the admission to stroke unit variable. Between 2018 and 2021, the admission to stroke unit variable was used as part of the inclusion criteria (see Chapter 2); therefore, by default, the final dataset did not include cases that had no admission to stroke unit information recorded.

TABLE 5.1: DATA COMPLETENESS FOR ADMISSION TO STROKE UNIT VARIABLE, BY YEAR[50]

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Admission to stroke unit	99%	99%	99%	99%	99%				
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

[50] Between 2013 and 2017, 191 cases did not have admission to stroke unit information recorded. Between 2018 and 2021, the admission to stroke unit variable was used as part of the inclusion criteria (see Chapter 2); therefore, the final dataset did not include cases that had no admission to stroke unit information recorded.

Findings

Figure 5.1[51] shows the proportion of patients with a stroke who were admitted to a stroke unit for each of the reporting years. Despite a gradual increase from 65% in 2013 to 70% in 2021, there has been a consistent failure to meet the target of 90% of patients with a stroke being admitted to a stroke unit.

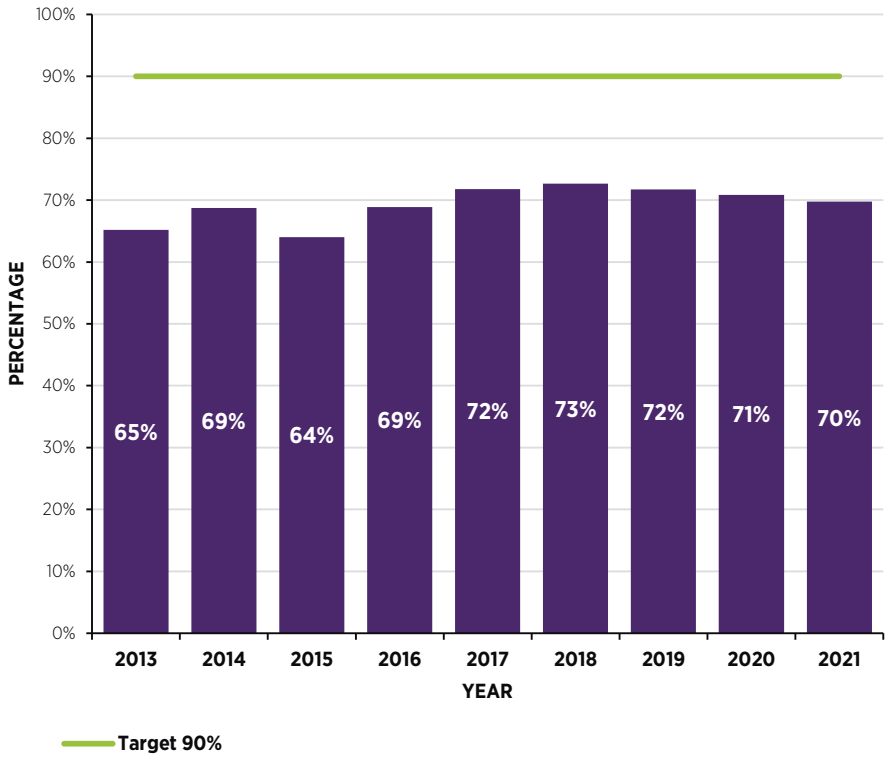


FIGURE 5.1: ADMISSION TO A STROKE UNIT, BY YEAR (n=35050) [52, 53]

[51] For a detailed description of how analysis for Figure 5.1 was performed, please see Appendix 4.

[52] Between 2013 and 2017, 191 cases did not have admission to stroke unit information recorded. Those cases were excluded from Figure 5.1. Between 2018 and 2021, the admission to stroke unit variable was used as part of the inclusion criteria (see Chapter 2); therefore, the final dataset did not include cases that had no admission to stroke unit information recorded.

[53] In 2015 and 2016, Mater Misericordiae University Hospital provided data to calculate the national KPI results only. Figure 5.1 includes additional Mater Misericordiae University Hospital data (n=611).

Figure 5.1A shows a statistical process control (SPC) chart of the proportion of patients with a stroke who were admitted to a stroke unit, by quarter. Over the 9-year reporting period, the target of 90% of patients with a stroke being admitted to a stroke unit was never met. There was a decline in admission to a stroke unit in Q1 of 2021 (62.4%) below the lower control limit, which signifies a special cause variation. It is likely that infection control measures due to COVID-19 impacted on this result.

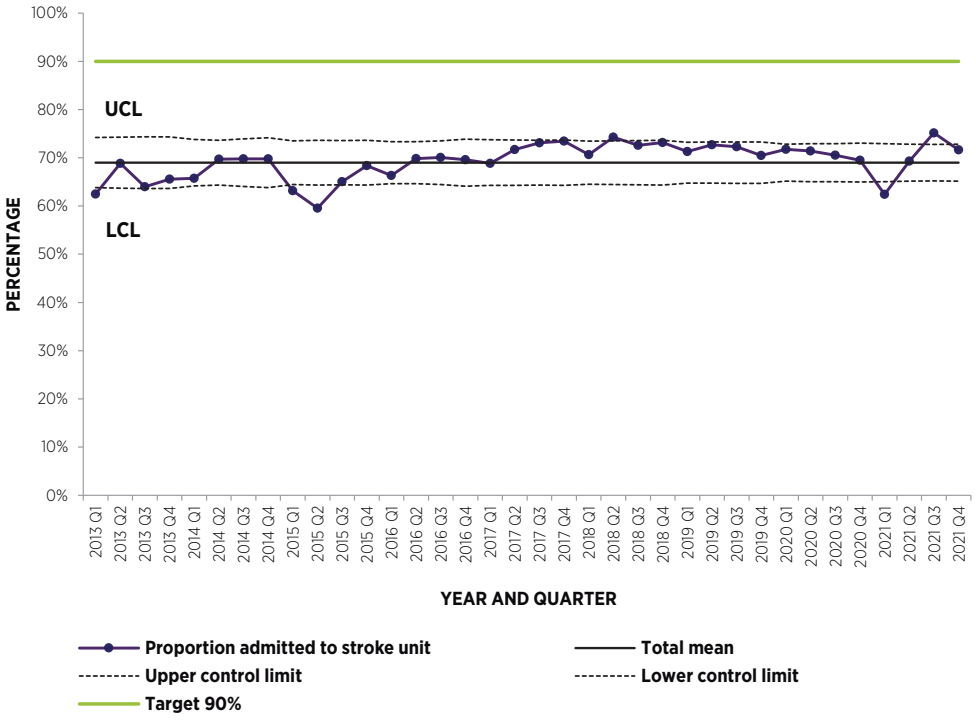


FIGURE 5.1A: STATISTICAL PROCESS CONTROL CHART OF PROPORTION OF PATIENTS WITH A STROKE WHO WERE ADMITTED TO A STROKE UNIT, BY QUARTER AND YEAR (n=35050) [54, 55]

KQI 1: Percentage of cases admitted to a stroke unit (target: 90%).

2021: 70%

[54] Between 2013 and 2017, 191 cases did not have admission to stroke unit information recorded. Those cases were excluded from Figure 5.1A. Between 2018 and 2021, the admission to stroke unit variable was used as part of the inclusion criteria (see Chapter 2); therefore, the final dataset did not include cases that had no admission to stroke unit information recorded.

[55] In 2015 and 2016, Mater Misericordiae University Hospital provided data to calculate the national KPI results only. Figure 5.1A includes additional Mater Misericordiae University Hospital data (n=611).

REASON FOR NON-ADMISSION TO A STROKE UNIT

The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that by September 2021, all 24 participating hospitals had a stroke unit, compared with 20 hospitals in 2015; however, stroke unit bed capacity was inadequate, with 30% of patients with a stroke not accessing a stroke unit bed. This is an opportunity for improvement, and this report recommends increasing the number of stroke unit beds, as recommended by the *National Stroke Strategy 2022–2027* (NSP, 2022).

Data completeness

Table 5.2 displays the data completeness for non-admission to stroke unit variables. Between 2013 and 2017, there were six categories to select from: '1. No stroke unit', '2. Bed not available', '3. Symptoms too mild', '4. Symptoms too severe', '5. Infection control risk' and '8. Other'. Of note, in 2018, categories 3 and 4 were removed as options, as all patients with a stroke should be admitted to a stroke unit regardless of stroke severity. In 2018, completion of the admission to stroke unit variable became part of the inclusion criteria (see Chapter 2), and therefore all cases reported from 2018 have either 'yes' or 'no' selected for this variable.

TABLE 5.2: DATA COMPLETENESS FOR NON-ADMISSION TO STROKE UNIT VARIABLES, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Admission to stroke unit	99%	99%	99%	99%	99%				
Reason for not admitting to stroke unit	95%	90%	99%	95%	96%	96%	98%	100%	99%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

The proportion of patients with a stroke who were not admitted to a stroke unit due to either no stroke unit or no stroke unit bed availability in the hospital ranged from 44% to 60% during the reporting period. In 2021, this percentage was 44%; however, there was an associated increase in the proportion not admitted due to infection control risk (10%), likely due to COVID-19 infection control measures. The category 'Other' includes reasons such as no stroke service referral, palliative care, and intensive care unit admission.

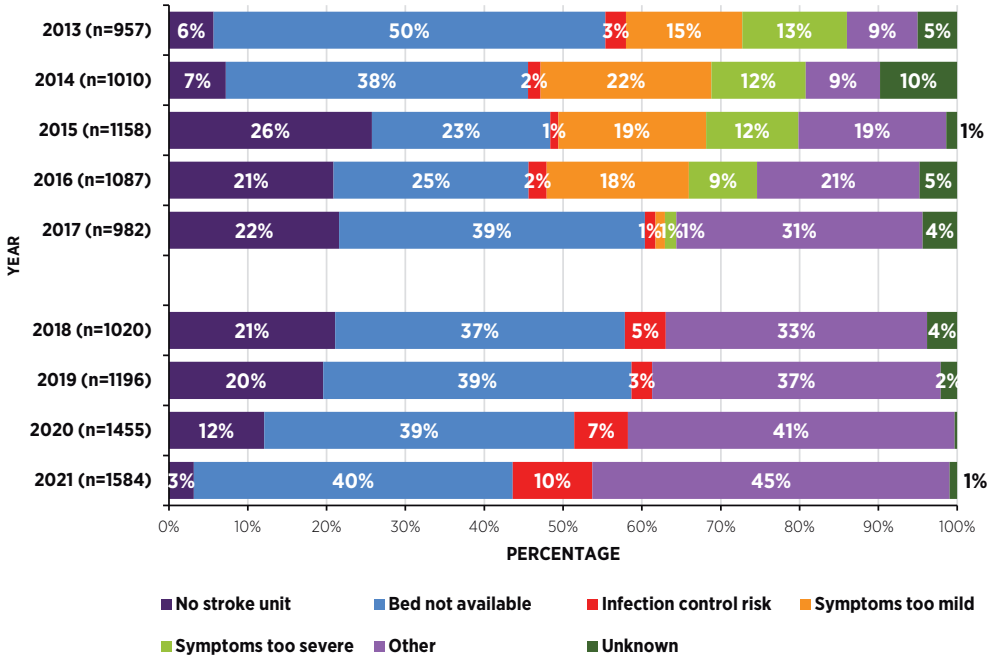


FIGURE 5.2: REASON FOR NON-ADMISSION TO A STROKE UNIT, BY YEAR (n=10449)[56,57,58]

[56] Refers only to patients who were not admitted to a stroke unit. Figure 5.2 does not include cases for Mater Misericordiae University Hospital for 2015 and 2016, as there was no relevant information recorded for those years.

[57] From 2013 to 2014, Letterkenny University Hospital had nine beds in the rehabilitation unit that it referred to as stroke unit beds. After the 2015 organisational audit, it was agreed that these beds should not be considered stroke unit beds. From 2015, his increased the proportion of cases not admitted to a stroke unit due to 'no stroke unit' in Figure 5.2. In 2021, Letterkenny University Hospital opened a stroke unit.

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

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; Irish Heart Foundation, 2010).

Swallowing difficulties are common in patients with a stroke. 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). Evidence derived from both experimental and observational studies demonstrates that swallow screening following stroke has a significant protective health benefit against pneumonia, mortality, dependency and length of stay (Sherman et al., 2021). Access to timely swallow screening is reported quarterly as a KQI on the INAS dashboard.

Data completeness

Collection of the swallow screening variable began in 2016, with a 9% completion rate; this increased to 97% in 2021 (Table 5.3).

TABLE 5.3: DATA COMPLETENESS FOR SWALLOW SCREENING VARIABLE, BY YEAR

	2016	2017	2018	2019	2020	2021
Swallow screening	9%	84%	94%	95%	96%	97%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%

2021 **68%**
2017 **58%**

Swallow screening rates have increased

Findings

From 2017 to 2021, the proportion of patients with a stroke who received a swallow screen increased from 58% (n=2032) in 2017 to 68% (n=3567) in 2021 (Figure 5.3).[59]

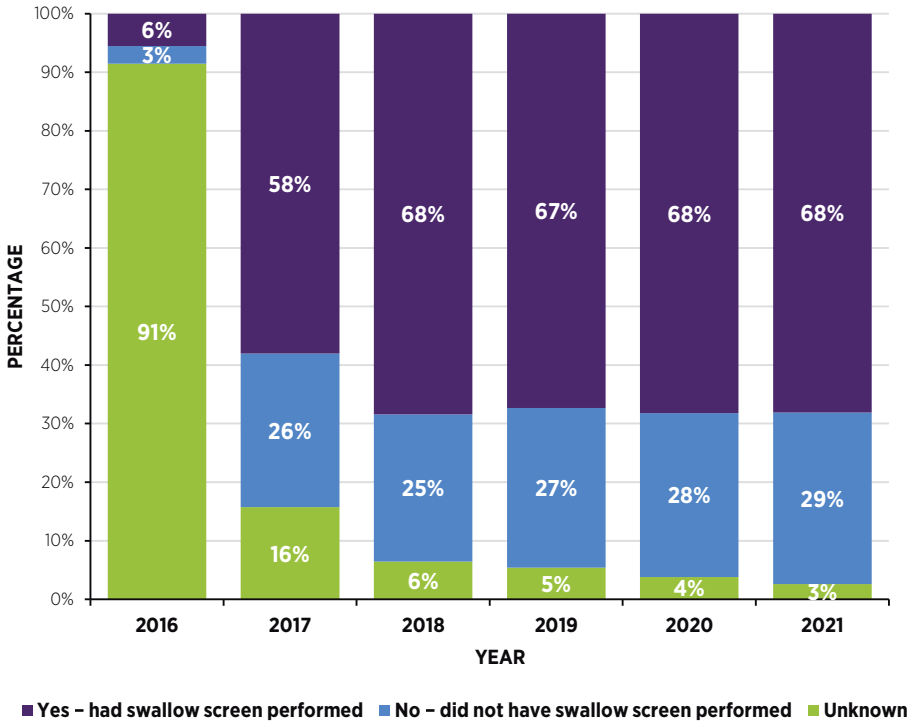


FIGURE 5.3: SWALLOW SCREENING, BY YEAR (n=25255)

KQI 6: Percentage of cases who have a swallow screen completed (Target: 100%).

2021: 68%

[59] For a detailed description of how analysis for Figure 5.3 was performed, please see Appendix 4.

SWALLOW SCREENING WITHIN 4 HOURS OF ADMISSION

The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that 21 out of 24 participating hospitals had a swallow screening training programme available within the hospital; however, the actual number of nurses in a hospital trained in swallow screening varied between hospitals. It is not known how much access there is to swallow screening in the out-of-hours period. The NSP (2017) developed a guidance document on swallow screening, and in 2022, the NSP was planning a national quality improvement programme to increase access to timely swallow screening.

Data completeness

Table 5.4 displays the increasing level of data completeness for the variables required to analyse the provision of swallow screening within 4 hours of hospital admission, from 75% in 2016 to 97% in 2021. Unknown data are displayed within Figure 5.3A.

TABLE 5.4: DATA COMPLETENESS FOR SWALLOW SCREENING WITHIN 4 HOURS VARIABLES, BY YEAR

	2016	2017	2018	2019	2020	2021
Swallow screening	9%	84%	94%	95%	96%	97%
Swallow screen within 4 hours	75%	94%	96%	98%	96%	97%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%

Findings

In total, 40% (n=5911) of those patients who received a swallow screen had it completed within 4 hours of presentation to hospital. For 3 consecutive years (2019–2021), the proportion of patients with a stroke receiving a swallow screen within 4 hours remained at 43% (Figure 5.3A).[60] Table 5.6 shows that, consistently, patients with a stroke are almost twice as likely to have a swallow screen when they are admitted to a stroke unit compared with those who are not admitted to a stroke unit.

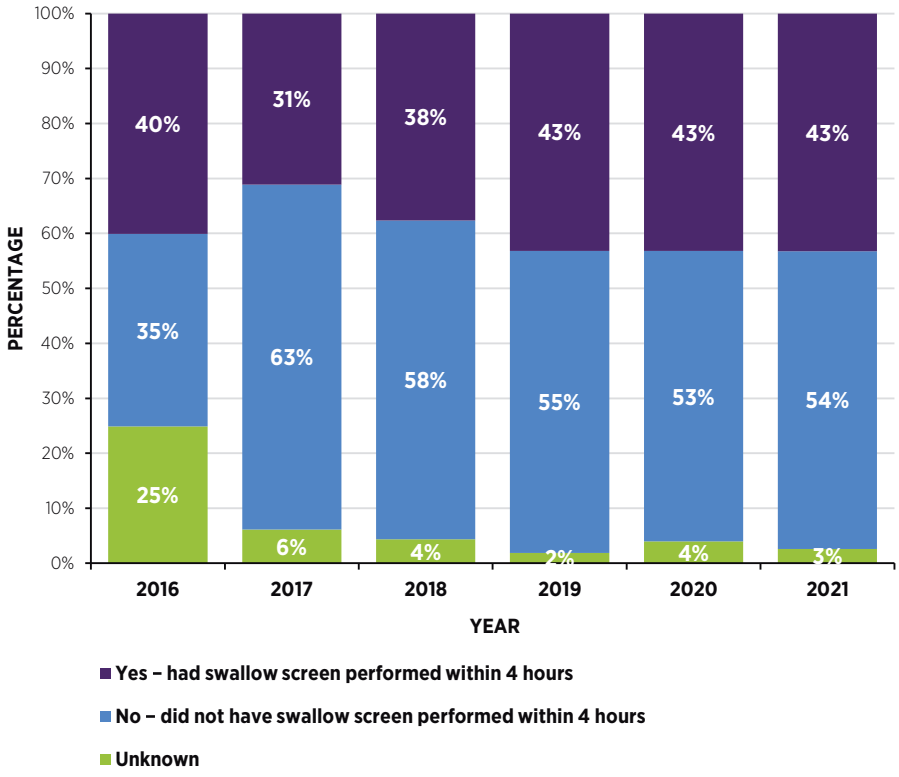


FIGURE 5.3A: SWALLOW SCREENING WITHIN 4 HOURS OF HOSPITAL ADMISSION, BY YEAR (n=14596)

KQI 7: Percentage of cases who have a swallow screen completed within 4 hours of hospital admission (Target: 100%).

2021: 43%

[60] For a detailed description of how analysis for Figure 5.3A was performed, please see Appendix 4.

MOOD SCREENING

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

Services for people with a stroke should provide screening for mood and cognitive disturbance using validated tools, and should include specialist clinical psychology provision for severe or persistent symptoms of emotional disturbance, mood or cognition (Royal College of Physicians, 2016). The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that only six participating hospitals reported that they provided any form of mood assessment or treatment, and only five hospitals had access to clinical psychologists as part of stroke unit care. There is no information related to the screening tools used to assess mood or cognition, and it is not clearly defined how the 'not indicated' variable is assessed. At present, a pathway for the assessment and management of depression following stroke in the acute setting is available on the HSE website (NSP, 2016).

Data completeness

Collection of the mood screening variable began in 2016 and reached 96% completion in 2021 (Table 5.5). Data quality improved over this period, from 24% (n=841) of patients not having information about mood assessment recorded in 2017 to only 4% (n=227) in 2021 (Figure 5.4).

TABLE 5.5: DATA COMPLETENESS FOR THE MOOD ASSESSMENT VARIABLE, BY YEAR

	2016	2017	2018	2019	2020	2021
Mood assessment	5%	76%	84%	82%	95%	96%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%

Findings

Between 2017 and 2021, an average of 26% of patients with a stroke received a mood assessment, with the lowest proportion (23%, n=951) being recorded in 2019 and the highest (29%, n=1437) in 2020. Further education and training in relation to mood screening and assessment in the acute stage of stroke is required. Enhancing the psychological services provided to patients with a stroke is a key part of the *National Stroke Strategy 2022–2027* (NSP, 2022) and the INAS Governance Committee recommends the full implementation of the strategy.

Mood screening rates have remained low.

2021 **27%**
2017 **27%**

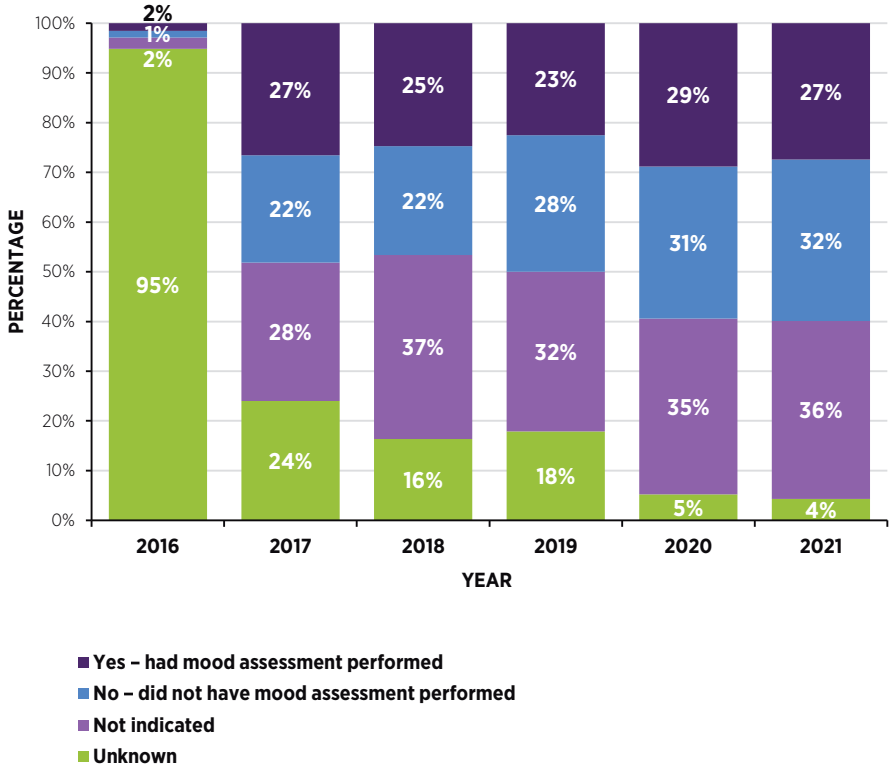


FIGURE 5.4: MOOD ASSESSMENT, BY YEAR (n=25255)

SWALLOW AND MOOD SCREENING IN STROKE UNITS

Table 5.6 shows that throughout the 9-year reporting period, admission to a stroke unit increased the likelihood of a patient having a mood and swallow screen completed.

TABLE 5.6: SWALLOW AND MOOD SCREENING, BY ADMISSION TO A STROKE UNIT AND YEAR

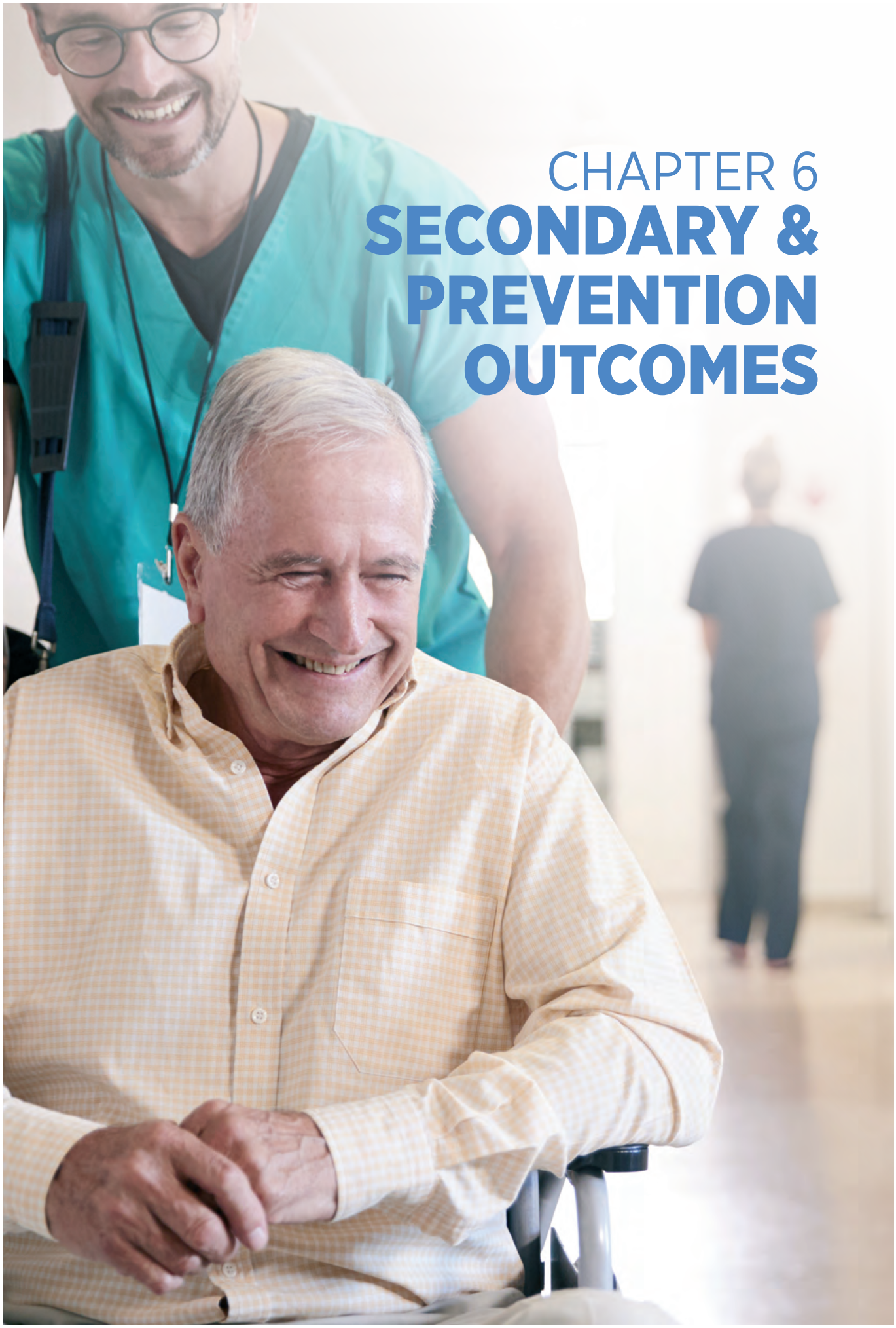
		Swallow screening		Mood assessment	
		N	%	N	%
2016	Admitted to stroke unit (n=2452)	164	7%	45	2%
	Not admitted to stroke unit (n=1087)	32	3%	9	1%
2017	Admitted to stroke unit (n=2499)	1729	69%	817	33%
	Not admitted to stroke unit (n=982)	299	30%	114	12%
2018	Admitted to stroke unit (n=2710)	2094	77%	778	29%
	Not admitted to stroke unit (n=1020)	458	45%	145	14%
2019	Admitted to stroke unit (n=3030)	2314	76%	790	26%
	Not admitted to stroke unit (n=1196)	531	44%	161	13%
2020	Admitted to stroke unit (n=3534)	2749	78%	1200	34%
	Not admitted to stroke unit (n=1455)	654	45%	237	16%
2021	Admitted to stroke unit (n=3655)	2859	78%	1170	32%
	Not admitted to stroke unit (n=1584)	708	45%	267	17%

KEY FINDINGS FROM CHAPTER 5

•	Despite a gradual increase in the proportion of patients with a stroke who were admitted to a stroke unit from 65% in 2013 to 70% in 2021, there has been a consistent failure to meet the target of 90% of patients with a stroke being admitted to a stroke unit (Figure 5.1), with the lack of stroke unit bed availability reported as the main factor for non-admission to a stroke unit throughout the reporting period (Figure 5.2).
•	Between 2017 and 2021, the proportion of patients with a stroke who received a swallow screen increased from 58% to 68% (Figure 5.3); however, only 40% (n=5911) of those patients had swallow screening completed within the recommended 4 hours of presentation to hospital.
•	Admission to a stroke unit increased the likelihood of a patient having a mood and swallow screen completed (Table 5.6). However, on average, between 2017 and 2021, only 26% of patients with a stroke received a mood assessment (Figure 5.4).

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

Admission to a stroke unit remains a key pillar of stroke care, and the trends identified in this report indicate that there is a consistent failure to meet national targets. This is an opportunity for improvement, and this report recommends increasing the number of stroke unit beds, as recommended by the *National Stroke Strategy 2022–2027* (NSP, 2022). There is variation in the availability of swallow screening, and the development of a swallow screening quality improvement initiative through the NSP is welcomed.



CHAPTER 6
SECONDARY & PREVENTION OUTCOMES

CHAPTER 6: SECONDARY AND PREVENTION OUTCOMES

When a person has had a stroke, they have an increased risk of having 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). Secondary prevention includes early treatment with antithrombotics such as aspirin, and the diagnosis and treatment of atrial fibrillation and symptomatic carotid stenosis. Patients should also be assessed for, and given information on, risk factors and lifestyle management issues, and they should be counselled on possible strategies to modify their lifestyle and risk factors (Irish Heart Foundation, 2010).

SECONDARY PREVENTION: 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).

Data completeness

Between 2013 and 2021, the variable regarding whether a patient was prescribed new or altered antithrombotic therapy had a high completion rate (between 95% and 99%) (Table 6.1).

TABLE 6.1: DATA COMPLETENESS FOR ANTITHROMBOTICS VARIABLE, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
New or altered antithrombotic therapy	96%	95%	95%	97%	95%	96%	96%	98%	99%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

Figure 6.1 shows the proportion of patients with ischaemic stroke who were prescribed new or altered antithrombotic therapy, by year. There was a gradual increase in the proportion of patients with ischaemic stroke prescribed antithrombotic therapy, from 85% (n=2132) in 2013 to 89% (n=4023) in 2021.

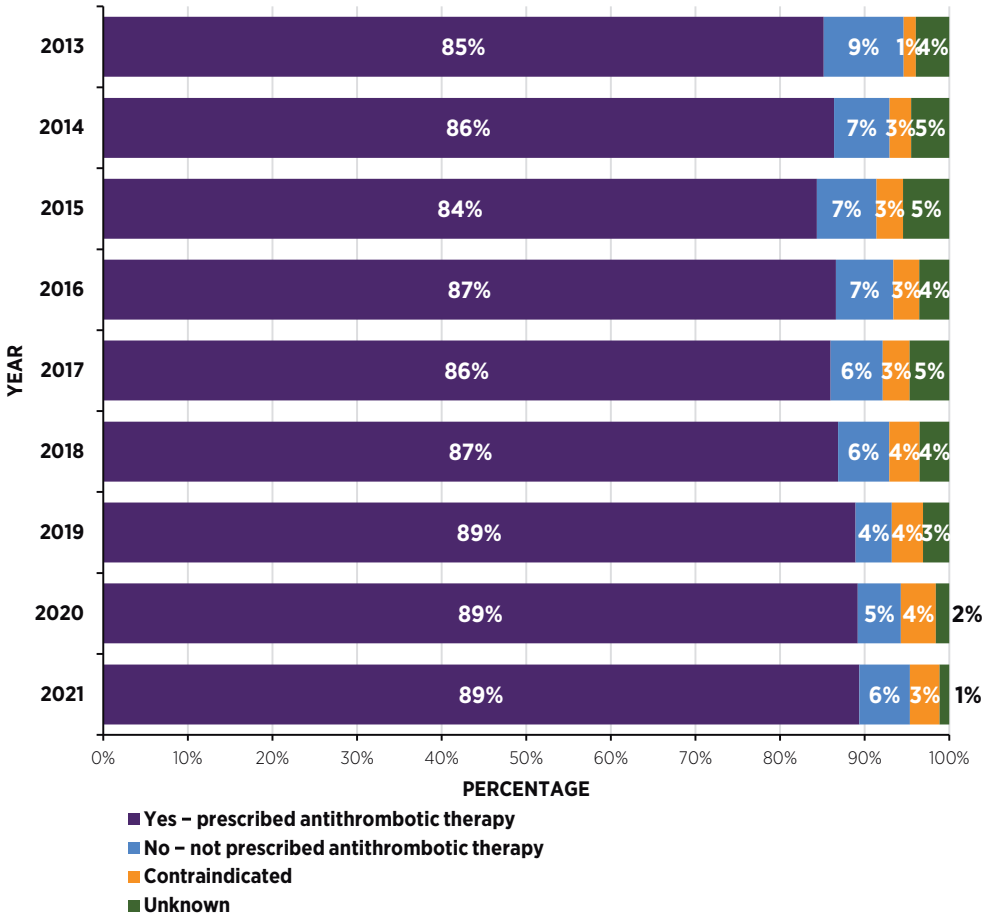


FIGURE 6.1: PROPORTION OF PATIENTS WITH ISCHAEMIC STROKE PRESCRIBED ANTITHROMBOTIC THERAPY, BY YEAR (n=29974)

SECONDARY PREVENTION: ANTITHROMBOTIC THERAPY START TIMES

Data completeness

Between 2013 and 2021, the completion of variables used to calculate the start times for antithrombotic therapy was at least 95% in each reporting year (Table 6.2).

TABLE 6.2: DATA COMPLETENESS FOR START TIMES FOR ANTITHROMBOTICS VARIABLE, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
New or altered antithrombotic therapy	96%	95%	95%	97%	95%	96%	96%	98%	99%
Hospital arrival date	100%	100%	100%	100%	99%	100%	100%	100%	100%
Antiplatelet/ anticoagulant start date	95%	96%	99%	99%	99%	99%	98%	99%	100%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

Figure 6.2[61] shows that, in each reporting year, the majority of patients with ischaemic stroke commenced antithrombotic therapy on the same day as, or the day after, hospital arrival. The proportion of patients with ischaemic stroke who commenced antithrombotic therapy on the same day as hospital arrival gradually increased over the reporting period, from 43% (n=911) in 2013 to 59% (n=2392) in 2021.

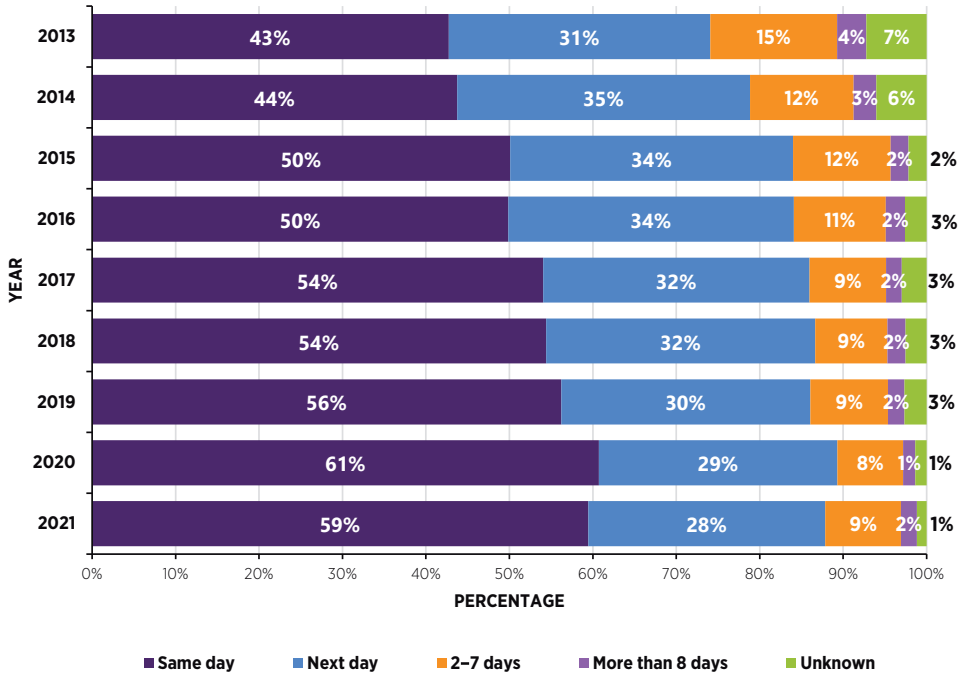


FIGURE 6.2: START TIMES FOR ANTITHROMBOTICS, BY YEAR (n=26159)[62]

[61] For a detailed description of how analysis for Figure 6.2 was performed, please see Appendix 4.
[62] Figure 6.2 refers only to patients with ischaemic stroke and who had antithrombotic therapy.

SECONDARY PREVENTION: ATRIAL FIBRILLATION PREVALENCE

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 the cerebral arteries. AF is treated with medications that prevent the formation of blood clots in the heart.

Data completeness

Between 2013 and 2021, the information about whether a patient with a stroke had AF had a high completion rate of between 92% and 95% (Table 6.3).

TABLE 6.3: DATA COMPLETENESS FOR ATRIAL FIBRILLATION VARIABLE, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Atrial fibrillation	92%	93%	93%	95%	94%	92%	93%	95%	95%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

In total, the prevalence of AF among all patients with a stroke over the reporting period was 29% (n=10016); 61% (n=21232) of patients with a stroke did not have AF, results were pending for 3% (n=1195), and 6% (n=2187) had no information recorded. Figure 6.3 indicates the proportion of patients with a stroke who had AF, by stroke type and year. Overall, a higher proportion of patients with ischaemic stroke had AF (between 26% and 34%) compared with those with haemorrhagic stroke (between 16% and 24%).

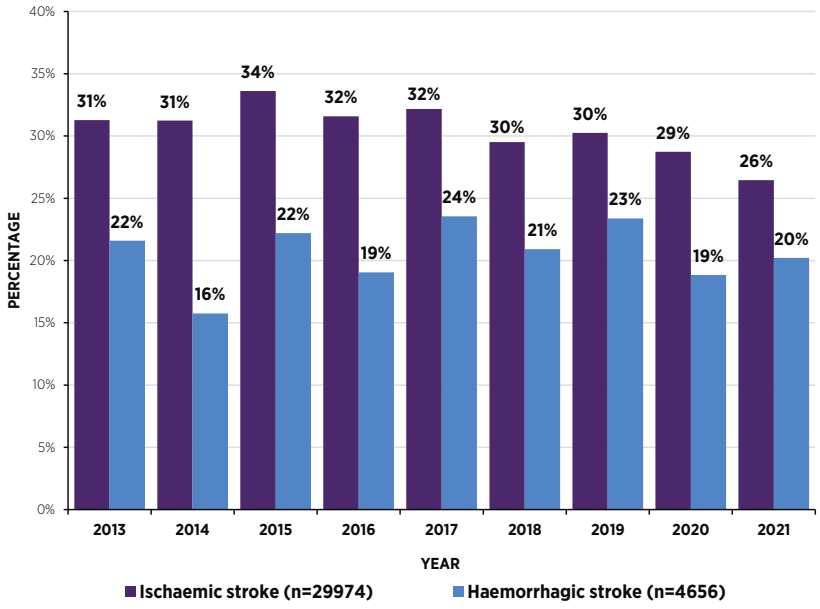


FIGURE 6.3: PROPORTION OF ATRIAL FIBRILLATION IN PATIENTS WITH ISCHAEMIC AND HAEMORRHAGIC STROKE, BY YEAR (N=34630)

PREVALENCE OF KNOW AF PRE-STROKE

Data completeness

Between 2013 and 2021, the completion of variables that were used to calculate the prescription of anticoagulant therapy for patients with known AF prior to stroke was between 92% and 99% (Table 6.4).

TABLE 6.4: COMPLETENESS OF ANTICOAGULANT MEDICATION AND ATRIAL FIBRILLATION VARIABLES, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Atrial fibrillation	92%	93%	93%	95%	94%	92%	93%	95%	95%
AF known prior to stroke	95%	93%	94%	96%	97%	98%	98%	98%	99%
Antiplatelet/ anticoagulant prescribed prior to stroke	99%	97%	98%	98%	98%	97%	99%	99%	99%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

Out of the total stroke population for the reporting period (N=34630), 18% (n=6313) had known AF pre-stroke (ischaemic: n=5491, 18%; haemorrhagic: n=822, 18%). Treatment with anticoagulant medication pre-stroke was reported in 81% (n=5122) of those cases. Figure 6.4 shows the proportion of patients with ischaemic and haemorrhagic stroke who were prescribed anticoagulant medication for known AF. Between 2013 and 2021, 91% (n=744) of patients with haemorrhagic stroke and known AF prior to stroke were prescribed anticoagulant medication; this compares with 80% (n=4378) of patients with ischaemic stroke. Throughout the reporting period, the proportion of patients who were prescribed anticoagulant medication pre-stroke increased for both patients with ischaemic (from 70% to 83%) and haemorrhagic (from 83% to 91%) stroke. Between 2013 and 2021, prescription of direct oral anticoagulants (DOACs) prior to stroke increased from 9% in 2013 to 80% in 2021, with a corresponding decrease in warfarin prescription, from 46% in 2013 to 11% in 2021 (Figure 6.4A).

A recommendation from the *Irish National Audit of Stroke National Report 2020* (NOCA, 2022a) was to complete a study in order to explore the factors contributing to stroke in patients prescribed anticoagulation therapy. Additional items have been added to the INAS dataset to inform this study, and the results will be published in the INAS National Report 2022.

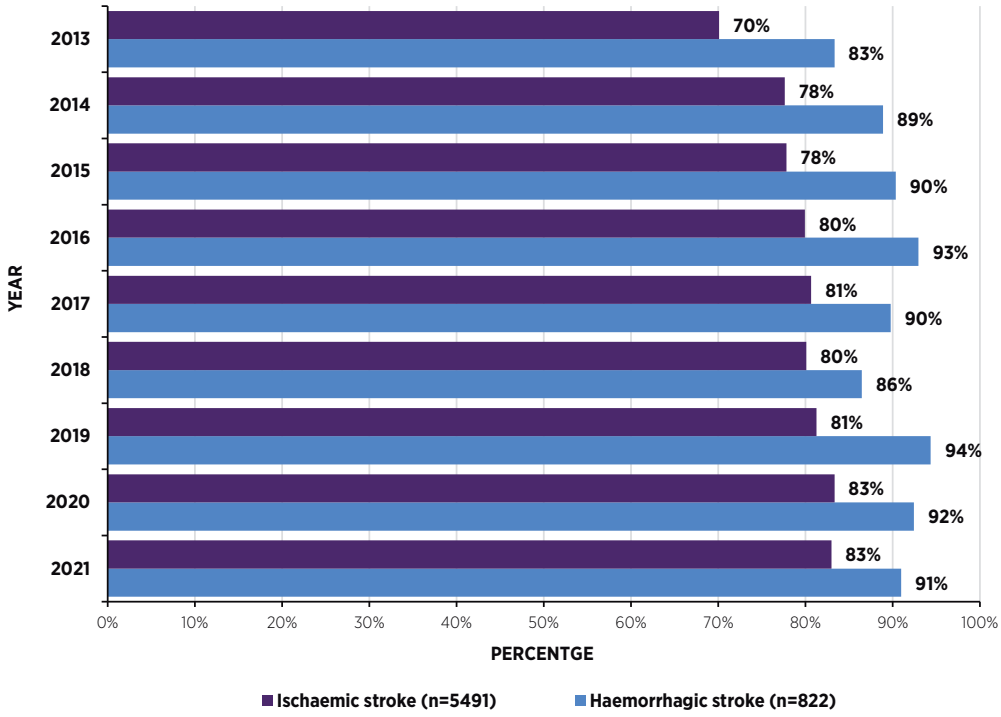


FIGURE 6.4: PROPORTION OF PATIENTS WITH KNOWN ATRIAL FIBRILLATION PRIOR TO STROKE WHO WERE PRESCRIBED ANTICOAGULANT MEDICATION, BY STROKE TYPE AND YEAR (n=6313)

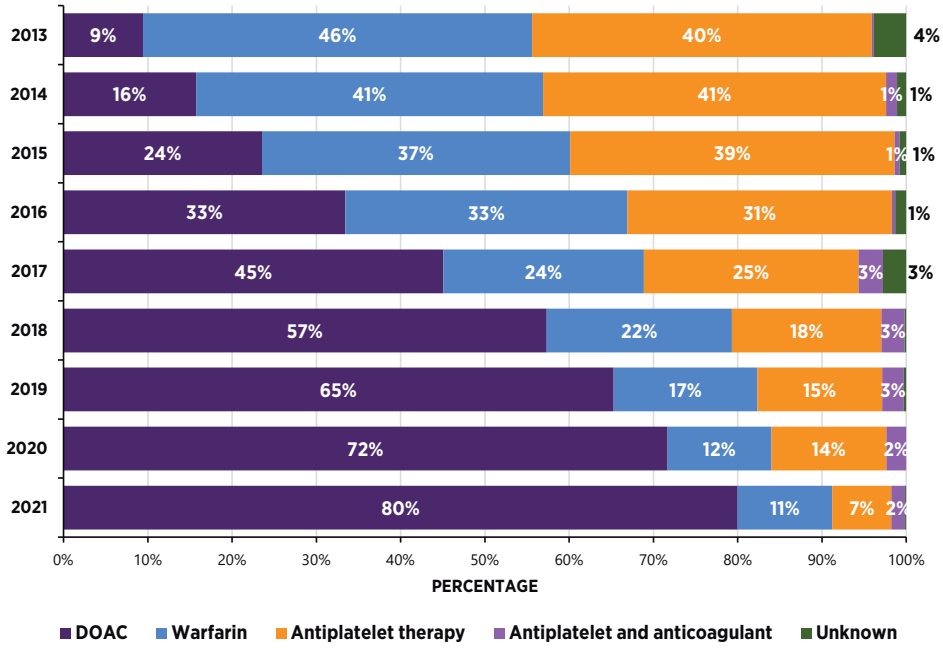


FIGURE 6.4A: ANTICOAGULANT MEDICATION PRESCRIBED PRIOR TO STROKE, BY YEAR (n=5122)[63]

[63] Figure 6.4A includes cases with known AF prior to stroke. DOAC medication includes dabigatran, rivaroxaban and apixaban; antiplatelet therapy includes aspirin, clopidogrel, other antiplatelet and dual antiplatelet.

AF: ANTICOAGULATION TREATMENT AFTER STROKE FOR ALL PATIENTS WITH STROKE AND AF

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

Data completeness

Between 2013 and 2021, the completion of variables used to calculate secondary prevention due to AF was between 85% and 95% (Table 6.5).

TABLE 6.5: DATA COMPLETENESS OF SECONDARY PREVENTION TREATMENT AND ATRIAL FIBRILLATION VARIABLES, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Atrial fibrillation	92%	93%	93%	95%	94%	92%	93%	95%	95%
AF/anticoagulant prescribed for secondary prevention	93%	91%	93%	94%	85%	87%	92%	95%	94%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

Throughout the reporting period, the proportion of AF in patients with ischaemic stroke, excluding those who died, was 29% (n=7879).[64] The proportion of patients with ischaemic stroke and AF who had antiplatelet or anticoagulant medication prescribed post-stroke for secondary prevention increased from 73% (n=498) in 2013 to 84% (n=887) in 2021 (Figure 6.5).[65]

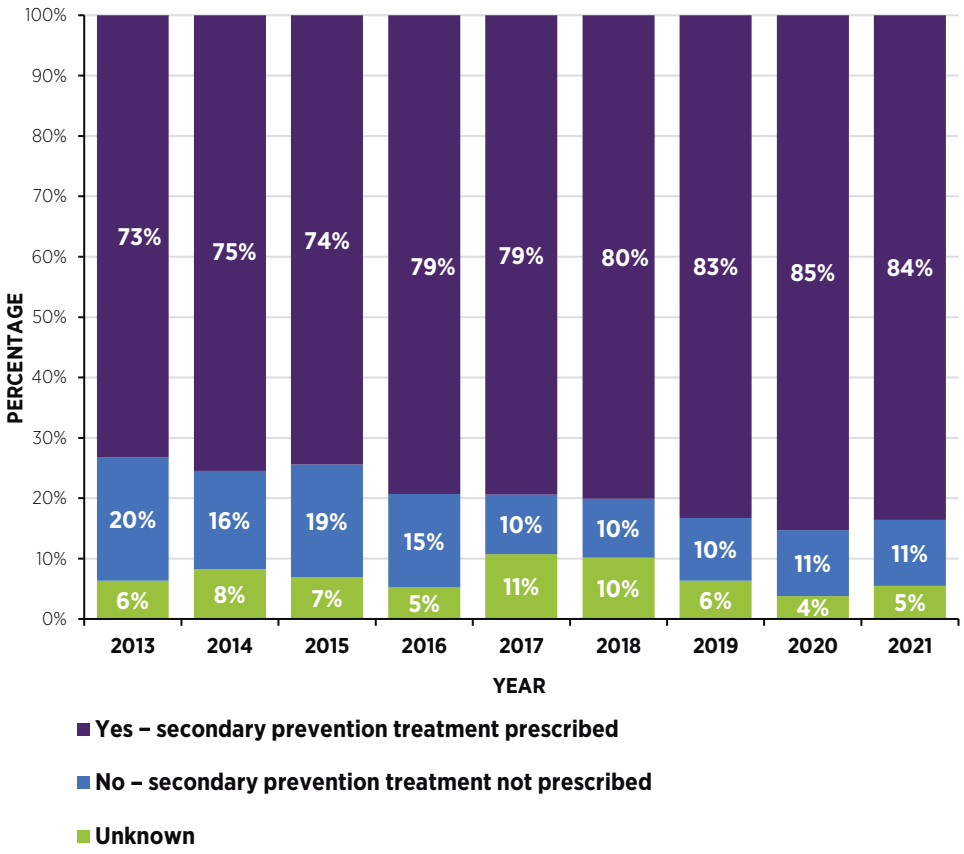


FIGURE 6.5: SECONDARY PREVENTION TREATMENT FOR ATRIAL FIBRILLATION IN PATIENTS WITH ISCHAEMIC STROKE, BY YEAR (n=7879)[66]

[64] Patients with ischaemic stroke who died (n=2610) were excluded from this calculation.
[65] For a detailed description of how analysis for Figure 6.5 was performed, please see Appendix 4.
[66] Patients with ischaemic stroke who died (n=2610) were excluded from this calculation.

SECONDARY PREVENTION: 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 artery stenosis. Patients with moderate/severe carotid artery stenosis are at increased risk of a stroke and should receive appropriate therapy. Carotid intervention can be performed on asymptomatic carotid artery stenosis, but data collection on this is outside the remit of the INAS.

Data completeness

Completion of the carotid stenosis variable has gradually increased, from 74% in 2013 to 96% in 2021 (Table 6.6).

TABLE 6.6: DATA COMPLETENESS OF CAROTID STENOSIS VARIABLE, BY YEAR

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Carotid stenosis	74%	76%	75%	83%	84%	87%	92%	93%	96%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%	100%	100%	100%

Findings

Between 2013 and 2021, 7% (n=2082) of patients with ischaemic stroke had symptomatic carotid stenosis (Figure 6.6), with 33% (n=681) of those patients referred for carotid endarterectomy, 12% (n=252) referred for carotid stenting and 5% (n=103) referred for both.

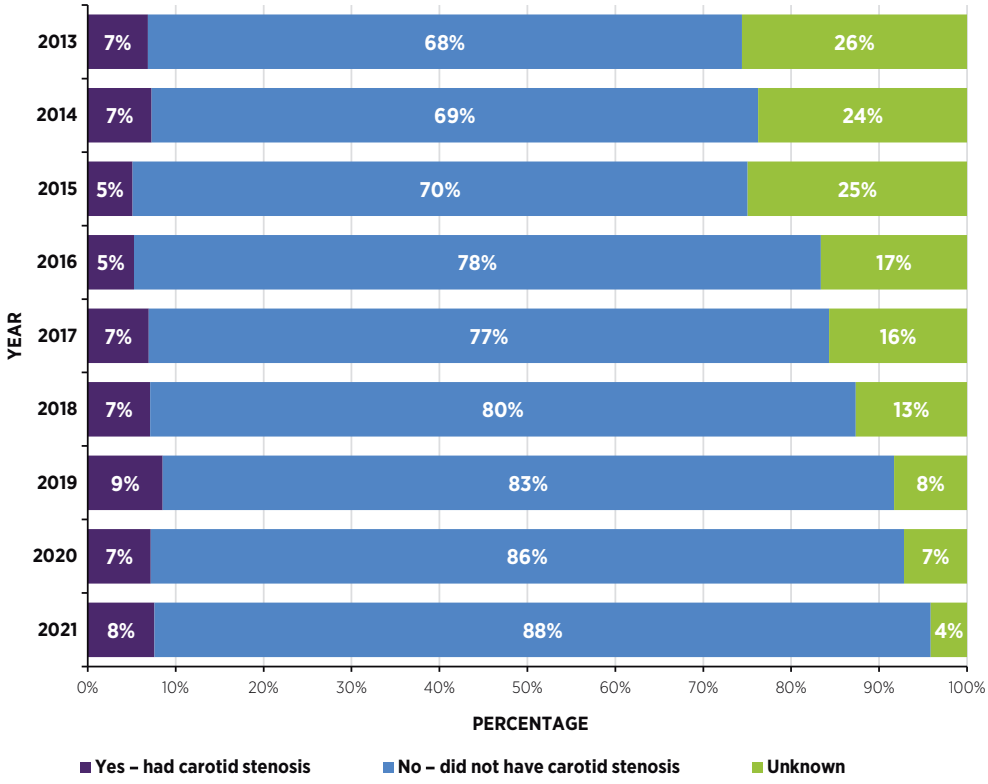


FIGURE 6.6: PATIENTS WITH ISCHAEMIC STROKE AND CAROTID STENOSIS, BY YEAR (n=29974)

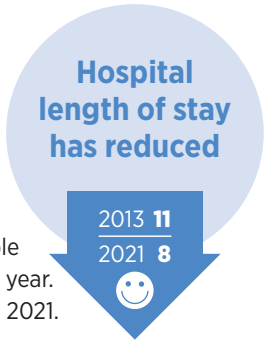
OUTCOMES: LENGTH OF STAY

The hospital length of stay (LOS) can vary between hospitals due to different service provision for rehabilitation. Some hospitals provide rehabilitation on-site, and some provide it off-site. If a hospital provides on-site rehabilitation, the hospital LOS for patients with a stroke will be longer than if the patient is discharged to an off-site rehabilitation service.

HOSPITAL LENGTH OF STAY

Data completeness

Hospital LOS was extracted from Hospital In-Patient Enquiry (HIPE) data and is complete for all cases.



Findings

Between 2013 and 2021, the national median LOS in hospital for patients with a stroke was 9 days (interquartile range (IQR): 5–19 days). Table 6.7 displays the median and IQR of total bed days spent in hospital by year. The median hospital LOS has decreased from 11 days in 2013 to 8 days in 2021.

TABLE 6.7: MEDIAN AND INTERQUARTILE RANGE OF BED DAYS SPENT IN HOSPITAL FOR PATIENTS WITH A STROKE, BY YEAR [67]

Year	Patients (n)	Bed days (n)	Median LOS (days)	IQR	
				Percentile 25 (days)	Percentile 75 (days)
2013	2790	61 062	11	6	22
2014	3259	67 767	10	6	21
2015	3670	77 491	10	5	21
2016	3836	73 097	10	5	20
2017	3502	62 379	9	5	18
2018	3730	66 792	9	5	19
2019	4226	76 138	9	5	18
2020	4989	76 871	8	4	16
2021	5239	77 516	8	4	16
Total	**35 241**	**639 113**	**9**	**5**	**19**

[67] During 2015 and 2016 Mater Misericordiae University Hospital only collected data for the three key performance indicators (KPIs). Therefore, Mater Misericordiae University Hospital was excluded from the majority of analyses in this report for those 2 years (n=611) ; however, it was included in Table 6.7.

STROKE UNIT LENGTH OF STAY

Standard: All patients with a stroke should be admitted to a stroke unit and should spend greater than 90% of their hospital stay in the stroke unit (HSE, 2012).

Data completeness

Table 6.8 displays the completeness of the variables used to calculate the proportion of time spent in a stroke unit. Between 2018 and 2021, the admission to stroke unit variable was used as part of the inclusion criteria (see Chapter 2); therefore, by default, the final dataset did not include cases that had no admission to stroke unit information recorded. Stroke unit admission and discharge dates had a high proportion of completeness, varying between 99% and 100%.

TABLE 6.8: DATA COMPLETENESS OF STROKE UNIT LENGTH OF STAY VARIABLES, BY YEAR[68]

	2013	2014	2015	2016	2017	2018	2019	2020	2021
Admission to stroke unit	99%	99%	99%	99%	99%				
Stroke unit admission date	99%	99%	99%	99%	99%	100%	100%	100%	100%
Stroke unit discharge date	99%	100%	99%	99%	99%	99%	100%	100%	100%
Proportion of data used for the analysis	92%	93%	93%	96%	96%	98%	99%	99%	100%

Findings

During the reporting period, the median total hospital LOS for all patients with a stroke admitted to a stroke unit was 10 days (IQR: 6–21 days). The median LOS in a stroke unit for those who were admitted to a stroke unit bed was 8 days (IQR: 4–15 days). Figure 6.7[69] illustrates the proportion of bed days spent in a stroke unit, by year, for those admitted to a stroke unit. Between 2013 and 2021, out of all the time patients with a stroke spent in a hospital bed, an average of 66% of that time was spent in a stroke unit bed. Although there was an increase in the proportion of hospital stay spent in a stroke unit bed, from 57% (20,802 bed days) in 2013 to 68% (40,926 bed days) in 2021, this proportion remains far off the 90% target.

Figure 5.2 shows that the most common reason for non-admission to a stroke unit was the lack of a stroke unit bed; this may also be the reason why the target of 90% of the hospital stay being spent in a stroke unit bed is not being met. The shortage of stroke unit beds was also identified in the *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b). These results impact on the ability of a stroke service to ensure that patients with a stroke access care in a stroke unit for the majority of their hospital stay.

Increasing the availability of stroke unit beds is a recommendation of this report.

[68] Between 2013 and 2017, 191 cases did not have admission to stroke unit information recorded. Between 2018 and 2021, admission to stroke unit variable was used as a part of the inclusion criteria (see Chapter 2), therefore final dataset did not include cases that had no admission to stroke unit information recorded.
[69] For a detailed description of how analysis for Figure 6.7 was performed, please see Appendix 4.

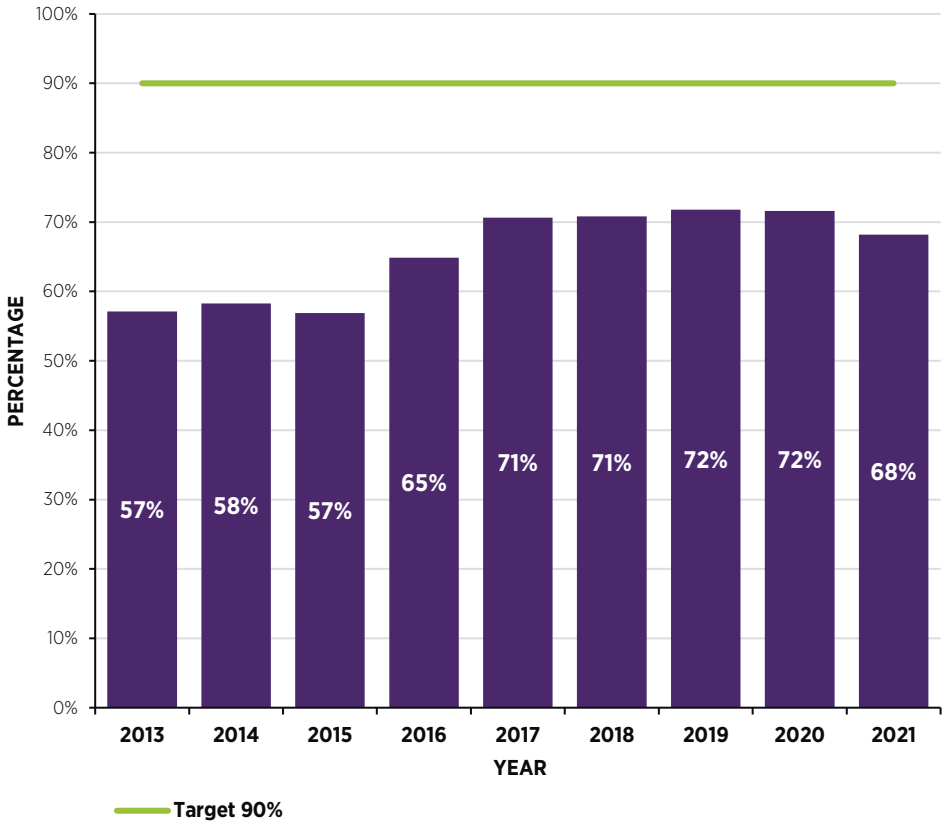


FIGURE 6.7: PERCENTAGE OF BED DAYS SPENT IN A STROKE UNIT, FOR PATIENTS WHO SPENT SOME OR ALL OF THEIR HOSPITAL STAY IN A STROKE UNIT, BY YEAR (N=442124)[70]

KQI 2: Percentage of time patients with a stroke spend in a stroke unit (target: 90%).

2021: 68%

[70] Cases that had no time information recorded or for whom it was recorded incorrectly (n=1447) were excluded from Figure 6.7

OUTCOMES: DISCHARGE DESTINATION

In 2016, the INAS began collecting the discharge destination of patients with a stroke, as there were some limitations within HIPE data in coding the discharge destination of patients with a stroke who were discharged from an acute hospital to a rehabilitation unit. Where a rehabilitation unit and long-term care facility were co-located, some of these episodes of care were inadvertently classified as having been discharged to long-term care. For discharges from 1 January 2022, a new HIPE variable, 'discharge mode', was introduced to indicate why a patient was transferred to a healthcare facility (e.g. rehabilitation), when documented. HIPE data related to all other discharge destinations (e.g. home, death) correlated well with stroke audit portal data and are used to measure total in-hospital mortality.

Data completeness

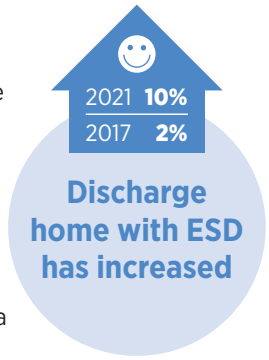
The stroke audit portal data (2016–2021) were used to analyse discharge destination in this report. Completion of this variable reached 99% by 2021 (Table 6.9).

TABLE 6.9: DATA COMPLETENESS OF DISCHARGE DESTINATION VARIABLE, BY YEAR

	2016	2017	2018	2019	2020	2021
Discharge destination	8%	88%	98%	99%	99%	99%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%

Findings

Between 2017 and 2021, the majority of patients with a stroke were discharged home (51%, n=11066). There was an increase in the proportion of patients with a stroke discharged home with Early Supported Discharge (ESD), from 2% (n=61) in 2017 to 10% (n=530) in 2021 (Figure 6.8). While this is an improvement, it is still well below the 46% reported in the UK (Sentinel Stroke National Audit Programme, 2021). Increasing the number of ESD teams as planned in the *National Stroke Strategy 2022–2027* (NSP, 2022) is a recommendation of this report.



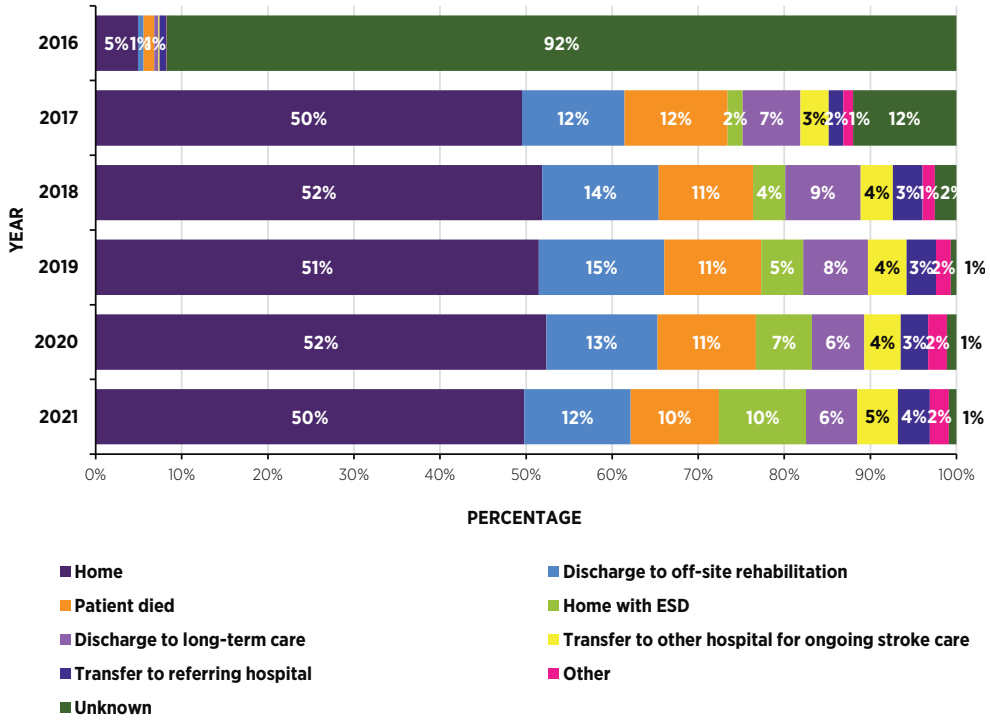


FIGURE 6.8: DISCHARGE DESTINATION OF PATIENTS WITH A STROKE, BY YEAR (n=25255)

OUTCOMES: IN-HOSPITAL MORTALITY

Data completeness

In order to provide in-hospital mortality for the full reporting period (2013–2021), the HIPE discharge destination code was analysed. This is complete in all cases.

Findings

The total crude in-hospital mortality rate was 11.6% (n=4012). When analysed by stroke type, the in-hospital mortality rate was 8.7% (n=2610) for patients with ischaemic stroke, ranging from 10.1% (n=253) in 2013 to 7.2% (n=326) in 2021, a 29% reduction. Patients with haemorrhagic stroke had an overall in-hospital mortality rate of 30.1% (n=1402), ranging between 27.0% (n=113) and 36.4% (n=164) over the reporting period. As mortality is unadjusted for age, sex or stroke severity, it is not reported at hospital level. No follow-up data are collected in the INAS, and implementation of an individual health identifier to capture follow-up data for patients is a recommendation of this report.

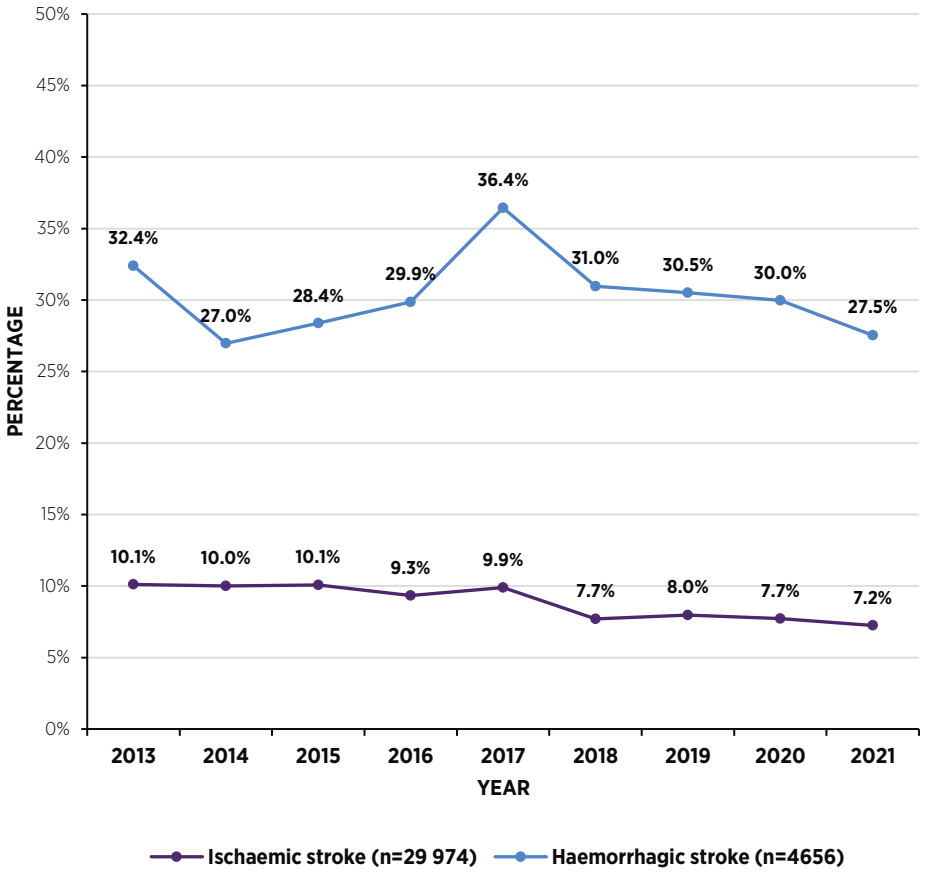


FIGURE 6.9: MORTALITY RATE, BY STROKE TYPE AND YEAR (N=34630)[71]

[71] Figure 6.9 utilises the HIPE discharge code.

DISCHARGE OUTCOMES: PRE-STROKE AND DISCHARGE MODIFIED RANKIN SCALE SCORES

The modified Rankin Scale (mRS) is a simple universal scoring system for disability (Figure 6.10) that 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.

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 6.10: MODIFIED RANKIN SCALE

Data completeness

The mRS score has been collected by the INAS since 2016; throughout this reporting period, there was an increase in the amount of information recorded for both admission and discharge mRS scores, resulting in more accurate data each subsequent year. The recording of mRS scores continues to improve; in 2021, pre-stroke and discharge mRS score data were inputted on a total of 93% of all stroke cases (Table 6.10).

TABLE 6.10: DATA COMPLETENESS OF MODIFIED RANKIN SCALE SCORE VARIABLE, BY YEAR

	2016	2017	2018	2019	2020	2021
mRS score pre-stroke	5%	80%	88%	89%	91%	93%
mRS score on discharge	5%	78%	87%	88%	91%	93%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%	100%	100%	100%

Findings

The proportion of patients who had no disability (mRS score=0) prior to admission to hospital gradually increased from 55% (n=1913) in 2017 to 62% (n=3241) in 2021. However, it is difficult to compare outcomes between the years due to variations in data quality (Figure 6.11).

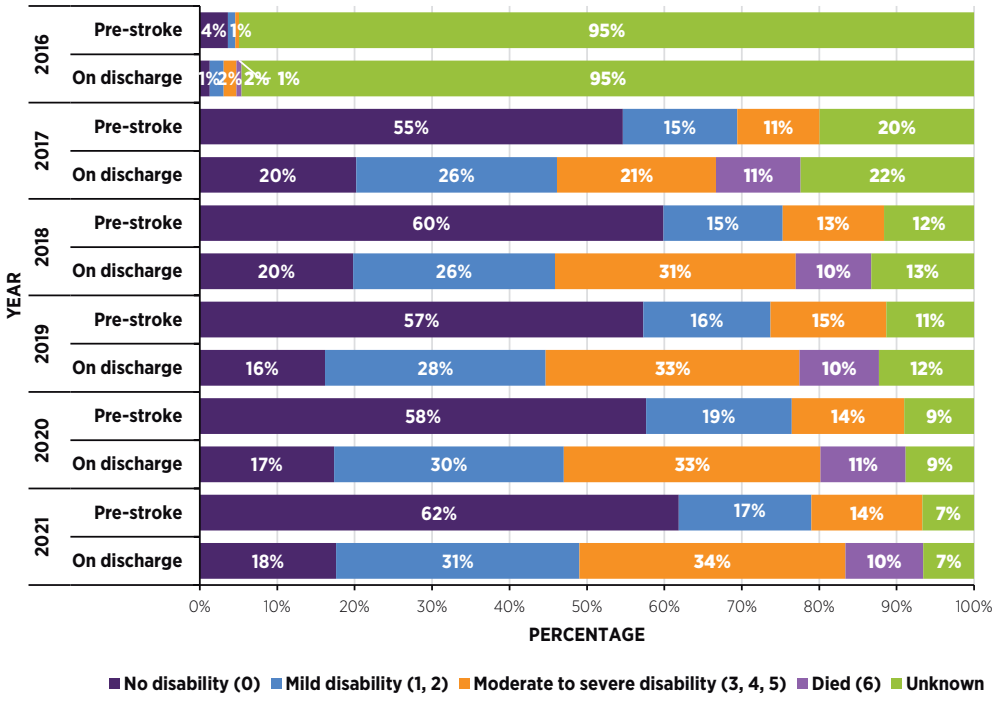


FIGURE 6.11: MODIFIED RANKIN SCALE SCORES, PRE-STROKE AND ON DISCHARGE, BY YEAR (n=25255)

Figure 6.12 shows the mRS score on discharge, by stroke type and year. Between 2017 and 2021, 20% (n=3674) of patients with ischaemic stroke had no disability on discharge, compared with 7% (n=203) of patients with haemorrhagic stroke.

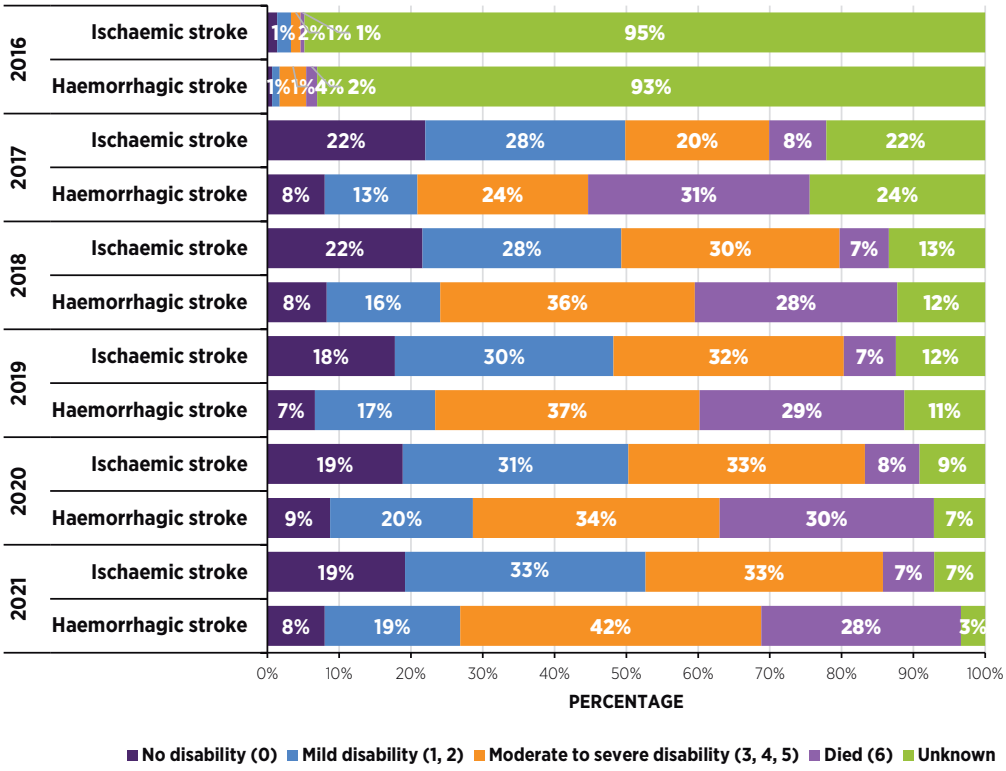


FIGURE 6.12: MODIFIED RANKIN SCALE SCORES ON DISCHARGE, BY STROKE TYPE AND YEAR (n=25255)

KEY FINDINGS FROM CHAPTER 6

•	In total, the prevalence of AF among all patients with a stroke over the reporting period was 29% (n=10016). Out of the total stroke population for the reporting period (N=34630), 18% (n=6313) had known AF pre-stroke (ischaemic: n=5491, 18%; haemorrhagic: n=822, 18%). Treatment with anticoagulant medication pre-stroke was reported in 81% (n=5122) of those cases.
•	The median hospital LOS has decreased from 11 days in 2013 to 8 days in 2021.
•	Although there was an increase in the proportion of hospital stay spent in a stroke unit bed, from 57% (20,802 bed days) in 2013 to 68% (40,926 bed days) in 2021, this proportion remains far off the 90% target (Figure 6.7).
•	There was an increase in the proportion of patients with a stroke discharged home with ESD, from 2% (n=61) in 2017 to 10% (n=530) in 2021 (Figure 6.8), but this is still well below the 46% reported in the UK (Sentinel Stroke National Audit Programme, 2021).
•	The crude in-hospital mortality rate for patients with ischaemic stroke decreased by 29% over the reporting period, from 10.1% in 2013 to 7.2% in 2021. For patients with haemorrhagic stroke, the overall crude in-hospital mortality rate was 30.1% (n=1402), ranging between 27.0% (n=113) and 36.4% (n=164) over the reporting period (Figure 6.9).

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

Eighteen percent of patients with a stroke had a diagnosis of AF prior to the onset of stroke. The majority (81%) were already on anticoagulant medication. The INAS is in the process of completing a spotlight audit on the prescription of, and compliance with, anticoagulation prior to stroke, and the results will be available in 2023. Although there has been a reduction in the total hospital LOS, there is a consistent failure to meet the target of 90% of the hospital stay spent in a stroke unit, and implementing the National Stroke Strategy (NSP, 2022) is a recommendation of this report.

CHAPTER 7

HEALTH AND SOCIAL CARE PROFESSIONALS DATASET

CHAPTER 7: HEALTH AND SOCIAL CARE PROFESSIONALS DATASET

PARTICIPATING HOSPITALS

In 2021, 19 hospitals had additional data recorded for patients who were seen by a health and social care professional (HSCP); this was an increase from 15 hospitals in 2020. In Table 7.1, check marks (✓) signify that a hospital had additional HSCP information recorded. In 2021, 11 hospitals had all three included HSCP disciplines reporting to the audit, which was an increase from 9 hospitals in 2020. It is important to highlight that this chapter does not represent all the physiotherapy, occupational therapy, or speech and language therapy activity in a named hospital, nor does it imply that there is no such activity in hospitals that are not currently represented in this analysis. Participation in data collection is not mandatory for HSCPs in acute stroke units. Rather, this chapter is an overview of some key discipline-specific information about the therapy provided to patients with a stroke.

TABLE 7.1 PARTICIPATING HOSPITALS, BY DISCIPLINE

Hospital	Number of cases with HSCP	PT (n=16)	OT (n=15)	SLT (n=15)
Beaumont Hospital	363	✓	✓	✓
Connolly Hospital	188	✓	✓	✓
Cork University Hospital	257	✓	✓	✓
Mater Misericordiae University Hospital	211	✓	✓	✓
Naas General Hospital	108	✓	✓	✓
Our Lady of Lourdes Hospital Drogheda	217	✓	✓	✓
Regional Hospital Mullingar	121	✓	✓	✓
St Luke's General Hospital, Carlow/Kilkenny	99	✓	✓	✓
St Vincent's University Hospital	318	✓	✓	✓
University Hospital Galway	157	✓	✓	✓
University Hospital Limerick	304	✓	✓	✓
Sligo University Hospital	92	✓	✓	
St Columcille's Hospital, Loughlinstown[72]	36	✓	✓	
Tipperary University Hospital	59		✓	✓
Mayo University Hospital	25	✓		✓
Tallaght University Hospital	196	✓		✓
St James's Hospital	216	✓		
Mercy University Hospital	83		✓	
University Hospital Kerry	42			✓
Bantry General Hospital				
Cavan General Hospital				
Letterkenny University Hospital				
Portiuncula University Hospital				
University Hospital Waterford				
Wexford General Hospital				

[72] St Columcille's Hospital, Loughlinstown provides a stroke rehabilitation service only.

PARTICIPATING HSCP DISCIPLINES

In 2021, a total of 3,092 patients with a stroke had additional HSCP information recorded. Figure 7.1 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 cases recorded by each discipline in 2021 compared with 2020; cases with physiotherapy data recorded increased from 1,828 to 2,039, cases with occupational therapy data recorded increased from 917 to 1,344, and cases with speech and language therapy data recorded increased from 1,239 to 1,571 (NOCA, 2022a).

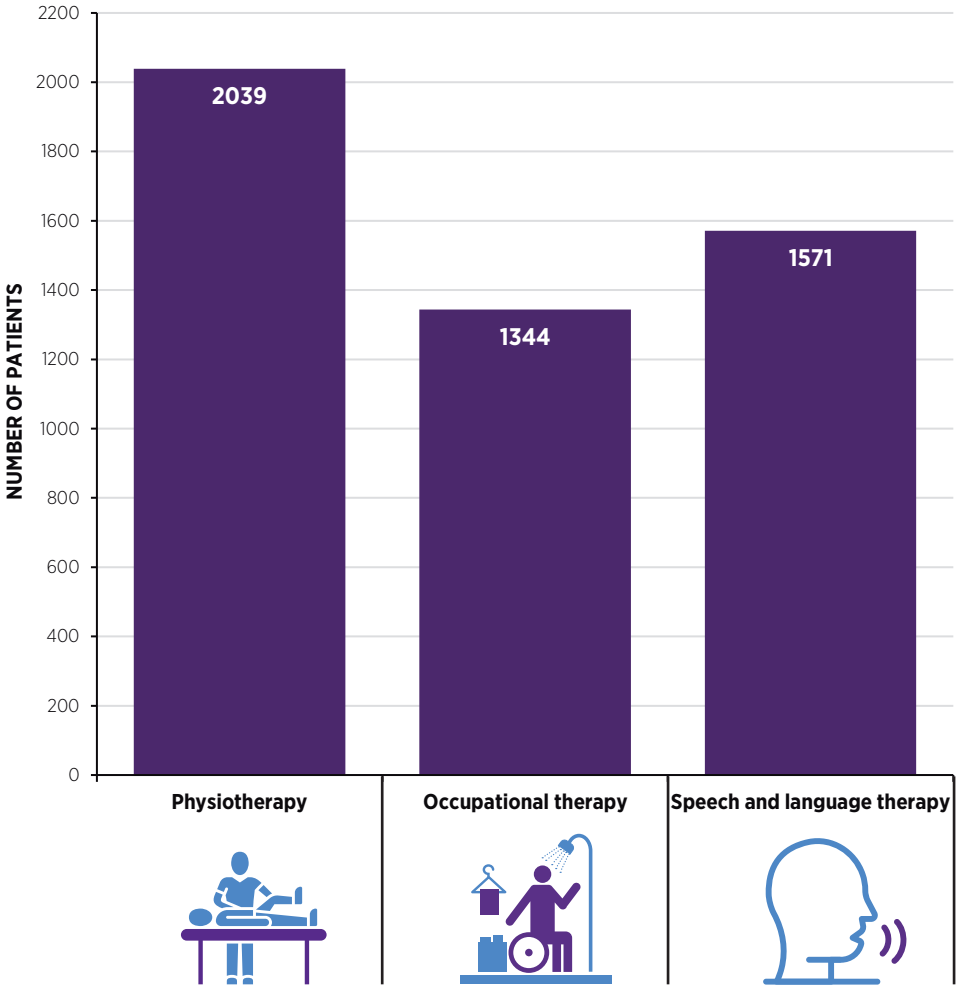


FIGURE 7.1: REPORTED NUMBER OF PATIENTS ASSESSED BY HEALTH AND SOCIAL CARE PROFESSIONALS (n=3092)[73]

[73] Figure 7.1 refers to number of assessments (i.e. a patient could have been assessed by one or more HSCPs).

HSCP ASSESSMENT

Time from hospital arrival to therapy assessment

Data completeness

Table 7.2 shows the completion of variables used to calculate time from hospital admission to therapy assessment.

TABLE 7.2: DATA COMPLETENESS OF TIME FROM HOSPITAL ADMISSION TO THERAPY ASSESSMENT BY DISCIPLINE, 2021

	Physiotherapy	Occupational Therapy	Speech and language Therapy
Patient seen date	99%	99%	99%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%

Findings

More than one-half (n=1048, 51%) of patients with a stroke who were seen by a physiotherapist (PT) were seen on the day of or the day after hospital admission. Thirty-four percent (n=454) of patients with a stroke who were seen by an occupational therapist (OT) and 50% (n=779) of those who were seen by a speech and language therapist (SLT) were seen on the day of or the day after hospital admission (Figure 7.2).[74]

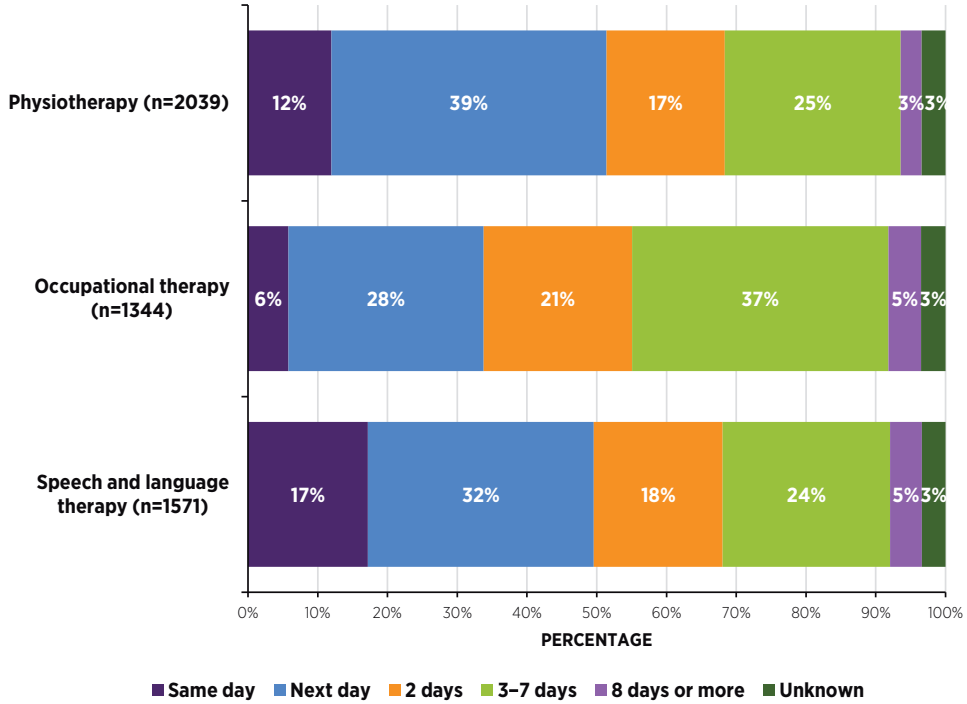


FIGURE 7.2: TIME FROM HOSPITAL ADMISSION TO THERAPY ASSESSMENT, BY DISCIPLINE (n=3092) [75, 76]

[74] For a detailed description of how analysis for Figure 7.2 was performed, please see Appendix 4.
[75] Figure 7.2 refers to number of assessments (i.e. a patient could have been assessed by one or more HSCPs).
[76] 'Unknown' includes cases that had no information recorded, or for whom information was recorded incorrectly.

For patients with a stroke admitted to hospital at the weekend, time to assessment was longer compared with those who were admitted on a weekday. Figure 7.2A[77] shows the time from hospital admission to therapy assessment by weekday versus weekend admission. Fourteen percent (n=218) of patients who were admitted on a weekday were assessed by a PT on same day, compared with 5% (n=26) of patients who were admitted at the weekend. Almost no patients who were admitted during the weekend were assessed by an OT (n<5) or SLT (n<5, 1%) on the same day. Although current stroke care HSCP services are largely delivered Monday to Friday, the potential for extended daily hours and the provision of service 7 days a week is detailed in the terms and conditions of employment of many staff and, as such, a 7-days-a-week service may be a possibility in Ireland, as has been seen in UK stroke services.

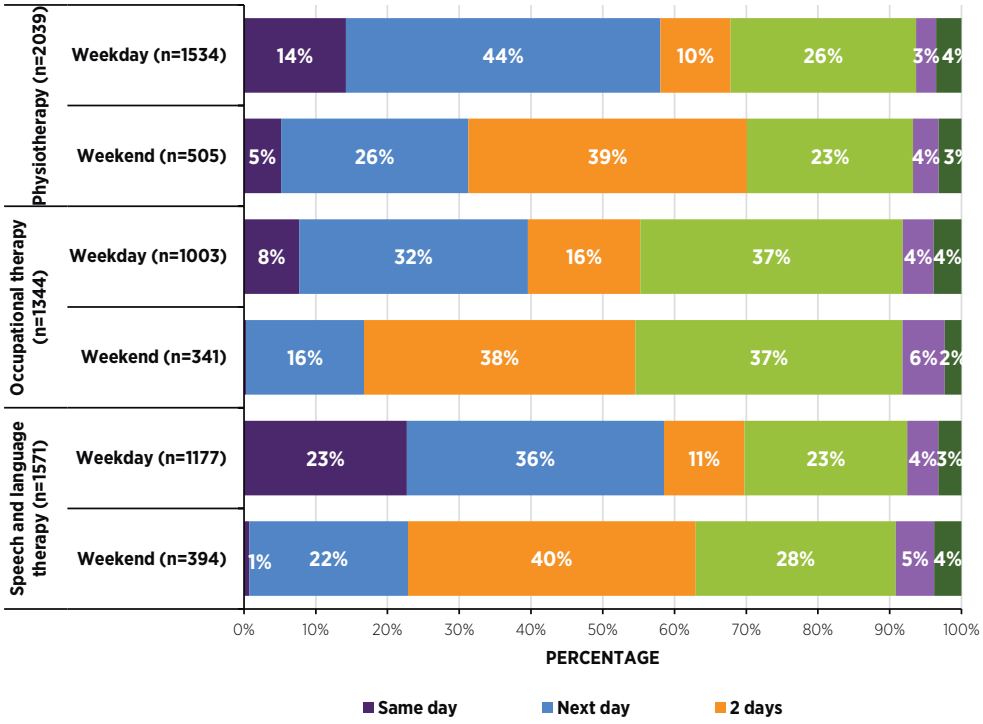


FIGURE 7.2A: TIME FROM HOSPITAL ADMISSION TO THERAPY ASSESSMENT, BY WEEKDAY VERSUS WEEKEND ADMISSION AND DISCIPLINE (n=3092) [78,79]

[77] For a detailed description of how analysis for Figure 7.2A was performed, please see Appendix 4.
[78] Figure 7.2A refers to number of assessments (i.e. a patient could have been assessed by one or more HSCPs).
[79] 'Unknown' includes cases that had no information recorded, or for whom information was recorded incorrectly.

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, 2022; Royal College of Physicians, 2016; Irish Heart Foundation, 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.

Data completeness

Table 7.3 shows the proportion of patients who had intensity of therapy recorded.

TABLE 7.3: DATA COMPLETENESS OF INTENSITY OF THERAPY VARIABLE, BY DISCIPLINE, 2021

	Physiotherapy	Occupational Therapy	Speech and language Therapy
Patient received a sufficient amount of therapy	98%	98%	92%
Proportion of data used for the analysis (unknown data included in the results)	100%	100%	100%

Findings

The amount of therapy provided to the patient was calculated on minutes of therapy received in 56% (n=1141) of cases seen by a PT, 55% (n=735) of cases seen by an OT and 44% (n=692) of cases seen by an SLT.

In 2021, PTs reported that 51% (n=1046) of patients with a stroke received sufficient therapy, compared with 56% in 2020. OTs reported that 38% (n=512) of patients with a stroke received sufficient therapy, similar to the 39% reported in 2020; and SLTs reported that 46% (n=720) of patients with a stroke received sufficient therapy, which was also similar to the 45% reported in 2020 (Figure 7.3). The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that the total number of PTs, OTs and SLTs fell below the recommended number. Physiotherapy had 53% (n=30.5) of the recommended number of PTs, occupational therapy had 45% (n=25.0) of the recommended number of OTs, and speech and language therapy had 66% (n=18.0) of the recommended number of SLTs. If stroke teams were resourced according to the recommended numbers of therapists, it is likely that patients with a stroke would receive an increased intensity of therapy from these disciplines.

Patients' physical dependency following a stroke can also impact on therapists' ability to provide sufficient therapy. In 2021, 31% (n=624) of patients with a stroke who were assessed by a PT and 27% (n=359) of those who were assessed by an OT 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 and occupational

therapy services for patients with a stroke. The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) illustrated that therapy assistants were employed in 12 (50%) of the participating hospitals to provide assistance with stroke rehabilitation. Eleven (46%) hospitals reported that they had access to a physiotherapy assistant, 4 (17%) had access to an occupational therapy assistant and 2 (8%) had access to a speech and language therapy assistant. Increasing the number of stroke unit beds and the human resourcing to support these beds is a recommendation of this report.

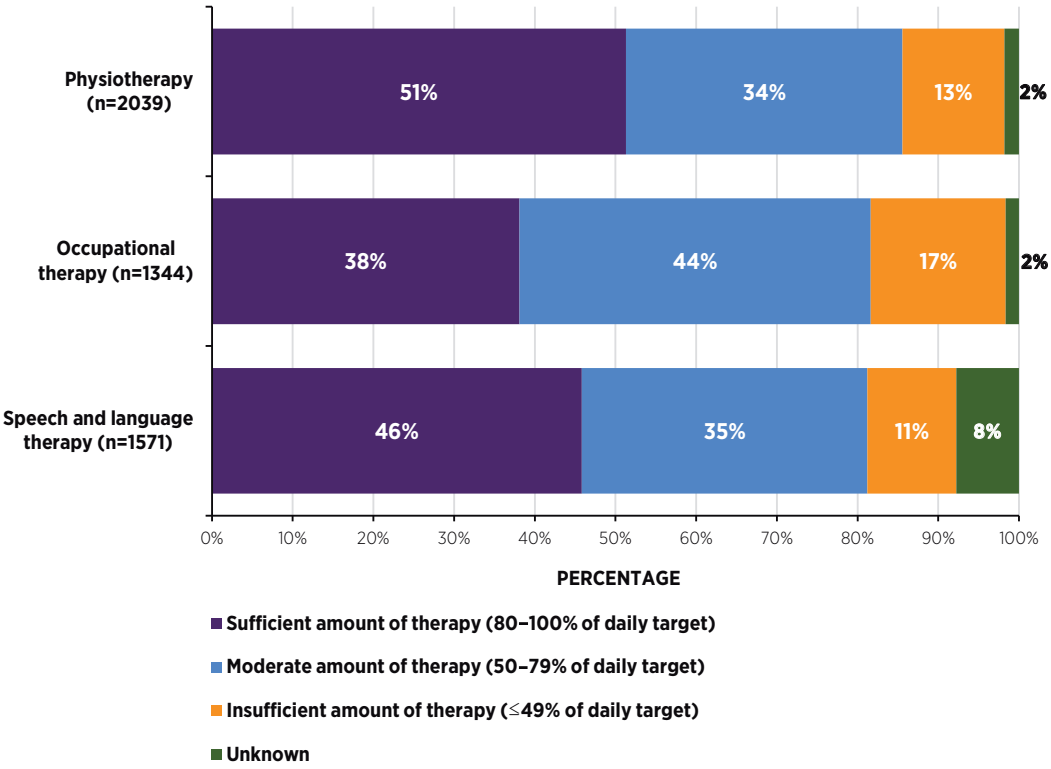


FIGURE 7.3: INTENSITY OF THERAPY, BY DISCIPLINE (n=3092)[80]

[80] Figure 7.3 refers to number of assessments (i.e. a patient could have been assessed by one or more HSCPs).

ONWARD REFERRAL

Onward referral refers to the hospital or community service a patient with a stroke was referred to on discharge from the acute hospital.

Data completeness

Table 7.4 shows the proportion of patients who had onward referral information recorded.

TABLE 7.4: DATA COMPLETENESS OF ONWARD REFERRAL VARIABLES, BY DISCIPLINE, 2021

Physiotherapy onward referral	96%
Proportion of data used for the analysis (unknown data included in the results)	100%
Occupational therapy onward referral	95%
Occupational therapy onward referral service	94%
Proportion of data used for the analysis (unknown data included in the results)	100%
Speech and language therapy further requirements	98%
Speech and language therapy onward referral service	95%
Proportion of data used for the analysis (unknown data included in the results)	100%

Findings

Figure 7.4 shows the distribution of onward referral destinations for each discipline. On discharge from acute hospital services, 44% (n=900) of patients with a stroke seen by a PT and 44% (n=586) seen by an OT did not require an onward referral. Following assessment by an SLT, 51% (n=797) of patients with a stroke were not referred for further speech and language therapy. Almost one-fifth of cases seen by a PT (19%, n=382) or an OT (18%, n=248) required inpatient rehabilitation in another hospital on discharge from acute services. This was 15% (n=233) for patients seen by an SLT.

There was an increase in the number of patients referred to ESD by a PT, from 9% (n=169) in 2020 to 12% (n=241) in 2021, with a similar increase in patients referred by an SLT, from 7% (n=92) in 2020 to 9% (n=139) in 2021. Ten percent (n=140) of patients seen by an OT were referred for ESD in 2021. This aligns with the finding in the *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) that four additional ESD teams were established in 2020 and 2021.

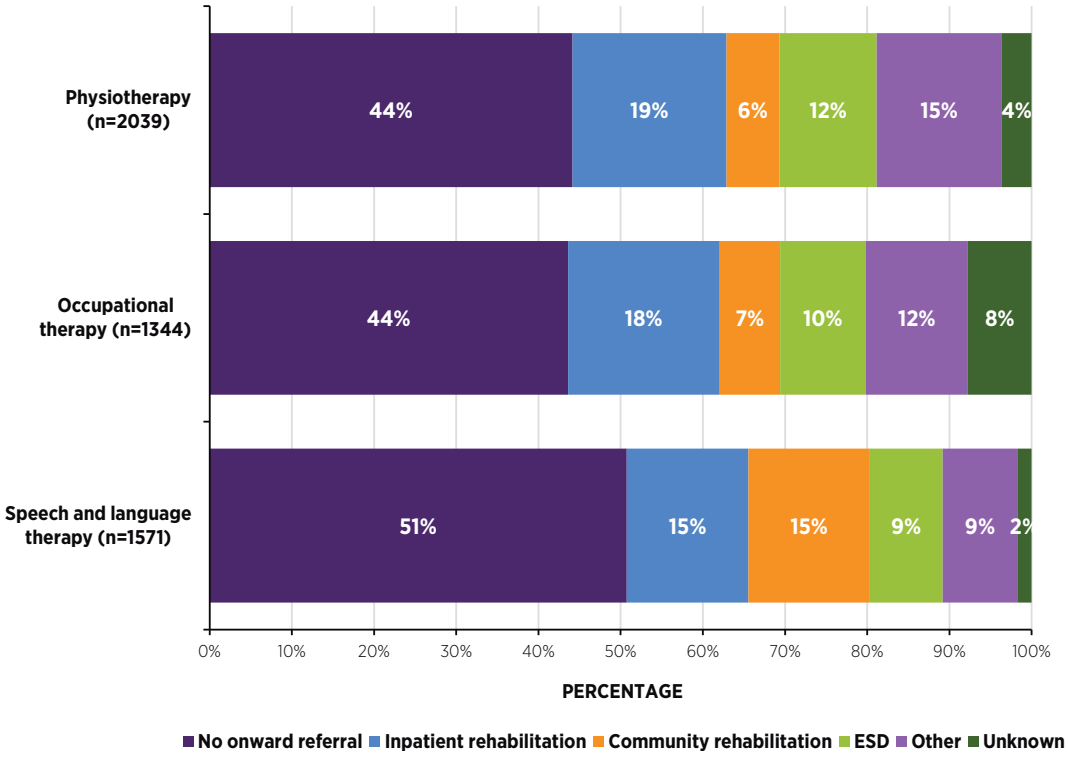


FIGURE 7.4: ONWARD REFERRAL, BY DISCIPLINE (n=3092) [81,82]

[81] Figure 7.4 refers to the number of referrals (i.e. a patient could have been referred by one or more HSCPs).
[82] 'No onward referral' includes patients who died in hospital.

PHYSIOTHERAPY
PT: MOBILITY OUTCOMES

Standard: People with limited ability to walk after a stroke should be assessed by a physiotherapist with experience in neurological rehabilitation to guide management (Royal College of Physicians, 2016).

Data completeness

The data completeness of the variables used to measure physiotherapy mobility outcomes is presented in Table 7.5.

TABLE 7.5: DATA COMPLETENESS OF PHYSIOTHERAPY MOBILITY OUTCOMES VARIABLES, 2021

Indoor mobility pre-admission	98%
Indoor mobility on discharge	96%
Proportion of data used for the analysis	95%

Findings

Among patients with a stroke in 2021 who were seen by a PT, 77% (n=1494) did not require an aid for mobility prior to the onset of stroke. However, post-stroke, this decreased to 46% (n=890). The percentage of patients who required the supervision or assistance of one person to walk increased from 5% (n=95) pre-stroke to 18% (n=346) on discharge. Post-stroke, 8% (n=160) required the assistance of another person to transfer from bed to a chair, and 10% (n=188) required a hoist to transfer (Figure 7.5). This remains largely unchanged from 2019 and 2020.

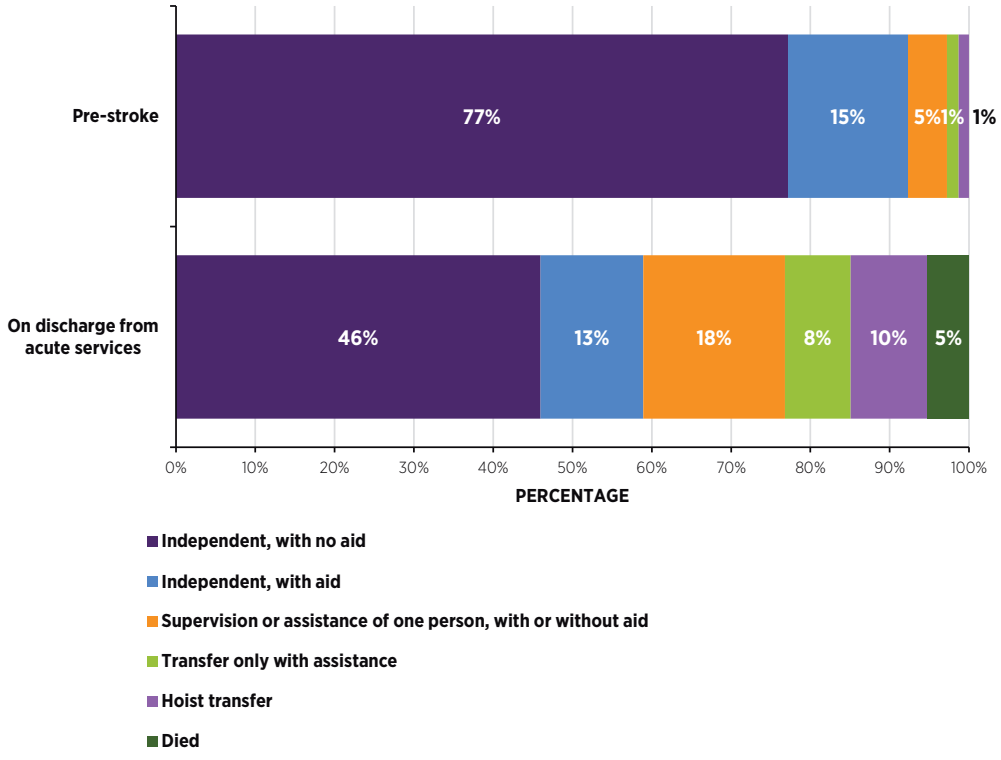


FIGURE 7.5: PHYSIOTHERAPY MOBILITY OUTCOMES (n=1936)[83]

[83] For 103 cases, information was not available. These cases were excluded from Figure 7.5.

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

Standard: People with a stroke should be formally assessed for their safety and independence in all areas of relevant personal activities of daily living by a clinician with the appropriate expertise, and the findings should be recorded using a standardised assessment tool (Royal College of Physicians, 2016).

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.

Data completeness

The data completeness of the variables used to measure ADLs on admission and discharge is presented in Table 7.6.

TABLE 7.6: DATA COMPLETENESS OF PRE- AND POST-STROKE ACTIVITIES OF DAILY LIVING VARIABLES, 2021

Pre-stroke ADLs	98%
Post stroke ADLs	97%
Proportion of data used for the analysis	96%

Findings

Figure 7.6 displays the distribution of personal ADLs among patients with a stroke both pre-admission and on discharge from acute services. Prior to admission, 75% (n=970) of patients with a stroke who were seen by an OT were independent in their ability to attend to their personal ADLs. On discharge, this fell to 39% (n=501). On discharge, 10% (n=132) of patients with a stroke required supervision or set-up (e.g. with bathing), 26% (n=337) required assistance with personal ADLs and 12% (n=159) required full care.

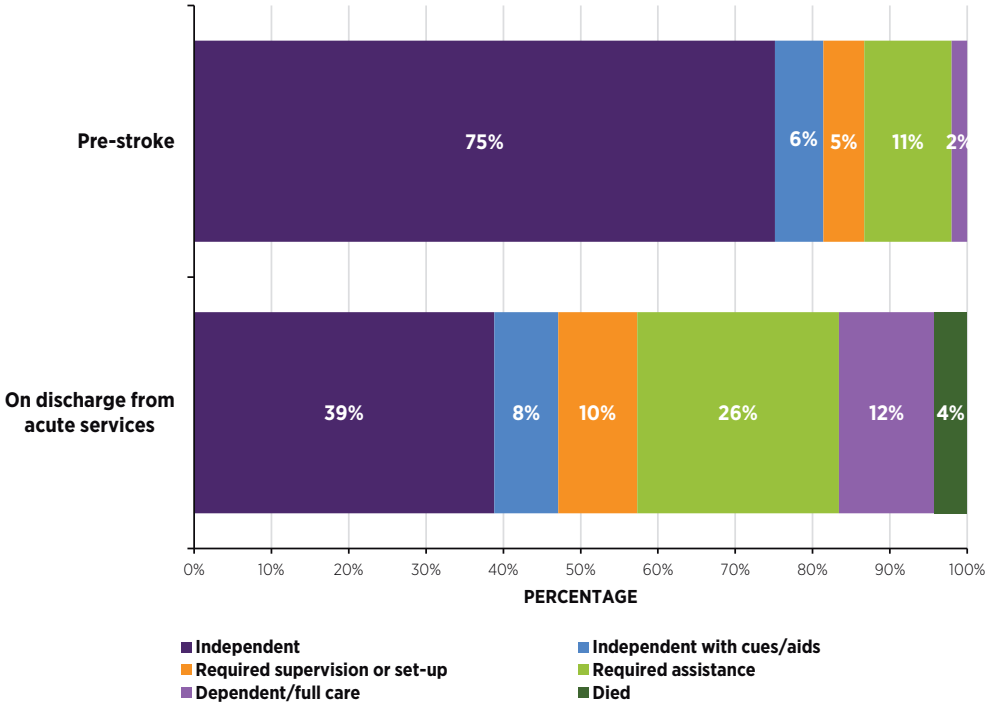


FIGURE 7.6: OCCUPATIONAL THERAPY ACTIVITIES OF DAILY LIVING PRE- AND POST-STROKE (n=1291)[84]

[84] Information was not available for 53 cases. These cases were excluded from Figure 7.6.

OCCUPATIONAL THERAPY: COGNITION AND PERCEPTUAL ASSESSMENT

Standard: All patients with a stroke should be screened for cognitive and perceptual deficits using validated and reliable screening tools (Stroke Foundation, 2022; Royal College of Physicians, 2016).

Cognitive impairment can be associated with poorer outcomes after stroke, such as increased LOS and reduced independence (Royal College of Physicians, 2016).

Sixty-four percent (n=858) of patients with a stroke who were assessed by an OT in 2021 were screened for cognitive problems. Sixteen percent (n=214) of patients with a stroke were unable to complete the screening due to patient factors in 2021, which was the same as the proportion in 2020.

Three-quarters (77%, n=1034) of patients with a stroke had a visual field assessment completed by an OT during their admission in 2021.

OCCUPATIONAL THERAPY: PATIENT EDUCATION ON DRIVING AND WORKING

Standard: People who have had an acute stroke or transient ischaemic attack (TIA) should be asked about driving before they leave the hospital or specialist outpatient clinic (Irish Heart Foundation, 2010).

The current Irish regulations regarding driving after a stroke are available from the National Driver Licence Service (National Driver Licence Service, 2022).

Data completeness

Table 7.7 shows the data completeness of the variables used to measure the provision of education on returning to work and driving.

TABLE 7.7: DATA COMPLETENESS OF PROVISION OF EDUCATION ON RETURNING TO WORK AND DRIVING VARIABLES, 2021

Driving prior to admission	89%
Advice on driving limitations	95%
Proportion of data used for the analysis	89%
Paid employment prior to admission	93%
Advice on returning to work	96%
Proportion of data used for the analysis	93%

Findings

Forty-four percent (n=595) of patients with a stroke who were seen by an OT drove prior to admission. Figure 7.7 indicates that 84% (n=498) of those patients received individualised advice on driving limitations after stroke prior to being discharged from hospital, similar to the 85% reported in 2020. Nineteen percent (n=255) of patients with a stroke who were seen by an OT were in paid employment prior to their stroke. On discharge, 65% (n=165) of those patients had been given advice about returning to work, a slight increase from 62% in 2020, with an additional 15% (n=39) referred onward for further advice (Figure 7.7).[85]

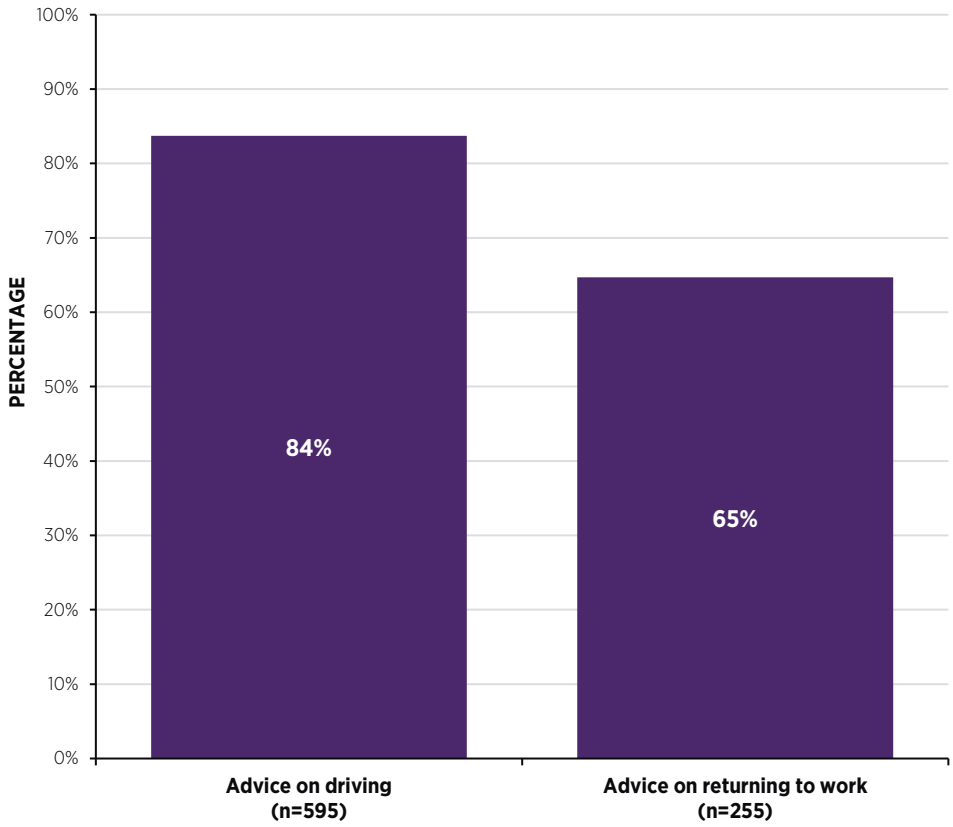
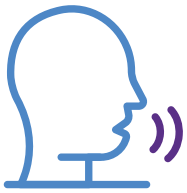


FIGURE 7.7: OCCUPATIONAL THERAPY PATIENT EDUCATION ON RETURNING TO WORK AND DRIVING (n=617)[86]

[85] For a detailed description of how analysis for Figure 7.7 was performed, please see Appendix 4.
[86] Figure 7.7 refers to number of cases for each type of advice (i.e. a patient could have been employed and drove, therefore was counted twice).

SPEECH AND LANGUAGE THERAPY

SLT: COMMUNICATION AND SWALLOW DIFFICULTIES



Data completeness

In 2021, almost all patients (99.7%) who were seen by an SLT had the initial assessment diagnosis recorded. Completion of each of the diagnosis variables ranged from 86% to 99.7% (Table 7.8).

TABLE 7.8: DATA COMPLETENESS OF COMMUNICATION AND SWALLOW DIFFICULTIES VARIABLES, 2021

Initial assessment diagnosis	99.7%
Swallow difficulty	99%
Dysarthria	94%
Dyspraxia	92%
Aphasia	95%
Cognitive linguistic communication disorder	86%
Voice difficulties	93%
Proportion of data used for the analysis	99.7%

Findings

Following initial assessment, a diagnosis of communication and/or swallow difficulties was made in 82% (n=1296) of patients with a stroke who were assessed by an SLT, while no difficulties were identified, or the difficulty was unknown, in 17% (n=271) of cases. Figure 7.8 displays the difficulties that were identified for the 1,296 patients who had a diagnosis of communication and/or swallow difficulties in 2021.

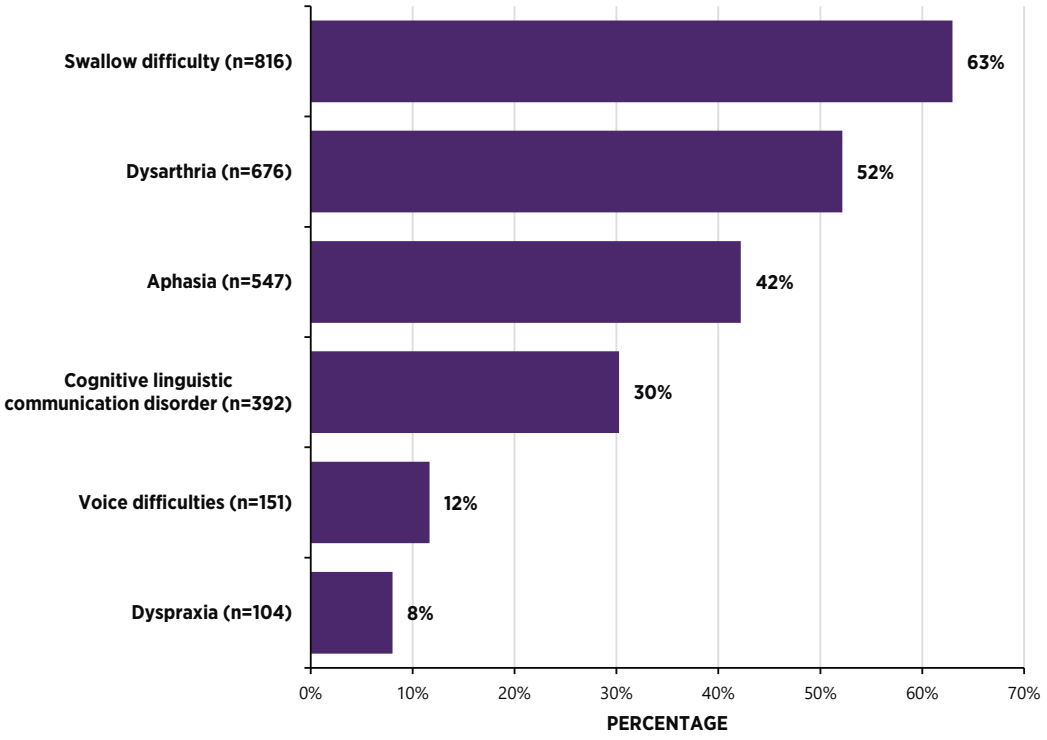


FIGURE 7.8: COMMUNICATION AND SWALLOW DIFFICULTIES IDENTIFIED BY SPEECH AND LANGUAGE THERAPISTS (n=1296)[87]

[87] Figure 7.8 represents patients who had a diagnosis of swallow and/or communication difficulty diagnosed by an SLT.

SPEECH AND LANGUAGE THERAPY: PRE- AND POST-STROKE COMMUNICATION

Standard: People with communication problems after stroke should be assessed by a speech and language therapist in order to diagnose the problem and to explain the nature and implications to the person, their family/carer and the multidisciplinary team (Royal College of Physicians, 2016).

Data completeness

The completeness of variables used to measure communication ability on admission and discharge is presented in Table 7.9. Out of all the cases that were seen by an SLT in 2021, 97% had communication ability information recorded on both admission and discharge

TABLE 7.9: DATA COMPLETENESS OF PRE- AND POST-STROKE COMMUNICATION ABILITY VARIABLES, 2021

Pre-stroke communication	98%
Post-stroke communication	99%
Proportion of data used for the analysis	97%

Findings

Figure 7.9 displays pre- and post-stroke communication ability. Prior to admission, the majority (80%, n=1215) of patients with a stroke who were assessed by an SLT 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; 31% (n=468) were reported to have mild communication difficulties, 18% (n=271) had moderate communication difficulties, 9% (n=136) had severe communication difficulties and 3% (n=43) had profound communication difficulties.

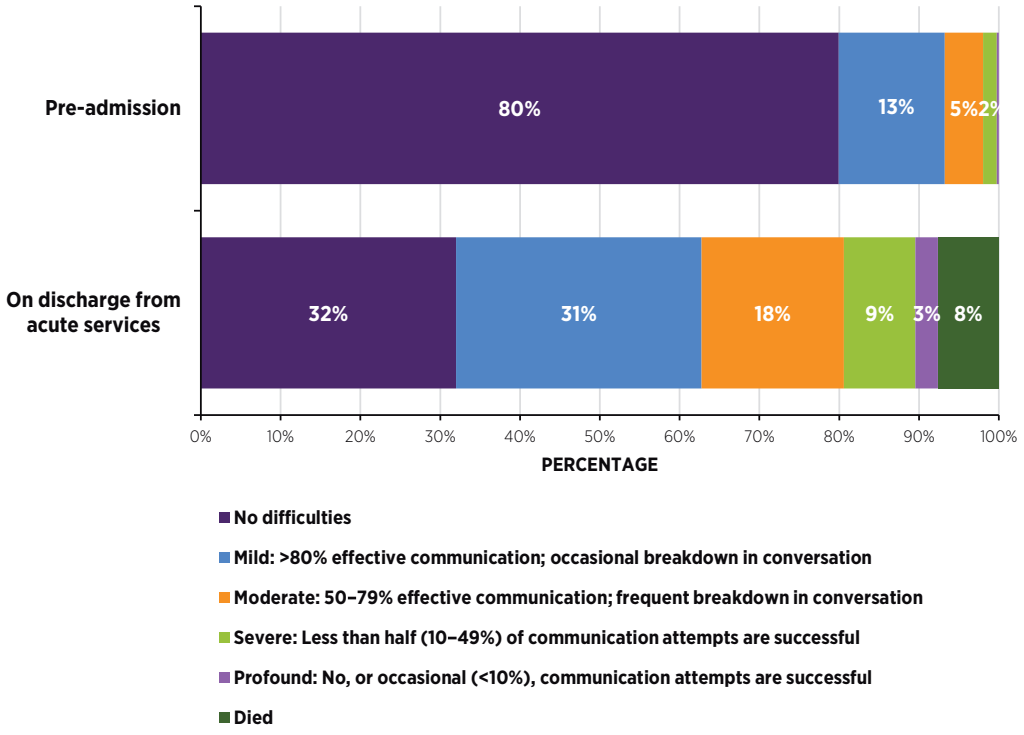


FIGURE 7.9: SPEECH AND LANGUAGE THERAPY PRE- AND POST-STROKE COMMUNICATION ABILITY (n=1520)[88]

[88] Information was not available for 51 cases. These cases were excluded from Figure 7.9.

SPEECH AND LANGUAGE THERAPY: 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). Dysphagia is linked with an increased risk of pneumonia, malnutrition and dehydration, and with reduced health-related quality of life. Acute dysphagia is common after a stroke and can be chronic for some patients. 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'. There is no clear evidence or consensus from international guidelines on dysphagia after a stroke as to how routinely instrumental dysphagia assessment should be completed for patients with a stroke; only that instrumental assessment should be available (Dziewas *et al*., 2021). However, the validity of clinical evaluation has been frequently queried, and high silent aspiration rates have been reported in the stroke population (Daniels *et al*., 1998), so instrumental dysphagia assessment should have an important role in dysphagia management post-stroke.

Data completeness

Almost all patients who were seen by an SLT in 2021 had information recorded on whether they had videofluoroscopy (99%) or fiberoptic endoscopic evaluation of swallowing (FEES) (99%) (Table 7.10).

TABLE 7.10: DATA COMPLETENESS OF SWALLOW INVESTIGATION VARIABLES, 2021

Videofluoroscopy	99%
Proportion of data used for the analysis (unknown data included in the results)	100%
FEES	99%
Proportion of data used for the analysis (unknown data included in the results)	100%

Findings

Figure 7.10 displays the percentage of patients who had an instrumental assessment of their swallow completed during hospital admission in 2021. Seven percent (n=113) of patients had a videofluoroscopy examination, and 4% (n=60) had a FEES performed.

These findings warrant closer attention, especially as instrumental assessment was considered indicated (but was not available) in only 2% of cases. Even accounting for caution carrying out instrumental dysphagia assessments during the COVID-19 pandemic due to its identification as an aerosol-generating procedure (Schindler *et al*., 2021), these figures appear low.

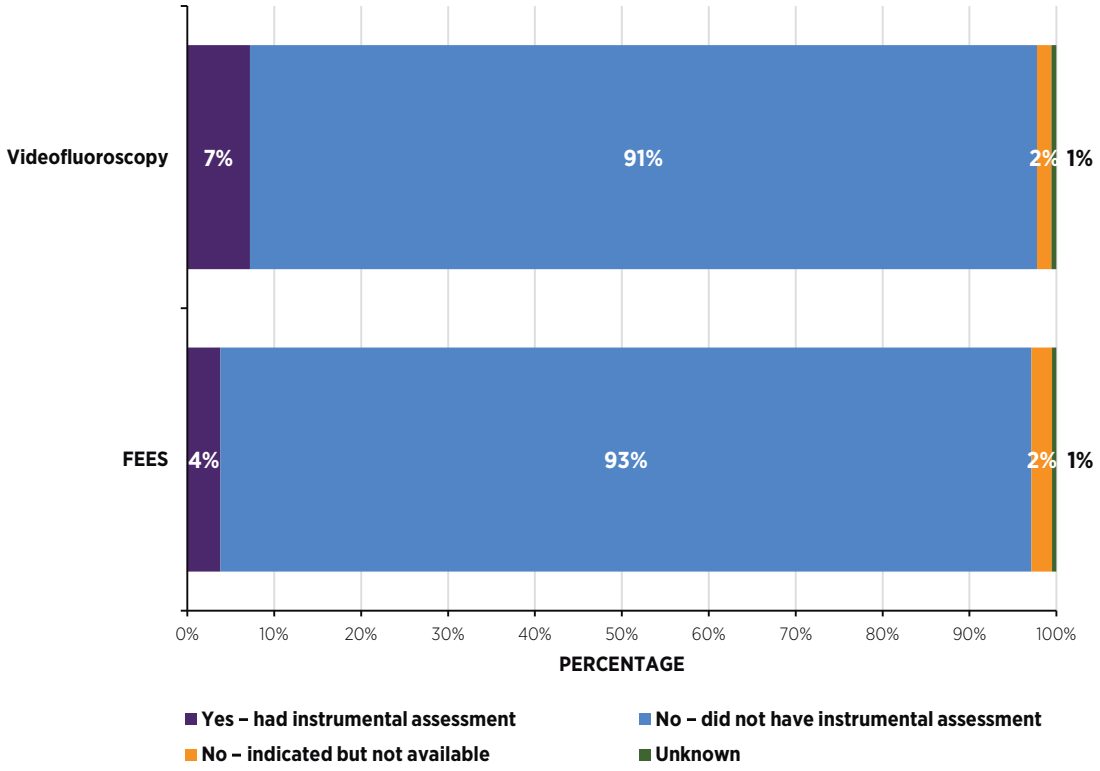


FIGURE 7.10: SPEECH AND LANGUAGE THERAPY SWALLOW INVESTIGATIONS (n=1571)

SPEECH AND LANGUAGE THERAPY: PRE- AND POST-STROKE MODIFIED FLUIDS AND TEXTURE-MODIFIED DIET

Data completeness

The completeness of variables used to measure modified fluids and texture-modified diet on admission and discharge is presented in Table 7.11.

TABLE 7.11: DATA COMPLETENESS OF PRE- AND POST-STROKE MODIFIED FLUIDS AND TEXTURE-MODIFIED DIET VARIABLES, 2021

Pre-stroke texture-modified diet	99%
Post stroke texture-modified diet	99%
Proportion of data used for the analysis	98%
Pre-stroke modified fluids	99%
Post stroke modified fluids	99%
Proportion of data used for the analysis	98%

Findings

Prior to admission, only 2% (n=29) of patients with a stroke who were assessed by an SLT had been recommended modified fluids and 6% (n=89) had been on a recommended texture-modified diet. Post-stroke, 24% (n=365) of patients who were assessed by an SLT had a texture-modified diet recommended to them and 15% (n=235) were recommended modified fluids on discharge from acute services (Figure 7.11). Five percent (n=74) of patients with a stroke required enteral feeding on discharge from acute services.

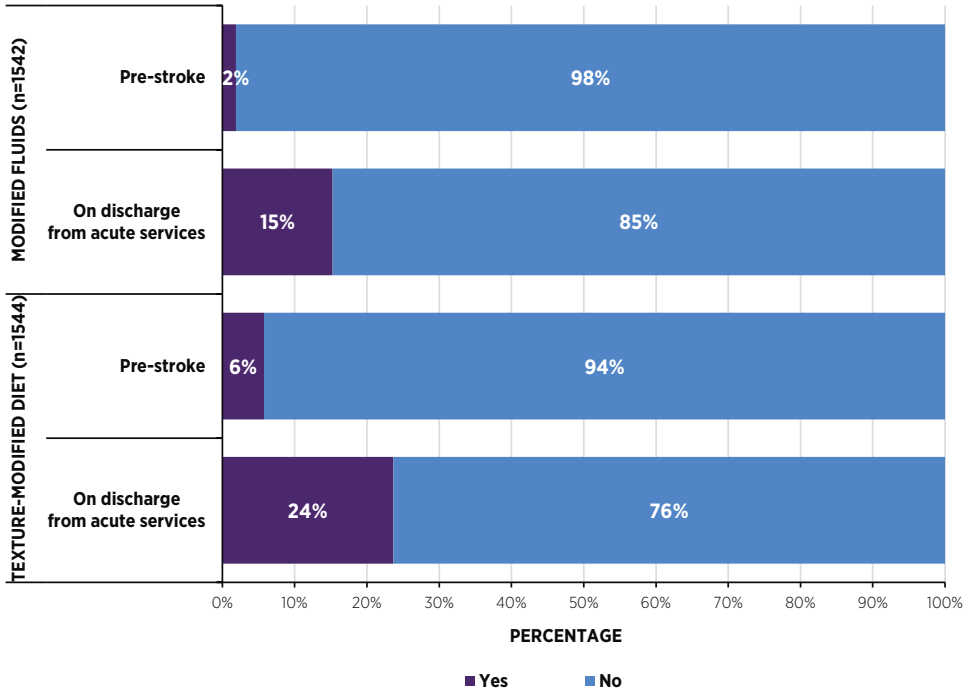


FIGURE 7.11: PRE- AND POST-STROKE MODIFIED FLUIDS AND TEXTURE-MODIFIED DIET

KEY FINDINGS FROM CHAPTER 7

•	In 2021, 19 hospitals had additional data recorded for patients who were seen by a health and social care professional (HSCP); this was an increase from 15 hospitals in 2020. There was also an increase in the number of cases recorded by each discipline in 2021 compared with 2020; cases with physiotherapy data recorded increased from 1,828 to 2,039, cases with occupational therapy data recorded increased from 917 to 1,344, and cases with speech and language therapy data recorded increased from 1,239 to 1,571 (NOCA, 2022a). This in line with recommendation 2 from the *Irish National Audit of Stroke National Report 2020*.
•	In 2021, PTs reported that 51% (n=1046) of patients with a stroke received sufficient therapy. OTs reported that 38% (n=512) of patients with a stroke received sufficient therapy, and SLTs reported that 46% (n=720) of patients with a stroke received sufficient therapy (Figure 7.3). In line with findings in the *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b), there are significant deficits in HSCP staffing across acute stroke units, impacting on the optimal delivery of care.
•	The low rates of instrumental assessment of swallow – 7% for videofluoroscopy and 4% for FEES – warrant closer attention by SLTs, especially as instrumental assessment was considered indicated (but was not available) in only 2% of cases (Figure 7.10).

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

2021 has again seen an increase in participation in the HSCP dataset. Increased engagement with the professional bodies and dissemination of the findings from this report aim to maximise participation so that reporting by hospital and against standards will be possible in the near future.

CHAPTER 8
QUALITY IMPROVEMENT

CHAPTER 8: **QUALITY IMPROVEMENT**

The INAS is more than just a clinical audit. It is a powerful and important resource that can be used to support improvement work, assurance work and research that enhances the care of patients with a stroke. This chapter presents information on four quality improvement (QI) initiatives:

- the implementation of the INAS dashboard in NOCA
- the Stroke HIPE data reconciliation project in University Hospital Limerick
- the development of a patient information booklet in Bantry General Hospital
- the Door to Decision in Under 30! QI project.

INAS DASHBOARD

A dashboard is a visual display of performance intended to provide information on KQIs at a glance. In 2021, the INAS Governance Committee approved seven KQIs, enabling the NOCA Data Analytics and Research team to build the INAS dashboard (Figure 8.1). The INAS dashboard is an interactive web-based tool that allows each hospital to monitor its performance, identify trends and create reports based on INAS data from 2016 onwards. The INAS dashboard is updated quarterly and is available to stroke teams 3 months in arrears.

FIGURE 8.1: IRISH NATIONAL AUDIT OF STROKE DASHBOARD, 2021

Each INAS KQI is also presented in a run chart within the dashboard. Run charts are graphs presenting data over time and are tools for assessing the effectiveness of change. They also help depict how well (or poorly) a process or outcome is performing. The national mean in the chart is based on the national average of the KQI in the previous closed year. Figure 8.2 displays the run chart for KQI 1.

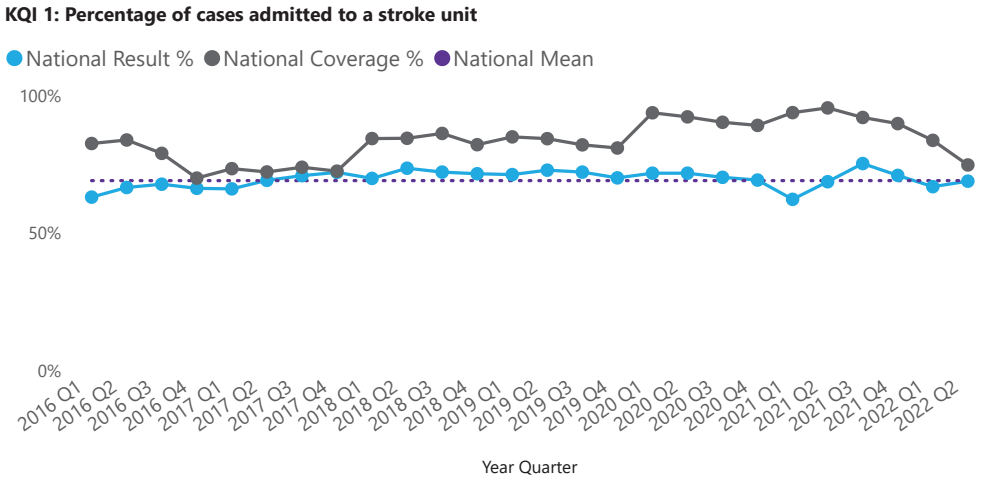


FIGURE 8.2: RUN CHART FOR KEY QUALITY INDICATOR 1 (PERCENTAGE OF CASES ADMITTED TO A STROKE UNIT)

STROKE HIPE DATA RECONCILIATION PROJECT IN UNIVERSITY HOSPITAL LIMERICK

In 2018, the stroke team in University Hospital Limerick (UHL) identified a discordance between the number of patients with a stroke who were treated by the stroke team and the number entered in HIPE. This led to inadequate representation of stroke admissions to UHL, negative reputational consequences by not being included in national reporting on stroke, and reduced funding for stroke service provision.

Shiji Paulose, a Clinical Nurse Specialist in Stroke at UHL, led out on a project that aimed to improve accuracy and clarity in the data collection; to understand the Australian coding standards and rules around HIPE coding of strokes; to improve data entry in HIPE; to improve the standard of stroke care in UHL; and to ensure the data were an accurate representation of the volume of work completed by the stroke service in UHL.

Shiji and the data analyst in UHL compared 2018 HIPE data with stroke audit portal data collected, and identified some areas for improvement in the coding of stroke cases. Collaborative engagement with the HIPE manager and the stroke team resulted in a reconciliation of the stroke data and changes in the training of staff and coding of stroke cases.

UHL is now included in national stroke reporting through the INAS, the correct funding for stroke services is provided, and regular quality control meetings are held with key stakeholders.

Shiji, on behalf of the project team in UHL, was awarded a Highly Commended certificate for the NOCA Quality Improvement Champion Award 2022 (Figure 8.3).

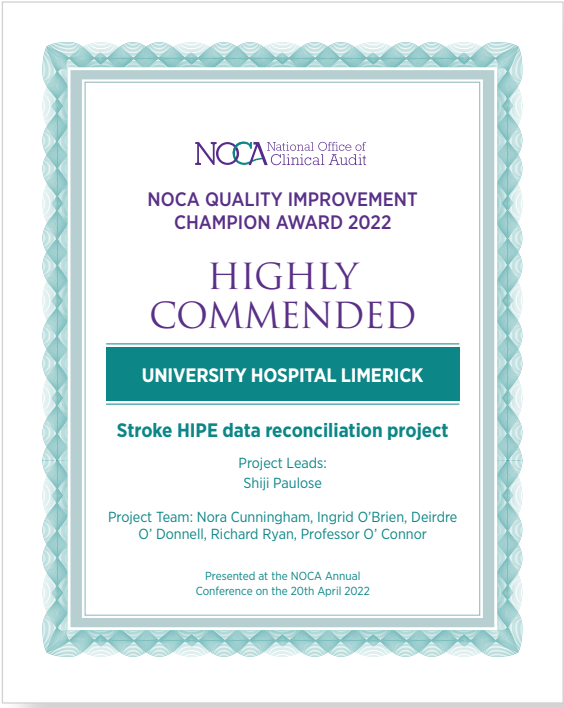


FIGURE 8.3: NATIONAL OFFICE OF CLINICAL AUDIT HIGHLY COMMENDED AWARD

PATIENT INFORMATION BOOKLET IN BANTRY GENERAL HOSPITAL

Noreen Lynch is a Clinical Nurse Specialist in Stroke in Bantry General Hospital. Noreen provides care to patients with a stroke both in hospital and after they have been discharged. She works closely with the West Cork Stroke Support Group and, over a 5-year period, she recorded the frequently asked questions of stroke survivors and their families. In collaboration with the multidisciplinary team in Bantry General Hospital, Noreen produced a booklet (Figure 8.5) to support patients with a stroke and their families through the journey to recovery (Appendix 10).

Noreen (centre) is pictured with Kathy Day, Clinical Nurse Manager (left) and Katie O'Sullivan, Occupational Therapist (right) (Figure 8.4).

The booklet provides information on:

- the hospital
- stroke and the effects of stroke
- tests and investigations
- the role of the multidisciplinary team, rehabilitation, and goal setting
- useful contacts, websites and apps
- frequently asked questions.

This QI initiative was launched by the West Cork Stroke Support Group and is used in the acute stroke unit in Bantry General Hospital to support patients with a stroke on their journey to recovery.

FIGURE 8.4: MULTIDISCIPLINARY TEAM, BANTRY GENERAL HOSPITAL

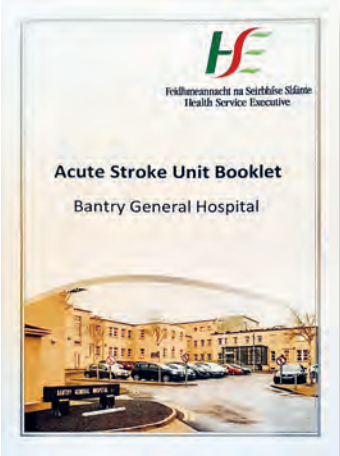


FIGURE 8.5: ACUTE STROKE UNIT BOOKLET, BANTRY GENERAL HOSPITAL

DOOR TO DECISION IN UNDER 30! QI PROJECT

In 2018, the Door to Decision in 30! national QI project commenced, led by Professor John Thornton and the National Thrombectomy Service (NTS) in Beaumont Hospital. In 2020, the NTS won an Irish Healthcare award for Excellence in Healthcare Management. This project has been central to some key improvements in the pathway of stroke care in hospitals in Ireland. In 2021, 20 hospitals participated in the project, and improvements continue to be made despite some significant challenges to the healthcare system in 2021. Figure 8.6 outlines the key results for 2021, and further detail is available in the *National Thrombectomy Service Annual Report 2021* (NTS, 2022).

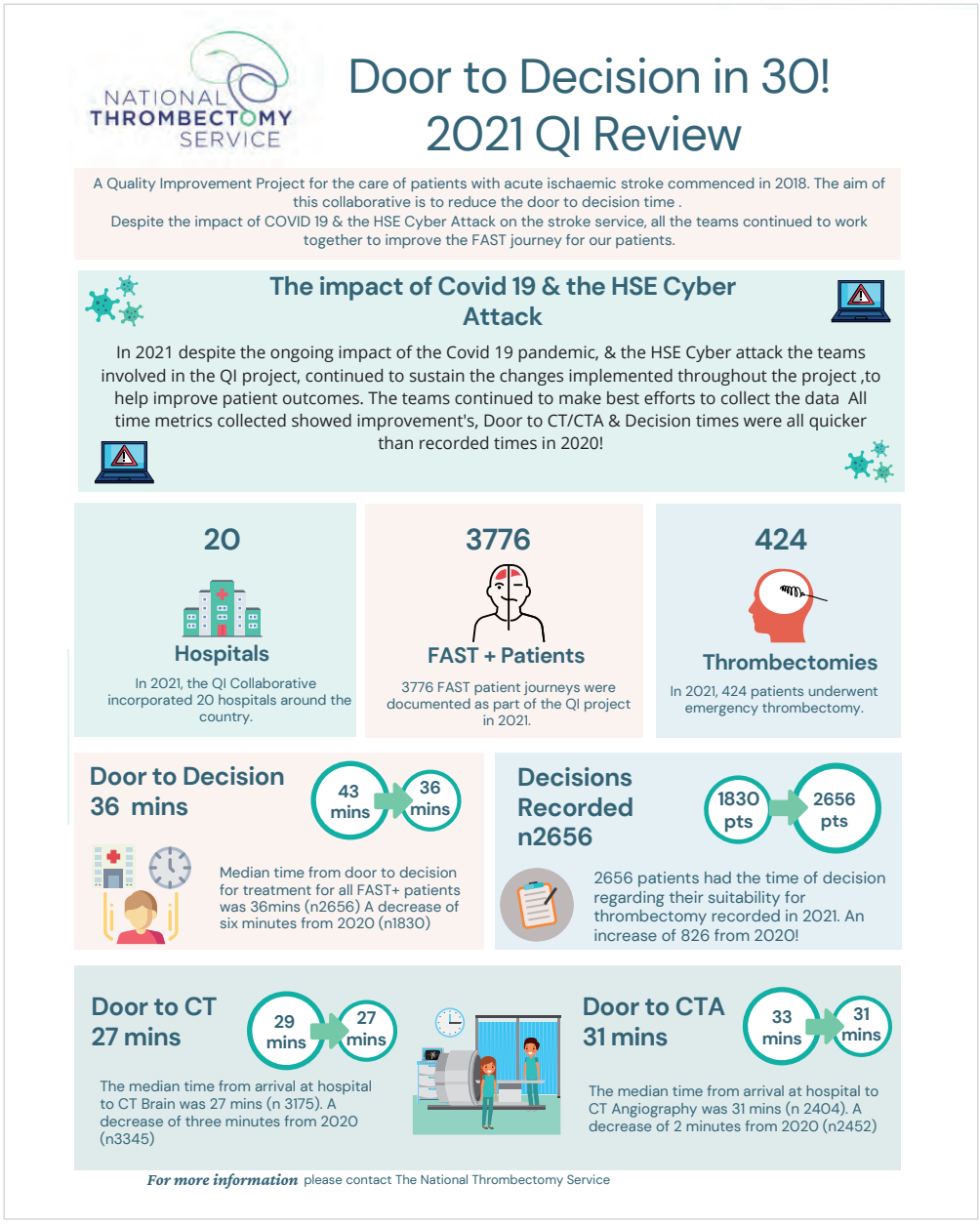


FIGURE 8.6: DOOR TO DECISION IN 30! KEY RESULTS FOR 2021

CHAPTER 9
AUDIT UPDATE

CHAPTER 9: **AUDIT UPDATE**

Table 9.1 displays an update on recommendation from the INAS National Report 2020 (NOCA, 2022a)

UPDATE ON AUDIT RECOMMENDATIONS FROM 2020

RECOMMENDATIONS FOR NOCA	
RECOMMENDATION	**STATUS**
Complete a study in order to explore the factors contributing to stroke in patients prescribed anticoagulation therapy.	**Action on this recommendation is in progress. An additional six questions related to treatment of atrial fibrillation prior to stroke were added to the INAS dataset in November 2021. Information and training was offered to all stroke teams to support the collection of accurate data from 1 January 2022 to 31 December 2022. Results will be published in the INAS National Report 2023.**
Increase the participation of HSCPs in the HSCP dataset within the INAS.	**Action on this recommendation is in progress. The INAS has been liaising with the National Health and Social Care Professions Office to establish a HSCP advisory group to support the HSCP representative on the INAS Governance Committee. As of 2022, there is an OT and an SLT representing each of their professional bodies to support the INAS HSCP representative. These representatives will champion the implementation of the HSCP dataset in all hospitals participating in the INAS.** **The number of hospitals submitting data to the HSCP dataset increased from 15 in 2020 to 19 2021, and the total number of cases submitted increased from 2,609 in 2020 to 3,092 in 2021.**
RECOMMENDATIONS FOR THE NATIONAL STROKE PROGRAMME	
RECOMMENDATION	**STATUS**
Develop a stroke awareness campaign.	**Action on this recommendation is in progress. In 2021, the Irish Heart Foundation (IHF) delivered its Act F.A.S.T. (face, arm, speech, time) campaign, with the support of the Department of Health, the Health Service Executive (HSE) and its National Stroke Programme (NSP) on radio and social media (https://www.youtube.com/watch?v=WckB15sJ9r4). The campaign was jointly funded by the Government of Ireland and the IHF. The NSP is working with the HSE Communications Division and the IHF to plan for ongoing campaigns, and has submitted costing details to the 2023 HSE estimates process to run another campaign.**

Pilot a large vessel occlusion ambulance bypass for patients with a large vessel occlusion to the endovascular thrombectomy (EVT) stroke centres in Dublin and Cork.	**Action on this recommendation is in progress. The NSP has had discussions with Beaumont Hospital and the Royal College of Surgeons in Ireland (RCSI) Hospital Group. The Chief Executive Officer of Beaumont Hospital has suggested that any pilot involving bypass to Beaumont Hospital occur initially on a small scale and within the RCSI Hospital Group to better 'road test' and understand the procedures and impact of any larger-scale reconfiguration. No pilot has been agreed or planned as of the writing of this report in October 2022.**
Improve the level of swallow screening for patients with a stroke.	**Action on this recommendation is in progress. The development of a national QI project on swallow screening is a priority for the NSP. The NSP SLT Lead and Nurse Lead will assist in the roll-out of the project with the support of a QI lead in the Royal College of Physicians of Ireland.**
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.	**Action on this recommendation is in progress. The Irish National Audit of Stroke Organisational Audit Report 2021 (NOCA, 2022b) found that only five hospitals have access to a clinical psychologist as part of stroke unit care. The NSP has prioritised the funding of five clinical psychology posts for 2023 with a view to further developing services over the next 5 years, and has submitted costing details to the 2023 HSE estimates process.**

TABLE 9.1: UPDATE OF RECOMMENDATIONS FROM THE INAS NATIONAL REPORT 2020

VALUE OF AUDIT

This 2013–2021 national trend report shows the commitment of stroke services to a culture of QI since the establishment of the National Stroke Register in 2011.

It has taken many years to embed the capture of high-quality data into practice, and this report shows the annual increase in case submissions (Figure 3.1) to the stroke audit portal, together with the improvement in data quality (Appendix 9) over the reporting period. Increasing visibility of the quality of stroke care in hospitals in Ireland through the publication of the INAS annual reports (NOCA, 2022a, 2020) has led to increased participation and improved data quality.

In February 2022, NOCA launched the *Irish National Audit of Stroke National Report 2020* (NOCA, 2022a) virtually, and the event was attended by more than 240 participants. In March 2022, the *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) was published, the results of which allow us to link the organisation of stroke services in each hospital with the results in the clinical audit.

The data inform the national stroke KPIs, which in turn inform the HSE *National Service Plan 2022* (HSE, 2022). In addition, the national KPIs are included in the NOCA reports that are sent to Hospital Group managers quarterly. The implementation of the INAS dashboard (Figure 8.1) of seven KQIs has allowed hospital stroke teams and hospital management access to timely data with the aim of driving QI locally.

The recommendations within the INAS and the follow-up on previous recommendations will, if implemented, lead to improved outcomes for patients by increasing stroke awareness in the population; improve the timeliness of emergency treatments; and provide information to support the roll-out of QI initiatives, such as the forthcoming swallow screening QI programme.

AUDIT ACTIVITY

In 2021, virtual audit coordinator meetings were held every 2 months in order to support the audit coordinators with data collection, training, and identification of areas for improvement. In 2021, the HSE ransomware attack effected the ability of HIPE staff and stroke teams to input data, and workarounds were identified locally in order to ensure that data were submitted for 2021.

Data validation processes have been finalised and will be reviewed continuously as the INAS dataset evolves. The Data Validation Report (DVR) and coverage report are routinely sent to each audit coordinator 1 month in advance of the execution of the INAS dashboard in order to ensure that all validations are incorporated into the dashboard.

Following engagement with the NTS, an additional variable was added to the thrombectomy dataset to incorporate the date and time a patient left the referring/first hospital for transfer to an EVT stroke centre. This ensures that the INAS is fully aligned with the NTS data.

PUBLICATIONS

Recent publications and published abstracts (Table 9.2) from the INAS include:

Kennedy, C., Gabr, A., McCormack, J., Collins, R., Barry, M. and Harbison, J. (2022) The association between increasing oral anticoagulant prescribing and atrial fibrillation related stroke in Ireland. *British Journal of Clinical Pharmacology*, 88(1), pp. 178-186. Available from: https://doi.org/10.1111/bcp.14938 [Accessed 18 August 2022].

PUBLISHED/ACCEPTED ABSTRACT	TITLE	AUTHOR(S)
European Stroke Organisation Conference May 2022	Exploring variations in proportional admission of primary intracerebral haemorrhage	J. Harbison J. McCormack R. Collins T. Cassidy
	Patient and process outcomes for acute stroke in Ireland: In-hours versus Out-of-hours	E. Loughlin A. Gabr E. marks J. McCormack J. Harbison J. Thornton R. Galvin M. O'Connor
	Evolution of stroke services in Ireland: a fifteen year review	J. Harbison J. McCormack R. Collins T. Cassidy
	Potential for, and obstacles to, ESO stroke unit accreditation: a national study	J. Harbison J. McCormack R. Collins T. Cassidy

TABLE 9.2: PUBLISHED ABSTRACTS

AUDIT DEVELOPMENT PLAN

In 2021, the INAS Governance Committee agreed that there would be limited access to data for research and service evaluation projects until there was a review of the quality of historical data. Now that the quality of data from 2013 to 2021 has been verified, data will be made accessible through the NOCA data access procedure.

The INAS is committed to ongoing data quality initiatives to ensure that the data collected are relevant and agile. A spotlight audit on atrial fibrillation commenced in November 2021 and is due to be completed in December 2022, and, as described in Recommendation 2, another spotlight audit on thrombolysis will be developed for 2023.

The INAS is currently engaged in a Health Research Board Applied Partnership Award project, led by Professor Anne Hickey, aiming to identify the core minimum datasets for acute and non-acute stroke care, and patient-reported outcome measures, in addition to identifying resourcing needs and implementation procedures for national clinical audit. The results of this research and other locally agreed items will inform a revision of the current INAS dataset.

CHAPTER 10
RECOMMENDATIONS

CHAPTER 10: **RECOMMENDATIONS**

RECOMMENDATION 1

The number of stroke unit beds should be increased so that at least 90% of patients with a stroke are cared for in a stroke unit.

Rationale

- Stroke unit care is a form of care provided in hospital by nurses, doctors and therapists who specialise in looking after people with a stroke (Langhorne *et al.*, 2020). People with a stroke should be treated in a stroke unit throughout their hospital stay unless stroke is not the predominant clinical problem (Royal College of Physicians, 2016; HSE, 2012; IHF, 2010), and this is a national KPI reported annually in the HSE National Service Plan. During the 9-year reporting period covered by this report, there was a gradual increase in the number of patients with a stroke who were admitted to a stroke unit, from 65% in 2013 to 70% in 2021; however, there has been a consistent failure to meet the target of 90% of patients with a stroke being admitted to a stroke unit (Figure 5.1). There was also an increase in the proportion of hospital stay spent in a stroke unit bed, from 57% (20,802 bed days) in 2013 to 68% (40,926 bed days) in 2021, but this also remains far off the 90% target. The HSE *Stroke Model of Care* (HSE, 2012) states that stroke unit care must be underpinned by a comprehensive specialist multidisciplinary team including speech and language therapy, physiotherapy, occupational therapy, clinical nutrition, social work and clinical psychology. In 2021, 88% of stroke units operated below the recommended nurse staffing level, and there were wide gaps in HSCP staffing levels from the internationally recommended numbers of staff needed (NOCA, 2022b). The impact of this is shown in the HSCP dataset results for 2021, when PTs reported that only 51% (n=1046) of patients with a stroke received sufficient therapy; this figure was 38% (n=512) for OTs and 46% (n=720) for SLTs (Figure 7.3).

Evidence that the action will be effective

- A Cochrane Review carried out by Langhorne *et al.* (2020) found that patients with a stroke who receive stroke unit care are more likely to be alive, living at home, and independent in looking after themselves 1 year after their stroke. The apparent benefits were independent of patient age, sex, initial stroke severity, or stroke type, and were most obvious in units based in a discrete stroke ward. Throughout the 9-year reporting period covered in this report, admission to a stroke unit increased the likelihood of a patient having a mood and swallow screen completed (Table 5.6), indicating that specialised stroke care is provided to patients with a stroke who are admitted to a stroke unit. The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) reported that the total number of designated stroke unit beds at the time the audit was carried out was 239; however, the total number of patients with a stroke in hospital at that time was 342, indicating that only 70% of patients with a stroke had access to a stroke unit bed. Increasing the number of stroke unit beds would ensure that hospitals could meet the target of 90% of patients with a stroke being admitted to a stroke unit.

Who will benefit from the recommendation?		
• All patients with a stroke and their families/carers will benefit from accessing stroke unit care. Clinical teams will benefit from working in an environment where excellence in stroke care is prioritised, and healthcare providers will be assured that the right care is given to the right patient at the right time.		
What actions should be taken?	**Who is responsible for implementation?**	**When should this be implemented?**
• Hospital beds should be reorganised in order to ensure that there is enough capacity for all patients with a stroke to be admitted to, and spend the majority of their hospital stay in, a stroke unit.	Hospital management	Immediately
• All hospitals should have an acute stroke pathway incorporating clinical, radiological and bed management processes.	Hospital management, in collaboration with the Clinical Lead and stroke governance committee in each hospital	Immediately
• Stroke teams should be resourced to the recommended staffing levels, and this should be driven by the implementation of the *National Stroke Strategy 2022–2027* (NSP, 2022).	NSP	Should be aligned to the timelines within the *National Stroke Strategy 2022–2027*.

RECOMMENDATION 2

Increase the thrombolysis rates in all hospitals providing acute stroke care.

Rationale

- Treatment with thrombolysis for eligible patients with a stroke has been a standard of care since 1996, and is a national KQI for stroke care (HSE, 2012). Thrombolysis rates decreased from 12% in 2015 to 10% in 2021 (Figure 4.8) and ranged from 0% to 25% between hospitals throughout the 9-year reporting period of this report. This report has indicated a decreasing trend in the proportion of patients with a stroke accessing stroke care within 3 hours of symptom onset, from 59% (n=591) in 2013 to 46% (n=1429) in 2021 (Figure 4.5), limiting access to treatment with thrombolysis. The proportion of patients with ischaemic stroke who arrived at a hospital within the recommended time window for thrombolysis and who received it has also decreased, from 34% (n=205) in 2013 to 24% (n=334) in 2021. A recommendation from the *Irish National Audit of Stroke National Report 2020* (NOCA, 2022a) to develop an ongoing stroke awareness campaign aimed at informing the public of the necessity of accessing stroke care as an emergency should increase the proportion of patients eligible for thrombolysis. However, the reasons as to why patients who access hospital in a timely fashion do not receive thrombolysis are not known.

  The European Stroke Organisation (ESO) guidelines on intravenous thrombolysis for acute ischaemic stroke have recommended that advanced brain imaging (magnetic resonance or computed tomography perfusion (CTP)) be used to select patients for treatment with thrombolysis if they present between 4.5 and 9.0 hours after the start of symptoms, or if a stroke is noticed upon waking from sleep (Berge *et al*., 2021). The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that all participating hospitals had access to computed tomography (CT) and computed tomography angiography (CTA), but only six hospitals had access to CTP. All hospitals had access to MRI but only one hospital had access to MRI outside of normal working hours. Increasing access to advanced imaging may also increase thrombolysis rates for patients who arrive at hospital between 4.5 hours and 9.0 hours after the onset of stroke symptoms, thus leading to better patient outcomes following stroke.

Evidence that the action will be effective

- Xian *et al*. (2022) and the learnings from the NTS Door to Decision in Under 30! QI project show that QI projects looking at the acute stroke care pathway are associated with substantial improvement in the timeliness of thrombolysis treatment, increased rates of thrombolysis treatment, and improved clinical outcomes.

Who will benefit from the recommendation?		
• Patients with a stroke would benefit by having an increased opportunity to access emergency treatments for stroke.		
What actions should be taken?	**Who is responsible for implementation?**	**When should this be implemented?**
• All hospitals should have an acute stroke pathway incorporating clinical, radiological and bed management processes in order to ensure a more efficient and timely response to patients with acute stroke.	Hospital management and stroke governance committees are responsible for the implementation of acute stroke care pathways.	Immediately
• All hospitals providing acute stroke services should have access to advanced brain imaging, MRI and CTP 24 hours a day, 7 days a week.	Hospital management should review the availability of advanced imaging for stroke teams within their hospital.	Immediately
• The INAS should conduct a spotlight audit on thrombolysis in order to understand the reasons for low thrombolysis rates.	NOCA will be responsible for the implementation of a spotlight audit on thrombolysis.	2023

RECOMMENDATION 3

All hospitals providing acute stroke care should have an active stroke governance committee.

Rationale

- The process of clinical governance should be embedded within all healthcare organisations. Stroke services should develop a culture of continuous QI, and attention to good governance is mandatory (Royal College of Physicians, 2016). The *Irish National Audit of Stroke Organisational Audit Report 2021* (NOCA, 2022b) found that 83% (n=20) of participating hospitals have a stroke governance committee; however, only 65% (n=13) report that they use local INAS data to inform the meeting agenda. The INAS dashboard was implemented in 2021 (Figure 8.1). This is an interactive web-based tool that allows each hospital to monitor its performance, identify trends and create reports based on INAS data from 2016 onwards. The INAS dashboard is updated quarterly and is available to stroke teams 3 months in arrears.

Evidence that the action will be effective

- In addition to the INAS national reports, the INAS dashboard provides run charts that can show weekly, monthly and quarterly results. With the support of an active stroke governance committee that is committed to using the INAS data to identify areas for improvement and to develop QI initiatives, there should be a reduction in the variation of performance across all hospital sites.

Who will benefit from the recommendation?

- Patients will increasingly access timely and high-quality stroke care and be assured that stroke teams and hospital management are seeking and responding to information regarding service quality and safety.

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• Each hospital should ensure that it has an active stroke governance committee, comprising clinical, management and quality improvement leads, which meets at least quarterly. The stroke governance committee should use the INAS dashboard and INAS national reports to monitor performance locally and to develop and implement QI plans within the stroke service.	Hospital management	Immediately

RECOMMENDATION 4

Increase the number of early supported discharge teams.

Rationale
• Early Supported Discharge (ESD) allows patients with a stroke to be discharged early from hospital and continue rehabilitation in their own homes under the care of specialist therapists in the community. Between 2017 and 2021, there was an increase in the proportion of patients with a stroke who were discharged home with ESD, from 2% (n=61) in 2017 to 10% (n=530) in 2021 (Figure 6.8). While this is an improvement, it is still far below the 46% reported in the UK (Sentinel Stroke National Audit Programme, 2021). Langhorne *et al.* (2017) found that there was a 5-day reduction in the length of stay for patients with a stroke who were discharged home with ESD. In 2021, this equated to approximately 2,650 bed days saved. If an additional 36% (n=1886) of patients with a stroke had been discharged home with ESD, another 9,430 bed days could have been saved.
Evidence that the action will be effective
• Patients with a stroke who are discharged home with ESD are more likely to be living at home and independent in carrying out activities of daily living 6 months after their stroke compared with patients who receive usual care (Langhorne *et al.*, 2017).
Who will benefit from the recommendation?
• Patients with a stroke will benefit from better outcomes. ESD teams will be able to provide high-quality, patient-centred rehabilitation based on the principles of Sláintecare. Hospitals will benefit through the availability of saved bed days. Community services will benefit from fewer referrals to their service.

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• Each stroke service should evaluate the ESD requirements for its patients, and hospital management should allocate resources to establish an ESD team.	Hospital management, in collaboration with stroke teams	Immediately
• The number of ESD teams should be increased according to the implementation plan documented in the *National Stroke Strategy 2022–2027* (NSP, 2022).	NSP	Should be aligned to the timelines within the *National Stroke Strategy 2022–2027*.

RECOMMENDATION 5

Expand the use of the individual health identifier in order to increase follow-up for patients on discharge or transfer to another hospital.

Rationale
• The individual health identifier (IHI) is used to uniquely identify each person engaging with the HSE and relevant social care agencies. The benefits of the IHI are that it can be linked to all health records and will allow health records to be found across different patient systems. This is important within stroke services, as it will allow each patient's journey of care to be mapped accurately from initial call for help, through the acute hospital phase of care and into rehabilitation and community services. This report found that there was a gradual increase in the proportion of patients with a stroke who were transferred from one acute hospital to another, from 2% (n=50) in 2013 to 8% (n=428) in 2021 (Figure 4.4). This was possibly due to the increased occurrence of interhospital transfers for thrombectomy since 2016 (Figure 4.11). Tracking the patient journey for these patients can be difficult due to the lack of an IHI, and there may therefore be some duplication or loss of information for this cohort of patients. In addition, the INAS only collects information up to the point of discharge from hospital, and follow-up information is not available. Access to the IHI could increase the ability of the INAS to capture follow-up data in order to measure the effectiveness of the treatments or new processes of care provided to patients with a stroke.
Evidence that the action will be effective
• Initially, the INAS will have the ability to report on the full journey of care for each patient, particularly those who are transferred from one hospital to another. Longer-term outcomes such as 30-day, 6-month and 1-year mortality could also be measured and reported on.
Who will benefit from the recommendation?
• The ability to record the full patient journey and follow-up data for all patients will benefit clinical audit reporting in the INAS, thus assuring the healthcare system that there is a culture of continuous QI within the INAS and within all stroke services.

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• The IHI should be attached to health records across different patient systems.	eHealth Ireland	Aligned with eHealth Ireland implementation timeline.
• NOCA should engage with the Healthcare Pricing Office (HPO) to assess how access to the IHI as part of the HIPE case/stroke audit portal could assist in tracking patients with stroke as they access care in different hospitals.	NOCA, in collaboration with the HPO	2023

RECOMMENDATION 6

Develop a best practice tariff for acute stroke care.

Rationale
• Acute stroke care in Ireland is provided based on evidence-based clinical guidance from Ireland (IHF, 2015 2010), the UK (Royal College of Physicians, 2016) and the ESO (Ringelstein *et al*., 2013). However, there is evidence of variation in the quality of care received by patients with a stroke throughout this report. A Best Practice Tariff (BPT) is a nationally agreed amount paid to hospitals and is designed to incentivise high-quality care, with the aim of reducing unexplained variation in clinical quality, and to encourage best practice. This is aligned to the *ABF Programme Implementation Plan 2021-23* (HSE, 2021) supporting the development of additional BPTs within the healthcare system.
Evidence that the action will be effective
• Dedicated QI initiatives within healthcare systems are of clear benefit, and incentivising QI activities can lead to improvement in QI processes and outcomes (Moloo *et al*., 2022). Metcalfe *et al*. (2019) reported improved outcomes after hip fracture in England compared with Scotland, where there is no BPT in operation. The Irish Hip Fracture Database introduced a BPT in 2018 and has found that it has had a positive impact on the healthcare system as steady improvements in the proportion of patients receiving the best practice standards of care have been seen year on year (Ferris *et al*., 2022).
Who will benefit from the recommendation?
• Patients with a stroke will benefit from improved quality of care, leading to better outcomes. Clinical teams will benefit from having access to a financial reward, allowing them to fund additional QI initiatives and stroke-specific equipment and resources that would otherwise not be prioritised when funding is managed at senior hospital management level.

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• NOCA and the NSP should engage with the HPO to develop a BPT for stroke.	The INAS, in collaboration with the NSP, the HPO and HSE Acute Operations	Aligned to the timeline of the Activity Based Funding (ABF) Implementation Plan
• The INAS should engage with the NSP to identify and agree the KQIs to be achieved in order to receive a BPT.	The INAS, in collaboration with the NSP	2023–2024
• The INAS should report on the impact of a BPT quarterly as part of the INAS dashboard and in annual reporting.	The INAS, in collaboration with the NOCA Data Analytics and Research team	Aligned to the development of a BPT for stroke

CHAPTER 11
CONCLUSION

CHAPTER 11: **CONCLUSION**

When the Irish National Stroke Register was incorporated into NOCA as the INAS, it was always our intention to subject the historical data to analysis in the same way as our current audit. This evaluation enables us to see trends and changes in stroke management and outcomes, and also allows us to determine the quality of data collected historically.

The most striking change has been the huge increase in the quantity of patient data collected. With data on 5,239 stroke cases collected in 2021, this nearly doubles the number of cases included in 2013, our first full year of operation (n=2790). The great increase in the number of patients for whom data are collected means that we have generally expressed data as proportions for comparability purposes. Small differences in proportions between groups, such as age, may reflect this or other factors in some centres, such as the evolution of the definition of stroke used in some centres (NOCA, 2022b).

There appears to have been an increase in the proportion of men and younger people being identified as having had a stroke, especially since 2018. This reflects international experience (Scott *et al*., 2022) and is of some concern; however, part of the effect may be due to the increased effectiveness of stroke prevention using anticoagulation for atrial fibrillation. Between 2013 and 2021, the relative proportion of patients admitted who had atrial fibrillation decreased by 13%, and atrial fibrillation is specifically an issue that can cause severe stroke in older people. The INAS is currently performing a spotlight audit on atrial fibrillation management in stroke, the results of which should be available in 2023.

The proportion of people receiving thrombolysis for ischaemic stroke has declined over the reporting period, and we need to be concerned as to the increase in delay from stroke onset to hospital presentation. This reinforces the recommendation in the *Irish National Audit of Stroke National Report 2020* (NOCA, 2022a) regarding the importance of public education regarding the symptoms of stroke. This delay has been somewhat offset by an encouraging progressive improvement in the efficiency with which patients with a stroke are seen and treated on arrival at hospital. Increased access to thrombectomy has led to high thrombectomy rates – 9.5% in Ireland, compared with 2.0% in the UK – in 2021.

Accessing stroke unit care remains a concern, and we have never reached the 90% target agreed by the NSP; however, there has been a decrease in median hospital length of stay, from 11 to 8 days, over the 9-year reporting period. This decrease is likely due in part to the increase in the number of ESD teams across the country. In addition, in-hospital mortality for ischaemic stroke has decreased by 29%, from 10.1% in 2013 to 7.2% in 2021.

Another great improvement has been in the collection of data for our HSCP dataset, giving us a greater appreciation of patients' challenges in the period following their admission to hospital for stroke. The data show an ongoing shortage of these HSCP resources that are key to optimum outcomes for, and prompt discharges of, people with stroke. The HSCP dataset and challenges in obtaining outcome data beyond the patient's stay add increasing weight to the arguments for increased support for data collection across all national clinical audits and for the roll-out of an IHI, which would allow us to collect outcome data at 3 and 6 months post-discharge and beyond, as is recommended by European guidelines (Ringelstein *et al*., 2013).

The data items collected by the National Stroke Register and the INAS have evolved over their 9 years of operation, and the work done to produce this report will allow us to make these data available with confidence for use in research, service development and planning. We look forward to the results of the current Health Research Board-supported study, conducted by Professor Anne Hickey and colleagues, that will help us to define the optimal dataset that can be utilised in the INAS and help us build for the future.

The INAS makes recommendations in each annual report, and while some have been implemented, others have been very slow to progress. If implemented, the recommendations in this report would lead to substantial improvements in the patient journey, with significant improvements to outcomes and reductions in the overall cost of stroke care.

The INAS would not be possible without the support of the HPO and all stroke teams, in particular the clinical nurse specialists and advanced nurse practitioners in stroke who have championed QI initiatives and data management since 2011.

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