

Evaluation of an out-of-catchment ambulance hyperacute FAST+ (stroke) bypass pathway

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Abstract

Background

In March 2024, the Dublin Midland Hospital Group and National Ambulance Service introduced a Hyperacute FAST+ ambulance bypass protocol for patients who are normally in the catchment of two regional hospitals. This study aimed to describe the resource burden on the Tallaght University Hospital (TUH) emergency department (ED) and to quantify the patient journey times.

Methods

A single centre retrospective chart review was performed on all Hyperacute FAST+ patient presentations to TUH ED between March 2024 and February 2025. Journey times and distances were calculated using Google Maps.

Results

There were 62,728 attendances to TUH ED in the study period and of these 13,403 patients presented to TUH ED by ambulance. 162 (1.2%) of all ambulance attendances were patients presenting on the out of catchment Hyperacute FAST+ patients protocol. The mean age was 68 years. There were 93 males. The mean travel distance was 56.9km and the mean estimated travel time was 44.8 minutes. 91 patients (56.2%) were admitted to TUH. 16 (9.9%) patients conveyed on the pathway received thrombolysis and 9 (5.6%) received thrombectomy. The mean length of stay for admitted patients to TUH was 13.6 days.

Discussion

This Hyperacute FAST+ bypass protocol resulted in high admission rates and hospital length of stay in the regional stroke centre.

Introduction

Stroke is a leading cause of death and adult disability worldwide, with an estimated 12 million new cases and approximately seven million deaths each year, leading to over 160 million disability-adjusted life years lost.^{1,2} In Ireland, stroke remains the leading cause of acquired adult neurological disability and accounts for around 7,500 cases annually, many resulting in long-term impairment.^{3,4} Reperfusion therapies for ischaemic stroke are highly time-sensitive. Treatment with thrombolysis is considered in certain patients with ischaemic stroke in whom treatment can be started within 4.5 hours of known symptom onset or within nine hours of the midpoint of sleep when they have woken with symptoms, and where they have evidence from computed tomography perfusion.⁵ Select patients meeting fixed criteria can be considered for mechanical thrombectomy up to 24 hours after the onset.⁵

Recognition of acute ischaemic stroke in a prehospital context is beneficial because it minimises delay to definitive treatment associated with improved survival and reduced morbidity in a cost-effective way.⁶ The National Clinical Guideline for Stroke for the United Kingdom and Ireland stipulates that ambulance personnel should be trained to recognise people with symptoms indicating an acute stroke as an emergency requiring transfer to a hyperacute stroke centre with pre-alert notification to the stroke team.⁵ Use of the face, arm, speech, time (FAST) scales has been shown to achieve high levels of detection and diagnostic accuracy of stroke.^{7,8} This scale includes the most common symptoms of at least 80% of the cases constituting anterior stroke.⁹ Previous research in Ireland demonstrated that 57.1% of pre-hospital FAST+ patients arriving at Emergency Departments (ED) by ambulance received a final diagnosis of stroke.¹⁰ In 2023, 49% of ischemic stroke patients were ineligible for thrombolysis due to a delay from symptom onset to hospital arrival regardless of mode of arrival.³ The National Ambulance Service directs suspected acute stroke patients to the most appropriate facility for specialised and/or multidisciplinary approach to care recognising that this may not be available at the nearest hospital.¹¹

In March 2024, Naas General Hospital acutely became unable to provide a 24/7 Hyperacute FAST+ assessment for patients within its own catchment area and the catchment area of Midlands Regional Hospital, Portlaoise which it also covered. In response Dublin Midland Hospital Group and the National Ambulance Service configured an emergency Hyperacute FAST+ bypass protocol which involved bypass of Naas General Hospital and Midland Regional Hospital, Portlaoise. Paramedics identify potential stroke patients using the Face, Arm, Speech, Time plus (FAST +) test.¹⁰ For patients conveyed from the catchment areas of Naas General Hospital and Midland Regional Hospital, Portlaoise meeting FAST+ criteria, paramedics are directed to bring them directly to Tallaght University Hospital (TUH). TUH

Emergency Department were given funding for an extra registrar in emergency medicine post as part of the introduction of this bypass protocol.

TUH is the designated regional hyperacute FAST+ receiving hospital with an acute stroke unit. The 2024 protocol built on an earlier 'Protocol for Improving Times for Stroke patients requiring Onward transfer from Primary stroke centre to thrombectomy centre' (PITSTOP) protocol in place in TUH since 2020.¹² PITSTOP is an intervention which has been supported by the National Ambulance Service without additional funding. It involves the ambulance crew waiting with the patient on arrival at TUH until a decision is made on whether to transfer the patient to the endovascular thrombectomy (EVT) stroke centre. This means that the same ambulance crew can then transport the patient immediately to the EVT stroke centre, thus reducing the "door-in to door-out" (DIDO) time.¹² The 2024 hyperacute FAST+ protocol involved the ambulance crew waiting with out-of-catchment patients on arrival at TUH until a decision is made by the stroke team to admit the patient to TUH for hyperacute care or to repatriate to the ED of the patient's local hospital. To date there has been no published data on the impact this protocol has had on attendances to TUH ED.

This study aims to characterize the demographics and outcomes of hyperacute FAST+ adult patients from out of catchment who presented to TUH ED via ambulance under the bypass protocol. The study endeavours to inform future regional strategies to optimize stroke pathways, ensuring timely and appropriate treatment for patients nationwide.

Methods

This single centre retrospective study analysed Hyperacute FAST+ patient presentations to TUH ED via ambulance bypass. No ethical concern was identified by the joint research ethics committee of Tallaght University Hospital and St James's Hospital (Project ID: 4856). The project was classified and approved as a service evaluation by Tallaght University Hospital's Quality Safety Risk Management Department. No external funding was requested for its conduct.

The primary outcome was to document the number of Hyperacute FAST+ patient presentations to Tallaght University Hospital ED since the introduction of the Hyperacute FAST+ bypass in March 2024.

The study setting was Tallaght University Hospital ED, an adult ED which sees patients aged 16 years and older and has 62,000 attendances annually. Tallaght University Hospital is a level 4 model hospital with a mixed suburban and rural catchment area. Tallaght University

Hospital's catchment area extends across south west Dublin (predominantly in the postcodes of Dublin 12, Dublin 22, Dublin 16 and Dublin 24) and North Wicklow (Blessington area). The capacity of Tallaght University Hospital is 465 inpatient beds plus 94 beds off site.

Data for this study was sourced from the TUH ED Information System (Symphony). All ambulance attendances between the designated study period of 1st March 2024 and 28th February 2025 were analysed. Inclusion criteria included those patients who attended Tallaght University Hospital ED via the Hyperacute FAST+ protocol. Patients were excluded if their ambulance response location was within the TUH catchment area.

The following patient-specific data collated included age, gender and the location points from where ambulances conveyed patients on the hyperacute FAST+ bypass protocol to Tallaght University Hospital. Process measures included mean ED patient LOS. For this project, this was defined as time from the patient's arrival to the time they left the ED (either discharged from the hospital or admitted to ward).

Outcome measures included number of patients within the study cohort who were thrombolysed in Tallaght University Hospital and the number of patients referred for mechanical thrombectomy in the neuroradiology intervention centre in Beaumont Hospital. ED discharge outcome (admission, discharge or repatriation to a regional hospital), and hospital LOS and in-hospital mortality were collated. In-hospital mortality and LOS was obtained from the Tallaght University Hospital's inpatient electronic record system Synergy. Two project team members (LP and RR) calculated pre-hospital journey times and distances using Google Maps. The location from where the paramedic crew conveyed the patient from were extracted from the ED clinical and pre-hospital records. Any queries relating to locations were queried with project team members in the National Ambulance Service who checked records from the national ambulance service's database. This facilitated clarification and increased accuracy in cases where discrepancies were identified.

Descriptive statistics, including mean and standard deviation (SD), was conducted using IBM SPSS (version 29.0.2) and Microsoft Excel.

Results

A total of 62,728 patients presented to TUH ED during the study period of March 2024 to February 2025. Of these, 13,403 presented to TUH ED by way of ambulance.

Study population

One hundred and sixty-two patients presented to Tallaght University Hospital ED by ambulance from outside the hospital's tradition catchment area via the hyperacute FAST+ protocol (Figure 1).

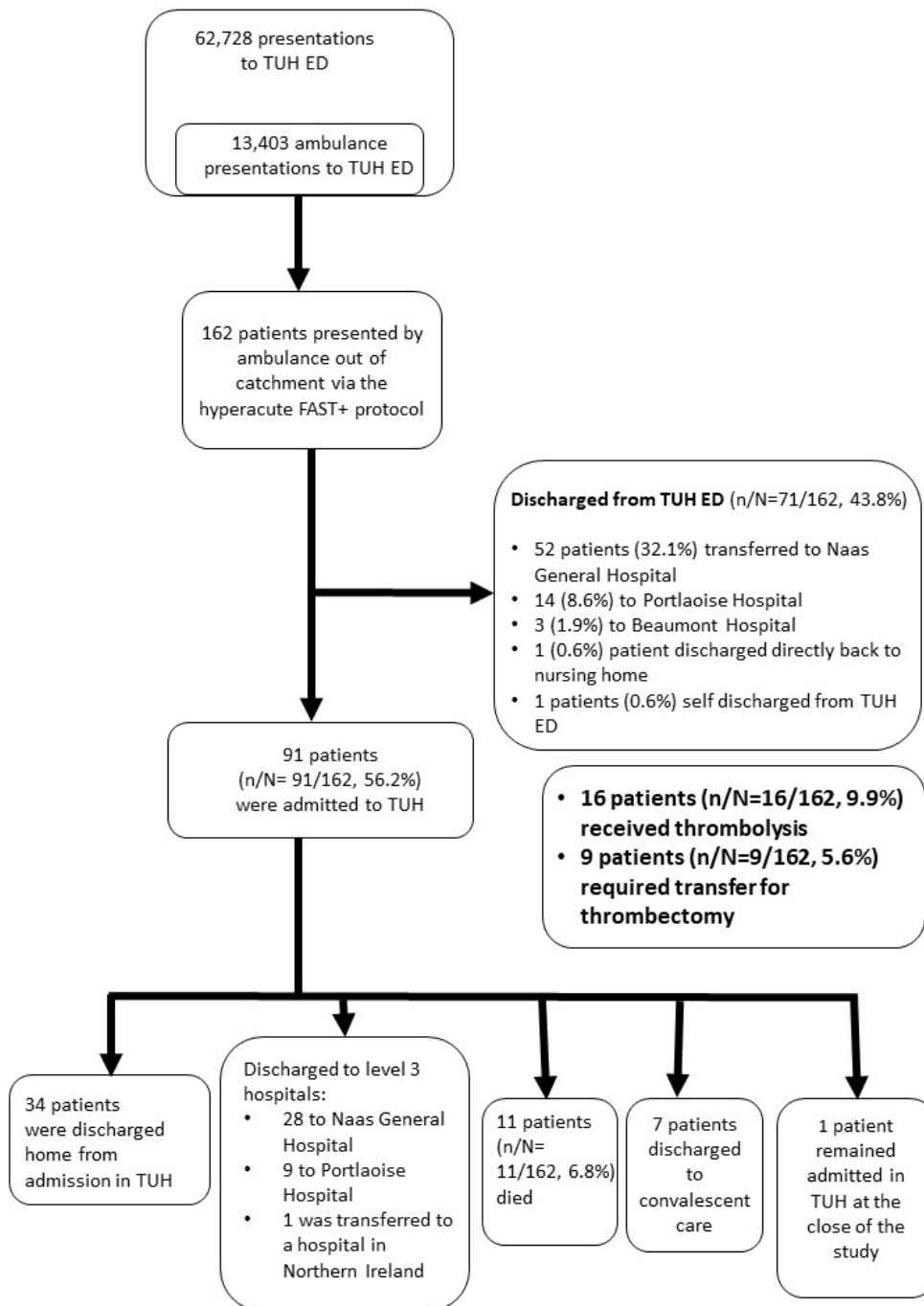


Figure 1: Study population

The mean age of patients was 68.5 years (SD 15.3 years), ranging from 32 to 99 years. Ninety-three patients (57.4%) were male and sixty-nine (42.6%) were female.

The majority of patients were conveyed by ambulance from locations in County Kildare (n=91, 56.2%), followed by County Laois (n=52, 32.1%) and County Wicklow (n=17, 10.5%) (Figure 2). The mean travel distance for the patients attending TUH ED was 56.2 kilometres (SD 25km). The mean pre-hospital travel time collated from the location where ambulances conveyed patients from and correlated with Google Maps was 45 minutes (SD 14.2 minutes).

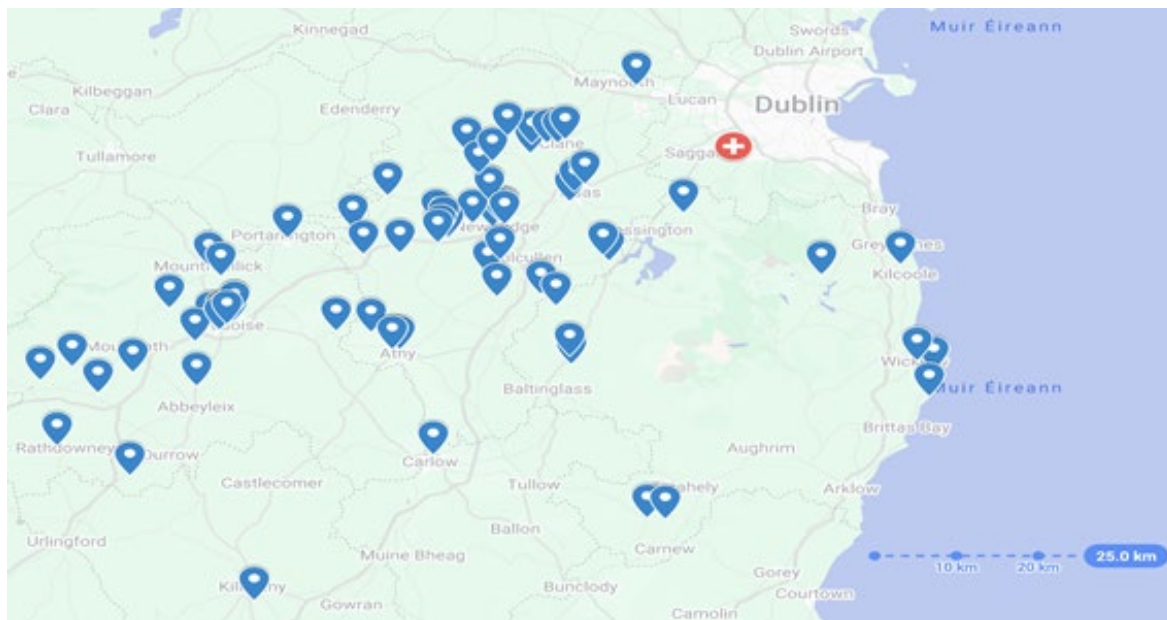


Figure 2: Location points (blue markers) from where ambulances conveyed patients on the hyperacute FAST+ bypass protocol to Tallaght University Hospital (depicted with red cross symbol)

Thrombolysis and transfer for mechanical thrombectomy

Sixteen patients of the study cohort received thrombolysis at TUH, and 9 patients in total required transfer for thrombectomy (Figure 1).

Patient disposition

Of these, 71 patients (71/162, 43.8%) were not admitted to TUH (Figure 1). Sixty-six patients were repatriated to regional hospitals whose catchment the patients were originally conveyed from. Fifty-two patients (32.1%) were transferred to Naas Hospital and 14 (8.6%) to Portlaoise Hospital. Three patients (4.2%) were transferred onwards to the neurosurgical service in Beaumont Hospital.

Ninety-one patients (56.2%) were admitted to TUH. Eleven patients of the study cohort died (6.8%) in Tallaght University Hospital.

Thirty-four patients (37.4%) were discharged home after an admission to Tallaght University Hospital (Figure 1). Thirty-six patients were repatriated after the acute phase of the care had been completed to regional hospitals whose catchment the patients were originally conveyed from. Twenty-eight patients were repatriated to Naas Hospital and nine to Portlaoise Hospital after their acute phase of their admission was completed in Tallaght University Hospital. One patient was transferred to a hospital in Northern Ireland which was near their home. Seven patients (7.7%) were discharged to convalescent care from Tallaght University Hospital and one patient remained in inpatient in Tallaght University Hospital at the time the data abstraction was completed for this study (15/5/2025).

Outcome measures

The 162 patients had a mean 5.1 hour patient experience time (length of stay) at TUH ED. The mean length of stay for admitted patients in Tallaght University Hospital was 13.6 days.

Discussion

This study presents an analysis of the clinical and logistical implications of implementing a regional Hyperacute FAST+ ambulance bypass protocol in an area of the Dublin Midlands Region. The primary finding—that 162 patients from outside TUH’s catchment area were assessed under the bypass protocol in its first year—demonstrates the protocol’s immediate uptake and operational feasibility. These patients constituted approximately 1.2% all ambulance attendances were patients presenting on the out of catchment Hyperacute FAST+ patients protocol. This data indicating that while the absolute number is small, the clinical complexity and resource implications are significant. Over half of these out of catchment patients (56.2%) required inpatient admission and an average hospital length of stay of nearly two weeks in Tallaght University Hospital.

The demographic profile of patients, with a mean age of 68.5 years and a near-equal gender distribution, is consistent with national stroke epidemiology.^{13,14} From a process perspective, the mean pre-hospital travel time of 45 minutes and average distance of 56.1 km underscore the logistical demands placed on the ambulance service and receiving hospital. Despite these extended journeys, 9.9% of patients received thrombolysis, and 5.6% were transferred for mechanical thrombectomy. This data is caveated by the inherent heterogeneity of the study population. Whilst all included patients in the study were conveyed to TUH ED on the Hyperacute FAST+ ambulance bypass protocol, not all patients were not found to be FAST+

on arrival to TUH ED. The national rate of thrombolysis which has remained stable at 10-12% since 2013 and the thrombectomy rate is lower than the national rate of 11%.³ A formal analysis of onset-to-treatment times was beyond the scope of this study and remains an area for future research.

Hyperacute FAST+ patients are seen on arrival to the ED by an early senior clinical decision input, the mean ED patient experience time in the study cohort was 5.1 hours. The aetiology for this was not elucidated as they fell out of scope of the study. The authors postulate that some of the delays may relate poor timely availability of inpatient beds during the study period. Also, there may have been delays waiting for inter-hospital ambulance repatriation back to the regional hospital's EDs for those patients who were deemed not to require thrombolysis or mechanical thrombectomy.

Approximately 44% of patients were not admitted to TUH following ED evaluation, with 40.7% being repatriated to their local hospitals from TUH ED directly after assessment by the stroke assessment team. These findings suggest that there may be scope to optimize pre-hospital triage strategies to identify Hyperacute FAST+ patients.

Notably, 56.2% of patients required admission to Tallaght University Hospital with a mean hospital length of stay (LOS) of 13.6 days. These figures reflect a substantial clinical burden, both on TUH's inpatient services and on downstream capacity in regional hospitals, particularly for convalescent and step-down care. Nearly half of those admitted were eventually repatriated to local hospitals, indicating effective inter-hospital coordination. However, the process of repatriation may still benefit from targeted monitoring to avoid delays that can increase length of stay and strain hyperacute resources in Tallaght University Hospital.

The in-hospital mortality rate of 6.8% aligns with known stroke mortality figures in Ireland and internationally, particularly for an older and medically complex cohort.^{13,14} However, the absence of clinical severity measures (e.g. NIHSS scores), imaging data and post-discharge functional outcomes limits more granular interpretation. Prospective studies incorporating these parameters are needed to assess the long-term effectiveness and safety of the bypass protocol.

International guidelines support diverting suspected stroke patients to stroke centres or hospitals with acute stroke capability, rather than the nearest hospital, to ensure timely access to time-critical treatments like thrombolysis and neuroimaging.^{5,15,16} These pathways emphasize efficiency by prioritising patients at designated facilities and focus on thresholds to balance transfer delays with the potential benefits of reaching a specialised centre. By way

of comparison, England has adopted new nomenclature and uses the terms ‘comprehensive stroke centres’ (CSCs, those capable of delivering both thrombolysis and thrombectomy) and ‘acute stroke centres’.¹⁶ A 2022 review by Ford et al. in the UK, recognises that most sites receiving acute stroke patients do not have mechanical thrombectomy capability.¹⁶ Ford et al opine that all ambulance services will be increasingly affected by a “drip-and-ship” secondary transfer model for patients assessed as potentially suitable for mechanical thrombectomy at the initial ASC.¹⁶

This study is limited by its retrospective, single-centre design, and by its reliance on electronic health record data, which may be incomplete or subject to variability in documentation. Specifically, the lack of a comparator group with patients within the Tallaght University Hospital catchment area limits the ability to draw causal inferences regarding the effect of the bypass protocol on patient outcomes. The decision to not include a comparator group was a pragmatic one due to the human resources available to the project. Two second year Trinity medical students were seconded to do the data abstraction on a two-week research elective to Tallaght University Hospital Emergency Department. With this resource implication, it was not possible to review the approximately twelve thousand ambulance attendances from within our catchment area to abstract data on the within catchment hyperacute FAST+ ambulance attendances.

Additionally, key clinical metrics such as onset of symptoms prior to the ambulance call, NIHSS scores, imaging findings, and modified Rankin Scale (mRS) scores at discharge or follow-up were not available as were out of scope of the study. These would be valuable in prospective studies in informing our thrombolysis rates and clinical effectiveness of the protocol beyond process metrics.

The project team opted to use Google Maps to present indicative distances and journey times. The authors accept that in relation to the journey times, there may be a discrepancy in these times. FAST+ patients are assigned a “Delta” or “red response” by the national ambulance service and the closest emergency response is dispatched immediately.¹¹ It is not also possible to comment on the impact of ambulance journey times on thrombolysis rates in this study.

The implementation of the Hyperacute FAST+ bypass protocol within a single health region has led to high admission volumes and extended hospital length of stay at the TUH stroke centre. This study is a starting point for researching the utility and feasibility of regional stroke pathways and their clinical safety. Further prospective research is needed to evaluate long-term clinical outcomes, patient satisfaction, and cost-effectiveness. This study provides a foundation for continued refinement of regional stroke care pathways in Ireland.

Declarations of Conflicts of Interest:

None declared.

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