



Feidhmeannacht na Seirbhíse Sláinte  
Health Service Executive

**HSE Quality and Clinical Care Directorate**

## **Stroke Clinical Care Programme**



**STROKE**

### **Model of Care**

**Version: Final Draft**

**Date: April 2012**



## Forward

In 2009 over seven and a half thousand people were admitted to hospital with a stroke. The devastating impact of stroke on an individual's quality of life, their family and the health service are key incentives to develop and deliver the most effective services for stroke patients.

The **mission** of the National Stroke Programme is to deliver better care through better use of resources. The **vision** is to design standardised models for the delivery of integrated clinical care and to embed the sustained clinical operational management of the integrated pathway

The stroke model of care sets out how access to acute stroke treatment will be improved through the development of preventative, treatment and rehabilitation services. The quality of care delivered to stroke patients is monitored through the implementation of a stroke register in each hospital admitting acute stroke patients.

The work of the Irish Heart Foundation Stroke Council has been very influential in keeping stroke care high on the national policy agenda. The stroke model of care draws on a number of sources including the Stroke Council's Audit of Stroke Care and Cost of Stroke Care in Ireland studies.

The 2010 Cardiovascular Health Policy provides the strategic context for the development of the national stroke programme.

We would like to sincerely thank everyone who took the time to read the earlier drafts and provided feedback.

---

Peter Kelly  
Consultant Neurologist  
Joint National Clinical Lead for Stroke

---

Joe Harbison  
Consultant Geriatrician/Stroke Physician  
Joint National Clinical Lead for Stroke



# Table of Contents

|    |  |    |
|----|--|----|
| 1  | Introduction.....                                      | 7  |
| 2  | Background and Policy Context.....                     | 9  |
| 3  | Governance .....                                       | 11 |
| 4  | Prevention – Atrial Fibrillation.....                  | 16 |
| 5  | Prevention – TIA/Carotid.....                          | 21 |
| 6  | Emergency Stroke Care .....                            | 27 |
| 7  | Acute Stroke Unit Care.....                            | 33 |
| 8  | Stroke Care in the Community .....                     | 36 |
| 9  | Stroke Register/Evaluation & Information Systems ..... | 44 |
| 10 | Linkages / Communication.....                          | 47 |
|    | References.....  | 49 |

## Appendices



# 1 Introduction

In recent years new techniques and strategies for improving the care of people with stroke have emerged. For example, the benefits of organised clinical services for stroke care have been clearly established. Hospital-based Stroke Units for acute and initial rehabilitation of patients with stroke and TIA are associated with a reduction in death and institutional care of around 20%, with one additional patient returned to community living for every 20 patients treated. Following emergency admission to hospital with stroke, administration of 'clot-busting' thrombolysis therapy can reverse or substantially reduce disability in one-third of patients treated within 90 minutes of stroke onset. However, strict administration guidelines mean that only 8-15% of confirmed ischaemic stroke patients are eligible for such treatment. Because of the potential for catastrophic brain haemorrhage associated with thrombolysis given inappropriately and the brief time-window for treatment, substantial organisation is needed to select appropriate patients on arrival in emergency departments and to safely deliver treatment to those most likely to benefit.

At the end of peoples' hospital stay there is substantial evidence that Early Supported Discharge programmes for selected stroke patients are associated with reduced hospital costs, fewer bed-days used, and greater patient satisfaction.

Recent data suggests that organised rapid-access diagnostic services for ambulatory patients with TIAs ('warning' strokes) result in 80% reduction of disabling strokes within one week, and substantial savings in cost and hospital bed utilisation. Available evidence suggests that these services may be delivered in various settings (same-day TIA clinics, day hospital/medical assessment units, stroke units), provided rapid access is available to specialist assessment, diagnostic investigations, and appropriate treatment.

In Ireland and internationally, patients with stroke and TIA have traditionally been admitted to general medical wards and have had acute medical care provided by hospital physicians with general but not further specialist training in stroke medicine. Similarly, healthcare governance structures and systems of care have usually been generic in nature, with little development of specific governance structures, services, and cross-specialty systems tailored to the needs of patients with stroke and TIA.

The **mission** of the National Stroke Programme is to deliver better care through better use of resources. The **vision** is to design standardised models for the delivery of integrated clinical care and to embed the sustained clinical operational management of the integrated pathway

## 1.1 Aim

The overall aim of the National Stroke Programme is to ensure

- National rapid access to best-quality stroke services
- Prevent 1 stroke every day.
- Avoid death or dependence in 1 patient every day.

## **1.2 Objectives**

### **Quality**

- Develop governance structure
- Develop and disseminate care pathways, protocols and care bundles
- Increase anticoagulation in known atrial fibrillation
- Develop a stroke register

### **Access**

- Develop national 24/7 access to safe stroke thrombolysis through service development, telemedicine and training
- Develop national access to Stroke Unit care in all hospitals accepting stroke patients
- Develop national access to rapid TIA assessment
- Develop early supported discharge programme.

### **Cost**

- Achieve cost savings through reduced AvLOS for stroke patients through improved access to stroke unit care
- Achieve cost savings through reduced AvLOS for TIA patients through improved access to rapid assessment
- Achieve cost savings through reduced LOS by implementing early supported discharge for selected stroke patients



## 2 Background and Policy Context

The national policy *Building Healthier Hearts* (1999) addressed health promotion and risk factor reduction for all cardiovascular diseases.<sup>1</sup> In relation to health services the report focussed on heart disease. The emergence of effective therapies for stroke and the absence of a plan to develop stroke services were subsequently highlighted by the Council on Stroke of Irish Heart Foundation (IHF). *Changing Cardiovascular Health National Cardiovascular Health Policy 2010 – 2019* updates information on prevention and makes recommendations on all aspects of stroke care.<sup>2</sup>

The development of acute stroke services was included in the HSE Business Plan for 2009:

*In advance of the (national cardiovascular) report publication, each hospital network will address priority issues in the development of acute stroke services, including:*

- *the development of acute stroke units*
- *designating a lead medical consultant for stroke*
- *providing care through multidisciplinary teams*
- *improving the emergency response in cases of suspected stroke.*
- *also, (after agreement by the IHF Council on Stroke) to commence implementation of the guidelines relevant to the acute system to achieve the agreed standards of care.*

Developments in emergency and acute stroke services were estimated in HSE surveys in April 2009 and in June 2010.

The IHF Council on Stroke developed National Clinical Guidelines for the Care of People with Stroke and Transient Ischaemic Attack (TIA) with relevant professional organisations.<sup>3</sup> The draft guidelines were provided to the Department of Health and Children and to Health Information and Quality Authority during the final consultation period and are subject to an annual review process to maintain their accuracy and quality.

In 2010 the IHF started a media campaign to raise awareness of the signs and symptoms of acute stroke and the need to seek emergency health care (the FAST campaign).<sup>4</sup> It also funded a study by the Economic and Social Research Institute (ESRI) of the cost of stroke in Ireland.<sup>5</sup> The HSE is liaising with the IHF about updating and developing additional information materials for stroke patients and carers.<sup>6</sup>

The Irish National Audit of Stroke Care (INASC) undertook six investigations: organisational study and clinical audit (acute hospitals); general practitioner survey, public health nurse and allied health professional survey, nursing home survey, and patient / carer survey.<sup>7</sup> The audit identified important deficiencies across the spectrum of stroke care.

The implementation of the national stroke programme is set against the backdrop of the implementation of the Primary Care Strategy and the development of primary care teams.<sup>8</sup> The broader context is the HSE Integration Programme, linking the delivery and management of hospital and community services with the establishment of the Integrated Services Directorate.

The Stroke Programme is one of the Clinical Strategy & Programmes Directorate clinical care programmes aiming to improve access, quality and cost-effectiveness of services. Access to acute stroke treatment will be improved through the development of thrombolysis, rehabilitation and TIA services. Quality objectives will be achieved through the development of a governance structure and the implementation of a stroke register to monitor the process and outcome of care for the patient. Cost objectives will be achieved through more targeted use of resources and decreased length of stay.

**The purpose of this document is to communicate the steps that are planned by the National Stroke Programme to achieve an integrated stroke service, spanning pre-hospital, hospital, community and primary care.**

**The areas covered in this plan are**

- 1. Governance**
- 2. Prevention - Atrial Fibrillation**
- 3. Prevention - TIA/Carotid**
- 4. Emergency Stroke Care**
- 5. Acute Stroke Unit Care**
- 6. Stroke Care in the Community**
- 7. Stroke Register**
- 8. Linkages/Communication**

## **3 Governance**

### **3.1 Background**

The 2010 Cardiovascular and Stroke Policy recommended that organised stroke care is developed at a regional level via the creation of Stroke Networks. It states: *'A Stroke Network model is recommended internationally.... based on substantial international precedent, having been successfully introduced in Canada, the United States of America, the United Kingdom, Austria, Germany and other European countries. The creation of a network model of Stroke Partnerships has also been supported by the Stroke Council of the Irish Heart Foundation, which represents all major professional, patient, and advocacy groups involved in Stroke care in Ireland'*.<sup>1</sup> The policy does not require that Stroke Networks will operate on a 'hub and spoke' model, as operates in some countries. Rather, the proposed Irish model aims to balance the elements of stroke care that can be delivered safely and effectively at general hospitals with those that require expertise or technology that is available at a partnering regional hospital. It recognises the importance of the role of the general hospital for provision of many aspects of stroke care close to the local community, such as medical management of many stroke patients, rehabilitation, prevention, and provision of ongoing care in collaboration with community services. This principle will continue to apply as the roles of Irish hospitals evolve along the Models 1-4 spectrum as outlined in the Acute Medicine Programme.

Current clinical guidelines also recommend that patients with stroke and TIA are cared for by specialist multidisciplinary organised services. These services will operate within individual hospitals, between hospitals and local communities (eg. Early Supported Discharge), between general hospitals and regional hospitals (eg. carotid endarterectomy), and between referring hospitals and hospitals providing national or supra-regional services (eg. neurosurgery). Regardless of which hospital model (1-4) is delivering care, organised stroke services will require a clear clinical governance structure to ensure that they are delivered consistently, safely, cost-effectively and in accordance with recommended standards of care. This governance structure should operate at local, regional, and national levels; should be inclusive of patients, medical, nursing, allied health professional (AHP) and non-clinical stakeholders; and should be closely integrated with other disease-specific programmes within the HSE Quality and Clinical Care Directorate.

### **3.2 Current Status**

During 2011 areas and hospitals completed an Area Implementation Plan for stroke services. These plans clearly show the continuum of care from primary and secondary prevention to diagnosis and treatment and long term care for patients with suspected or acute stroke.

The current picture with regard to the provision of emergency and acute stroke unit care is outlined in Sections Six and Seven.

### **3.3 Approach to deal with**

#### **3.3.1 National Clinical Governance**

The Clinical Strategy and Programmes Directorate has established common clinical governance structures on a national and regional basis for all programmes. See Appendix 1.

These are:

1. Programme Clinical Lead(s), supported by Project Teams, including representatives from Public Health, General Practice, Nursing, Allied Health Professions, Project and Programme Managers
2. Working Group: Multidisciplinary groups, representing professional bodies with expertise, and patient representatives
3. Clinical Advisory Group: Physician group, representing the Royal College of Physicians, Ireland, Director of Nursing/Midwifery Reference Group, Stroke Therapy Advisory Group, National Therapy Managers Advisory Group.
4. Regional Lead Physicians: For the Stroke Programme, 2 senior Stroke Physicians per HSE Network have agreed to provide regional representation, working closely with the National Lead Physicians. In addition, Stroke Physicians leading the development of early networks (Network Leads) will provide a key regional leadership role.
5. The implementation of the programme is tracked through the monitoring of key performance measures and the implementation of the national stroke register will support this aspect.

#### **3.3.2 Local Clinical Governance – Local Stroke Groups;**

It is intended that local clinical governance will be provided supported by the formation of local Stroke Teams in each hospital providing stroke care, and its surrounding community. These will consist of a hospital Stroke Physician, senior hospital AHP representative, senior member of hospital nursing management, senior non-clinical administrator (CEO/hospital manager, or deputy), Stroke Clinical Nurse Specialist, Community GP, Community Senior Nurse and/or Community AHP representative.

The aims of these groups will be:

1. To provide agreed multidisciplinary leadership and governance for stroke care at the institutional level, in a clear and structured manner
2. To develop hospital and community services for patients with stroke and TIA, supported by the national stroke programme including adaptation of national templates and protocols to local circumstances.
3. To promote safe delivery of stroke care, meeting recommended quality standards
4. To improve communication between disciplines within hospitals, between hospitals and community services, between hospitals within regions, and between hospitals and the clinical stroke programme.

In some hospitals, similar structures to these groups are likely to exist. It is anticipated that they will meet 4-6 times annually, depending on local preferences and needs. Formation of Local Stroke Groups will be an early implementation goal of the stroke programme.

Implementation will begin in mid-October 2010, with verification of group membership by end 2010. Validation of group activity will be conducted by end Q2 2011.

### **3.3.3 Regional / Inter-hospital Governance - Stroke Networks**

As clinical governance structures are developed within hospitals and the communities they serve, the stroke programme will facilitate the formation of groups of hospitals to form Stroke Networks. This step will be completed in close consultation with patient and professional groups, Regional Directors of Operation, and other CSPD programmes, particularly the Acute Medicine Programme, and will take account of regional reconfiguration plans.

#### ***The aims of a Stroke Network are:***

- To provide equitable and early access to complex treatments available at a regional level, which cannot be safely delivered in all hospitals (e.g. carotid endarterectomy)
- To provide equitable and early access to expertise (eg. neuroradiology, neurology) and complex diagnostic investigations (eg. cerebral angiography) which may not be safe or feasible to provide in all hospitals within a region
- To implement agreed common standards of safe, high-quality care for patients with Stroke/TIA, regardless of where they live in Ireland
- To implement agreed systems for service audit and improvement
- To ensure appropriate training and education of healthcare professionals delivering stroke care

Development of agreed pathways for patient assessment, inter-hospital transfer, rapid access to specialty services/diagnostics, audit systems, and education resources will be led by the Stroke Programme, supported by the Working Group, Clinical Advisory Group, professional representatives, and patient organisations. As described in the 2010 Cardiovascular Policy, governance of Stroke Networks will be multidisciplinary, most likely comprising selected members of the Local Stroke Groups of each hospital/community within the Network. Patient representatives will be included. Agreement of hospital groups to form Stroke Networks will be reached by mid-2011, with first Stroke Network regional meetings held by end 2011.

### **3.3.4 Corporate and Financial Governance**

The delivery of the national stroke programme is governed by HSE corporate and finance policies, codes and circulars, these are outlined in Appendix 2.

### **3.3.5 Risk Management**

The importance of risk management as an essential process for the delivery of quality and safe services, as set out in the HSE Risk Management policy, is recognised by the stroke programme. The development and delivery of stroke services will be in the context of this policy and the programme will work with the National Director of Quality and Patient Safety in relation to national risk management issues. Risk Management at an operational level is a line management function.<sup>9</sup>

### **3.4 Resources Required**

#### **3.4.1 Capital:**

There is unlikely to be additional capital expenditure required to develop either local groups or national networks.

#### **3.4.2 Revenue:**

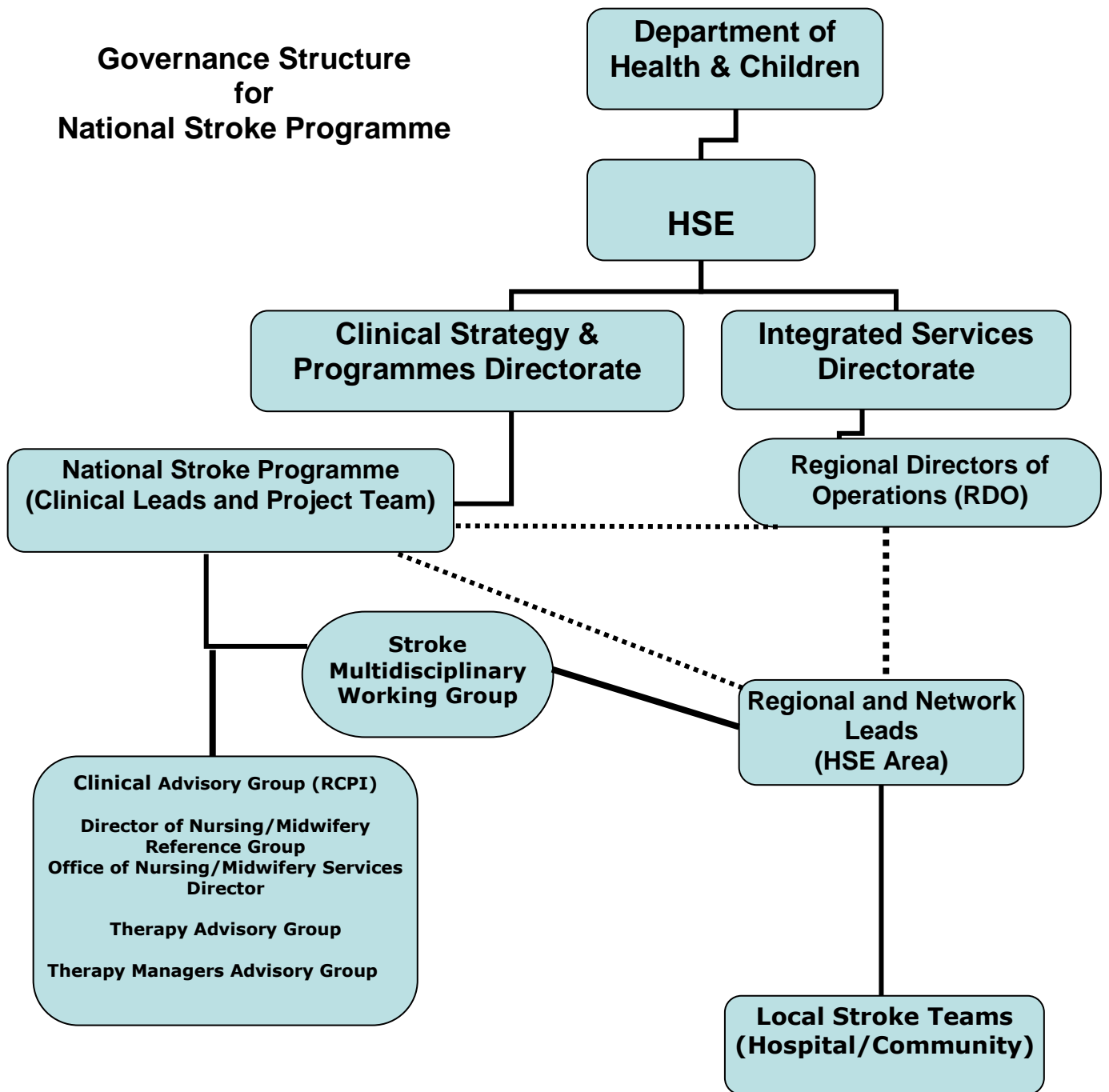
**Personnel:** For optimal function, regional networks will require some secretarial and administrative support. Initially these will be provided from existing resources, but additional staff are likely to be needed as networks develop.

**Overheads:** No significant additional overhead costs to develop local groups or regional networks are foreseen. Development of telemedicine networks to allow cooperative work between hospitals will require investment. Current options for providing telemedicine vary in cost to establish. Evaluation of telemedicine systems is currently underway and a systems specification and business case are under development in cooperation with HSE ICT directorate.

### **3.5 Programme Targets:**

1. Local Stroke Groups established in at least 75% (24) of acute hospitals by end 2010. (Quarter 4 2010)
2. At least 75% (24) of acute hospitals affiliated to a Stroke Network by end 2011. (Quarter 4 2011)
3. Validation of Stroke Network activity will be conducted by end Q4 2011. (Quarter 4 2011)
4. Implementation of protocols for the care of patients with stroke and TIA. (Quarter 4 2011)

Figure 1: Governance Structure for the National Stroke Programme



## 4 Prevention – Atrial Fibrillation

### 4.1 Background

Atrial fibrillation (AF) is a common cardiac arrhythmia, occurring in 1-2% of the general population. The prevalence increases with age from less than 0.5% at 40-50 years, to 5-15% at 80 years.<sup>10,11</sup> The United Nations Population Division and World Health Organisation estimate that the world proportion of people aged 65 or older will increase from 7.3% in 2005 to 16.2% in 2050. In Ireland, substantial increases are predicted, with increases in the over-80s by two-thirds by 2021.

In population studies AF has been associated with a 5-fold risk of stroke, independent of other vascular risk factors. Many studies have indicated that 20-30% of all strokes are attributed to AF, both in Ireland and internationally.<sup>12</sup> Ischaemic strokes associated with AF are often fatal and those patients who survive are left more disabled by their stroke and more likely to suffer a recurrence than patients with other causes of stroke. Consequently, the risk of death from AF-related stroke is doubled and the cost of care increased 1.5 fold.<sup>13,14</sup>

The risk of stroke associated with AF is reduced by up to 67% by anticoagulant prophylaxis (prevention treatment), usually with warfarin.<sup>15</sup> However, despite evidence of substantial benefit, under-utilisation of anticoagulation remains very common. In the North Dublin Stroke Study (NDPSS), only 25% of patients with a prior known diagnosis of AF were on anticoagulation therapy at the time of their stroke.<sup>16</sup> Internationally, many studies have reported similar findings. For example, in the Canadian Stroke Network<sup>17</sup> only 40% of AF patients considered eligible were on anticoagulation therapy at the time of stroke and the SAFE II trial has shown that less than 25% of patients with NVAF admitted for stroke were previously receiving OAC although approximately 70% would have been eligible.<sup>18</sup>

International studies have found that various factors contribute to non-prescribing of anticoagulation therapy in patients with AF. Warfarin therapy is associated with risk of haemorrhage, which may be major and occasionally fatal. For this reason, the decision to begin warfarin in a patient with AF is often difficult, particularly in older individuals who may be frail, or have a complex medical history, recent falls, or other factors which may cause concern for increased risk of major bleeding complications. No standardised approach exists for the selection of appropriate patients for warfarin therapy. Consequently, physician-related and patient-related factors frequently influence the decision to prescribe.<sup>19</sup>

Some studies have found that non-specialist hospital and community physicians may over-estimate bleeding risk and under-estimate stroke risk, especially in older patients in whom there is concern about falling.<sup>19,20</sup>

Other data suggest that some patients may incompletely understand the benefits of anticoagulation therapy. This may be improved by education, using pictorial aids and decision aids.<sup>21,22</sup> Alternatively, some patients may make an informed decision to decline therapy, deterred by the



inconvenience of travelling for blood tests for warfarin monitoring, the need to avoid alcohol, or other reasons.

Guidelines which recommend warfarin treatment in AF are based on highly-selected patients that were enrolled in clinical trials. These are not fully-representative of those encountered in 'real-world' clinical care settings. Thus, it is also possible that a substantial portion of patients who are not treated with warfarin may be appropriately selected as unsafe for warfarin by their treating physician. Supporting this possibility, one Boston-based study reported that, among 49% of older AF patients not anticoagulated, almost all were considered for warfarin therapy but not treated because they had at least one contraindication.<sup>14 23</sup>

Due to a narrow therapeutic range of warfarin, anticoagulation monitoring is essential, delivered in a hospital clinic, primary care, or home-based setting. Studies comparing hospital clinic to primary care monitoring have reported conflicting results, some finding modest improvements in anticoagulation control and patient satisfaction in hospital-delivered care, others finding improved outcomes in primary care.<sup>24,25,26</sup>

AF is defined as a cardiac arrhythmia with the following characteristics:

1. The surface ECG shows 'absolutely' irregular RR intervals i.e. RR intervals that do not follow a repetitive pattern
2. There are no distinct P waves on the surface ECG.
3. The atrial cycle length (when visible), i.e. the interval between two atrial activations, is usually variable and less than 200 ms or greater than 300 bpm

Differential diagnosis includes supraventricular arrhythmias, most notably atrial tachycardias and atrial flutter. Clinically, it is reasonable to distinguish five types of AF based on the presentation and duration of the arrhythmia: first diagnosed, paroxysmal, persistent, long-standing persistent and permanent AF.

An irregular pulse should always raise the suspicion of AF, but ECG recording is necessary to diagnose AF. Any arrhythmia that has the ECG characteristics of AF and lasts sufficiently long for a 12-lead ECG to be recorded, or at least 30 s on a rhythm strip, should be considered as AF.<sup>27,28</sup>

AF can be diagnosed by examining the pulse and confirmed by means of a simple low cost test (electrocardiography), which is acceptable to most patients. Population screening for AF in adults 65 years and older in the general practice setting has been shown to be effective in the detection of new cases. Evidence suggests that opportunistic screening is the preferred model of care. This includes opportunistic pulse taking, prompted by flagged case notes in adults 65 yrs and older during routine clinic attendances and subsequent 12-lead electrocardiography on those with an irregular pulse. This preventive strategy was demonstrated to be as effective as systematic population screening with both being more effective than "routine practice".<sup>29</sup> This suggests that routine electrocardiography within this population is unnecessary for the detection of atrial fibrillation as long as healthcare professionals are conscientious about feeling the pulse.

## **4.2 Current Status**

Atrial fibrillation is a growing public health problem in Ireland. This has been identified by several Irish studies. The NDPSS identified AF in 31% of all incident stroke patients (n=568) of which 46% were newly diagnosed.<sup>16</sup> Of those with pre-existing atrial fibrillation 28% were on OAC, 55% were on anti-platelet therapy and 17% were on no treatment. In addition the Irish National Audit of Stroke Care (INASC) 22% of 2173 acute stroke patients were known to have atrial fibrillation of whom 26% were on warfarin, 57% were on anti-platelet therapy and 22% were on neither.<sup>30</sup> These studies reiterate previous findings in both hospital and community-based studies in Ireland.<sup>31,32</sup> Consistent with international literature physician-related factors frequently influence the decision to prescribe anticoagulation therapy in Ireland.

The problem of under-detection and under-treatment has been addressed in the Department of Health policy 'Changing Cardiovascular Health, National Cardiovascular Health Policy 2010-2019'.<sup>2</sup> Recommendation 4.7 highlights the need for effective means for early detection in people aged 65 years and older in addition to clinical leadership of integrated anticoagulation services. It states the following:

- A screening programme for atrial fibrillation should be established with formal evaluation to ensure an effective means of implementation for people aged 65 and over
- Clinical leadership of integrated anticoagulation services must be established within service networks so that GP's and hospital staff achieve and assure optimal care for all
- Structured anticoagulation services will be developed between primary care services and hospital anticoagulation clinics.

Despite the well-recognised association between atrial fibrillation and ischemic stroke, and the benefits of anticoagulation therapy, a large proportion of patients in Ireland with atrial fibrillation remain undetected and under treated.

## **4.3 Approach to deal with**

### **4.3.1 General approach:**

If anticoagulation rates were increased in patients with prevalent known AF by 12%, it is estimated that this would result in approximately 2,000 additional patients on anticoagulation therapy nationally, with an estimated 86 new strokes prevented and up to €1.9 million euro saved annually. To address this problem, a national multidisciplinary Atrial Fibrillation Working group will be established in collaboration with the other CSPD Clinical Programmes. See Appendix 3. This will include representatives from Primary Care, Cardiology, Haematology, Pharmacy, Drugs and Therapeutics, Neurology, Geriatric Medicine, and Public Health. This group will develop and implement solutions to improve the detection and treatment of AF, with emphasis on stroke prevention, and will communicate with relevant stakeholders.

### **4.3.2 Specific Objectives**

#### **1. Gap analysis:**

An analysis will be conducted to address the following knowledge gaps:

- (a) epidemiology -baseline profile of incidence and prevalence of AF in Ireland
- (b) proportion of AF patients likely safe for anticoagulation therapy
- (c) current clinical governance and operation of anticoagulation monitoring services in Ireland

#### **2. Standards:**

Standards will be defined in line with best available evidence and international guidelines and in consultation with relevant stakeholder groups (patients, professional, Dept of Health and Children, HSE, HIQA) for:

- (a) detection of patients with AF (See Appendix 19)
- (b) selection of appropriate patients for oral anticoagulation prophylaxis
- (c) implementation of safe and effective anticoagulation monitoring within Stroke Networks, including optimal use of ICT
- (d) national clinical governance structures for anticoagulation monitoring

#### **3. Standardised shared care model for AF:**

- (a) Anticoagulation services should be developed that reflect patient centered care with appropriate quality assurance and clinical governance.
- (b) Integrated care pathways for AF patients will be developed which will span community and hospital settings, including rapid specialist access when needed.
- (c) Structured systems of support will be developed for GP's who wish to deliver an anti-coagulation monitoring service.
- (d) The model will be implemented and evaluated in at least one Stroke Network by Q4 2012.

#### **4. Detection**

A programme of opportunistic screening for AF in hospitals and the community will be implemented and evaluated in at least one Stroke Network by Q4 2012. This will be in collaboration with other chronic disease programmes and the Primary Care programme and may be AF-specific, or as part of a more general approach to identify and treat risk factors for vascular diseases, including stroke

#### **5. Information/Communications Technology:**

To evaluate current ICT systems used in anticoagulation services and develop a standard ICT approach, and implement in at least one Stroke Network by Q4 2012.

#### **6. Education and training:**

- (a) Standards and guidelines will be communicated to hospital and community physicians treating patients with AF via an education programme. This will be delivered through professional bodies and training meetings.

- (b) Education materials for patients and families will be developed and disseminated via the Stroke Programme web-site, Voluntary bodies, and other approaches.

#### **4.4 Resources required**

Unknown until initial scoping and data review exercise is complete and Pharmacoeconomics exercise in respect of newer agents available.

#### **4.5 Programme Targets:**

1. Gap analysis conducted of proportion of AF patients likely safe for anticoagulation and current anticoagulation monitoring systems. (Quarter 2 2011)
2. Agreed standards defined in line with international guidelines for detection of patients with AF, selection of appropriate patients for oral anticoagulation prophylaxis, and safe/effective monitoring. (Quarter 3 2011)
3. National clinical governance system defined for anticoagulation monitoring. (Quarter 4 2011)
4. Standards communicated to hospital and community physicians. (Quarter 4 2011)
5. Implementation and evaluation of a structured model of shared hospital/community care for AF patients, including a standardised ICT system, in at least one Stroke Network. (Quarter 4 2012)
6. Implementation and evaluation of an opportunistic screening programme in hospital and community settings in at least one Stroke network. (Quarter 4 2012).

## **5 Prevention – TIA/Carotid**

### **5.1 Background - Transient Ischaemic Attack**

Transient ischaemic attack (TIA) is an acute loss of focal brain or visual function lasting less than 24 hours, attributed after investigation to vascular disease of the brain or eye (frequently temporary occlusion of a brain or ocular artery by a small clot which travelled from an artery elsewhere in the vascular system). Although the TIA symptoms resolve completely (by definition), TIAs are associated with high risk of stroke occurring in the following weeks, with stroke rates of 10-13% reported in high-quality population studies. Early recognition and treatment of TIA provides an ideal opportunity for rapid intervention to prevent stroke.

Until recently, internationally and in Ireland, services for patients with TIA have been provided with those for other acute medical illnesses. Patients with sudden brief neurological symptoms have traditionally been referred to emergency departments, where they are often initially evaluated by non-specialist trainee doctors. Due to concerns about stroke risk, such patients are often admitted to hospital for monitoring, diagnostic investigations, and assessment by a stroke specialist (usually a consultant neurologist or geriatrician). However, the diagnosis of TIA is frequently difficult in daily practice, and many patients with brief neurological symptoms are eventually assigned a diagnosis other than TIA after specialist assessment. Examples of conditions that are frequently mistaken for TIA at initial assessment include faints, light-headedness, seizures, anxiety, unsteadiness, and confusion. Studies of TIA diagnosis have demonstrated higher diagnostic accuracy, reduced hospital admission, and reduced bed-day utilisation when patients are assessed by stroke specialist services.

In addition to improved diagnosis and reduced hospital admission rates, recent evidence indicates that early assessment, investigation, and treatment of TIA is associated with a substantial reduction in early stroke rates. In the EXPRESS study, stroke rates were reduced by 80% by a specialist TIA service, with major reductions in disability, hospital admissions, and costs.<sup>33</sup> Different models of rapid specialist service delivery have been developed. These include rapid access TIA clinics (5-day or 7-day), and stroke-specialist assessment in dedicated assessment units (similar to Medical Assessment Units), acute stroke units, or emergency departments, and telemedicine-supported services in rural settings. Although randomised trials have not been performed, current evidence indicate that early specialist-delivered assessment and treatment of TIA is effective for stroke prevention in both clinic-based and hospital-based settings compared to other models of TIA care.

### **5.2 Background - Carotid Artery Stenosis**

Carotid artery stenosis is defined as narrowing of the lumen (interior) of the internal carotid artery in the neck, usually by atherosclerotic plaque ('hardening of the artery'). Carotid stenosis causes TIA or stroke in 12-17% of patients in high-quality population studies, usually due to small emboli (clots) travelling from the diseased artery to upstream brain arteries.

Similar to TIA, carotid stenosis is associated with high risk of early further strokes. These may cause substantial disability in patients who recovered completely or near-completely after an initial

TIA or minor stroke. Large clinical trials have established that, for patients with recent TIA or non-disabling stroke, carotid stenosis causing 50-99% narrowing of the artery are often best treated by surgical removal of the diseased arterial segment.<sup>34</sup> This operation is called a carotid endarterectomy (CEA), and is usually performed by a skilled vascular surgeon. However some contra-indications apply and careful patient selection is required in a multidisciplinary setting.

Recent evidence and guidelines indicate that, to obtain maximum benefit from CEA, carotid stenosis must be detected and surgery performed within 2 weeks of the onset of symptoms for eligible patients.<sup>35,36</sup> However, delays to CEA are frequent in daily practice, both internationally and in Ireland. In some cases this is because patients do not seek medical attention after a brief TIA. In other cases, delays occur in performing diagnostic investigations to detect carotid stenosis, in referring for CEA assessment, or in assessment being performed after referral is received by a multidisciplinary stroke/vascular surgery team.

## **5.3 Current Status**

### **5.3.1 TIA**

From 2000-2006, HIPE data indicate that an average of 2,445 patients annually were discharged from Irish acute hospitals with a principal diagnosis of TIA. From 2000-2006, 50% of TIA patients remained in hospital for at least 5 days, and 25% remained in hospital for 8.5 days or more according to HIPE.<sup>37</sup> In 2007, most patients (96.8%) presenting with TIA were admitted as an in-patient. These hospitalisations accumulated to 17,467 bed days over the year representing 0.5% of total bed occupation in Acute Hospital Services.<sup>37</sup>

Data from the North Dublin Population Stroke Study suggest that approximately 2,600 TIAs occurred in the Irish population in 2006, which is largely consistent with HIPE. Many further patients (at least 1,200) will be referred for assessment and will have a non-TIA diagnosis eventually assigned.

The 2006 INASC audit reported that 6 Irish hospitals operated a TIA assessment clinic.<sup>7</sup> The frequency of operation of these clinics (weekly, 5-day, or 7-day) was not reported. Hospital-based pathways for early specialist TIA assessment were not reported in INASC. It is likely that TIA service provision has evolved since 2006, although updated data are not currently available.

In Oxfordshire establishment of Emergency TIA Clinics resulted in a reduction of 80% in risk of future stroke or TIA. In the community there was an overall drop in recurrent stroke of 4.4% and in recurrent TIA of 8% in the 90 days following.<sup>38</sup> If effective rapid access TIA services could be established in all hospitals (based in clinics, emergency departments, stroke units, or medical assessment units), this would result in an eventual reduction of approximately 110 strokes per annum nationally. The annual cost of a stroke in 2007 according to the ESRI was €22,282 suggesting a potential saving from prevented stroke alone of €2.4million.<sup>5</sup>

Average length of stay for TIA in Ireland is long by international standards at 6.5 days. Creating rapid assessment services would serve to reduce average length of stay for all TIAs by preventing

admission of up to one-third and increasing speed of investigation of others. It is estimated that by this approach, the average length of stay for TIA is likely to be reduced by 2 days in the first year of full service operation and by three days by year three. Assuming a bed day cost of €300 this would approximate to a saving of 5000 - 5500 bed days and €1.5 million in the first year.

### **5.3.2 Carotid stenosis in symptomatic patients:**

Nine Vascular Surgery Units currently exist nationally. Five of these are in Dublin (Beaumont, Mater, AMNCH, St Vincents, St James'), and one each in Galway, Limerick, Waterford and Cork. Diagnostic facilities for assessment of carotid stenosis are widely available, including ultrasound, MRI and CT angiography.

The evidence to support an association between hospital volume and outcome in carotid endarterectomy remains vague. A recent Scottish Technology Scoping report cites UK frameworks as recommending a minimum of either 35 elective CEA procedures, or 75 carotid endarterectomies, per year.<sup>39</sup>

In 2009, 343 carotid endarterectomies were performed in Irish hospitals but few within a 2 week interval from onset. The CASES Canadian stroke registry recently reported that the number needed to treat to prevent one stroke with carotid endarterectomy performed within 2 weeks from onset was only 6.<sup>40</sup> Similar data are reported from randomised trials. As an initial goal, if 50% of Irish endarterectomies for recently-symptomatic patients were performed within 2 weeks then 29 further strokes could be prevented, with a potential saving of around €560,000 annually.

INASC reported that only 35% of patients with stroke had carotid imaging performed within 3 months of symptom onset to assess for carotid stenosis. This compared with 50% in the 2004 UK Sentinel Audit. Overall, 11% of patients in INASC had carotid stenosis recorded as the likely cause of stroke. The rate of CEA or interval between symptom onset and CEA was not reported.

The 2010 National Cardiovascular Policy recommended that *'patients with recent TIA or non-disabling stroke should have urgent ipsilateral carotid assessment by Doppler ultrasound or CT/MRA. Carotid endarterectomy should be performed within 2 weeks of symptoms.'*

Organisational management at stroke network level should involve:

- Defined care pathways with vascular surgery units
- Access to expertise in carotid imaging and vascular surgery.
- Multidisciplinary Decision-making forum about surgical intervention
- Regular audit of carotid interventions to ensure high standards'

## **5.4 Approach to deal with:**

### **5.4.1 TIA**

Standardised care pathways will be developed and agreed with all hospitals providing acute care for patients with TIA, to ensure early stroke specialist assessment, appropriate diagnostic investigations, and early treatment. These will be provided via daily TIA clinics, when this service model is feasible based on available resources, with referral pathways for onward referral to

therapy professions as indicated e.g. for dietary modification to reduce stroke risk. Alternatively, standard rapid assessment protocols will be delivered in stroke units and medical assessment units.

Standard pathways will also be developed and implemented for specialist referral from general practitioners and emergency departments, agreed with the Irish College of General Practitioners and Irish Association of Emergency Medicine. Training and education will be provided to referring and treating physicians, supported by web-based materials.

Rapid access systems for diagnostic investigations, particularly carotid and brain imaging, will be developed to facilitate clinic-based or rapid MAU/stroke unit-based assessment. Guidelines for hospital admission for high-risk patients will be agreed with vascular surgical departments, facilitated by validated prognostic clinical prediction scores. **(Q4 2011)**

#### **5.4.2 Carotid stenosis:**

Standard pathways for rapid access to carotid imaging will be developed and implemented for all patients with non-disabling ischaemic stroke and TIA, in agreement with the Radiology Programme and Irish Association of Vascular Surgeons.

Clear protocols and pathways for referral to vascular surgery units will be developed and implemented, in agreement with the Irish Association of Vascular Surgeons. All hospitals accepting patients with TIA/acute stroke will have an agreed link to a named vascular surgery unit, based on existing referral patterns and regional service plans. Standard operating procedures will be agreed with bed management teams in hospitals providing vascular surgery services, to prioritise access of patients from referring hospitals. Similar SOPs will operate to prioritise acceptance back to the referring hospital from the vascular surgery unit when the patient is medically fit for transfer, if further hospital care is needed. Referral pathways should also be in place for onward referral to therapy professions as indicated. Patients with carotid stenosis or undergoing a carotid endarterectomy should have the same access to secondary prevention services as TIA patients e.g. referral for dietary intervention to reduce stroke risk.

### **5.5 Resources required**

#### **5.5.1 Capital**

This strand will not require new capital resources. In larger hospitals aiming to pursue the model of daily urgent neurovascular clinics, locations in which to operate the clinics will need to be identified.

#### **5.5.2 Revenue**

Personnel: Staffing for these services will come from current numbers and where necessary from staff appointed to support acute stroke services. There has been a reduction in the number of asymptomatic carotid endarterectomies being performed in most centres in recent years so there is likely to be some extra capacity meaning that no additional requirement for vascular surgeons is thought necessary to meet increased demands. Stringent admission protocols and bed



management will be necessary to permit urgent assessment and admission of suitable patients however which will require administrative support.

Overheads: We do not expect an increase in radiological procedures to support this strand, but some investigations will need to be performed in a more timely fashion which will require coordination with diagnostic Imaging Services. We have had preliminary discussions with the Radiology Programme in this regard.

## **5.6 Programme Targets**

### **5.6.1 TIA**

1. Management and referral pathway development, consultation, and dissemination – (Quarter 2 2011)
2. Pathways operational – completed (Quarter 4 2011)
3. TIA education module development – (Quarter 2 2011)
4. TIA education delivery - first round completed (Quarter 4 2011)
5. Rapid access system for diagnostic investigations developed (Quarter 2 2011)
6. Validation of implementation– (Quarter 2 2012)
7. Time from presentation to specialist evaluation less than 48 hours in at least 50% of patients. (Q2 2012)
8. Reduce average length of stay for TIA by at least 1 day by end 2012, approximately 2,000 bed days saved. (Q4 2012)
9. Reduce TIA admissions by 15% (360 admissions avoided) – approx 2,000 further bed-days saved. (Q4 2012)
10. Prevent 110 strokes (Q2 2012)

### **5.6.2 Carotid stenosis**

1. Management and inter-hospital referral pathway development, consultation, and dissemination – completed (Quarter 4 2011)
2. Development of local protocols for rapid access to carotid imaging – completed (Quarter 4 2011)
3. Linkage with vascular surgery units to be developed (Quarter 4 2011)
4. Improve carotid imaging rates to 50% of all ischaemic stroke/TIA patients, or 80% of non-disabling ischaemic stroke/TIA
5. Improve time to carotid imaging to less than 2 weeks in 75% of imaged patients
6. For carotid stenosis patients with non-disabling stroke/TIA, goal time to vascular surgery unit referral within 1 week of symptom onset in 75% of patients
7. For patients undergoing CEA, goal time to CEA within 2 weeks of symptom onset in 50% of patients treated
8. Rapid assessment, imaging, referral, transfer and CEA operational in at least 50% of hospitals by end Quarter 4 2011, and in all hospitals by end Quarter 4 2012
9. Validation of implementation– Quarter 4 2012

10. Prevent 30 strokes per year in symptomatic patients with carotid stenosis when fully operational – Quarter 4 2013

## 6 Emergency Stroke Care

### 6.1 Background

Thrombolysis ('clot-dissolving') treatment for stroke has been available internationally since 1996 and licensed in the EU since 2003. This treatment produces major benefit for treated patients, with one-third experiencing important improvements in disability (e.g. recovering the ability to walk or self-care) with sometimes complete reversal of the effects of the stroke.

Because the treatment carries a risk of serious brain haemorrhage, it must be delivered by a trained team, including experienced Consultant Stroke Specialists, who assess the patient in A+E within minutes of arrival.

This treatment is now the recommended standard of emergency stroke care by expert international groups such as the European Stroke Organisation and American Stroke Association.<sup>41,42</sup>

The Cardiovascular Health Policy recommends that hospitals in each region form Stroke Networks, with a team of Stroke Specialists providing thrombolysis to the population served within each Network.<sup>2</sup> For general hospitals where it may not be possible to have several Stroke Specialists on-call on a 24/7 basis, thrombolysis may be provided through emergency patient transfer where feasible within the time window or via a telemedicine link with a specialist in a Comprehensive Stroke Centre in the hospital network or related network.

#### 6.1.1 Cost-effectiveness of Stroke Thrombolysis

A recent report by the UK National Audit Office (Reducing Brain Damage: Faster Access to Better Stroke Care) highlighted that thrombolysis rates were 9% in leading Australian hospitals.<sup>43</sup> It estimated that achieving these rates in England would save £16 million in direct costs and result in 1,500 full recoveries in stroke patients. Similarly, the ESRI Cost of Stroke in Ireland study estimated that approximately €2 million annually could be saved in direct stroke costs from provision of a national stroke thrombolysis service.<sup>5</sup>

This segment of the programme considers management of stroke from onset in the community to initial care in hospital. This strand clearly includes a number of components, these include:

- Diagnosis in the community (paramedic training).
- Rapid transfer to hospital with stroke services appropriate to the need of the patient (rapid ambulance protocols)
- Emergency department management.
- Emergency Brain Imaging
- Thrombolysis training and governance of emergency stroke teams.

## **6.2 Current status**

The INASC and North Dublin Population Stroke Studies independently found that less than 1% of patients with ischaemic stroke were treated with thrombolysis in 2006.<sup>7,16</sup> More recent surveys performed by the HSE have indicated that this situation is improving in recent years.

Internationally, unbiased audits of national services have shown similar low thrombolysis rates. In 2008, the UK Sentinel Audit found that 16% of patients fulfilled the 3 key criteria for thrombolysis treatment.<sup>44</sup> The overall thrombolysis rate was 1.6% (160 patients). National audits in Australia<sup>45</sup> and New Zealand<sup>46</sup> have also reported national thrombolysis rates of 3%. A recent examination of a large stroke dataset in the US shows a national rate of 2.4% (ischaemic stroke admissions who received thrombolysis).<sup>47</sup> Germany has fared better with a stroke thrombolysis rate at 4.5%, while Sweden recently reported a rate of 6.6% for 2008.<sup>48</sup>

### **6.2.1 Hospital Emergency Stroke Services Survey**

The Hospital Emergency Stroke Services (HESS) survey was completed by the project team in July 2010. Thirty-two of the thirty-three acute hospitals (defined as admitting stroke patients through an Emergency Department, 97%), who were invited to participate, returned information for the survey. The HESS survey collected data on issues related to this strand and highlights the variation in levels of provision of stroke care both within and between hospital networks.

The main results were:

**(1) Thrombolysis:** Twenty-five hospitals (76%) reported providing a stroke thrombolysis service. The level of reported service varied between hospitals with 49% (16) of hospitals providing thrombolysis on a 24/7 basis and the remaining 9 hospitals providing the service on a Monday-Friday 9-5 or ad hoc basis. The availability of thrombolysis varied considerably between HSE regions. Twenty-three (70%) hospitals had at least 1 consultant able to perform thrombolysis but in 8 (24%) of these there was only one consultant trained and experienced (at least 10 patients treated) in providing this therapy, meaning that a 24/7 service was not feasible. Of the hospitals providing thrombolysis, 72% reported an audit system in place. There are still large areas of the country where no thrombolysis is routinely available. More advanced endovascular therapies for acute stroke such as intra-arterial thrombolysis and thrombectomy are only available in a few areas.

**(2) Imaging:** In the HESS survey, 73% of hospitals reported a 24/7 CT brain imaging capability with a further 8 (24%) offering a 9-5 weekday service. Only 2 hospitals reported 24/7 MRI scanning availability and 13 (39%) reported no MRI scanning on site. The availability of MRI scanning varied between hospitals and networks.

**(3) Pre-hospital care:** Only thirteen (39%) of the thirty three hospitals reported an existing prioritisation protocol by ambulance dispatch in response to suspected stroke. In 46% of hospitals arrangements were in place with the local ambulance services to fast track patients presenting with stroke. A similar percentage of hospitals reported that EMTs assess patients using the FAST score (Face-Arm-Speech Test). While just over 60% of hospitals reported having a rapid assessment

protocol in use in ED, only 46% were aware of ambulance advance warning to ED of a suspected stroke case. As information on training of ambulance personnel and pre-hospital notification of ED personnel was not gathered, no comment can be made on these areas of working between ED and ambulance services. The 3<sup>rd</sup> edition of the PHECC national guidelines has explicit guidance for the assessment of stroke patients.

### **6.3 Approach to deal with**

The aim of this programme strand is to increase the rate of thrombolysis nationally to 7.5% from a current estimated level of 3.0% by the end of 2012. Assuming a net number needed to treat (NNT) of 10 to prevent one patient dying or becoming dependent on others for care and a NNT of 3 people to reduce disability, this would result in an additional 34 extra lives saved and disability reduced in 112. If the thrombolysis rate can be increased to 10% as in Finland then 53 lives could be saved and 250 spared avoidable disability.<sup>49</sup> The ESRI COSI<sup>5</sup> report calculated that, based on 2007 figures, a 10% thrombolysis rate (increase of 9% on INASC figures) would achieve a saving of approximately €878,000. A 4.5% -5% rate may therefore result in savings of around €450,000.

#### **6.3.1 Thrombolysis**

National availability to thrombolysis for patients eligible for treatment will be provided by implementation of 4 approaches. These will be:

- (a) Development of trained emergency stroke teams in hospitals currently without such teams, including appointment of consultant stroke physicians (neurologists and geriatricians) in key hospitals. These teams may operate on a 24/7 basis or 9-5 basis, depending on local circumstances, including proximity to an alternative hospital where thrombolysis is available, and available expertise in safe delivery of stroke thrombolysis.
- (b) Provision of support from designated experienced stroke teams to less experienced physicians who have undergone appropriate training while they are building experience for clinical decision-making ('buddy system'), via telephone and remote imaging review when required. All such services will be closely audited to ensure quality and safety of care.
- (c) Development of rapid access ambulance protocols to ensure transport of patients who may be eligible for stroke thrombolysis to the nearest hospital within a stroke network where a stroke thrombolysis service is available
- (d) Development of telemedicine services with linkage to a 24/7 comprehensive stroke centre for hospitals which may require additional support in delivery of thrombolysis, particularly out of routine working hours (nights, weekends, holidays). (The 2010 DOHC policy document *Changing Cardiovascular Health* describes comprehensive stroke centres as providing 24-hour 7-day thrombolysis; MRI; vascular surgery; multidisciplinary rehabilitation; assess, treat and return protocol; rapid access TIA clinic; cardiac assessment; carotid artery stenting; tele-medicine support).

The specific combination of these complementary approaches to be applied will vary across different geographic regions and HSE networks, depending on local and regional circumstances. However, the result will be standard across all networks and regions – universal national access to

an emergency stroke service trained in the delivery of safe, effective stroke thrombolysis for eligible patients.

### **6.3.2 Imaging**

A national standard protocol for conduct and interpretation of urgent imaging of patients with suspected stroke will be developed in collaboration with the National Diagnostic Imaging programme. The National Integrated Medical Imaging System (NIMIS) project will have significant impact on how this is delivered and implemented. Clinical care pathways for imaging in specific situations will be developed based on recommendations in international and the Irish guidelines.

### **6.3.3 Pre-hospital care**

In cooperation with the ambulance services, national training will be provided for emergency personnel in stroke recognition and management. Operational protocols will be developed for rapid ambulance dispatch, assessment, transfer, and pre-hospital notification, including defined pathways for access to hospitals providing emergency stroke treatment. It is emphasised that a critical mass of available emergency ambulances will be required in each region to successfully implement these rapid transfer protocols.

### **6.3.4 Training**

A nationally agreed standard of training necessary to allow delivery of thrombolysis locally or by telemedicine will be developed and delivered in collaboration with the Royal College of Physicians, Ireland. A thrombolysis training course, under the direction of Prof. Sean Murphy through the RCPI, is currently being delivered to reinforce skills and facilitate consistency of practice and clinical governance. This will include the development of a mentorship programme for units inexperienced with thrombolysis. A national nurse education programme is also planned. The development of national care bundles and pathways for the emergency management of stroke and TIA in the ED is under way, in collaboration with the Emergency Medicine Programme. A training module in emergency stroke medicine will also be developed for emergency department and acute medicine physicians, in collaboration with the Acute Medicine and Emergency Medicine programmes and the RCPI.

### **6.3.5 Audit**

All hospitals providing stroke thrombolysis will be required to conduct a regular (at least quarterly) audit meeting of treated patients, and potentially-eligible patients who did not receive treatment to ensure the safety of the service and identify areas for improvement in service provision. These meetings may occur on a regional basis, including several hospitals within a Stroke Network, depending on local agreements. Collection of data for audit may be supplemented by participation in other quality improvement initiatives (eg. the Safe Implementation of Thrombolysis in Stroke [SITS] Registry), depending on local preferences.<sup>50</sup>

### **6.3.6 Telestroke**

The provision of emergency stroke care via telemedicine is now the norm in many countries.

These services, sometimes referred to as telestroke networks, have emerged to meet the demand for expert patient assessment for thrombolysis and the scarcity of consultants to meet this need. In Ireland the Dublin Mid-Leinster Stroke Network established a telestroke network and the evaluation supported the feasibility of implementing a telestroke system in the Irish healthcare context.

The Telemedicine Rapid Access for Stroke and Neurological Assessment (TRASNA) project is the national telestroke project

To assist in the implementation of this strand, a small multidisciplinary group with experience in development of stroke thrombolysis services was assembled from local and regional stroke service providers along with ICT and procurement managers. The group plan to implement the telestroke system in 2012. See Appendix 4.

## **6.4 Resources Required**

### **6.4.1 Capital**

Identification of much of the capital investment required will fall under the auspices of the Emergency care programme. Concerns have been expressed by Ambulance service managers that their ability to deliver a very rapid response to stroke patients in some areas is inhibited by a lack of vehicles at certain times either because there are not enough available for duty or they are being used for other duties such a patient transfer between hospitals. In some areas delivery of specialist stroke services will entail use of telemedicine as outlined above. Funding has been agreed for capital investment in telemedicine systems nationally.

### **6.4.2 Revenue**

**Personnel:** Issues of staffing in emergency services and emergency departments falls under the purview of the Emergency Medicine Programme. As discussed above, thrombolysis is technically difficult and may be harmful if administered inappropriately. Delivery of the therapy requires availability of trained staff with support of specialist stroke physicians. The National Strategy for Cardiovascular and Stroke Care identified the need to appoint new stroke consultants to permit delivery of effective care nationally. Five posts for consultant neurologist with stroke specialisation have recently been approved. Approximately 15 additional consultant Geriatrician/Stroke physician appointments will be necessary in the next two to three years to permit specialist care of all stroke patients, including delivery of thrombolysis.

**Overheads:** Thrombolysis is a relatively inexpensive procedure, costing less than €1,000 per patient. Economic assessment by the National Institute for Health and Clinical Excellence in the UK found that this cost was easily compensated by the reduced expenditure on prolonged hospital care and long term care of those benefiting from the procedure.

## **6.5 Programme Targets**

1. Proportion of confirmed ischaemic stroke patients (*confirmed on brain imaging*) treated with thrombolysis increased to 7.5% nationally. (Q4 2012)
2. Proportion of in-hospital deaths following thrombolysis consistent with SITS registry safety data. (Q4 2012)
3. Proportion of neurological deterioration associated with intracerebral haemorrhage (ECASS2 defined parenchymal haematoma Type 2) consistent with SITS registry safety data. (Q4 2012)
4. Care pathways implemented in 90% of acute hospitals providing acute stroke care. (Q4 2011)
5. Door-to-needle time less than 1 hour in at least 50% of Irish hospitals providing thrombolysis (Q4 2012)
6. Proportion of non-stroke patients thrombolysed less than 3% of all thrombolysed annually (Q4 2012)



## 7 Acute Stroke Unit Care

### 7.1 Background

The European Stroke Organisation defines a Stroke Unit as a multidisciplinary core team including specialist doctors, nurses, and therapists based in a discrete ward designated for stroke patients. 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.<sup>3</sup>

Stroke Unit care includes:

- Unit organisation indicated by regular, planned Multidisciplinary team meetings
- Access to health disciplines including Medical Social Workers, Dieticians, Psychologists and Neuro-Ophthalmologists
- Availability of protocols and pathways for admission, investigation and management of common clinical situations.
- Availability of equipment and skills for physiological monitoring including Blood pressure, blood oxygen, blood glucose and heart rhythm.
- Presence of robust audit and governance structures.

The Cardiovascular Health Policy (2008) and other guidelines recommend that a Stroke Unit with protected beds for stroke care exist in every acute hospital admitting stroke patients. The Irish Stroke Audit found that only one (3%) of Irish hospitals had a Stroke Unit, compared to 80-90% in Northern Ireland, Scotland, and England.

Incontrovertible evidence for benefit associated with organised stroke unit care exists. Stroke unit care is likely to be the only intervention in stroke medicine that is of benefit to all patients presenting to hospital. Estimated benefits from stroke unit care are:

1. **Death and Dependency:** In a recent summary of 23 clinical trials, Stroke Units reduced death and dependency by one-fifth (22%).<sup>51</sup>
2. **Cost savings:** Few analyses are available. The most rigorous was a randomised UK trial of Stroke Unit vs General ward vs Home care conducted by Kalra et al. They found that Stroke Unit care reduced overall healthcare costs by 22% compared to care on a General Ward.<sup>52</sup> The ESRI Cost of Stroke in Ireland report estimated that €5 million approximately could be saved annually by provision of stroke unit care to 95% of admitted patients.<sup>5</sup>
3. **Number Needed to Treat:** The Stroke Units Trialists Collaboration estimated that 1 extra patient returned to independent community living for every 20 patients treated on a Stroke Unit. The rate of nursing home admission is estimated to be reduced by 2-3% (absolute rates), corresponding to a relative reduction of approximately 20%.

4. **Length of Stay:** The UK National Audit Office 2005 report noted that increased Stroke Unit care was associated with a reduction in acute hospital mean LOS from 34 days in 2001 to 28 days in 2004, an 18% reduction.<sup>43</sup> Consistent with this estimate, the Cochrane Collaboration also reported that Stroke Unit care was associated with a significant LOS reduction of about 6 days.<sup>51</sup> This is probably due to immediate access to experienced stroke-trained specialists, protected 'fast-track' access to key diagnostic investigations, early therapist assessments, and efficient communication with community services.

## **7.2 Current Status**

The Irish National Audit of Stroke Care reported a stroke unit in only one Irish hospital with units near development in 3 others in 2006. The 2010 HESS survey found that 18 acute Irish hospitals reported operating a Stroke Unit. Another Stroke Unit is reported to have opened in July 2010, bringing the total to 19 (59% of acute hospitals) by end 2010. In addition, 2 non-acute hospitals operate rehabilitation stroke units. In total, 21 Stroke Units were identified nationally by end 2010. Of the Units operating in acute hospitals, 16 hospitals reported operating an acute or combined (acute plus rehabilitation) Stroke Unit, while a further 3 acute hospitals reported a rehabilitation stroke unit.

In the HESS survey, 34 acute stroke beds were reported nationally and a combined total of 140 acute/rehabilitation stroke beds were reported. Including the 2 rehabilitation units operating in non-acute hospitals, the total number of protected stroke beds is 156. Access to stroke beds, regardless of type, varies within and between HSE areas. By comparison, the INASC recommended a minimum bed provision of 365 nationally. This figure was emphasised as a conservative estimate.

Validation of the information on Stroke Units reported in the HESS survey is planned for 2012.

## **7.3 Approach to deal with**

### **7.3.1 New Stroke Units**

Stroke Units will be developed in all acute hospitals currently without Units, who admit patients with stroke via the ED, with prioritisation of hospitals with high numbers of stroke admissions annually. It is intended to develop such Units in all regions nationally, including all HSE regions. It is estimated that development of 9 additional Stroke Units will result in 90% of all acute Irish hospitals operating a Stroke Unit, and 90% of all Irish patients with stroke admitted to a hospital with a functional Unit. An additional 2,700 patients annually would be admitted to hospitals operating a Stroke Unit. The steps involved are:

- a. Identification of initial hospitals for new Stroke Unit development, based on geographic location and volume of patients admitted annually.

- b. Identification of gaps in key personnel of the stroke Unit team, by a workforce survey undertaken by the Project Team
- c. Agreement within HSE CSPD and Integrated Services Directorate, including Regional Directors of Operations and hospital CEOs/Clinical Directors and Directors of Nursing, to fill key gaps in staffing via redeployment or new appointments, as appropriate. This is likely to require negotiation for specific posts to be prioritised for appointment, either within or excluded from the existing employment moratorium.
- d. Identification of appropriate physical space within selected hospitals in consultation with hospital CEOs, Clinical Directors, and Local Stroke Teams
- e. Purchase of appropriate capital equipment
- f. Movement of clinical care to new Stroke Units, with local clinical governance by the Local Stroke Team

**7.3.2 Development of standard protocols and pathway templates for Stroke unit care.** See Appendices 7 to 18.

**7.3.3 Development of training programmes for health professionals involved in stroke unit care.**

**7.3.4 Development of an audit/governance structure and necessary data set for all stroke patients admitted to hospital.**

**7.4 Programme Targets**

1. Acute, combined (acute and rehabilitation) or rehabilitation stroke unit in 90% of hospitals accepting patients with stroke/TIA by end 2011, and all hospitals by end 2012 (Q4 2012)
2. Increase rate of stroke unit care from 3% to 50% of all acute stroke patients, admitted for at least 50% of their hospital treatment (Q1 2012)
3. Implementation of protocols for Stroke Unit care in at least 90% of units by end 2011, and all hospitals by end 2012 (Q4 2012)
4. Development a Stroke Unit Quality Index in partnership with the Irish Heart Foundation, HSE, HIQA, and Dept of Health and Children (Q3 2011)

## 8 Stroke Care in the Community

### 8.1 Background

Irish hospitals are under unprecedented pressure to reduce hospital admissions, length of stay and costs. There is substantial international evidence to support early transfer of the stroke patient back into their community from a fiscal, physical, psychological, risk management and social aspect. This is reflected in a key objective of the Primary Care Strategy, specifically to provide care for the patient in their own home or as close to their home as possible.<sup>8</sup> The national Community Stroke Services Survey (CoSS)<sup>53</sup> clearly defines the significant gaps in community stroke services to providing evidence based, best practice model of care, specifically neuro trained multidisciplinary teams, equipment and facilities. If these gaps are not addressed, stroke patients discharged home earlier will be at increased risk of hospital re-admission, long-term disability and ultimately premature institutionalised care. In addition, recent advances made in acute stroke care in Ireland will be undermined without appropriate, prompt, responsive community stroke services to discharge the patients home to.

Benefits from organised community multidisciplinary stroke services include:

- decreased length of hospital stay
- decreased overall cost of care. Dunkerly<sup>54</sup> found average length of stay of 58 days in their community stroke rehabilitation programme costed £1,510 pp vs. 58 days in acute hospital = £4,293
- increased patient satisfaction
- decreased risk of long-term institutionalisation

### 8.2 Current status.

The Irish National Audit of Stroke Care (INASC) confirmed anecdotal evidence that post hospital discharge care for people with stroke in Ireland was fragmented at best.<sup>7</sup> The stroke patient can be a casualty of poor discharge planning. Over 52% of community therapy managers surveyed in CoSS said they rarely or never have multidisciplinary communication with the patient's hospital team prior to discharge home whilst 75.7% said that they did not have access to relevant hospital records.<sup>53</sup> Lack of integrated discharge planning can lead to long delays in initiating services and equipment provision increasing risk and anxiety, delayed support and loss of the potential rehab window. CoSS confirmed that 78.9% of stroke patients receive their post acute hospital service in a generic Primary Care setting, indicating that neuro rehabilitation in community is extremely limited which can lead to longer hospital stays than is medically necessary or increased discharges to long-term care. There is much evidence that service and information needs of people with stroke, their families and carers after transfer from hospital to community are not adequately met.<sup>55</sup> Carers reported poor follow up procedure for initiating rehab in the home.<sup>56</sup> The CoSS survey found that a key worker is rarely or never allocated (77.2%) to clients with stroke to facilitate a seamless

transfer across the continuum and ongoing needs of the stroke patient in the home/community. This leads to isolation and vulnerability of the person with a stroke and their carer, often an elderly family member.

INASC<sup>7</sup> found 15% of people with stroke were institutionalised from acute care and more discharged to intermediate care, possibly due to low levels of home support. There remains very limited access to therapy in nursing homes. Limited focus on education and primary prevention of recurring strokes when patients are adapting to being home and more receptive to learning represents a lost opportunity. INASC recommended that community rehabilitation should be developed to facilitate early supported discharge. It has been shown that better outcomes are achieved for post acute stroke patients in organised multidisciplinary care which community based rehabilitation must be benchmarked against.<sup>57</sup>

There are, undoubtedly, pockets of excellence where stroke services are organised, standardised, built around individual patient's needs, evidence based and results orientated. These must be replicated across the country to become the norm for all people with stroke discharged from hospital if we are to improve on the outcomes shown in INASC.<sup>7</sup>

See Appendix 5 for list of members of Community services subgroup.

## **8.3 Achievements to date**

### **8.3.1 Clinical Care Pathways**

A clinical care pathway was developed for people with stroke on discharge from acute hospital with 4 optional and integrated discharge paths to facilitate the individuals' changing needs. (See Figure 2)

### **8.3.2 Community Stroke Services Survey**

The Community Stroke Services Survey (CoSS)<sup>52</sup>, developed and rolled out by the National Stroke Community subgroup in Q2 2011, had a 92.7% overall response rate across 8 disciplines.

Key points included:

- Only a small percentage of each discipline's staff is dedicated to stroke services e.g Physiotherapy 2.3%, Occupational Therapy 4.8%, Speech and Language Therapy 9.2%, Public Health Nursing 0.8%, Public Health Nursing 0.8% and Nutrition and Dietetics 1.9%
- Only 15.8% said they had a local Stroke Team comprising of both acute and community disciplines
- Only 15.3% indicated that they had an Early Supported Discharge protocol agreed with Acute Hospital Services.
- Lack of consistency in defined referral criteria for access to services, including age limitations (both below and above 65), medical card, geography, rehab potential, requiring more than 1 discipline
- lack of adequate IT infrastructure for basic service statistical information and analysis to aid service development e.g. numbers of stroke clients referred, stroke specific waiting lists, specialised equipment provision

- stroke waiting lists for each discipline and average length of wait were significant for some services, often manually collated, and small in other areas, possibly due to referrers believing it futile to refer when stroke specific services are limited.

The CoSS survey showed that several counties have no access to a community Nutrition and Dietetics Service. Current community resources do not permit all home enterally fed clients to be seen. Of those who are seen, few receive domiciliary visits due to small numbers of staff on the ground and increased service demands. Only a small number of stroke patients are referred for secondary prevention to community.

The survey also showed that Community Occupational Therapy and Physiotherapy waiting lists are lengthy in many areas with many therapists covering a generic caseload, limiting resources available for people with stroke. Equipment provision to facilitate independence is often the only OT intervention for people with stroke in community whilst treatment by an occupational therapist with expertise in stroke care, has been shown to demonstrably reduce activity limitation after stroke, potentially decreasing dependency and cost on health services by maintaining someone in their own home.<sup>58</sup>

Similarly, Community SLT for adults with stroke is not consistently available across the country and waiting lists may be long. A swallow disorder or communication problem will result in distress for the person and his / her family. Where a swallow disorder exists, lack of prompt SLT input may put the person at risk of aspiration pneumonia and possible readmission to hospital. Access to videofluoroscopy assessment of swallow in the hospital can be problematic for the community SLT. Access to funding for communication devices varies and in some areas is not available at all. In counties with a dispersed population, access to therapy services such as SLT can be challenging and may limit the intensity and duration of the rehabilitation programme. Conversational partner schemes providing a demonstrably significant benefit to the person with a communication disorder remain limited in rural areas.

The CoSS survey found an estimate of only 0.8% of total WTE in Public Health Nursing dedicated to people with stroke in the community. This is not surprising as the role of the PHN/RGN encompasses the care of all patients referred in the community with a medical card including those with chronic diseases e.g. stroke. This confirms the priority for dedicated nursing posts to provide skilled care for people with stroke/neurorehab, as part of the Neurorehab Team at Health Service Area level. Within the Public Health Nursing Services, a number of services including the Community Rehabilitation & Support Team (C.R.&S.T.) and the Community Intervention Teams (CITs) facilitate the early discharge of elderly people from hospital who can benefit from enhanced multidisciplinary rehabilitation, for a defined period of time, in their own home environment.

Just over half (53.4%) of respondents to the CoSS survey stated that they always or mostly offer review visits to people with stroke post discharge. All patients with residual impairment after an initial period of rehabilitation should be offered six monthly reviews and offered referral to specialist services if there are new problems or a change in physical or social environment.<sup>59</sup>

The COSI study<sup>5</sup> found that indirect costs to the state, relating to the loss of productivity by people with stroke, were €99-169 million. Many factors that people with stroke have highlighted as barriers to them returning to work are lack of information, difficulty with transport, fatigue, reduced confidence, and an inability to meet previous expectations. In a UK study of people aged under 65 who had had a stroke, just 17% of people were in work one year on.<sup>60</sup> Vocational rehabilitation is a set of services designed to enable participants to attain skills, resources, attitudes, and expectations needed to seek work, complete the interview process, obtain a job and maintain a job.<sup>61</sup> Vocational services also need to support the person with stroke once they return to employment as employment retention may also be a problematic area for people with stroke. Although cost-efficacy studies have not been completed to date for vocational rehabilitation with stroke, programmes for those with traumatic brain injury have been found to be cost-effective, with costs recovered within 20 months.<sup>62</sup>

While much intervention in the community for people with stroke can and is based in the service users home, work place or local community, it is essential to have access to a centralised treatment and administration space, to complete interventions such as splinting, group work, standardised assessments (AOTI submission to Rehab strategy)<sup>63</sup> and gain access to specialised non portable equipment such gait trainers and balance masters.

### **8.3.3 Early Supported Discharge**

A business case for an Early Supported Discharge (ESD) programme, including calculated typical costs per patient through ESD in city settings with hospital outreach services and in a rural setting with community rehabilitation was developed and signed off by the Project Team. Two sites have agreed to re-configure staffing in order to pilot ESD programmes for a one year period from September 2011:

- Urban hospital outreach service : Mater Misericordiae University Hospital and HSE Dublin North Inner City ISA
- Rural community in-reach service- HSE Midlands community rehabilitation team and Mullingar Hospital.

A sum of € 39,160 for each site was secured via the national programme for travel and basic equipment costs to implement these pilots. A number of other sites have also expressed interest in contributing to this data in early 2012 and are undertaking audits to gather baseline figures of patients who may be suitable for ESD at their sites.

### **8.3.4 Joint Nursing and AHP Stroke Education & Training Programme**

The Office of Nursing/Midwifery Services Directorate and Therapy Professions Council representatives are developing collaborative stroke training and education programmes in modular format to meet the needs of different staff working with stroke patients in all settings defined in the stroke care pathway e.g. stroke specialist through to the home carer. The first foundation course is at pilot stage and will be delivered as a Train the Trainers programme upon completion of the online Stroke Training and Awareness Resources competency module.<sup>64</sup>

## **8.4 Approach to deal with**

With recent, ongoing improvements in the management of acute stroke care and the need to decrease hospital length of stay, patients can and should be going home sooner. CoSS<sup>53</sup> clearly identified the gaps in community stroke services and puts a fresh focus on the need for re-organisation of community stroke care to facilitate timely, safe transition to home/ongoing rehab via Early Supported Discharge and/or continued Rehab close to home as soon as medical intervention is no longer necessary. This can only occur when appropriate community supports are in place.

The ongoing Community Subgroup Working Plan includes:

### **1. Key Recommendations for improving stroke care in the community**

These have been defined by the National Stroke Community Subgroup based on results of COSS and the National Clinical Guidelines for Stroke<sup>3</sup> to address current gaps in community stroke service and are currently with the National Project Team for consultation.

### **2. Roll out of Six to Eight Pilot NeuroRehab Teams encompassing ESD and ongoing rehabilitation**

The demands on acute hospitals continue to increase while budgets and staff numbers are being reduced, leading to major congestion and overflow. This, combined with the CoSS results, puts a great urgency on the need to organise the fragmented and often absent community stroke care from within available community resources and some key additional posts into neuro rehab teams as per our Community Stroke Care Pathway. The potential impact is far reaching, including a reduction of length of stay for this cohort of patients by as much as 20% with similar outcomes and greater patient satisfaction achievable, provided there is a dedicated service with expertise that can respond in a timely manner. The National Stroke Project Team proposes the development of 6 - 8 pilot neuro rehab teams, to include rehab for stroke and acquired brain injuries, with the following criteria

- The pilots are established where there is a robust Acute Stroke Unit
- Demonstrated need to develop Early Supported Discharge
- Demonstrated delayed discharges due to lack of responsive community service
- Where there is an existing community Adult Disability MDT or similar with basic neuro expertise



**3. Build in an Integrated Discharge Planning practice (per HSE Code of Practice 2008)<sup>65</sup>,** specific for stroke patients into the pilot models to promote a seamless and continuous transfer into community stroke services, including general practice.

**4. Proposal for essential reappointment of key community staff**

Following the pilot results, the national stroke community subgroup will develop a proposal for reorganisation of a percentage of community posts into neurorehabilitation teams to address community stroke service gaps identified in CoSS.

**5. Referral criteria for community neuro rehab,** specific to Acquired Brain Injury will be developed by the community stroke subgroup

**6. An agreed best practice model of care** for each stage of the Stroke Community integrated care pathways

**7. Link with Geriatric Medicine Programme** to expedite Fair Deal and review how homecare packages are being delivered

**8. Review with Rehabilitation, Care of the Elderly and Primary Care Programmes** how to ensure stroke patients in extended care have access to skilled therapies for maintenance to reduce hospital readmissions and for periodic reviews to identify late rehabilitation potential. Rehabilitation Medicine has an important role to play for the under 65 year olds inappropriately placed in long term care facilities.

**9. Standardising Patient Information:** Work with IHF Stroke Council on this project and promote it with staff through the intranet and patients/carers through a national campaign.

## **8.5 Resources Required**

### **8.5.1 Capital & Revenue**

The cost of implementing an early supported discharge programme for a period of 8 weeks to 100 patients per annum was estimated to be €231,810. This figure was based on a review of consensus data from international trials of ESD services together with data collated from a 6 month audit carried out at the Mater Misericordiae University Hospital (MMUH). The cost of ESD service provision will be validated via the two pilot programmes which the stroke programme has planned to commence from mid- September for a period of one year.

Cost of training for reappointed staff into community rehab team including a. clinical and b. team development will be defined by 2 pilots completed in Q4 2012

### **8.5.2 Potential Benefit**

#### **Community Neuro-rehabilitation teams/ Community Neuro Specialist Teams:**

Reappointing of staff and addition of some key posts to multidisciplinary rehabilitation teams and staff up-skilling in neuro-rehabilitation and in team working will

- reduce and eliminate much of the gaps identified in INASC and the CoSS survey above
- reduce average length of hospital stay
- reduce hospital re-admission
- decrease institutionalisation and reliance on Fair Deal

#### **Early Supported Discharge**

If appropriately resourced and implemented, early supported discharge programmes may offer substantial opportunities for delivering rehabilitation and other aspects of post-acute stroke care to patients in their home instead of in the hospital setting. When carefully selected according to need, it is estimated that approximately 25% of hospitalised stroke patients may be eligible. Benefits include improved patient outcomes, improved patient satisfaction, substantial reductions in hospital length of stay, and reduced hospital costs.

#### **Team Training**

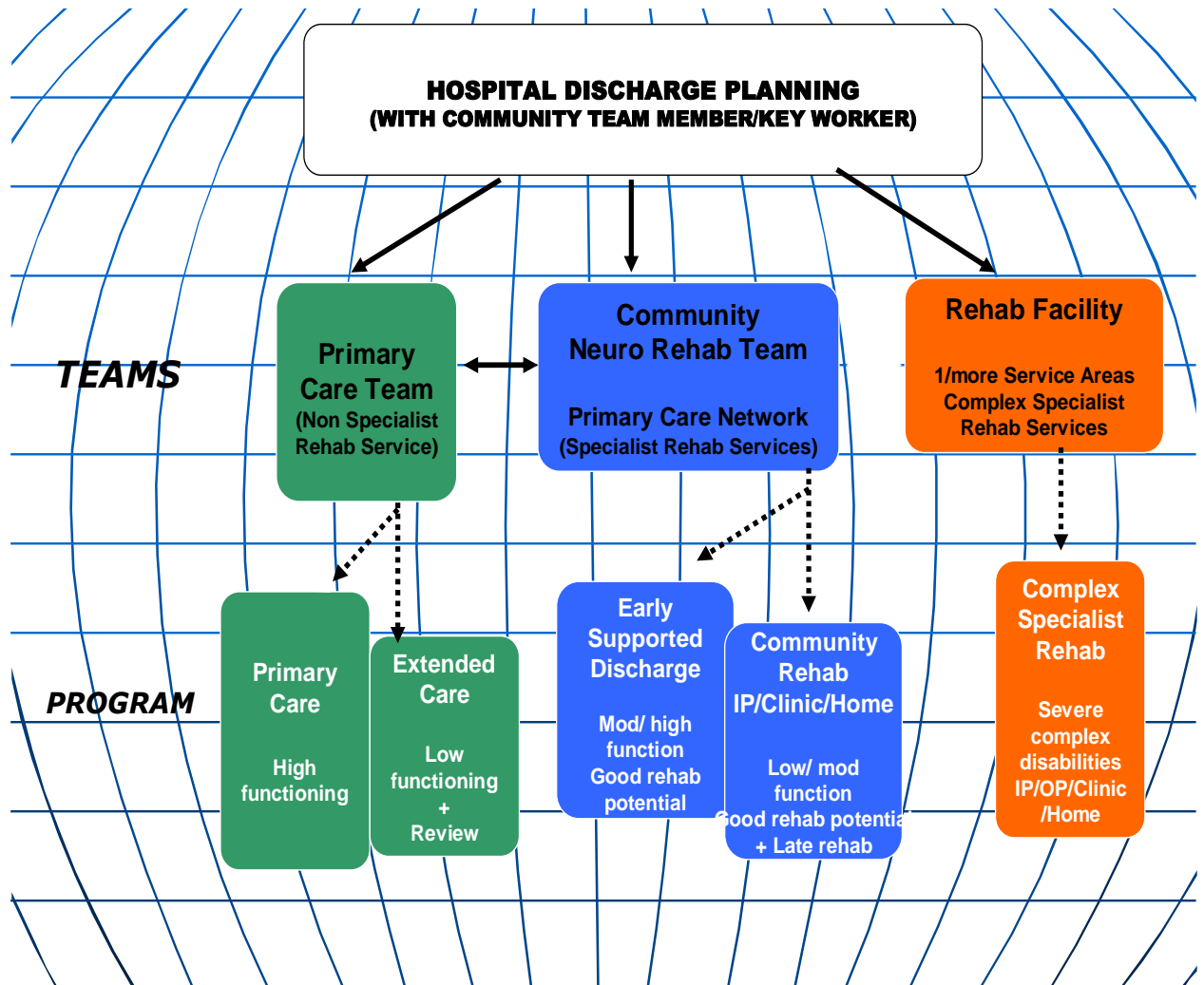
Team training will ensure a collective understanding of patient needs, enhance the quality of care provided, improve patient outcomes and reduce complications. Stroke patient and carer training will also help to reduce anxiety and risk in the home setting.<sup>66,67</sup>

## **8.6 Programme Targets**

1. Pilot 6 to 8 Community Neuro- rehabilitation teams in collaboration with their local acute stroke rehabilitation team to provide, in addition to ESD, community neuro-rehabilitation for stroke clients with low to moderate function and good rehabilitation potential (Q2 2012)
2. Submit proposal for dedicated community neuro rehabilitation posts not available in these pilot areas (Q4 2011)
3. Agree team based outcome measures of Community Neurorehab Teams to measure benefits under Cost, Quality and Access (Q2 2012)
4. Length of hospital stay reduced by 8 days in patients treated via Early Supported Discharge programme (Q4 2012)
5. Patient satisfaction and quality of life improved in patients treated via Early Supported Discharge programme (Q4 2012)
6. Baseline audits will be undertaken in a further 6-8 sites to determine numbers of patients suitable for ESD on a national basis
7. Method and content identified to collate nationally stroke outcome measures of multidisciplinary community neuro-rehabilitation where they exist (Q4 2012)

Figure 2: Clinical Care Pathway for people with Stroke on discharge from acute hospital

## COMMUNITY NEURO CARE PATHWAY



Developed by  
**COMMUNITY STROKE SUBGROUP**  
 of  
 The National Stroke Clinical Care Programme.  
 Finalised 29.11.11

## 9 Stroke Register/Evaluation & Information Systems

### 9.1 Background

Patient safety, quality assurance of services and health information are key issues for the chronic disease programmes in the Clinical Strategy & Programmes Directorate. This is in accordance with the National Strategy for Health Information<sup>68</sup> and the Policy Framework for the Management of Chronic Diseases<sup>69</sup> includes *'the use of information systems and registers to plan and evaluate care for individuals with chronic disease'* among the principles for effective and efficient care of these conditions.

The National Cardiovascular Health Policy 2010 – 2019 recommends *'a comprehensive cardiovascular health services information system should be developed as a priority to enable the implementation of this policy'* (Recommendation 8.2) and *'minimum cardiovascular-specific datasets should be agreed and mechanisms established for collection of this information as part of routine care and in a manner that enables ready collation of national profiles'* (Recommendation 8.3).<sup>2</sup> Data standards for priority information modules of cardiology information systems were developed in association with the European Society of Cardiology during Ireland's US Presidency in 2004.<sup>70</sup> National Stroke and TIA Guidelines recommend that *'a centralised shared database for audit of all aspects of stroke care should be established to inform risk management and quality of services and to promote stroke research'*.<sup>3</sup>

### 9.2 Current Status

At the outset of the development of the national stroke programme there were a number of key research/audit documents and data sources used by the project team to inform the planning and development of the stroke programme. These included

- The Irish National Audit of Stroke Care (2008)<sup>7</sup>
- Survey of Acute Stroke Services (2009)<sup>71</sup>
- Hospital In-patient Enquiry (HIPE) data from Health Atlas
- Cost of Stroke Care in Ireland Study (2010)<sup>5</sup>

### 9.3 Approach to deal with

Information on stroke services and patient level data are required for the following purposes:

- To monitor the facilities, staff and processes in place for acute stroke care
- To compare patient profiles and outcomes with those recorded elsewhere
- To support clinical audit
- Overall, to assess the quality of patient care, plan improvements in stroke services and evaluate progress in implementing the Stroke Programme.

In general there are three sources of information on acute stroke care – hospital data (HIPE in Ireland); organisation and workforce surveys (such as INASC) and patient registers.

### **9.3.1 HIPE Data**

Analyses of HIPE data for acute stroke patients have informed development of the Stroke Programme. Information on these analyses will continue to be disseminated, including to service planners and health professionals.

### **9.3.2 Organisation and workforce surveys**

A number of surveys were carried out by the project team and their findings used to inform the development of business cases for the implementation of the programme. These include

- **The Hospital Emergency Stroke Services (HESS) Survey – 2010**
  - Reports: HESS survey – overall results October 2010
- **Phase 1 Workforce Planning Survey – 2010 Acute Hospitals**
  - Reports: WFP Report 1 Profession specific audit results and WFP Report 2 Hospital specific audit results
- **Phase 2 Workforce Planning Survey – 2011 Community Stroke Services Survey (CoSS)**
  - Reports: Report 1 – General audit results-September 2011  
Report 2 – Profession-specific audit results-September 2011  
Report 3 – Additional profession-specific audit results-September 2011  
Report 4 – Summary audit report – December 2011
- **Survey of Warfarin Clinic Services in Acute Hospitals – 2011**
  - Reports: Warfarin Clinic Survey Report – November 2011

Surveys of the structure of services and additional performance indicators relevant to acute care (including rehabilitation) and thrombolysis will continue to be carried out as part of the overall evaluation of the stroke programme implementation.

### **9.3.3 Stroke Register- Background**

Key issues for the establishment of an acute stroke register in Ireland were reviewed by Prof. Peter Kelly with input from a multidisciplinary panel of experts, grant-aided by the Irish Heart Foundation. The work is informed by a study of international stroke registers by Dr. Catherine Lynch which, with the support of an Advisory Group, included the compilation of draft data standards for acute stroke care.<sup>72</sup> The Stroke Improvement National Audit Programme (SINAP) in the UK is also relevant; this electronic acute stroke information system builds on previous audits (including INASC) undertaken by chart review.<sup>73</sup> In relation to stroke thrombolysis, a number of Irish consultants contribute to the Safe Implementation of Treatments in Stroke (SITS) Register.<sup>74</sup> A new SITS database was launched October 8<sup>th</sup> 2010.

In 2010/2011 the national stroke programme worked in partnership with Economic and Social Research Institute (ESRI) HIPE unit to develop and implement a national stroke register. In agreeing register content, particular attention was paid to basic variables recorded in Irish international registers and audits (eg. INASC,<sup>7</sup> Sentinel UK,<sup>44</sup> SINAP,<sup>73</sup> RIKS Stroke,<sup>48,49</sup> Registry of Canadian Stroke Network<sup>75</sup>). An acute stroke data screen or portal to the HIPE system was

developed and piloted in the Mater University Hospital in April/May 2011. By the end of September 2011 the register was rolled out in six hospitals. To provide valid data, it is essential that clinical diagnosis of stroke and TIA is validated by stroke teams familiar with individual patients. The clinical nurse specialist for stroke is the person responsible for the maintenance of the register at hospital level. The stroke register data are merged with the HIPE file-demographic, bed use, diagnostic and discharge data, when the patient is discharged.

#### **9.3.4 Stroke Register-Governance/Implementation**

The implementation of the stroke register is overseen by a National Stroke Register Interim Implementation Group. The group comprises representatives from the national stroke programme, ESRI and stroke register users. See Appendix 6. The process for hospital implementation involves a presentation from a member of the national implementation group, followed by a training session by ESRI HIPE unit staff. At the end of 2011 the six hospitals where the register was up and running were invited to give their views and feedback on the system and the data elements. This feedback was considered by the national group and changes were made to the dataset. Appendix 20 shows the data set for 2012. All hospitals with access to the HIPE portal are now requested, through the Area Implementation Plan, to implement the HIPE Stroke portal.

### **9.4 Plan for monitoring acute stroke care**

In 2011, three Key Performance Indicators (KPIs) were developed for the stroke programme as part of the overall public health workstream for all of the clinical care programmes. Their development was linked to the development the HIPE portal dataset and implementation of the stroke register.

The following three KPIs were agreed for reporting from 1<sup>st</sup> January 2012

1. The percentage of acute stroke patients who spend all or some of their hospital stay in an acute or combined stroke unit
2. For acute stroke patients admitted to an acute or combined stroke unit, the percentage of their hospital stay spent in the stroke unit
3. The percentage of patients with confirmed acute ischaemic stroke in whom thrombolysis is not contraindicated who receive thrombolysis

See Appendix 20 for complete metadata details as per HIQA template.

### **9.5 Programme Targets**

- The overall plan for monitoring of stroke services and surveillance of patient care will be agreed by the end of Q1 2011.
- Agreement of KPIs and dataset to be collected as part of national register. (Q1-Q4 2011)
- Pilot of stroke register via HIPE Stroke Register Portal conducted in 2 Hospitals (Q2 2011).
- Continue the implementation of the national stroke register (Q1 – Q4 2012)

## 10 Linkages / Communication

A comprehensive communication plan underpins the implementation of the national Stroke Programme. Similar to other clinical care programmes, the Stroke Programme is developed and implemented through a core Project Team, Working Group and Advisory Group. These groups make up the national governance structure for the Programme and they form part of a wider Communication Plan.

The table below shows the communications processes for the Programme.

| STAKEHOLDER  | PURPOSE  | CURRENT ACTION  |
|--|--|---|
| Project Team   | Day to day management of Programme<br>Agree Programme objectives, set out tasks and time frames  | Weekly teleconferences<br>Fortnightly/monthly meetings  |
| Director of Clinical Strategy & Programmes Directorate (CSPD)  | 2-way updates<br>Raise issues<br>Sign off on Business Cases/Service Plan   | Fortnightly updates with Stroke Programme Clinical Leads  |
| Working Group  | Agree Stroke Programme plan with Team<br>Ensure consultation with and ownership from hospital, community and voluntary groups<br>Regional Leads will play a key role in the regional development of stroke networks<br>Provide support for local planning and implementation | Membership of Working Group agreed including regional stroke leads, members of the IHF Stroke Council, general practice, vascular surgery, First meeting of Regional Leads held in July 2010. Monthly teleconferences in 2011.<br>First meeting of Working Group held in October 2010. Regular meeting held in 2011<br><i>The full list of members is shown in Appendix 1</i> |
| Clinical Advisory Group (RCPI)   | Consult with consultant physicians treating patients with stroke on plans and guidelines   | Awaiting first meeting, to be convened by RCPI  |
| Office of Nursing/Midwifery Services Directorate (ONMSD) and Directors of Nursing/Midwifery Advisory Group | Consult with senior nursing representatives involved in treating patients with stroke on plans and guidelines  | Meeting held with Stroke Programme Clinical leads and ONMSD Director (Dr O Halloran) and the Directors of Nursing at the outset. Consulted on all aspects relevant to nursing.  |
| Therapy Advisory Group   | Consult with representatives of therapy and allied health professions treating patients with stroke on plans and guidelines  | Ongoing consultation with representatives of TAG via Stroke Clinical Leads and Project Team   |
| Linkages to other CSPD clinical care programmes –  | Identify and address overlap issues<br>Co-ordinate programmes<br>Collaborate on shared issues  | Meetings held with Clinical Leads for Acute Medicine, Diagnostic Imaging, ED programme, Primary Care programme, Rehabilitation programme, Elderly care programme, Neurology programme, Acute Coronary Syndrome programme, Epilepsy programme  |
| Irish College of General Practitioners   | Consult with general practitioners treating patients with stroke on plans and guidelines   | Ongoing consultation with representatives of ICGP via Stroke Clinical Leads and Project Team  |
| Other functions in CSPD – Quality and Risk   | Build quality improvement processes into plans   | Meetings held with Dr. Philip Crowley,  |

| <b>STAKEHOLDER</b>  | <b>PURPOSE</b>   | <b>CURRENT ACTION</b>   |
|---|--|---|
| Integrated Services Directorate – National Director and RDOs  | Promote objectives of programme<br>Agree ways of working<br>Advise on operational management structures for stroke services<br>Make recommendations re service delivery<br>Agree implementation issues   | Meetings held and Regular contacts with RDOs established.   |
| Other Directorates – CPCP (for planning, monitoring, metrics); Communications; Commercial and Support Services (for ICT)  | Understand wider organisational plans and processes<br>Discuss Stroke issues – ICT, metrics, etc.<br>Communicate to wider public<br>Fulfil statutory obligation regarding PQs  | High level metrics for 2011 service plan agreed<br>KPIs designed<br>Plan to design Stroke page for HSE Intra and Internet sites for staff and patients<br>Range of PQs regarding stroke services/plans answered |
| Hospital/community staff managing stroke services – CEO/Managers, DON, Clinical Director, Business Managers, Physicians, CNS, AHPs  | Promote objectives of Programme<br>Standardise Model of Care<br>Conduct gap analysis and discuss solutions<br>Provide guidance<br>Get feedback on progress   | Local Stroke Groups set up based on hospital/community integrated service<br>Stroke Networks established  |
| General Practitioners and practice staff  | Promote objectives of Programme and consult on a standardised Model of Care<br>Identify primary care issues, conduct gap analysis and discuss solutions<br>Make recommendations<br>Provide guidance Coordinate initiatives re care in the community with other Programmes and agree with GPs | GP representative appointed to Stroke Working Group<br>Liaise with ICGP on guidance and training for GPs through same   |
| Professional Bodies: Royal College of Physicians in Ireland; Office of Nursing/Midwifery Services Directorate, Irish College of General Practitioners, Irish Society Chartered Physiotherapists; Irish Association of Speech and Language Therapists; Association of Occupational Therapists of Ireland; Irish Nutrition and Dietetic Institute; Irish Association of Social Workers; Psychological Society of Ireland; Society of Chiropractors and Podiatrists of Ireland | Consult re programme objectives<br>Establish role in developing Diabetes Services<br>Address HR and training issues  | Liaise with professional bodies to appoint Regional Leads and Advisory Group members  |
| Patients and Families/<br>Patient Advocacy  | Obtain patient feedback on provision of care<br>Promote education and self- care   | Meeting held with representatives of patient groups and Clinical Leads<br>Two patient advocates to be appointed to Working Group  |
| Voluntary Sector  | Incorporate voluntary bodies perspective in stroke service development   | Clinical Leads have had several meetings with Irish Heart Foundation, including presentation to Council on Stroke   |
| DoHC/Oireachtas   | Stroke services will be developed in line with national policy   | Clinical Leads have met with Minister and senior public servants at DoHC, and presented to a cross-party group at Joint Oireachtas Committee for Health   |



## References

- <sup>1</sup> Cardiovascular Health Strategy Group. Building Healthier Hearts. The Report of the Cardiovascular Health Strategy Group, Department of Health and Children. Dublin: Stationery Office, 1999
- <sup>2</sup> Cardiovascular Health Policy Group Changing Cardiovascular Health. National Cardiovascular Health Policy, Department of Health and Children. Dublin: Government Publications 2010 Available at: [http://www.dohc.ie/publications/changing\\_cardiovascular\\_health.html](http://www.dohc.ie/publications/changing_cardiovascular_health.html)
- <sup>3</sup> Council on Stroke Irish Heart Foundation National Clinical Guidelines and Recommendations for the Care of People with Stroke and Transient Ischaemic Attack. Dublin: Irish Heart Foundation, 2010 Available at: [http://www.irishheart.ie/iopen24/stroke-council-t-13\\_396\\_398.html](http://www.irishheart.ie/iopen24/stroke-council-t-13_396_398.html)
- <sup>4</sup> Assessed at: [http://www.stroke.ie/iopen24/fast-campaign-t-483\\_487.html](http://www.stroke.ie/iopen24/fast-campaign-t-483_487.html)
- <sup>5</sup> Smith S, Horgan F, Sexton E, Wiley M and Steering Group. Cost of Stroke in Ireland. Dublin: Irish Heart Foundation 2010 Available at: [http://www.stroke.ie/iopen24/cost-stroke-report-t-483\\_509\\_788.html](http://www.stroke.ie/iopen24/cost-stroke-report-t-483_509_788.html)
- <sup>6</sup> Assessed at: [http://www.stroke.ie/iopen24/learn-about-stroke-t-483\\_495.html](http://www.stroke.ie/iopen24/learn-about-stroke-t-483_495.html)
- <sup>7</sup> Horgan F, Hickey A, McGee H, O'Neill D. Irish National Audit of Stroke Care. Dublin: Irish Heart Foundation, 2008 Available at: <http://www.stroke.ie/iopen24/stroke-audit-t-668.html>
- <sup>8</sup> Department of Health and Children. Primary care. A new direction. Dublin: Stationery Office, 2001 Available at: [http://www.dohc.ie/publications/primary\\_care\\_a\\_new\\_direction.html](http://www.dohc.ie/publications/primary_care_a_new_direction.html)
- <sup>9</sup> Link to relevant documents:  
[http://hsenet.hse.ie/8N8AkmGZQli7JZDAOVpxIA%3d%3d/eng/about/Who/Quality\\_and\\_Clinical\\_Care/Quality\\_and\\_Patient\\_Safety\\_Documents/handbk.pdf?ImportedResourceId=8N8AkmGZQli7JZDAOVpxIA%3d%3d](http://hsenet.hse.ie/8N8AkmGZQli7JZDAOVpxIA%3d%3d/eng/about/Who/Quality_and_Clinical_Care/Quality_and_Patient_Safety_Documents/handbk.pdf?ImportedResourceId=8N8AkmGZQli7JZDAOVpxIA%3d%3d)
- <sup>10</sup> Stewart S, Hart CL, Hole DJ, McMurray JJ. Population prevalence, incidence, and predictors of atrial fibrillation in the Renfrew/Paisley study. *Heart* 2001;86:516-21
- <sup>11</sup> Go AS, Hylek EM, Phillips KA, Chang Y, Henault LE, Selby JV, et al. Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: the AnTicoagulation and Risk Factors in Atrial Fibrillation (ATRIA) Study. *JAMA* 2001;285:2370-75
- <sup>12</sup> Wolf PA, Abbott RD, Kannel WB, . Atrial fibrillation as an independent risk factor for stroke: the Framingham Stroke Study. *Stroke* 1991;147:1561-64
- <sup>13</sup> Stewart S, Hart CL, Hole DJ, McMurray JJ. A population-based study of long-term risks associated with atrial fibrillation: 20-year follow-up of the Renfrew/Paisley study. . *Am J Med* 2002;113:359-64.
- <sup>14</sup> Stewart S, Murphy N, Walker A, McGuire A, McMurray jj v. Cost of an emerging epidemic: an economic analysis of atrial fibrillation in the UK. *Heart* 2002;90:286-92
- <sup>15</sup> Hart RG, Pearce LA, Aguilar MI. Meta-analysis: antithrombotic therapy to prevent stroke in patients who have nonvalvular atrial fibrillation. *Ann Intern Med* 2007;146:857-67
- <sup>16</sup> Hannon N, Sheehan O, Kelly L, Marnane M, Merwick A, Moore A, et al. Stroke associated with atrial fibrillation--incidence and early outcomes in the north Dublin population stroke study. *Cerebrovascular Diseases (Basel, Switzerland)* 2009;29(1):43-49
- <sup>17</sup> Gladstone DJ, Bui E, Fang J, Laupacis A, Lindsay P, Tu JV, et al. Potentially preventable strokes in high-risk patients with atrial fibrillation who are not adequately anticoagulated. *Stroke* 2009;40:235-40
- <sup>18</sup> Deplanque D, Leys D, Parnetti L, Schmidt R, Ferro J, De Reuck J, et al. Stroke prevention and atrial fibrillation: reasons leading to an inappropriate management. Main results of the SAFE 2 study. *Br J Clin Pharmacol* 2004;57(6):798-806
- <sup>19</sup> Gattellari M, Worthington J, Zwar N, Middleton S. Barriers to the Use of Anticoagulation for Nonvalvular Atrial Fibrillation: A Representative Survey of Australian Family Physicains. *Stroke* 2008;39:227-30
- <sup>20</sup> Partington SL, Abid S, Teo K, Oczkowski W, O'Donnell MJ. Pre-admission warfarin use in patients with acute ischemic stroke and atrial fibrillation: The appropriate use and barriers of oral anticoagulant therapy. *Thromb Res* 2007;120(5):663-9
- <sup>21</sup> Man-son-Hing M, Laupacis A, O'Connor AM, Biggs J, Drake E, Yetisir E, et al. A patient decision aid regarding antithrombotic therapy for stroke prevention in atrial fibrillation: a randomized controlled trial. *JAMA* 1999;282(8):737-43
- <sup>22</sup> Beyth RJ, Quinn L, Landefeld CS. A multicomponent intervention to prevent major bleeding complications in older patients receiving warfarin. A randomized, controlled trial. *Ann Intern Med* 2000;2133(9):687-95.

- 
- <sup>23</sup> Hylek EM, D'Antonio J, Evans-Molina C, Shea C, Henault LE, Regan S. Translating the results of randomized trials into clinical practice: the challenge of warfarin candidacy among hospitalized elderly patients with atrial fibrillation. *Stroke* 2006;4:1075-80
- <sup>24</sup> Wilson SJ, Wells PS, Kovacs MJ, Lewis GM, Martin J, Burton E, et al. Comparing the quality of oral anticoagulant management by anticoagulation clinics and by family physicians: a randomized controlled trial. *CMAJ* 2003;169(4):293-8
- <sup>25</sup> Fitzmaurice DA, Hobbs FD, Murray ET, Holder RL, Allan TF, Rose PE. Oral anticoagulation management in primary care with the use of computerized decision support and near-patient testing: a randomized, controlled trial. *Arch Intern Med* 2000;160(15):2343-8
- <sup>26</sup> Henegan C, Alonso-Coello P, Garcia-Alamino JM, Perera R, Meats E, Glasziou P. Self-monitoring of oral anticoagulation: a systematic review and meta-analysis. *Lancet* 2006;367(9508):404-11
- <sup>27</sup> Kirchhof P, Auricchio A, Bax J, Crijns H, Camm J, Diener H-C, et al. Outcome parameters for trials in atrial fibrillation: executive summary. Recommendations from a consensus conference organised by the German Atrial Fibrillation Competence NETwork (AFNET) and the European Heart Rhythm Association (ERHA) *European Heart Journal* 2007;28:2803-17
- <sup>28</sup> Hobbs FD, Fitzmaurice DA, Mant J, Murray E, Jowett S, Bryan S, et al. A randomised controlled trial cost-effectiveness study of systematic screening (targeted and total population screening) versus routine practice for the detection of atrial fibrillation in people aged 65 and over. The SAFE study. *Health Technol Assess* 2005;9:1-74
- <sup>29</sup> Fitzmaurice DA, Hobbs FDR, Jowett S, Mant J, Murray ET, Holder R, et al. Screening versus routine practice in detection of atrial fibrillation in patients aged 65 or over: cluster randomised controlled trial. *BMJ* 2007;335(7616):383
- <sup>30</sup> Irish National Audit of Stroke Care Research Team. Irish National Audit of Stroke Care (INASC). Dublin Irish Heart Foundation, 2008
- <sup>31</sup> White S, Feely J, D. ON. Community-based study of atrial fibrillation and stroke prevention. *Irish medical Journal* 2004;97:2909-45.
- <sup>32</sup> Deasy C, Wakai A, McMahon GC. Emergency department protocolised management of acute atrial fibrillation: how many patients in a tertiary hospital are eligible? *Irish medical Journal* 2006;99(9):272-3
- <sup>33</sup> Rothwell PM, Giles MF, Chandratheva A, Marquardt L, Geraghty O, Redgrave J, Lovelock C, Binney LE, Bull LM, Cuthbertson F, Welch SJV, Bosch S, Carasco-Alexander F, Silver LE, Gutnikov SA, Mehta Z on behalf of the Early use of Existing Preventive Strategies for Stroke (EXPRESS) study Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison *The Lancet* October 2007; Volume 370, Issue 9596, Pages 1432 - 1442, 20
- <sup>34</sup> Chaturvedi, S. Bruno, A. Feasby, T. Holloway, R. Benavente, O. Cohen, SN. Cote, R. Hess, D. Saver, J. Spence, JD. Stern, B. and Wilterdink, J. Carotid Endarterectomy - An evidence-based review Report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology *Neurology* 2005;65:794-80
- <sup>35</sup> Liapis, CD. Bell, PFR. Mikhailidis, D. Sivenius, J. Nicolaidis, A. Fernandes, J. Biasi, G. Norgen, L. on behalf of the ESVS Guidelines Collaborators *ESVS Guidelines. Invasive Treatment for Carotid Stenosis: Indications, Techniques* *European Journal of Vascular and Endovascular Surgery* 2009; 37: S1eS1
- <sup>36</sup> Sacco, RL. Adams, R. Albers, G. Albers, MJ. Benavente, O. Furie, K. Goldstein, LB. Gorelick, P. Halperin, J. Harbaugh, R. Claiborne Johnston, S. Katzan, I. Kelly-Hayes, M. Kenton, E.J. Marks, M. Schwamm, L. Tomsick, T. Guidelines for Prevention of Stroke in Patients With Ischemic Stroke or Transient Ischemic Attack A Statement for Healthcare Professionals From the American Heart Association/American Stroke Association Council on Stroke: Co-Sponsored by the Council on Cardiovascular Radiology and Intervention: The American Academy of Neurology affirms the value of this guideline *Stroke* 2006, 37:577-61
- <sup>37</sup> O'Brien, F. Shelley, E. HIPE Stroke Reports 2006 2007 Copy on file
- <sup>38</sup> Rothwell PM, Giles MF, Chandratheva A, Marquardt L, Geraghty O, Redgrave JN, Lovelock CE, Binney LE, Bull LM, Cuthbertson FC, Welch SJ, Bosch S, Alexander FC, Silver LE, Gutnikov SA, Mehta Z; Early use of Existing Preventive Strategies for Stroke (EXPRESS) study Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison 2007 Oct 20;370(9596):1432-42

- 
- <sup>39</sup> Healthcare Improvement Scotland Technologies Scoping Report What is the published evidence of an association between hospital volume and outcome in elective carotid endarterectomy surgery? Number 2 December 2011
- <sup>40</sup> Hill, MD. Buchan, AM. for The Canadian Alteplase for Stroke Effectiveness Study (CASES) Investigators Thrombolysis for acute ischemic stroke: results of the Canadian Alteplase for Stroke Effectiveness Study CMAJ May 10, 2005 vol. 172 no. 10
- <sup>41</sup> Guidelines for Management of Ischaemic Stroke and Transient Ischaemic Attack 2008 The European Stroke Organization (ESO) Executive Committee and the ESO Writing Committee Assessed at: <http://www.eso-stroke.org/recommendations.php?cid=9> on 15/12/11
- <sup>42</sup> Adams HP Jr, del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, Grubb RL, Higashida RT, Jauch EC, Kidwell C, Lyden PD, Morgenstern LB, Qureshi AI, Rosenwasser RH, Scott PA, Wijdicks EFM, American Heart Association, American Stroke Association Stroke Council, Clinical Cardiology Council. Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology [trunc]. Stroke 2007 May;38(5):1655-71
- <sup>43</sup> Reducing Brain Damage: Faster Access to Better Stroke Care Report by the Comptroller and Auditor General HC 452 Session 2005-2006 16<sup>th</sup> November 2005 National Audit Office London
- <sup>44</sup> National Sentinel Stroke Audit Phase II (clinical audit) 2008 Report for England, Wales and Northern Ireland Prepared on behalf of the Intercollegiate Stroke Working Party by Clinical Effectiveness and Evaluation Unit Royal College of Physicians of London April 2009
- <sup>45</sup> Harris, D. Cadilhac, DA. Hankey, GJ. Hillier, S. Kilkenny, M. Lalor, E. On behalf of the National Stroke Foundation and the National Stroke Audit Collaborative National Stroke Audit: The Australian experience Clinical Audit 24<sup>th</sup> April 2010
- <sup>46</sup> Stroke Foundation of New Zealand National Acute Stroke Services Audit 2009 2010 Stroke Foundation of New Zealand Wellington, New Zealand
- <sup>47</sup> Kleindorfer, D. Yingying Xu. Moomaw, CJ. Pooja, K. Opeolu, A. Hornung, R. US geographic distribution of rt-PA utilisation by hospital for acute ischaemic stroke Stroke 2009; 40: 3580-3584
- <sup>48</sup> Eriksson, M. Jonsson, F. Appelros, P. Hulter Åsberg, K. Norrving, B. Stegmayr, B. Terént, A. Asplund, K. for the Riks-Stroke Collaboration Dissemination of Thrombolysis for Acute Ischemic Stroke Across a Nation Experiences From the Swedish Stroke Register, 2003 to 2008 Stroke 2010; 41: 1115-1122
- <sup>49</sup> Eriksson, M. Jonsson, F. Appelros, P. Asberg, KH. Norrving, B. Stegmayr, B. Terent, A. Asplund, K. and for the Riks-Stroke Collaboration Stroke 2010; 41: 1115-1122
- <sup>50</sup> Further information at: <https://sitsinternational.org/>
- <sup>51</sup> Stroke Unit Trialists' Collaboration . Organised inpatient (stroke unit) care for stroke. Cochrane Database of Systematic Reviews 2007, Issue 4. Art. No.: CD000197. DOI: 10.1002/14651858.CD000197.pub
- <sup>52</sup> Kalra, L. Evans, A. Perez, I. Knapp, M. Donaldson, N. Swif, CG. Alternative strategies for stroke care: a prospective randomised controlled trial The Lancet 2000; September 9: Vol 356
- <sup>53</sup> Community Stroke Services Survey Report 4 Summary Report Community Services Subgroup of the National Stroke Working Group December 2011
- <sup>54</sup> Dunkerly, A. Gallifent, R. Bligh, A. Outcomes of a Community Based Stroke Rehabilitation Service 2003 Accessed at [www.stroke.org.uk/document.rm?id=944](http://www.stroke.org.uk/document.rm?id=944) 5/1/12
- <sup>55</sup> Martin, BJ. Yip, B. Hearty, M. Marletta, S. Hill, R. Outcome, functional recovery and unmet needs following acute stroke. Experience of patient follow-up at 6 to 9 months in a newly established stroke service Scottish Medical Journal 2002; 6: 136-137
- <sup>56</sup> Ski, C. OConnell, B. Stroke: the increasing complexity of carer needs Journal of Neuroscience Nursing 2007; June: Vol. 39: No. 3: 172-179
- <sup>57</sup> Langhorne, P. Duncan, P. Does the organisation of post acute stroke care really matter Stroke 2001; 32: 268-274
- <sup>58</sup> Drummond reference to be supplied by Ciara Breen
- <sup>59</sup> Royal College of Physicians: National Clinical Guidelines for Stroke. 3rd ed. 2008 Assessed at: <http://bookshop.rcplondon.ac.uk/details.aspx?e=250>
- <sup>60</sup> Busch, MA. Coshall, C. Heuschmann, PU. McKeivitt, C. Wolfe, CDA. Sociodemographic differences in return to work after stroke – the South London Stroke Register (SLSR) Assessed at: <http://jnnp.bmj.com/content/early/2009/03/09/jnnp.2008.163295.full.pdf>
- <sup>61</sup> Occupational Therapy and Vocational Rehabilitation Ross, J. 2007 John Wiley & Sons Ltd England

- 
- <sup>62</sup> Radford, KA. Walker, MF Impact of Stroke on Return to Work Brain Impairment 2008; 9(2): 161–169i
- <sup>63</sup> AOTI submission to Rehabilitation Strategy ref. Ciara Breen
- <sup>64</sup> Stroke Training and Awareness Resources Assessed at: <http://www.strokecorecompetencies.org/node.asp?id=home> on 6/1/12
- <sup>65</sup> HSE Code of Practice for Integrated Discharge Planning 2008 November HSE Assessed at: [http://www.hse.ie/eng/services/Publications/services/Hospitals/Code\\_of\\_practice\\_for\\_integrated\\_discharge\\_planning.pdf](http://www.hse.ie/eng/services/Publications/services/Hospitals/Code_of_practice_for_integrated_discharge_planning.pdf)
- <sup>66</sup> Forster, A. Smith, J. Young, J. Knapp, P. House, A. Wright, J. Information provision for stroke patients and their caregivers Cochrane Database Systematic Reviews 2001;(3):CD001919
- <sup>67</sup> van den Heuvel, ET. de Witte, LP. Schure, LM. Sanderman, R. Meyboom-de Jong, B. Risk factors for burn-out in caregivers of stroke patients and possibilities for intervention. Clinical Rehabilitation 2001;15:669-77
- <sup>68</sup> Department of Health & Children Health Information A national strategy Dublin: Stationary Office 2004
- <sup>69</sup> Department of Health & Children. Tackling Chronic Disease. A Policy Framework for the Management of Chronic Disease. Dublin: Department of Health & Children; 2008
- <sup>70</sup> Flynn, MR. Barrett, C. Cosío, FG. Gitt, AK. Wallentin, L. Kearney, P. Lonergan, M. Shelley, E. Simoons, ML. The Cardiology Audit and Registration Data Standards (CARDS) European data standards for clinical cardiology practice European Heart Journal 2005; 26: 308-313
- <sup>71</sup> Shelley, E. Survey of Acute Stroke Services 2009 Copy on file
- <sup>72</sup> Lynch, CR. Supporting quality in acute stroke care Membership Thesis, Faculty of Public Health Medicine, Royal College of Physicians of Ireland, 2010
- <sup>73</sup> Royal College of Physicians SINAP (Stroke Improvement National Audit Programme) Assessed at: <http://www.rcplondon.ac.uk/clinical-standards/ceeu/Current-work/stroke/Pages/SINAP.aspx>
- <sup>74</sup> SITS International Coordination Office, Karolinska University Hospital, Stockholm, Sweden. Safe Implementation of Treatments in Stroke Assessed at: [www.sitsinternational.org](http://www.sitsinternational.org)
- <sup>75</sup> Registry of the Canadian Stroke Network Assessed at: <http://www.canadianstrokenetwork.ca/>