

## **Stroke Risk Factors, Subtype, and Outcomes in a Multi-Ethnic Stroke Population**

*J. Finnegan<sup>1</sup>, S. Mello<sup>2</sup>, N. Cogan<sup>2</sup>, S. Greene<sup>2</sup>, D. Ryan<sup>2</sup>, R. Collins<sup>2</sup>*

- 1. Tallaght University Hospital, Dublin, Ireland.*
- 2. Department of Age-Related Healthcare and Stroke Medicine, Tallaght University Hospital, Dublin, Ireland.*

### **Abstract**

#### **Aim**

We aim to describe differences in stroke risk factors, subtypes and outcomes in a multi-ethnic Irish Stroke population. Gaining an insight into prevalent risk factors and subtypes in ethnic groups may help target prevention efforts.

#### **Methods**

We retrospectively identified patients originally not of Irish ethnicity (ONIE) admitted to the acute stroke unit between 2016 and 2018 through surname recognition (N=44). Country of origin was confirmed on chart review. The presumed native Irish (PNI) patients admitted over the same time frame were used as a comparison group (N=437). Data was collected on stroke subtype, comorbidities, outcomes and socioeconomic factors.

#### **Results**

Patients ONIE made up 9.1% of all stroke unit admissions. Male gender was more common accounting for 33 of 44 (75%) patients ONIE and 251 of 437 (57.4%) PNI ( $p = 0.02$ ). Overall ONIE were younger than PNI patients (mean age 57.5 [SD 13.0] vs 69.6yr [SD 13.2],  $p < 0.001$ ). Patients ONIE also recorded higher rates of intracranial haemorrhage (ICH) (N = 15 [34.1%] vs N=51 [11.7%],  $p < 0.01$ ).

#### **Conclusion**

Our study demonstrates that stroke patients ONIE have a different stroke subtype and demographic profile compared to Irish patients. Patients ONIE are more likely to be young, male with higher rates of ICH.

## Introduction

Ireland is a country marked by a history of mass exodus beginning in the mid nineteenth century with the famine and continuing with fluctuating economic emigration since. However, in recent years those immigrating to the country outnumber those who leave by over 30,000 per year<sup>1</sup>. The most recent population census reveals that 12.7% of Irish residents are non-nationals, and a further 100,000 people hold dual citizenship<sup>1</sup>. This relatively recent influx of immigrants has impacted on healthcare delivery as physicians encounter an ever-diverse patient profile. Healthcare providers must not only become familiar with racial differences in genetic risk factor polymorphisms, but also be aware of cultural norms and beliefs that influence health seeking behaviour.

Previous studies have demonstrated ethnic variability in stroke incidence, subtype and mortality among immigrants to Western European countries, with differences apparent when compared to the native population and across ethnic groups<sup>2,3</sup>. Differences in stroke aetiology, risk factors and outcomes in a multi-ethnic first-generation immigrant population have not previously been compared to those of a native Irish population.

Using data gathered from the Tallaght University Hospital stroke register, we aim to describe trends and variances that exist between a racially diverse stroke population presenting to an urban tertiary level care centre. As a heterogenous disease, gaining an insight into prevalent risk factors and subtypes in ethnic groups may help target prevention efforts.

## Methods

Tallaght University Hospital is a large urban hospital located in Dublin with a catchment area of 450,000 people. The stroke registry collects data on all acute ischemic and hemorrhagic strokes, 90% of which were admitted to an acute stroke unit (ASU) in 2018<sup>4</sup>. Data collected includes demographic factors, co-morbid medical conditions, treatment, and outcomes. Medical record abstraction is performed for local and national audit by two stroke trained clinical nurse specialists on an ongoing, prospective basis.

Using the Tallaght University Hospital stroke registry, we retrospectively identified all patients with acute stroke admitted to the ASU in a two-year period between 2016 and 2018. Patients very likely to be originally not of Irish ethnicity (ONIE) were identified through surname recognition independently by two physicians. Their country of origin was then confirmed on chart review. Medical records were retrospectively reviewed to validate stroke registry accuracy and supplement data. We included the remaining presumed native Irish patients admitted to the ASU during the same period as a comparison group.

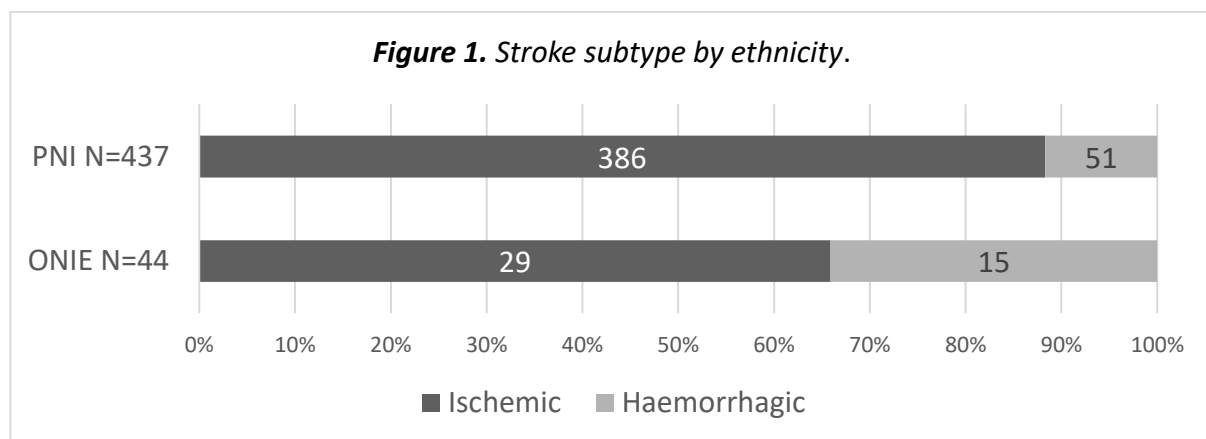
Patient demographics including age, gender, co-morbid conditions and socioeconomic class (dichotomized into manual or non-manual laborer) was collected. Stroke subtype was classified as either ischemic or hemorrhagic based on brain imaging. Relevant regular medications pre- and post-stroke were recorded. We used the modified Rankin Scale(mRS), length of stay, discharge destination, and death as stroke outcome measures.

Patients were divided into “Presumed Native Irish (PNI)” and “Originally Not of Irish Ethnicity” (ONIE) groups based on country of origin, and then further stratified into ethnic groups by continent of origin. For purposes of comparison, patients were also separated by stroke subtype into ischemic (AIS) or hemorrhagic (ICH) categories. Statistical software was used to calculate descriptive statistics, utilizing the Chi squared and t-test to analyse relationships between the groups.

## Results

A total of 481 patients were admitted to the ASU with a diagnosis of acute stroke between 2016 and 2018. Of these, 44 patients were confirmed to be of ONIE. This comprises 9.1% of all ASU stroke admissions. Seven patients originated from Africa, 15 from Asia and the remaining 22 from across Europe. Notably, no patients were identified from the Americas.

Male gender was more common regardless of ethnic or stroke subtype. Overall, male gender accounted for 33 of 44 (75%) patients ONIE and 251 of 437 (57.4%) PNI ( $p = 0.02$ ). Patients ONIE suffered from stroke at a much younger age than PNI (mean age 57.5 [SD 13.0] vs 69.6yr [SD 13.2],  $p < 0.001$ ). This difference was particularly marked for those with ICH (mean age 48.9 [SD 12.9] vs 70.8yr [11.6],  $p < 0.001$ ). There was a higher prevalence of ICH in the ONIE group ( $N = 15$  [34.1%] vs  $N=51$  [11.7%],  $p < 0.01$ ) (see Figure 1). When patients ONIE were further stratified by ethnicity, the rates of ICH remained high in all subgroups (African  $N = 3$  [43%], Asian  $N = 4$  [27%], European  $N = 8$  [36%]).



Hypertension was the most common vascular risk factor. There was no significant difference in its prevalence between ethnic group regardless of stroke subtype. Amongst patients ONIE with ICH, the prevalence of hypertension was 80%, with only one third of patients on treatment prior to admission. While the ONIE group with ICH did not have a significantly higher prevalence of hypertension they did report more smoking (26.6 vs 13.7 %  $p=0.05$ ) and a trend towards greater levels of diabetes mellitus (13.3% vs 3.9%,  $p = 0.18$ ). The rates of atrial fibrillation were similar between the two groups, as were the rates of pre-stroke anticoagulation (see Table 1).

**Table 1.** Baseline characteristics stratified by stroke subtype.

	Ischemic Stroke			Haemorrhagic Stroke		
	Irish N =386	ONIE N= 29	P value	Irish N = 51	ONIE N=15	P value
<b>Mean age</b>	69.4	62	0.004	70.8	48.9	<0.001
<b>Male Sex (%)</b>	225 (58.3%)	22 (75.9%)	0.06	26 (50.9%)	11 (73.3%)	0.13
<b>Mean BMI</b>	-	28.3	-	-	28	-
<b>Hypertension</b>	261 (67.6%)	20 (69.0%)	0.88	37 (68.2%)	11 (80%)	0.95
<b>Previous Stroke</b>	86 (22.3%)	7 (24.1%)	0.05	12 (17.6%)	1 (6.7%)	0.30
<b>Atrial Fibrillation</b>	118 (30.6%)	8 (27.6%)	0.85	11 (21.6%)	2 (13.3%)	0.48
<b>Diabetes</b>	88 (22.8%)	8 (27.6%)	0.86	2 (3.9%)	2 (13.3%)	0.18
<b>Smoker</b>	105 (27.2%)	9 (31%)	0.72	7 (13.7%)	4 (26.6%)	0.05
<b>Ex- Smoker</b>	135 (35%)	7 (24.1%)	0.66	16 (31.4%)	2 (13.3%)	0.17
<b>Preadmission antihypertensive treatment</b>	-	15 (51.7%)	-	-	5 (33.3%)	-
<b>Preadmission anticoagulation treatment</b>	32 (8.3%)	2 (6.7%)	0.79	7 (11.7%)	2 (13.3%)	0.97

20 patients ONIE had been resident in Ireland for more than 10 years, although 6 were only visiting temporarily. 73% were registered with a general practitioner on admission, compared to 97% of their Irish counterparts ( $p < 0.01$ ). Of those whose profession was identifiable through the medical records, 46.7% (14/30) were manual labourers and 53.3% (16/30) engaged in non-manual work (unknown occupation  $N = 14$ ). This is compared to 40.1% (99/242) and 59.1% (143/242) of the Irish stroke patients respectively ( $p = 0.55$ ) in whom occupation was recorded (unknown occupation  $N= 195$ ).

ONIE suffering haemorrhagic stroke had better outcomes than their PNI counterparts. Median modified Rankin Scale was lower at discharge (2 vs 4,  $p = 0.01$ ) and median length of stay was 3 days shorter. Patients ONIE had lower mortality rates regardless of stroke subtype and were more likely to be discharged home (see Table 2).

**Table 2.** Outcome measures stratified by stroke subtype.

	Ischemic Stroke			Haemorrhagic Stroke		
	Irish N =386	ONIE N= 29	P value	Irish N = 51	ONIE N=15	P value
<b>Median mRS</b>						
<b>Preadmission</b>	0	0	0.38	0	0	0.07
<b>Admission</b>	2	3	0.53	5	4	0.02
<b>Discharge</b>	1	1	0.34	4	2	0.01
<b>Mortality rate</b>	32 (8.3%)	1 (3.4%)	0.35	10 (19.6%)	0.0	
<b>Median length of stay (days)</b>	9	9		19	16	
<b>Discharged home</b>	300 (77.7%)	25 (86.2%)	0.28	23 (45.1%)	10 (73.3%)	0.05

## Discussion

Our study clearly demonstrates that stroke patients ONIE have a different demographic, subtype prevalence and risk factor profile compared to PNI patients. Patients ONIE are more likely to be young, male with higher rates of ICH. These findings are in keeping with the characteristics of young stroke patients described by the South London Stroke Registry<sup>5</sup>. Likewise, PNI patients in our study showed similarities with the population described in the North Dublin Stroke Study an equivalent age at presentation (70years) and an ICH rate of 11.6%<sup>6</sup>.

Racial differences in stroke incidence and survival have previously been reported in ethnically diverse countries such as the United Kingdom and America<sup>3,7</sup>. These studies have shown conflicting results conferring both race-associated advantages and disadvantages in stroke mortality rates. Kisella et al reported that black patients have higher age-adjusted mortality rates than whites explained by higher stroke incidence. However, data from the South London stroke register study refutes these findings, with evidence of a lower mortality rate in black patients<sup>7</sup>.

Patients ONIE in our study had better functional outcomes and lower mortality rates than their Irish counterparts, especially amongst those with ICH. No deaths occurred in ONIE patients with ICH despite the fact that this stroke subtype has a higher fatality rate than ischemic strokes. Because our overall study population was small, we could not carry out any meaningful subgroup analysis to better explain these differences. However, the young age of patients ONIE with ICH would intuitively confer a better chance of recovery, as an older PNI ICH cohort might be expected to be a frailer group, with reduced physiological reserve.

The Reasons for Geographic and Racial Differences in Stroke (REGARDS) study in the United States identified hypertension as a factor that plays a pivotal role in stroke risk between races<sup>8</sup>. In our study, hypertension was the most common risk factor for stroke across all subgroups, contributing to 80% of ICH in the ONIE group. Even though patients ONIE are much younger, they had a similar prevalence of hypertension when compared to older Irish patients, so likely age-adjusted hypertension prevalence would have been higher in the ONIE group. Howard et al. described hypertension as a triple threat for stroke in African Americans. Hypertension was more prevalent, it was less likely to be adequately controlled, and it resulted in a three-fold risk of stroke as compared to similar levels of hypertension in Caucasians. A 10mmHg difference in systolic blood pressure resulted in a 24% increase in risk of stroke in black patients, compared to an 8% increase in Caucasians<sup>9</sup>. Interestingly, there was not an increased stroke risk amongst normotensive people regardless of their race. These findings have important implications to target primary prevention efforts.

Immigrants unfamiliar with the healthcare system may have difficulty navigating services and seeking health related advice. Linguistic barriers as well as religious and cultural beliefs serve as barriers to accessing healthcare<sup>10</sup>. This is reflected in higher numbers of patients ONIE who were not registered with a general practitioner relative to PNI patients, and thus, more likely not to have cardiovascular risks assessed or treated.

The main limitation of our study is that neither our local nor national stroke registry prospectively collects data on ethnic origins. As such, we had to identify patients through surname recognition and then verify their country of birth through chart review. We found this methodology to have a specificity of 100%, in so far as, all patients so identified were born outside Ireland. This speaks to the homogeneity of recognisable Irish surnames, and to the fact that most immigrants to Ireland are first generation. Using this methodology we may have missed a small number of patients ONIE who have Irish surnames, nevertheless real differences were identified and a sample of the surnames identified revealed no foreign born patient. In particular, women who take the surname of an Irish husband could be missed. However, this subgroup may be representative of those who adopt the Irish lifestyle and culture to a greater extent, are more likely to be linked into the health service and may therefore have a risk profile more aligned to the native population.

In conclusion, our study has characterised a specific stroke profile of patients ONIE that differs greatly from that of the Irish population. In our stroke registry patients ONIE tend to be male, young, hypertensive, and have a higher prevalence of haemorrhagic stroke. These findings underscore the need to improve health education and services to our immigrant population to better identify cardiovascular risk and initiate preventative treatments. The cultural, economic and immigration-law barriers to this need to be better understood and tackled by a cross agency approach between our health and immigration services. This study provides us with initial Irish information on the patterns of stroke in our immigrant population and will help inform public health campaigns aimed at primary prevention and to encourage health seeking behaviour among immigrant groups.

**Ethical Approval:**

Local IRB ethical approval was obtained prior to commencement of this study.

**Declaration of Conflicts of Interest:**

The authors have no conflict of interest to declare.

**Corresponding Author:**

John Finnegan

Tallaght University Hospital,

Dublin,

Ireland.

E-Mail: john.finnegan@tuh.ie

**References:**

1. Central Statistics Office. Population and Migration Estimates - April 2019. Central Statistics Office. Cited on 22/9/2019. Available from:  
[https://pdf.cso.ie/www/pdf/20190829093831\\_Population\\_and\\_Migration\\_Estimates\\_April\\_2019\\_summary.pdf](https://pdf.cso.ie/www/pdf/20190829093831_Population_and_Migration_Estimates_April_2019_summary.pdf)
2. Agyemang C, Van Oeffelen AM, Norredam M, et al. Ethnic disparities in ischemic stroke, intracerebral haemorrhage, and subarachnoid haemorrhage incidence in the Netherlands. *Stroke*. 2014; 45(11): 3236-42
3. Heuschmann PU, Grieve AP, Toschke AM, et al. Ethnic group disparities in 10-year trends in stroke incidence and vascular risk factors: the South London Stroke Register (SLSR). *Stroke*. 2008; 39:2204–2210
4. Collins R, McCormack J. for the national stroke programme. National stroke register report 2018. Sept 2019; Health service executive document Ref CSP040/2019.  
<https://www.hse.ie/eng/about/who/cspd/ncps/stroke/resources/>
5. Wang Y, Rudd AG, Wolfe CD. Trends and survival between ethnic groups after stroke: The South London stroke register. *Stroke*. 2013; 44(2): 380-7
6. Kelly P, Crispino G, Sheehan O, et al. Incidence, event rates, and early outcome of stroke in Dublin, Ireland. *Stroke*. 2012; 43(8): 2042-47
7. Kissela B, Schneider A, Kleindorfer D, et al. Stroke in a biracial population: the excess burden of stroke among black people. *Stroke*. 2004; 35:426–431
8. Howard V, Cushman M, Pulley L, et al. The reasons for geographic and racial differences in stroke study: objectives and design. *Neuroepidemiology*. 2005; 25: 135-43
9. Howard G, Lackland DT, Kleindorfer MD, et al. Racial differences in the impact of elevated systolic blood pressure on stroke risk. *JAMA Internal Medicine*. 2013; 173(1):46-51
10. Zanchetta S, Poureslami I. H. Health literacy within the reality of immigrants' culture and language. *Canadian Journal of Public Health*. 2006; 97(2): 26-30