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RESEARCH ARTICLE

## Impact of Multimedia Campaigns on Recognition and Response to Stroke

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### ABSTRACT

**Background:** Timely recognition of stroke symptoms and appropriate emergency response offers those who experience stroke an increased chance of physical and psychosocial recovery. International research suggests there is a lack of knowledge amongst the general population of the signs and symptoms of stroke, this may impact on seeking treatment. Public awareness campaigns are designed to educate the public on how to recognise and respond to symptoms of stroke

**Aim:** To investigate recognition and response to stroke and associated factors.

**Design:** A cross-sectional study was designed, a researcher developed questionnaire sought information related to previous experience of stroke, knowledge of risk factors, recognition of stroke symptoms, awareness of treatment available and the ability to identify what the letters of the FAST acronym represent. The Stroke Action Test (STAT)<sup>41</sup> was used to investigate how participants would respond to specific symptoms of stroke.

**Sample:** A convenient sample (n=243) which included older people attending an outpatients' clinic in a large teaching hospital were included. A mixed method of data collection of online and paper version was used.

**Findings:** Results identified that 41% of participants recognised all six stroke symptoms as defined by the American Heart and Stroke Association. The symptom most frequently recognised by participants was numbness of the face, arm and leg (97%). The mean STAT score for participants was 9 which indicated that most participants would respond appropriately, by contacting the emerging services, to 9 out of a total of 21 items describing stroke in the STAT. Multivariate analysis identified that having previously had a stroke and knowledge of risk factors for stroke were significantly associated with recognition of stroke symptoms. Participants were most likely to respond to items which described classic stroke symptoms such as limb weakness and difficulty speaking.

**Conclusion** Awareness of treatment available for stroke is a predictor of appropriate response to stroke. Future stroke awareness campaigns should include information on the availability, benefits and timelines for treatment of stroke to help individuals who experience stroke overcome delays in their response to the recognition of stroke symptoms.

**Key Words:** Stroke, stroke knowledge, stroke symptoms, stroke action test, stroke awareness campaign

## Introduction

Although the incidence of stroke is decreasing, survivors of stroke are living with significant disability resulting in decreased quality of life.<sup>1</sup> Timely recognition of stroke symptoms and appropriate emergency response offers those who experience stroke an increased chance of physical and psychosocial recovery.<sup>2</sup> Early recognition of stroke symptoms is necessary to ensure emergency medical response and timely access to hospital treatment.<sup>3</sup> International research suggests there is a lack of knowledge amongst the general population of the signs and symptoms of stroke<sup>4-7</sup> which may explain delays in seeking treatment. However, individuals who are knowledgeable about stroke do not always take appropriate action.<sup>8</sup> Public awareness campaigns are designed to educate the public on how to recognise and respond to symptoms of stroke. The perceived impact of these campaigns on increasing individual's ability to recognise stroke symptoms and knowledge of appropriate response is varied.<sup>9-11</sup> The following paper will describe a research study aimed at evaluating a national stroke multimedia campaign in Ireland.

## Background:

There is over a decade of research investigating the general public's recognition and response to stroke.<sup>8, 13, 4, 14-21</sup> The impact of public awareness campaigns on recognition and response to stroke has been extensively investigated.<sup>7,11-12,22-29,</sup> However, methods used to investigate general public knowledge of stroke sign and symptoms have varied from web-based,<sup>30</sup> telephone,<sup>8, 4, 15, 17,31</sup> face to face,<sup>4,5, 8, 15, 17, 31, 36</sup> and postal surveys.<sup>21</sup> Each of these methods can bring their own shortcomings and are often dependant on availability of resources and small sample sizes. Questionnaires used to investigate recognition of stroke symptoms used both open-ended and closed-ended questions.<sup>4-6, 13-18, 21, 30-36</sup> The ability to name symptoms of stroke varied from 33%<sup>14</sup> to 62%,<sup>34</sup> when closed ended questions were asked compared to open ended questions on knowledge of stroke symptoms.<sup>15,32</sup> It is well-known that closed ended questions are less cognitively demanding and can bias responses.<sup>37</sup> Evidence suggests that variation in ability to name symptoms of stroke can also be explained by differences in demographic profiles of the research samples, as older people<sup>6,13-14,18,30-31,34</sup> with lower levels of education,<sup>33, 35, 14, 15, 18, 38, 36</sup> and people from marginalised communities<sup>35, 13, 17</sup> are less likely to recognise stroke symptoms. The symptoms most frequently recognised were limb weakness or paralysis<sup>35,34, 13</sup>

while failure to recognise atypical symptoms resulted in inappropriate response to symptoms.<sup>39, 40</sup> Older people are at high risk of stroke and when methods of investigation are not targeted to older people this can limit how best to deliver key health messages for those most at risk.<sup>17</sup>

The Stroke Action Test (STAT)<sup>41</sup> is an instrument designed to assess lay people's knowledge of the correct response to individual stroke symptoms. The Stroke Action Test (STAT) contains items that name or describe stroke symptoms and non-stroke symptoms. Studies have investigated how individuals respond to specific symptoms of stroke and found that just 14% of respondents would respond appropriately (by contacting the EMS) to more than 15 of the 21 STAT items/statements<sup>5</sup> while another study demonstrated that 18% of participants would respond appropriately to 11 of the 21 STAT items.<sup>32</sup> Participants were more likely to respond appropriately to items which described motor symptoms associated with stroke such as weakness or paralysis and are less likely to respond to items what they should do if they experienced stroke symptoms.<sup>4,13-18, 30-32, 34-35, 38</sup>

Large scale national studies have found that the ability to recognise stroke symptoms has not improved despite numerous public awareness campaigns.<sup>42,43</sup> Smaller regional studies have reported increased public knowledge of risk factors for stroke and increased ability to recognise stroke symptoms.<sup>26, 27</sup> A 90 minute education intervention aimed at middle aged men and women increased stroke knowledge in two semi-rural communities in Ireland.<sup>26</sup> In Germany, radio messages about how to recognise and respond to stroke as well as posters and fliers available at pharmacies, nursing homes and ambulances over a 6-month period increased stroke knowledge amongst the public.<sup>27</sup> Low-cost interventions have proven beneficial to increasing recognition of stroke symptoms and knowledge of appropriate response in communities.<sup>23, 24</sup> Also, a time series evaluation study has shown modest increases in thrombolytic therapy, which was sustained, overtime, following the UK Act FAST campaign.<sup>29</sup>

In Ireland, the Irish Heart Foundation launched the 'ACT F.A.S.T Stroke Awareness' campaign in 2010.<sup>44</sup> It was a multimedia campaign and was broadcast on TV and radio in three waves between 2011 and 2012. The aim of the campaign was to improve the public's ability to recognize the symptoms of stroke and to respond quickly by contacting the Emergency Medical Service (EMS). The acronym FAST (Facial drooping, Arm weakness, Speech difficulties and Time) has been used by the National Stroke Association, American Heart

Association, and others to educate the public on detecting symptoms of a stroke. FAST was first introduced in the United Kingdom in 1998 and emphasizes that effective stroke treatment is time dependent. It is estimated that it costs one million euros to run the campaign for four years, which makes it costly. The ACT FAST campaign in Ireland did not run between 2012 and until 2020 due to a downturn in the economic climate. The 2020 campaign concentrated mainly on social media and emphasized the importance of responding immediately to stroke symptoms to raise awareness of available timebound interventions to reduce death and disability from stroke.<sup>45</sup>

Research conducted following the 2011-2012 campaign identified that significant improvements were achieved in several areas of stroke knowledge<sup>7,11, 12</sup> however awareness of acute stroke interventions and intended behavioural response remained poor.<sup>7,11</sup> Studies to investigate recognition and response to stroke in Ireland have generally used researcher developed questionnaires including the Stroke Knowledge Score<sup>26</sup> and the Stroke Awareness Questionnaire.<sup>4,7, 11</sup> Items in these instruments are similar to the questionnaire used by O'Connell and Hartigan et al., (2014) which examined questions about risk factors for stroke and stroke symptoms. Response to stroke has been investigated using the Response to Symptoms Questionnaire<sup>11</sup> or by asking participants what they would do if they experienced stroke symptoms.<sup>4, 7, 11,26</sup> However, there is a need for research which investigates how individuals would respond to specific symptoms of stroke. Specifically, the STAT instrument has been used internationally<sup>5,20,32</sup> which lists symptoms that communicates the suddenness and severity of stroke symptoms to aid participants to recognize that the symptom is associated with stroke and respond accordingly. This warrants further investigation.

## Methods:

### Study Design

We used a non-experimental, descriptive and quantitative design. The primary aim was to to examine factors which influence recognition and response to stroke. A secondary aim was to investigate knowledge of risk factors for stroke amongst the public.

### Research Instrument:

The research instrument was designed to collect data to investigate knowledge of risk factors for stroke (part A) and recognition of stroke symptoms and response to stroke (part B). The risk factors listed for stroke are those identified by the National

Stroke Association.<sup>46</sup> Participants were required to identify what each letter of the FAST campaign represent with regard to the recognition of a stroke. Six items described symptoms of stroke as identified by the American Heart and Stroke Association<sup>47</sup> and one non-stroke symptom. Participants were asked to indicate which items they thought were symptoms of stroke. Part B of the questionnaire consisted of the Stroke Action Test.<sup>41</sup> The Stroke Action Test (STAT) was developed to examine items that require the respondent to associate individual symptoms with the most appropriate action.<sup>41</sup> The STAT contains 28 items that name or describe stroke symptoms (Stroke symptoms and general symptoms). The symptoms are presented in both medical language and lay language as described by people who have experienced stroke.<sup>41</sup> A total of 21 of these are related to stroke symptoms and 7 are nonstroke symptoms. The non stroke items represent urgent and non-urgent medical conditions and broaden response options and provide a control for social desirability bias.<sup>20</sup> For each item in the STAT, the respondent is asked 'if this happened to you or a relative/friend what would you do'. The respondent is then asked to choose one of four responses as follows: (1) call 911 immediately, (2) call doctor's office immediately, (3) wait one hour and then decide, (4) wait one day and then decide. The STAT is scored by counting how many times the respondent selects the correct answer (call 911) for the 21 items that describe stroke symptoms. Validity of the instrument was tested by comparing mean scores across subgroups of examinees (n=249) asked to complete the STAT.<sup>41</sup> STAT scores differentiated individuals with different levels of education and stroke training, or experience as expected. The STAT is unique in that it assesses if individuals can connect symptoms or symptoms of stroke to the appropriate action.

### Research Sample:

The target population were members of the public who may experience or witness a stroke. Therefore, it was necessary to collect data from older members of the public who may be at risk of stroke as well as younger members of the public who may experience or witness a stroke. Previous research has identified that the person who witnesses stroke is often the person who either makes the decision or influences the decision to seek medical assistance.<sup>51</sup> Convenience sample of adults over the age of 18 years who could understand English and can give informed consent, were invited to complete the questionnaire. Data were collected in 3 sites, the out-patient's department (OPD) of a large teaching hospital, a third level college and a industrial

factory all in the South of Ireland. The inclusion of respondents from three different sites facilitated inclusion of individuals with a diverse range of ages, education and experiences of stroke. The OPD was part of a community hospital providing long-term, rehabilitation and outpatient services to older people. The factory employed over 800 people and was part of a large multinational group while the third level college employed over 2,000 people and provides undergraduate and postgraduate courses in many disciplines. Ethical approval to conduct the study was obtained from the local Clinical Research Ethics Committee.

### Data Collection:

A small pilot study was conducted with a selection of potential participants (n=10), five of whom completed a researcher administered questionnaire and five completed an online version. The results of the pilot study found that the questionnaire was easy to read and completed in 15-20 minutes. Participants in the OPD group were asked to complete a hard copy of a researcher administered questionnaire, this yielded a response rate of 90% and allowed recruitment of older people (n=89) who may not have been accessible via an online platform. According to Age Action, half of Irish people aged between 65 and 74 have never used the internet while internet usage among those over 75 is negligible.<sup>49</sup> An online version of the questionnaire was distributed amongst the remainder of the sample. The online survey helped to reduce overall costs in terms of researcher's time as online questionnaires were completed in 3 weeks while it took up to 3 months to recruit the respondents in the outpatient's clinic. This was due mainly to the fact that clinics occurred weekly and not all attendees met the inclusion criteria of being able to give informed consent due to diagnosis of cognitive impairment.

### Data Analysis:

The data was analysed using the statistical package STATA (Version 13.0, StataCorp LP, College Station, TX, USA), the tests were two-sided and a p-value<0.05 were considered to be statistically significant. Prior to performing any statistical analysis, the reliability of the 28-item Stroke Action Test (STAT) was assessed using Cronbach's alpha. Descriptive statistics were used to summarise participants' characteristics and their recognition of and response to symptoms of stroke. For the primary analysis, the outcome measures (dependent variables) were knowledge of risk factors for stroke, recognition of stroke symptoms and response to stroke (STAT score). Factors likely to be associated with recognition and response to stroke were related to age, gender, education, previous history of stroke, awareness of treatment available for stroke and ability to identify what the letters of the FAST acronym represent.

A sample of 242 participants was recruited however, 11 participants from the online group were removed from the analysis of the STAT score as they had completed less than 80% of the STAT items. Therefore to eliminate the influence on non-responders to the total STAT score these responses were deleted and the final sample was 231 participants, of which 142 participants were in the online group and 89 participants were in the outpatients' group. The mean age of the total sample was 57.4 (SD 20.7) years. The youngest respondent was 18 years while the oldest was 97 years. There was a large percentage of female respondents (71%). Overall, 60% (n=140) had completed third level education. The mean age of participants in the online group was 43.6 (SD =12.4) years. The mean age of participants in the outpatients' group was 79.6 years (SD =9.3) years. There were more females than males in the outpatients' group (69%). The OPD group had a low level of education with just 8% (n=7) completing third level education (see table 1).

| Respondent Characteristics    |              | Total Sample<br>n=231 | Online Group<br>n= 142 | OPD<br>n= 89 |
|-------------------------------|--------------|-----------------------|------------------------|--------------|
| Age mean (standard deviation) |              | 57.37 (20.68)         | 43.60 (12.36)          | 79.65 (9.32) |
|                               |              | n (%)                 | n (%)                  | n (%)        |
| Gender                        | Male         | 68 (29)               | 33 (23)                | 35 (31)      |
|                               | Female       | 163 (71)              | 109 (77)               | 54 (69)      |
| Education Level               | Primary      | 60 (26)               | 0                      | 60 (67)      |
|                               | Second Level | 33 (14)               | 11 (8)                 | 22 (25)      |
|                               | Third Level  | 140 (60)              | 133 (92)               | 7 (8)        |

### Previous Experience of Stroke

Participants were asked to indicate if they had ever experienced a stroke or transient ischemic attack

(TIA) or if they had a family member who experienced a stroke or if they had been present when someone had a stroke. Just over 5% (n=13)

of participants in the total sample had experienced a stroke and 8% (n=19) had experienced a TIA. In all, 26% (n=63) of participants reported having a

family member who had experienced a stroke while 14% (n=35) of participants had been present when someone had a stroke (see Table 2).

**Table 2:** Participants' previous experience of stroke

| Previous experience of Stroke                                             |     | Total sample<br>(n=243)<br>n (%) | Online group<br>(n=154)<br>n (%) | Outpatient group<br>(n=89)<br>n (%) |
|---------------------------------------------------------------------------|-----|----------------------------------|----------------------------------|-------------------------------------|
| Have you ever had a stroke?                                               | Yes | 13 (5)                           | 1 (1)                            | 12 (13)                             |
| Have you ever had a TIA?                                                  | Yes | 19 (8)                           | 4 (3)                            | 15 (17)                             |
| Have you ever been present when someone had a stroke?                     | Yes | 35 (14)                          | 28 (18)                          | 12 (13)                             |
| Has anyone in your family (brothers, sisters, parents) ever had a stroke? | Yes | 63 (26)                          | 38 (27)                          | 25 (28)                             |

### Knowledge of Risk Factors for Stroke:

Participants were presented with known validated risk factors for stroke identified by the American Heart Association<sup>44</sup> and asked to consider each risk factor and indicate whether they felt that they were or were not a risk factor for stroke. The most frequently identified stroke risk factor among participants of the total sample was high blood pressure at 98% (n=239). Participants demonstrated knowledge of lifestyle related risk factors for stroke with at least 80% of participants

identifying smoking, high cholesterol and being overweight or obese as risk factors for stroke. However, just 45% (n=111) of participants identified irregular heartbeat as a risk factor for stroke. Overall, the median number of risk factors correctly identified by participants was 4 (IQR =4). Just 28% (n=69) of participants were able to correctly identify all 8 risk factors for stroke and all participants were able to identify one risk factor for stroke (See Table 3).

**Table 3:** Participants knowledge of risk factors for stroke

| Knowledge of risk factors for stroke | Total sample<br>(n=243) | Online group<br>(n=154) | OPD group<br>(n=89) |
|--------------------------------------|-------------------------|-------------------------|---------------------|
| <b>Risk Factors for Stroke</b>       | n (%) *                 |                         |                     |
| High Blood Pressure                  | 239 (98)                | 149 (97)                | 89 (100)            |
| Smoking                              | 213 (87)                | 135 (88)                | 77 (86)             |
| High Cholesterol                     | 209 (86)                | 125 (81)                | 83 (93)             |
| Being Overweight or Obese            | 194 (80)                | 131 (85)                | 62 (70)             |
| Diabetes                             | 143 (59)                | 91 (59)                 | 51 (57)             |
| Transient Ischemic Attack (TIA)      | 131 (54)                | 85 (55)                 | 45 (51)             |
| Drinking Alcohol                     | 125 (51)                | 85 (53)                 | 42 (47)             |
| Irregular Heartbeat                  | 111 (45)                | 64 (42)                 | 46 (52)             |

\* % reported is % of participants who correctly identified the risk factor

### Ability to Identify Letters of FAST Acronym

Participants were asked to identify what each letter of the FAST acronym represents. In all, 49% of participants in the total sample were able to identify what each of the letters of the acronym FAST represented. Furthermore 41% (n=100) of all participants were able to identify what all four letters of the FAST acronym represents.

### Awareness of Treatment Available for Stroke

Participants were asked to indicate if they had heard of the terms thrombolysis or thrombectomy which are treatments for ischaemic stroke. Overall, 52% (n=128) of participants in the total sample had heard of the term thrombolysis while 20% (n=48) had heard of the term thrombectomy.



### Recognition of Stroke Symptoms

Participants were presented with the six symptoms of stroke identified by the American Heart Association and Stroke Association and one non-stroke symptom. Participants were asked to

indicate which symptoms were associated with stroke. Sudden numbness or weakness of the face, arm or leg was identified by all participants as a symptom of stroke. Results are presented in Table 4 below:

**Table 4:** Identification of stroke symptoms by participants

| Recognition of stroke symptoms                       | Total Sample<br>(n =243)<br>n (%) | Online Group<br>(n=154)<br>n (%) | Outpatients' Group<br>(n=89)<br>n (%) |
|------------------------------------------------------|-----------------------------------|----------------------------------|---------------------------------------|
| Sudden numbness of weakness of the face, arm or leg  | 236 (97)                          | 148 (96)                         | 84 (94)                               |
| Sudden confusion or trouble speaking                 | 231 (95)                          | 147 (95)                         | 88 (99)                               |
| Sudden trouble walking, dizziness or loss of balance | 208 (85)                          | 125 (81)                         | 83 (93)                               |
| Sudden loss of responsiveness                        | 180 (74)                          | 102 (66)                         | 78 (88)                               |
| Sudden trouble seeing in one or both eyes            | 150 (61)                          | 100 (65)                         | 50 (56)                               |
| Sudden severe headache with no known cause           | 143 (59)                          | 84 (54)                          | 59 (66)                               |
| Severe Chest Pain                                    | 58 (24)                           | 26 (17)                          | 33 (37)                               |

### Response to Stroke:

Participants completed the STAT questionnaire as described previously and were asked to indicate how they would respond to symptoms of stroke as described in the STAT. Similar to previous studies<sup>5,32,41</sup> for each STAT item a respondent was given a score of 1 if they indicated that they would call 911 or go to the ED, otherwise they were given a score

of 0. The range of scores were 0-21, with a higher score indicating that the participant would respond appropriately to a greater number of stroke symptoms. A summary of scores are presented in Table 5. Cronbachs alpha was calculated for the STAT (total sample) using the 21 stroke items and showed excellent reliability ( $\alpha =0.911$ ).

**Table 5:** Summary of STAT scores

| STAT score         | Total sample<br>(n=233)<br>n (%) | Online group<br>(n=144) (missing data =10)<br>n(%) | OPD<br>(n=89)<br>n(%) |
|--------------------|----------------------------------|----------------------------------------------------|-----------------------|
| >18 high score     | 19 (8)                           | 18 (12)                                            | 1 (1)                 |
| 10-18 medium score | 90 (39)                          | 66 (46)                                            | 24 (28)               |
| <10 low score      | 124 (53)                         | 60 (42)                                            | 64 (71)               |

Two percent (n=4) of participants in the sample scored a total of 21 indicating that they would call 911 or go to the ED if they experienced any of the stroke symptoms described in the STAT. The scores were evenly distributed among the sample with a mean score of 9. This indicates that the majority of the sample would respond appropriately to less than 50% of the stroke symptoms described in the STAT. Cumulative scores indicated that 43% (n=100) of participants would respond appropriately to 50% of symptoms of stroke described in the STAT.

It is interesting that the three items in the STAT that the majority of participants in the total sample would respond to by calling 911 or going to the ED

were those which described classic symptoms of stroke. A total of 84% (n=197) of participants identified that they would call 911 or go the ED if they experienced the following 'suddenly, I couldn't reach for my purse because I couldn't make my right arm move', 'drooling out of the corner of my mouth' or 'the words wouldn't come out right.' Just under 70% of participants (n=158) indicated that they would call 911 or go to the ED if they experienced 'sudden weakness of the arm and face especially on one side, together with trouble speaking'. Nearly 65% (n=150) of participants indicated that they would call 911 or go immediately to the ED if they experienced the following 'I couldn't speak clearly, no matter how I tried'. Participants indicated that

they may not respond appropriately to less specific symptoms of stroke including visual changes , dizziness or headache. In all, 11% of participants (n=25) indicated that they would call 911 or go straight to the ED if they experienced 'sudden dizziness'. Just 15% (n=35) of participants would call 911 or go immediately to the ED if they experienced the following 'my left leg started tingling, almost like my leg was falling asleep'. Under 16% (n=37) of participants would call 911 or go to the ED if they witnessed the following 'I noticed that he/ she kept covering and uncovering his/her eyes and blinking and told me 'I can't see, a few minutes later everything was fine again'. Participants were more likely to 'wait an hour' before responding to less specific symptoms of stroke with 47% (n=110) indicating that they would 'wait an hour ' before responding to dizziness and 48% (n=111) of participants indicating that they would wait an hour before responding to tingling in their left leg as described above. When it comes to non-stroke symptoms participants in the sample indicated that they would respond appropriately to chest pain with 83% (n=194) of participants indicating that they would call 911 or go immediately to the ED if they experienced ' chest

pain lasting more than a few minutes or increasing in intensity'.

### Factors associated with recognition of Stroke Symptoms

Further analysis was conducted to test the relationship between recognition of stroke symptoms and factors such as demographic variables (age, gender and level of education), previous experience of stroke, awareness of treatment available for stroke, the ability to identify what the letters of the FAST acronym represent and knowledge of risk factors for stroke. Statistically significant relationships were identified between four factors and recognition of stroke symptoms, firstly female gender and recognition of stroke symptoms (p=0.015), secondly having had a stroke and recognition of stroke symptoms (p=0.003), thirdly the ability to identify what the letters of the FAST acronym represent and recognition of stroke symptoms (p<0.001) and finally, knowledge of risk factors for stroke and recognition of stroke symptoms (p<0.001). The unique contribution of each of the independent variables within the univariate analysis is displayed in table 6.

**Table 6:** Relationship Between Demographic Variables (Gender, Age, Level of Education) , Previous History of Stroke, Awareness of Treatment Available for Stroke, Ability to Identify what each Letter of FAST Represents, Knowledge of Risk Factors for Stroke and Recognition of Stroke Symptoms

| Categorical Variables                                                |     |      |        |                        |                 |               |                    |
|----------------------------------------------------------------------|-----|------|--------|------------------------|-----------------|---------------|--------------------|
| Variable                                                             | n   | mean | (SD)   | Regression Coefficient | (95% CI)        | p-value       | R <sup>2</sup> (%) |
| <b>Gender</b> Female (ref)                                           | 163 | 4.90 | (1.18) | 0                      |                 |               |                    |
| Male                                                                 | 163 | 4.44 | (1.56) | 0.46                   | (0.09 to -0.83) | <b>0.015*</b> | 2.5                |
| <b>Education</b> Second/Third (ref)                                  | 173 | 4.71 | (1.35) | 0                      |                 |               |                    |
| Primary                                                              | 60  | 4.83 | (1.34) | 0.12                   | (-0.51 to 0.28) | 0.566         | 0.1                |
| <b>Has anyone in your family ever had a stroke</b> No (ref)          | 167 | 4.66 | (1.34) | 0                      |                 |               |                    |
| Yes                                                                  | 63  | 4.94 | (1.39) | 0.28                   | (-0.12 to 0.67) | 0.166         | 0.8                |
| <b>Have you ever been present when someone had a stroke</b> No (ref) | 200 | 4.74 | (1.39) | 0                      |                 |               |                    |
| Yes                                                                  | 33  | 4.79 | (1.08) | 0.05                   | (-0.45 to 0.55) | 0.851         | 0                  |
| <b>Have you ever had a TIA?</b> No (ref)                             | 210 | 4.70 | (1.37) | 0                      |                 |               |                    |
| Yes                                                                  | 19  | 5.21 | (1.13) | 0.51                   | (-0.13 to 1.15) | 0.116         | 1.1                |
| <b>Have you ever had a stroke?</b> No (ref)                          | 218 | 4.68 | (1.37) | 0                      |                 |               |                    |
| Yes                                                                  | 13  | 5.85 | (0.38) | 1.16                   | (0.41 to 1.91)  | <b>0.003*</b> | 3.9                |

|                                                                               |     |                        |                           |                 |                   |                    |     |
|-------------------------------------------------------------------------------|-----|------------------------|---------------------------|-----------------|-------------------|--------------------|-----|
| <b>Have you heard of the term thrombolysis.</b><br>No (ref)                   | 110 | 4.68                   | (1.51)                    | 0               |                   |                    |     |
| Yes                                                                           | 123 | 4.80                   | (1.20)                    | 0.12            | (-0.23 to 0.47)   | 0.489              | 0.2 |
| <b>Have you heard of the term thrombectomy</b><br>No (ref)                    | 188 | 4.67                   | (1.39)                    | 0               |                   |                    |     |
| Yes                                                                           | 45  | 5.67                   | (1.16)                    | 0.40            | (-0.04 to 0.84)   | 0.077              | 1.3 |
| <b>Ability to identify what letters of FAST acroynm represent</b><br>No (ref) | 101 | 4.35                   | (1.55)                    | 0               |                   |                    |     |
| Yes                                                                           | 132 | 5.05                   | (1.09)                    | 0.71            | (0.36 to 1.05)    | <b>&lt;0.001*</b>  | 6.7 |
| <b>Continuous Variables</b>                                                   |     |                        |                           |                 |                   |                    |     |
|                                                                               | n   | Pearsons<br>Corr Coeff | Regression<br>Coefficient | (95% CI)        | p-value           | R <sup>2</sup> (%) |     |
| Age                                                                           | 233 | 0.080                  | 0.005                     | (0.03 to 0.014) | 0.226             | 0.6                |     |
| Knowledge of risk factors for stroke                                          | 233 | 0.421                  | 0.28                      | (0.20 to 0.36)  | <b>&lt;0.001*</b> | 17.8               |     |

Factors that were statistically significant as demonstrated with a p value  $\leq 0.25$  were incorporated into the multivariate analysis. Table 7

report the contribution of each factor to the recognition of stroke.

| <b>Table 7: Multivariate Analysis : Statistically Significant Variables (<math>p \leq 0.025</math>) and Recognition of Stroke Symptoms (n= 223)</b> |                               |                  |                   |                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------|-------------------|--------------------------------|
| <b>Independent Variable</b>                                                                                                                         | <b>Regression Coefficient</b> | <b>95% (CI)</b>  | <b>p-value</b>    | <b>Unique Contribution (%)</b> |
| Gender Female (ref)                                                                                                                                 | 0                             |                  |                   |                                |
| Male                                                                                                                                                | 0.35                          | (-0.006 to 0.70) | 0.054             | 1.32                           |
| Has anyone in your family ever had a stroke<br>No (ref)                                                                                             | 0                             |                  |                   |                                |
| Yes                                                                                                                                                 | 0.25                          | (-0.12 to 0.62)  | 0.192             | 0.61                           |
| Have you ever had a TIA<br>No (ref)                                                                                                                 | 0                             |                  |                   |                                |
| Yes                                                                                                                                                 | -0.04                         | (-0.60 to 0.62)  | 0.949             | 0.002                          |
| Have you ever had a stroke<br>No (ref)                                                                                                              | 0                             |                  |                   |                                |
| Yes                                                                                                                                                 | 0.95                          | (0.23 to 1.68)   | <b>0.011*</b>     | 2.31                           |
| Have you heard of the term thrombectomy<br>No (ref)                                                                                                 | 0                             |                  |                   |                                |
| Yes                                                                                                                                                 | 0.014                         | (-0.30 to 0.58)  | 0.527             | 0.14                           |
| Ability to identify what letters of FAST acroynm represent<br>No (ref)                                                                              | 0                             |                  |                   |                                |
| Yes                                                                                                                                                 | 0.21                          | (-0.16 to 0.58)  | 0.275             | 0.42                           |
| Age                                                                                                                                                 | 0.005                         | (0.003 to 0.013) | 0.240             | 0.49                           |
| Knowledge of Risk Factors for Stroke                                                                                                                | 0.23                          | (0.01 to 0.032)  | <b>&lt;0.001*</b> | 8.82                           |
| R <sup>2</sup> =24.6%. Adjusted R2 = 21.7% * p $\leq 0.05$                                                                                          |                               |                  |                   |                                |



Factors relating to previous history of stroke (Have you ever had a stroke) and knowledge of risk factors for stroke reached statistical significance in the multiple regression model with p-values  $\leq 0.05$ . A strong relationship remained when participants who had a stroke were able to recognise a higher number of stroke symptoms than those who had not. Similarly, participants who could identify a greater number of risk factors for stroke were able to recognise a higher number of symptoms of stroke. Overall, 24.6% (adjusted  $R^2 = 21.7\%$ ) of variation in recognition of stroke symptoms is explained by factors relating to previous experience of stroke and knowledge of risk factors for stroke. Knowledge of risk factors for stroke had the highest contribution of 8.82% to variation in recognition of stroke symptoms ( $p \leq 0.001$ ) followed by those who had a previous stroke contributed to 2.31% of the variation.

#### Factors associated with response to recognition of Stroke symptoms

To test the relationship between demographic variables (age, gender and level of education), previous experience of stroke, awareness of treatment available for stroke, the ability to

identify what the letters of the FAST acronym represent, knowledge of risk factors for stroke, recognition of stroke symptoms and response to stroke, univariate analysis was conducted. Statistically significant relationships were identified between nine factors and response to stroke, namely, female gender and response to stroke ( $p=0.003$ ), second or third level of education and response to stroke ( $p<0.001$ ), having had a family member who had a stroke and response to stroke ( $p= 0.010$ ), being present when someone had a stroke and response to stroke ( $p=0.027$ ), having heard of the term thrombolysis and response to stroke ( $p=0.010$ ), having heard of the term thrombectomy and response to stroke ( $p=0.001$ ), the ability to identify what the letters of the FAST acronym represent and response to stroke ( $p=0.005$ ), age and response to stroke ( $p<0.001$ ) and knowledge of risk factors for stroke and response to stroke ( $p<0.001$ ). The unique contribution of each of the independent variables within the univariate analysis is displayed in table 8. Independent variables with a p value  $\leq 0.25$  in the univariate analysis were eligible for inclusion in a multivariate analysis.

**Table 8:** Relationship between Demographic Variables (Gender, Age, Level of Education), Previous History of Stroke, Awareness of Treatment Available for Stroke, Ability to Identify what each Letter of FAST Represents, Knowledge of Risk Factors for Stroke, Recognition of Stroke Symptoms and Response to Stroke

| Categorical Variables                                                |     |       |        |                        |                 |                   |                    |
|----------------------------------------------------------------------|-----|-------|--------|------------------------|-----------------|-------------------|--------------------|
| Variable                                                             | N   | mean  | (SD)   | Regression Coefficient | (95% CI)        | p-value           | R <sup>2</sup> (%) |
| <b>Gender</b> Female (ref)                                           | 162 | 9.67  | (5.61) |                        |                 |                   |                    |
| Male                                                                 | 68  | 7.20  | (6.02) | 2.47                   | (0.83 to 4.10)  | <b>0.003*</b>     | 3.7                |
| <b>Education</b> Second/Third (ref)                                  | 172 | 9.99  | (5.66) |                        |                 |                   |                    |
| Primary                                                              | 60  | 6.00  | (5.66) | 3.99                   | (2.35 to 5.64)  | <b>&lt;0.001*</b> | 9.1                |
| <b>Has anyone in your family ever had a stroke</b> No (ref)          | 166 | 8.37  | (5.29) |                        |                 |                   |                    |
| Yes                                                                  | 63  | 10.59 | (6.43) | 2.21                   | (0.53 to 3.89)  | <b>0.010*</b>     | 2.9                |
| <b>Have you ever been present when someone had a stroke</b> No (ref) | 199 | 8.62  | (5.81) |                        |                 |                   |                    |
| Yes                                                                  | 33  | 11.03 | (5.59) | 2.41                   | (0.24 to 4.55)  | <b>0.027*</b>     | 2.1                |
| <b>Have you ever had a TIA?</b> No (ref)                             | 209 | 9.01  | (5.85) |                        |                 |                   |                    |
| Yes                                                                  | 19  | 8.58  | (6.06) | -0.43                  | (-3.20 to 2.34) | 0.760             | 0                  |
| <b>Have you ever had a stroke?</b> No (ref)                          | 217 | 8.78  | (5.72) |                        |                 |                   |                    |
| Yes                                                                  | 13  | 10.69 | (7.05) | 1.91                   | (-1.35 to 5.17) | 0.250             | 0.6                |

|                                                                            |     |                        |                           |                  |                   |                    |     |
|----------------------------------------------------------------------------|-----|------------------------|---------------------------|------------------|-------------------|--------------------|-----|
| <b>Have you heard of the term thrombolysis.</b> No (ref)                   | 110 | 7.93                   | (5.74)                    |                  |                   |                    |     |
| Yes                                                                        | 122 | 9.89                   | (5.77)                    | 1.97             | (0.48 to 3.46)    | <b>0.010*</b>      | 2.9 |
| <b>Have you heard of the term thrombectomy</b> No (ref)                    | 187 | 8.10                   | (5.52)                    |                  |                   |                    |     |
| Yes                                                                        | 45  | 12.53                  | (5.77)                    | 4.43             | (2.61 to 6.25)    | <b>&lt;0.001*</b>  | 9.1 |
| <b>Ability to identify what letters of FAST acroynm represent</b> No (ref) | 101 | 7.73                   | (5.83)                    |                  |                   |                    |     |
| Yes                                                                        | 131 | 9.91                   | (5.66)                    | 2.18             | (0.68 to 3.67)    | <b>0.005*</b>      | 3.4 |
| <b>Continuous Variables</b>                                                |     |                        |                           |                  |                   |                    |     |
|                                                                            | N   | Pearsons<br>Corr Coeff | Regression<br>Coefficient | (95% CI)         | p-value           | R <sup>2</sup> (%) |     |
| <b>Age</b>                                                                 | 232 | -0.255                 | -0.07                     | (-0.11 to -0.04) | <b>&lt;0.001*</b> | 6.5                |     |
| <b>Knowledge of risk factors for stroke</b>                                | 232 | 0.230                  | 0.67                      | (0.30 to 1.04)   | <b>&lt;0.001*</b> | 5.3                |     |
| <b>Recognition of stroke symptoms</b>                                      | 232 | 0.093                  | 0.40                      | (-0.16 to 0.96)  | 0.157             | 0.9                |     |
| p >= 0.25 *p ≤ 0.05                                                        |     |                        |                           |                  |                   |                    |     |

**Table 9:** Multivariate Analysis : Statistically Significant Independent Variables (p > 0.025) and Response to Stroke (n= 225)

| Independent Variable                                                       | Regression Coefficient | 95% (CI)         | p-value           | Unique Contribution (%) |
|----------------------------------------------------------------------------|------------------------|------------------|-------------------|-------------------------|
| <b>Gender</b> Female (ref)                                                 | 0                      |                  |                   |                         |
| Male                                                                       | -1.70                  | (-3.28 to -0.13) | <b>0.034*</b>     | 1.61                    |
| <b>Education</b> Second/Third (ref)                                        | 0                      |                  |                   |                         |
| Primary                                                                    | -2.87                  | (-5.07 to 0.68)  | <b>0.010*</b>     | 2.37                    |
| <b>Has anyone in your family ever had a stroke</b> No (ref)                | 0                      |                  |                   |                         |
| Yes                                                                        | 2.08                   | (0.39 to 3.77)   | <b>0.016*</b>     | 2.10                    |
| <b>Have you ever had a stroke</b> No (ref)                                 | 0                      |                  |                   |                         |
| Yes                                                                        | 5.31                   | (2.08 to 8.54)   | <b>&lt;0.001*</b> | 3.76                    |
| <b>Have you ever been present when someone had a stroke</b> No (ref)       | 0                      |                  |                   |                         |
| Yes                                                                        | -0.58                  | (-2.18 to 2.07)  | 0.957             | 0.0009                  |
| <b>Have you heard of the term thrombolysis</b> No (ref)                    | 0                      |                  |                   |                         |
| Yes                                                                        | -0.42                  | (-2.08 to 2.82)  | 0.618             | 0.09                    |
| <b>Have you heard of the term thrombectomy</b> No (ref)                    | 0                      |                  |                   |                         |
| Yes                                                                        | 3.06                   | (0.96 to 5.17)   | <b>0.005*</b>     | 2.92                    |
| <b>Ability to identify what letters of FAST acroynm represent</b> No (ref) | 0                      |                  |                   |                         |
| Yes                                                                        | 0.60                   | (1.05 to 2.25)   | 0.475             | 0.18                    |
| <b>Age</b>                                                                 | -0.025                 | (-0.07 to 0.024) | 0.314             | 0.36                    |
| <b>Knowledge of stroke risk factors</b>                                    | 0.24                   | (-0.18 to 0.66)  | 0.264             | 0.44                    |
| <b>Recognition of stroke symptoms</b>                                      | -0.12                  | (-0.71 to 0.47)  | 0.689             | 0.05                    |
| R <sup>2</sup> =24.1%. Adjusted R <sup>2</sup> = 20.2% * p ≤0.05           |                        |                  |                   |                         |

Factors relating to education, gender, previous history of stroke (Has anyone in your family ever had a stroke, have you ever had a stroke) and awareness of treatment available for stroke (have

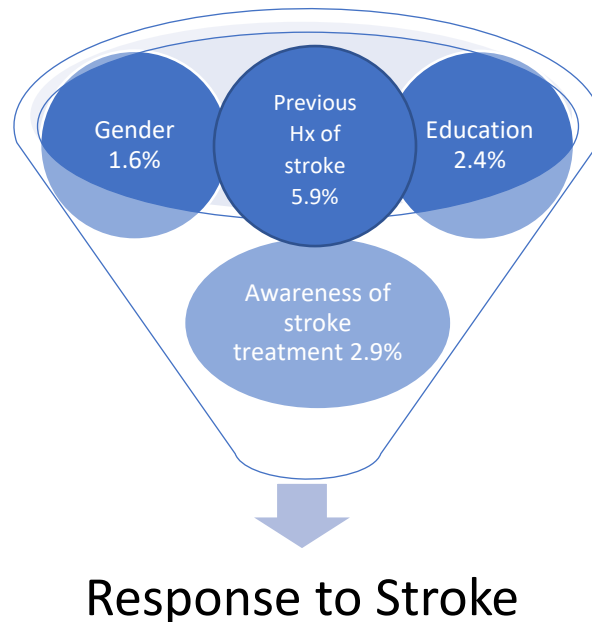
you heard of the term thrombectomy) all reached statistical significance in the multiple regression model with p-values ≤0.05 (See table 9). The strenght of the relationships were the same as the

univariate analysis with increased likelihood of appropriate response to stroke (higher STAT scores) by female participants and those who had completed third level education. Participants who had experienced a stroke or who had family members who had experienced stroke had higher STAT scores. Participants who had heard of thrombectomy were also more likely to respond appropriately to stroke and had higher STAT scores than participants who had not heard of thrombectomy.

Overall, 24.1% (adjusted R<sup>2</sup>= 20.2%) of variation in response to stroke is greatly influenced by 5 factors namely gender, education, a previous family member with a stroke, a personal

experience of stroke and awareness of treatment available for stroke. Having had a stroke had the highest unique contributed 3.76% to the variation in response to stroke ( $p < 0.001$ ), with having heard of thrombectomy contributed 2.92% of the variation ( $p = 0.005$ ) and having a family member who had a stroke contributed 2.08% of the variation ( $p = 0.016$ ). Having second/third level of education contributed to 2.37% of the variation in response to stroke ( $p = 0.010$ ) while female gender contributed 1.61% ( $p = 0.034$ ). See Figure 1 which explains the unique contribution of statistically significant factors to differences in response to stroke.

**Figure 1:** The Relationship between Gender, Previous History of Stroke, Level of Education, and Awareness of Treatment Available for Stroke to response to Stroke.



### Discussion:

Knowledge of stroke risk factors among respondents of this study was greater than reported in previously published research.<sup>7, 32, 33, 34, 35, 38</sup> Overall, 97% (n=237) of respondents in this study were able to identify more than 2 stroke risk factors. An earlier study conducted in Ireland found over 67% (n= 677) of respondents in their study could name 2 or more stroke risk factors,<sup>7</sup> while international studies found between 49% (n=92)<sup>35</sup> and 95% (n=904)<sup>33</sup> could identify 2 or more risk factors for stroke. High blood pressure was the most frequently identified risk factor by respondents in our study at 98% (n=239). This represents an increase from the findings an earlier

Irish study which reported that 55% (n=550) of respondents identified high blood pressure as a risk factor for stroke.<sup>4</sup> Results also suggest that participants in this study were more aware of the risk of stroke associated with high blood pressure than international counterparts.<sup>30, 35</sup> Previous studies reported decreased levels of knowledge of stroke risk factors among older female respondents.<sup>4, 5</sup> This was not the case in this study. The OPD group of respondents were older and less educated than respondents in the online group and yet 33% (n=29) of this group were able to identify all 8 risk factors for stroke compared to 25% (n=39) of the online group which had younger and more educated respondents. The OPD respondents may

have risk factors for stroke themselves as people with personal risk factors for stroke are more likely to correctly identify risk factors for stroke.<sup>7</sup> Furthermore 13% (n=12) of this group had experienced stroke while 17% (n=15) had experienced TIA and this may also have increased their knowledge of risk factors for stroke.

It is of concern that, irregular heart beat was identified as a risk factor for stroke by only 45% (n=111) of respondents making it the least frequently identified risk factor. These results are disappointing given the Irish Heart Foundation public awareness atrial fibrillation campaign in October 2017 which educated the public on how to 'feel the pulse' to identify an irregular heartbeat.<sup>45</sup> The campaign also explained the risk of stroke associated with atrial fibrillation. Atrial fibrillation raises a person's risk of stroke by 500% and as many as 70% of people with atrial fibrillation may die from stroke.<sup>46</sup> The level of awareness of atrial fibrillation as a risk factor for stroke among respondents in this study is similar to global levels of awareness.<sup>60</sup> Therefore, despite a recent awareness campaign, there is still a need to increase public knowledge about the risk of stroke associated with atrial fibrillation. Results identified interesting differences between the online and OPD group in relation to awareness of treatment available for stroke and the ability to identify what the 4 letters of the FAST acronym represent. While 65% (n=100) of the online group had heard of thrombolysis and 62% (n=95) were able to identify what the 4 letters of the FAST acronym represent, just 29% (n=26) of the OPD group had heard of thrombolysis and 4.5% (n=4) were able to identify what the 4 letters of the FAST acronym represent. To date, stroke awareness campaigns do not address the specific treatment available for stroke. However, it is possible that the T in the FAST campaign may prompt individuals to find out about treatments available for stroke in order to understand why it is important to immediately contact the emergency services when stroke symptoms occur. Explanations of treatments available for stroke should be included in stroke awareness campaigns. The FAST acronym could be changed to FAST<sup>2</sup> (T squared) and the additional T representing thrombolysis or thrombectomy which would strengthen the association between time and treatment. Knowledge of treatment available for stroke and understanding the importance of timely access to treatment is emerging as an important component of stroke awareness campaigns.<sup>7,12</sup> However, designing effective stroke education campaigns is challenging as they need to be broad enough so that they increased awareness of risk

factors for stroke, be able to recognise the symptoms of stroke and respond accordingly. Stroke awareness campaigns also need to be delivered using a variety of multiple social media platforms to ensure they target the public and specific groups most at increased risk of stroke.

Recognition of stroke symptoms among respondents in this study compared well to previously published research<sup>32, 14, 34, 4, 15</sup> with 41% (n=100) of respondents able to identify all six symptoms of stroke. The use of closed-ended question may have contributed to higher scores as previous research reported that ability to name one symptom of stroke varied considerably when open ended questions were asked compared to when closed ended questions were asked<sup>15,32,34</sup>. Previous studies have reported greater levels of knowledge about stroke symptoms among younger, more educated respondents<sup>6</sup> but this was not the case in this research. Overall, 48% (n=43) of respondents in the outpatient's group who were older and less educated were able to recognise all 6 stroke symptoms compared to 37% (n= 57) of the younger more educated respondents in the online group. This may be explained by the fact that they were attending an older adult outpatients' clinic and that healthcare professionals may have discussed stroke symptoms with them. Furthermore 13.5% (n=12) of the outpatient's group had experienced stroke while 17% (n=15) had experienced TIA and having experienced a stroke was associated with increased recognition of stroke symptoms in this study. Overall, the levels of knowledge of stroke symptoms reported in this study are encouraging as research has shown that when patients recognise symptoms as those associated with stroke, they are more likely to seek medical attention.<sup>3,27</sup> The results of this study also identified that having experienced a stroke and knowledge of risk factors of stroke were associated with increased recognition of stroke symptoms.

This is the first Irish study to use the STAT to investigate how members of the Irish public would respond if they experienced or witnessed symptoms of stroke. The STAT had satisfactory internal consistency ( $\alpha >0.9$ ). Findings demonstrated that 43% (n=100) of respondents would respond appropriately to more than half of the 21 stroke symptoms described in the STAT. This result is better than scores previously reported.<sup>5, 32</sup> There was a statistically significant relationship between level of education and response to stroke ( $p < 0.001$ ) with higher STAT scores by respondents with second/third level of education. There was also a statistically significant relationship between gender and response to stroke in the total sample with

female participants achieving higher STAT scores than male participants. Previous studies have not found a relationship between gender and response to stroke using the STAT.<sup>5, 20, 32</sup>

The items in the STAT which respondents in this study would respond to by calling 911 or going to the ED were items that described three symptoms of stroke (facial weakness, difficulty speaking and limb weakness). This supports findings of previous research<sup>5,21</sup> which found that stroke symptoms that involved motor weakness were more likely to elicit the appropriate response from study respondents. The STAT items least likely to elicit an appropriate response were items which described symptoms such as headache, changes in vision or dizziness. These findings are similar to results.<sup>7,11,41</sup> Previous research which has investigated delayed presentation for treatment of stroke reported that respondents often fail to recognise mild or atypical symptoms as being associated with stroke.<sup>51</sup> Results of this study support these findings as respondents were more likely to 'wait one hour' for symptoms such as sudden dizziness, visual changes or headache to resolve. In all 48% (n=111) of respondents would 'wait one hour' before seeking treatment for 'sudden dizziness'. These findings highlight the limitations of the FAST Stroke Awareness campaign which focuses on classical stroke motor symptoms.<sup>46</sup>

Clinical presentation of stroke symptoms has an influence on the time taken to seek treatment and those with more severe symptoms are likely to present earlier.<sup>52, 53</sup> The respondents in this study indicated that they were more likely to respond appropriately to more severe stroke symptoms (limb weakness and difficulty speaking) than less severe symptoms such as headache or dizziness. Similarly, more severe stroke symptoms were associated with earlier presentation to hospital.<sup>54</sup> Therefore, the FAST stroke awareness campaign in its current format is appropriate for the majority of the population however a different approach may be warranted to address the risk of atypical stroke symptoms in women and the very old.

Similar to previous research,<sup>19</sup> this study identified that having experienced a stroke or having a family member who experienced stroke was associated with appropriate response to stroke. Furthermore, awareness of treatment available for stroke was also associated with appropriate response to stroke. This is an important finding as lack of information about treatment available for stroke has been associated with delayed presentation for treatment of stroke in previous studies.<sup>55</sup> Awareness of treatment available for stroke is an essential part of stroke knowledge. Previous research has not

found an association between levels of stroke knowledge and appropriate intended response in the event of stroke.<sup>4, 5, 8</sup> Establishing a link between awareness of treatment available for stroke and appropriate response is an important finding in this study. It suggests that stroke awareness campaigns which increase knowledge about stroke may have the potential to influence behaviour when individuals experience stroke. This is an important outcome for stroke awareness campaigns to consider.<sup>12</sup>

All public awareness campaigns are designed to disseminate well defined messages to produce positive changes or prevent negative changes in health-related behaviours across large populations.<sup>56</sup> However, public awareness campaigns have had limited success, particularly in the areas of alcohol misuse, obesity and promotion of physical activity.<sup>57</sup> Health-related behaviours are difficult to change and public awareness campaigns can fail because they do not get the message right or they assume that information alone is sufficient to change behaviour.<sup>58</sup> Stroke awareness campaigns require not only information about the appropriate response to stroke but also need to create an understanding of the barriers to the desired response and how these can be overcome.<sup>29</sup> Furthermore, long running, multimedia campaigns with key messages which can be understood by the public are essential to success.<sup>58</sup> The FAST campaign appears to have successfully increased knowledge of stroke risk factors and awareness of stroke in Ireland.<sup>7</sup> Similarly, awareness of the correct action to take when stroke symptoms occur has increased.<sup>11</sup> The results of this research suggest that the current FAST campaign could be redesigned. As discussed above, respondents in this study were less likely to identify the less typical symptoms of headache and changes in vision with stroke. Furthermore, the inclusion of information on the specific treatments available for stroke and the timelines associated with these treatments may increase the likelihood of immediate contact with the emergency services by individuals who experience or witness stroke symptoms. The results of this study may be limited by the cross-sectional design. It only reflects the current situation at one point in time. This was the first study to use the STAT instrument in an Irish population. It was originally developed for use in the United States. While the STAT had satisfactory internal consistency ( $\alpha = 0.9$ ) it had not been adapted for use in Ireland and therefore did not take account of cultural differences between Ireland and the United States. The online sample may not have been representative of the general population. Overall,

13% of this group had been present when someone had a stroke. This is higher than what would be expected in the general population and suggests that the individuals who chose to answer the online survey may have had a particular interest in stroke. The use of online versus researcher administered questionnaire in this study may have influenced the research findings as those completing online surveys may have searched the internet for the correct answer prior to answering some of the items.

### Conclusion

Healthcare professionals need to be aware that males and those with primary level of education may not recognise and respond to stroke symptoms as appropriately as females and individuals with second/third level education. This information can assist healthcare professionals in tailoring stroke awareness education so that it targets those who are more vulnerable to the risk of stroke. Healthcare providers must ensure that patients are educated on the atypical stroke symptoms as these are not addressed in the FAST campaign. Information on risk factors, symptoms and treatment of stroke should be available in a variety of formats and accessible to all members of the public. Treatments for stroke are developing in line with advances in technology, communication of such advances is essential to ensure optimal care and outcomes for stroke survivors. Behaviour theories

such as the Health Belief Model <sup>59</sup> or decision-making frameworks may be helpful in determining response to stroke and support positive changes related to health promotion across large populations to prevent stroke.

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**Data Availability Statement:** The dataset generated for this study is available on request from the corresponding author.

**Conflict of Interest:** The authors declare no conflict of interest.

**Ethics Statement:** All respondents signed informed consent before participating in the survey. This study received ethical approval from the Social Research Ethics Committee of University College Cork.

**Author Contributions:** EoC, IH and GMcC: design, concept and supervision. EoC: data collection and data management. EoC and VL: statistical analysis. EoC and IH drafted the manuscript. All authors contributed, read and approved the final manuscript.



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