



Recombinant tissue plasminogen activator (rt-PA) utilisation by rural clinicians in ischaemic stroke: A survey of barriers and enablers

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List of Abbreviations and frequently used terms

rt-PA: Recombinant tissue plasminogen activator

GSAHS: Greater Southern Area Health Service

HNEAHS: Hunter New England Area Health service

WWBH: Wagga Wagga Base Hospital

ED: Emergency Department

NNP: Non Neurologist Physicians

ICH: Intracerebral Haemorrhage

AMI: Acute Myocardial Infarction

EM: Emergency Medicine

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Abstract

Aim: This research aimed to identify barriers which prevent rural health care providers from utilising rt-PA in acute ischaemic stroke and possible support mechanisms which could eliminate these barriers.

Methods: Data was obtained from surveys of rural health care providers involved in acute stroke patient care in three rural hospitals that had existing rt-PA pathways. Surveys were anonymous and gathered self assessed ratings of experience, practise environment, attitudes, existing support, barriers and possible enablers regarding rt-PA use in ischaemic stroke. Saturation sampling was used to recruit for the study. Two surveys were used; one to target physicians and a second for nursing staff. The surveys included both yes/no and short answer responses.

Results: A total of 10/38 (26%) responses were obtained from physicians and 13/69 (19%) from nurses. Physicians reported the strongest barriers to the use of rt-PA as pre hospital delays (91%), the risk of intracerebral haemorrhage (ICH) (73%) and clinical diagnostic uncertainty (60%). Physicians reported high levels of confidence in the support they received from their stroke units (90%), while reported levels of confidence in support from hospital administration (50%) and the ambulance service (60%) were notably lower.

Rural nurses involved in acute stroke care are poorly educated on stroke and rt-PA treatment for acute ischaemic stroke. A third of the respondents could correctly list six different stroke signs and a quarter could note the correct rt-PA administration time window. This lack of education was a primary barrier to rt-PA utilisation. The risk of ICH was also a barrier to rt-PA administration for rural nurses involved in acute stroke patient care.

Conclusions: Primary barriers for rural physicians in the utilisation of rt-PA treatment for acute stroke are pre hospital delays and clinical diagnostic uncertainty primarily due to their fear of ICH. Rural physicians involved in acute stroke care require education, specifically regarding the calculated risk of ICH following rt-PA utilisation if inclusion and exclusion criteria are adhered to. Exposure and practical experience is also required to improve their ability to clinically diagnose stroke patients who are eligible for rt-PA. This study made clear that nurses involved in the care of acute stroke patients also need education on both recognising stroke signs, the use of rt-PA, its efficacy and ICH risk and the use of thrombolysis pathways and protocols for acute stroke.

Future Directions: Further research is suggested into the effects of education and practical experience for rural health care providers involved in acute stroke patient care on rt-PA treatment rates.

Keywords: Emergency medicine, physicians, nurses, thrombolytic therapy, obstacle, attitude.

Executive Summary

Implications

In rural health care facilities across Australia, both physicians and nurses involved in acute stroke care are encountering significant barriers that are preventing the optimal administration of rt-PA in eligible stroke patients (1-8).

The findings from this research revealed that rural physicians are not entirely convinced that the benefits of rt-PA outweigh its risks. They also continue to fear the risk of ICH. These barriers were surprising as the literature indicated physicians have a significantly greater acceptance of rt-PA as the ideal treatment for ischaemic stroke (14-15). Nurses identified a poor level of stroke education and knowledge on rt-PA utilisation in acute stroke. ICH risk was also a significant barrier for nurses.

These attitudes may be explained by nurses and physicians working in rural areas having difficulty accessing continuing professional development programs as well as reduced access to the same facilities, equipment, supporting workforce and professional support that are available to those practising in metropolitan areas (22). Physicians in rural areas also have limited opportunities for mentoring or observational experience in utilising rt-PA due to fewer stroke specialists and neurologists in rural areas (10, 13).

Rural physicians involved in acute stroke patient care require education on the calculated risk of ICH following administration of intravenous rt-PA. Exposure and experience in the form of mentoring may improve physicians ability to confidently diagnose stroke patients who are eligible for rt-PA treatment.

Education on stroke signs, the use of rt-PA and protocols, its efficacy and ICH risk to nurses in the ED, particularly those that triage patients, is also recommended to potentially facilitate an increase in rt-PA treatment in stroke patients through nurse initiation of thrombolysis eligible assessment and pathways activation.

Context

Utilisation rates of thrombolysis for acute stroke in health care facilities across Australia are well below the best practise benchmarks. Although small numbers of metropolitan hospitals deliver rt-PA to up to 21% of patients the majority of Australian sites, in both metropolitan and rural areas, deliver rt-PA to 3% of patients (4, 5). To decrease the incidence of stroke related disability and mortality these thrombolysis rates need to be improved (16).

As is well acknowledged in the literature time is the primary barrier for rt-PA implementation (5, 7-8): the drug must be administered with four and a half hours of stroke onset with better outcomes with decreased time to treatment (16, 1). These pre hospital delays are caused primarily by poor public awareness in recognising stroke signs and an ignorance of the time treatment window and ambulance services delays in patient transfer (5, 7-8). It is crucial that pre hospital delay are addressed, however that intervention would be worthless if the available physician whom initially assesses and treats stroke patients in the emergency department (ED) are not willing and able to administer the therapy.

In order to increase the utilisation of rt-PA for rural stroke patients, health care providers that are involved in the initial assessment of patients on their arrival to the ED must recognise the presentation signs of stroke and urgently initiate an assessment on eligibility for rt-PA treatment.

Although research has been carried out to identify barriers faced by Emergency Medicine physicians in rt-PA administration no research has examined rural physicians or nurses involved in stroke care and their views on potential enablers for its use (3-4, 17). This research aimed to identify specific barriers for rural health care providers, both physicians and nurses and support mechanisms they require to increase the utilisation of rt-PA.

Approach

A paper-based survey was distributed to physicians and nurses, involved in acute stroke patient care in all rural NSW hospitals that had implemented rt-PA pathways. These hospitals were Wagga Wagga, Tamworth and Armidale. Saturation sampling was used in this study to decrease the risk of sampling bias and non-coverage errors (18).

The surveys were anonymous and voluntary. The surveys gathered self assessed ratings of experience, practise environment, attitudes, existing support, barriers and possible enablers regarding rt-PA use in acute stroke. The survey contained questions with yes/no answers or a list of optional answers and minimal questions requiring short answer responses.

A Stroke Care Coordinator (SCC) at each site, who was not directly involved in the research, was given a list of positions of the target participants and asked to identify the number of staff at their facility in these positions. Participants in the study included all staff and visiting physicians who were involved in the acute stroke patient care, these included: registrars and residents, stroke physicians, emergency medicine physicians, general physicians, ED Nursing Unit Managers (NUM), ED nurses and stroke unit nurses.

The SCC forwarded an initial survey package onto the identified potential participants. The package contained: a participation information sheet; a two-page survey (physicians) or a one-page survey (nurses) and a reply-paid addressed return envelope. Follow-up reminder letter packages were sent to all sites that received survey packages and also distributed by the SCC.

Returned surveys were coded on return. The small number of respondents prohibited the use of sophisticated statistical analysis hence only descriptive results are reported.

Results

This study highlighted a number of key factors that need to be taken into account when attempting to increase the utilisation rates for thrombolysis in acute ischaemic stroke patients in rural areas, these included:

Physicians

- Of the 64% (7/11) of physicians who had utilised rt-PA in the treatment of acute ischaemic stroke 86% had used it as a result of the implementation of clinical thrombolysis pathway at their facility.
- The majority (82%) of physicians surveyed were aware of The National Stroke Foundation's Clinical Guidelines for Acute Stroke Management (NSF 2007) but of the nine aware physicians only 67% agreed with them that when given with appropriate care and support intravenous rt-PA is effective and safe.
- Overall physicians were most confident in support they received from their stroke units (90%). They were also confident (80%) in support received from: their own knowledge base and experience; education and decision supports such as pathways and protocols; acute radiology services; and within the ED.
- The majority of physicians thought a general lack of support was not an obstacle to the use of rt-PA (7/11).
- The strongest reported barrier to the use of rt-PA was pre hospital delays (91%). Followed by and the risk of intracerebral haemorrhage (73%) and clinical diagnostic uncertainty (60%).

Nurses

- The most frequently reported level (6/13) of experience with the administration of rt-PA for either acute myocardial infarction (AMI) or ischaemic stroke was "some experience (3-4 times a year)".
- Levels of education in utilising rt-PA for acute ischaemic stroke were low. A single nurse had being involved in clinical trials and one other had received mentoring.
- Nurses had a poor awareness of stroke signs with only 33% (4/12) of respondents being able to correctly list six different stroke signs.
- A quarter (3/12) of nurses responded correctly regarding allowed time from symptom onset to rt-PA administration.
- The three most highly ranked barriers to the use of rt-PA from nurses were: lack of education and decision supports such as protocols and pathways, their own knowledge and the risk of ICH.

Further research

To increase the sample size this study could be repeated with the surveys extended to include nurses and physicians involved in acute stroke patient care in all rural hospitals that had implemented rt-PA pathways Australia wide.

Further research is suggested into the effects of education and practical experience for rural health care providers involved in acute stroke patient care on rt-PA treatment rates.

Introduction

A number of Australian rural referral hospitals have now established stroke care units and are beginning to introduce thrombolytic therapy with intravenous rt-PA for eligible acute ischaemic stroke patients. Intravenous rt-PA is a highly effective and cost effective therapy (16) and although it is being used in an increasing number of EDs and stroke units across Australia (1), implementation remains low nationally, at approximately 3% of all ischaemic stroke patients (14). Although some Australian hospitals have achieved thrombolysis rates of 21% (15).

The major practical consideration to implementation of tPA is the defined four and a half hour time window in which to commence tPA (1, 5, 7-8, 16). Only 39% of patients arrive to hospital within the prescribed timeframe (14). Pre hospital delays due to poor public awareness of stroke symptoms and time to seek medical advice remain the main challenges (7-8). Transport delays also contribute for those emergent stroke patients in rural areas with long distances between remotely located patients and centrally located physicians with stroke expertise (9, 12, 19, 23-24), particularly if the patient is firstly taken to a small facility that does not offer thrombolytic treatment (5).

Of near equal importance are the associated health system issues of coordinating prompt patient assessment with early brain imaging and reporting, expert neurological assessment and evaluation and having the necessary staffing and infrastructure in place to monitor and manage potential complications (1-2, 4, 6)).

Although some Australian stroke centres are equipped with such resources to provide timely and adequate assessments of acute stroke patients and administer rt-PA if eligible, unfortunately, this level of specialist expertise may be unavailable at some urban and most rural health care facilities (1, 9-12).

This gap in specialist stroke care leaves the rural health care providers who initially assess patients in the ED with a critical role at the forefront of stroke management (25), heightened by the time-dependent nature of thrombolytic therapy (1). However many rural health care providers lack experience in treating acute stroke, this combined with too few stroke specialists in rural facilities to provide education and mentoring results in local ED resistance to treat with rt-PA without real-time expert support, hence rt-PA use remains well below best practise benchmarks (11-12).

Background

Stroke is the second leading cause of death and leading cause of long-term disability in Australia (20). In 2009 there were approximately 60000 strokes with an associated cost burden estimated at AUD\$2 billion per year (21). Intravenous rt-PA therapy in selected patients with acute ischaemic stroke is a highly effective and cost effective therapy, resulting in a significant net reduction in the proportion of patients who are dead or become dependent in activities of daily living as a result of their stroke (16). To decrease stroke-related morbidity and mortality, the rate of thrombolytic therapy for eligible stroke patients must be improved (16).

According to the National Stroke Foundations (NSF) 2010 Guidelines rt-PA should only be undertaken in a hospital with appropriate infrastructures, facilities and network support (13). They also recommend that Intravenous rt-PA should only be given under the authority of a physician trained and experienced in stroke management (13). Unfortunately, this level of infrastructure and physicians with stroke expertise are unavailable at some urban and most rural health care facilities, presenting a major barrier to tPA delivery (1, 9-12).

Research has demonstrated that emergency medicine physicians are highly accurate in diagnosing stroke and in the assessment of intravenous rt-PA eligibility (26). Despite this accuracy, literature commonly documented fear of ICH as an obstacle that limited physicians utilisation of rt-PA (2-3). This fear was due to beliefs that serious adverse effects were common and consequently a belief that the benefits did not outweigh the risks (2-3).

However more recent literature reported that physicians attitudes toward rt-PA have changed with a significantly greater acceptance of rt-PA as the ideal treatment for acute ischaemic stroke. It elaborated that physicians have become convinced of the beneficial effects of thrombolytic treatment and felt that its risks were acceptable (4, 17). This suggests that fear of ICH is no longer the primary barrier for rt-PA utilisation in acute stroke.

Anxiety regarding implications of protocol violations and the spectre of potential litigation that accompanies a decision to start or withhold rt-PA therapy has also been documented as a concern for physicians who do not specialise in stroke administering rt-PA in the ED (28-29). Research on liability has shown that neurologists, physicians providing emergency medicine care and hospitals are generally at increased liability risk if they fail to provide rt-PA, rather than adverse events associated with its use (28, 29). However many physicians may not be aware of this; a 2010 survey in the United States indicated that only a quarter of physicians considered rt-PA use represented a legal standard of care (17).

Despite this change in physicians anxiety regarding fear of ICH and been at an increased liability risk if they fail to provide rt-PA many physicians involved in acute stroke patient care remain unsure about rt-PAs use (3, 28-29).

This coincides with is a notable lack of support from EM professional organisations in endorsing the use of rt-PA in acute ischaemic stroke. Although stroke neurologists and stroke societies widely consider rt-PA a proven effective therapy for acute stroke (29). In 2003 all the major professional EM organisations - the American College of Emergency Physicians (ACEP), the American Academy of Emergency Medicine (AAEM), and Society of Academic Emergency Medicine (SAEM) passed similar policies of no confidence in the use of thrombolytics for acute stroke (30).

More recently EM organisations attitudes have changed. This coincides with the literature suggesting a positive shift in physicians attitudes toward rt-PA utilisation in acute ischaemic stroke (4, 17). In 2009 the SAEMs Board of Directors officially retired its policy questioning the use of thrombolytic agents in patients with acute ischaemic stroke (30). ACEPs policy was also reviewed and recommendations made that t-PA

for acute ischaemic stroke patients could be considered an institutional level rt-PA if the necessary systems for its safe use were in place (31).

These policies changes are thought to be secondary to The European Cooperative Acute Stroke Study III (ESCASS III) which provided the further scientific proof for rt-PA administration in eligible acute ischaemic stroke patients that the EM physicians required to eliminate their nerves (30, 32). The AAEM has not changed their acute stroke policy despite the ESCASS III study outcomes nor the 2009 systematic review of thrombolysis for acute stroke concluding that t-PA administered between three and four and a half hours after the onset of symptoms results in improved clinical outcomes, (16, 32).

Despite remaining concerns of the broader community of physicians involved in acute stroke care, EM residents have expressed enthusiasm for utilising rt-PA therapy for acute ischaemic stroke (33). It has also been shown that resident-driven rt-PA protocol, with formal training and quality control, is safe and efficient (33).

Nurses in a key position to reduce delays and ensure the stroke symptom onset time to t-PA treatment time window is as narrow as possible (6). Nurses are often the first to assess a patient on their arrival to the ED, this enables them to facilitate priority assessments of suspected stroke patients regarding their eligibility for thrombolytic therapy. However no published research on nurses attitudes toward the utilisation of rt-PA treatment in ischaemic stroke could be identified. The majority of published research regarding barriers to the implementation of rt-PA has been exclusively within the medical arena (6).

Efforts are underway to improve delivery rates of acute stroke thrombolysis and various approaches are currently been evaluated (5). An extensively studied option is rt-PA implementation support for regional hospital with acute brain imaging capability using telemedicine services based in major stroke treatment facilities. When combined with intervention targeting ambulance services to ensure patients are transported to sites offering rt-PA telemedicine services, telemedicine support has been shown to improve access to rt-PA (9, 34-36). However, a supported telemedicine approach is not always suitable for smaller rural facilities (5).

In conclusion the literature indicated that fear of ICH is no longer the primary barrier to the utilisation of rt-PA in acute ischaemic stroke for physicians. Little information is known on the barriers for physicians in the rural setting and the treatment barriers as perceived by nurses are as yet unknown. No published literature could be identified that asked rural health care providers involved in acute stroke patient care to identify strategies to overcome these perceived barriers to implementing this lifesaving treatment. In addition the majority of research on stroke and its barriers has focused on populations in and around major metropolitan centres (1) and internationally.

This research explored the barriers which are preventing Australian rural health care providers, both physicians and nurses, from utilising rt-PA and possible support mechanisms which could eliminate these barriers. The surveys examined barriers lying within both the individual health care providers and the health system.

Method

Ethics approval

Ethics approval for this research was received from The Hunter New England Lead Human Research Ethics Committee with Site Specific Approval for GSAHS (HREC reference number: HREC/09/HNE/165, SSA reference number: SSA/09/GSAHS/57).

Study design

A paper-based survey was conducted which gathered self assessed ratings for this descriptive study.

Sampling

All rural sites within NSW that had implemented a functional rt-PA therapy service as defined by the NSF (ref) and had a specified SCC position were deemed eligible for inclusion. These included rural referral hospitals at Wagga Wagga, Tamworth and Armidale. The use of the SCC as the key contact at each facility was to minimise non-contact bias (18).

Saturation sampling was used to recruit for the study. All physicians and nurses involved in acute stroke patient care across these facilities invited to participate. This method was employed to decrease the risk of sampling and non-coverage errors (18).

Contact with the SCC at each facility was made via email containing an introduction to the study and a request for assistance. The researcher provided the Stroke Care Coordinator with a list of positions of the target participants and was asked to indicate how many staff fit the job descriptions within the hospital.

A package containing the number of surveys indicated was sent to each site. Each survey was accompanied by an information sheet and a reply-paid envelope to post completed survey directly back to the researcher. No incentives were given for participations, for the SCC, physicians or nurses.

Participants

Participants in the study were all staff and visiting physicians who were involved in acute stroke patient care and hence could potentially be involved in the rt-PA administration pathway, these included: registrars and residents, stroke physicians, emergency medicine physicians, general physicians, ED Nursing Unit Manager (NUM), ED nurses and stroke unit nurses.

No consent was sought, the survey is de-identified and participants indicated their consent by completing and returning the survey. The voluntary nature of participation was heavily emphasised in the participant information sheet provided with the surveys (Appendices 1 and 2).

Exclusions

Staff that were not involved in acute stroke patient care was excluded.

Survey design and piloting

To reach the geographical spread of rural physicians and nurses and also considering the diverse workforce of rural EM physicians, a paper-based survey was deemed the most appropriate (18). As with any paper-based survey, the response rate is a potential source of bias (18). To minimise the risk of selective response and non-response error (37), the survey was kept short and contained questions with yes/no answers or a list optional answers and minimal questions requiring short answer responses.

The survey was developed in consultation with a steering group consisting of Neurologists, EM physicians and Stroke Care Coordinators. Some of these steering group members were also experienced researchers which enabled expert refinement of the final survey tool.

Facilities in larger metropolitan centres with well established rt-PA pathways provided an experienced population for piloting of the survey. Staff in these centres were approached with drafts of the survey. Feedback from this round of piloting, along with consultation from the steering group developed the key structure of the survey.

Survey distribution

No member of the research team approached participants directly. The SCC at each site, who was not directly involved in the research or did not have any line management responsibilities for any potential participant, forwarded the survey packages onto the identified potential participants. To maximise response rate follow-up reminder letter (Appendices 3) packages were sent to all sites that received survey packages and also distributed by the SCC.

Survey collection

Participants were provided with an initial package containing:

- A participation information sheet
- A two-page survey (physicians) or a one-page survey (nurses)
- Reply-paid addressed return envelope

One month post the initial package been sent a second package was sent to SCC's containing:

- A reminder letter
- A copy of previously sent two-page survey (physicians) or a one-page survey (nurses)
- A second reply-paid addressed return envelope

Survey items

The following data items were collected in the survey:

The physicians survey included yes/no and short answer responses and examined:

- Awareness and opinions of the National Stroke Foundations Clinical Guidelines for Acute Stroke Management
- Previous intravenous-rt-PA: use, research involvement and education

- Level of support, barriers faced and potential enablers in utilising rt-PA within their health service

The nurses survey included yes/no and short answer responses and examined:

- Experience in rt-PA administration
- Previous level of involvement in rt-PA research and education
- Basic stroke and rt-PA knowledge
- Barriers to utilising rt-PA in their health service

Survey data management

Returned surveys were coded on return for the purposes of data entry. Data was managed with Microsoft Excel. All surveys containing data were confidentially shredded.

Statistical analysis

The small number of respondents prohibited the use of statistical analysis such as exact logistic regression and contingency tables hence only sophisticated descriptive results are reported.

Results

Potential participants

Three public hospitals in rural New South Wales: Wagga Wagga Base Hospital, Tamworth Rural Referral Hospital and Armidale Rural Referral Hospital were deemed eligible for the study. Across these health facilities 38 physicians and 69 nurses were identified as potential participants and subsequently survey packages were distributed to these personnel.

Physicians survey

Response rate

A total of 38 surveys were disseminated to physicians and responses were received from 26% (11/38).

Participant profile

The respondents came from a range of roles including: visiting physicians, ED physicians, general physicians, registrars and geriatricians.

Recombinant tissue plasminogen activator usage and education

Physicians were asked to respond in the negative or affirmative on a range of questions on their use and education with respect to intravenous rt-PA. Whilst 82%

(9/11) had utilised rt-PA in AMI only 64% (7/11) had used it in the treatment acute ischaemic stroke. Six of these seven physicians who had treated acute ischaemic stroke with rt-PA had done so as a result of the implementation of the clinical pathway at their facility.

Whilst only a single physician had been involved in the clinical trials for rt-PA a higher proportion had received mentoring or education in its use (7/11). Of these seven physicians who had mentoring or education 71% (5/7) had used rt-PA.

When questioned regarding their awareness and agreement of The National Stroke Foundation's Clinical Guidelines for Acute Stroke Management (NSF 2007) the majority (82%) of physicians were aware of the guidelines but of the nine physicians that were aware only 67% agreed with the guidelines that when given with appropriate care and support intravenous rt-PA is effective and safe.

Support

The physicians were asked a range of questions to determine their perceptions of the level of support they receive for the use of rt-PA in their hospital (Table 1). They were least confident in support from hospital administration (50%) and the ambulance service (60%) and most confident in the in support they received from their stroke units (90%). Of the 11 physicians surveys one did not complete this question.

Table 1: Proportion of physicians reporting adequate support in the use of intravenous rt-PA in acute ischaemic stroke in Armidale, Tamworth and Wagga Hospitals from a range of sources.

Source of Support	Percentage of physicians considering support adequate (n=10)
Support of stroke unit or equivalent inpatient care area	90%
Own knowledge base, experience	80%
Education and decision supports such as pathways and protocols	80%
Support from acute radiology services	80%
Support within emergency department	80%
Support from quality improvement services	70%
Developmental level of organized stroke care in your institution	70%
Support from ambulance services	60%
Support from hospital administration	50%

Barriers to utilisation

The barriers to the use of rt-PA noted most often were pre hospital delays and the risk of ICH (Table 2). Seven physicians provided their estimate of the risk of ICH following rt-PA and the median of these estimates was 5% (range 2% to 66%). Although only 27% (3/11) of physicians reported their own stroke neurology experience as a barrier to the use of rt-PA, a majority of physicians (6/10) reported clinical diagnostic uncertainty as a barrier. Of these six physicians four (67%) reported interpretation of the CT and uncertainty in the selection of suitable patients as a component in their clinical diagnostic uncertainty to the use of rt-PA. Whilst only half of the physicians felt they received adequate support from hospital administration only 27% (3/11) cited administrative barriers as an obstacle to rt-PAs use. Most physicians (7/11) felt that lack of support was not an obstacle to the use of rt-PA.

Table 2: Proportion of physicians considering various potential barriers as important obstacles in the use of intravenous rt-PA in acute ischaemic stroke in Armidale, Tamworth and Wagga Hospitals.

Potential Barriers	Proportion of Physicians perceiving barrier to exist
Pre hospital delays	91% (10/11)
Risk of Intra-cranial haemorrhage	73% (8/11)
If uncertainty cited as a barrier was it due to:	
<i>Interpretation of CT</i>	67%(4/6)
<i>Uncertainty with patient selection criteria</i>	67% (4/6)
Clinical diagnostic uncertainty	60% (6/10)
ED delays	54% (6/11)
Uncertainty about benefits of rt-PA	36% (4/11)
Experience with iv rt-PA inclusions and exclusions	36% (4/11)
Lack of support	36% (4/11)
Not ideal setting	33% (3/9)
Personal stroke neurology experience	27% (3/11)
Administrative barriers	27% (3/11)
Cost	0%

Nurses Survey

Response rate

A total of 69 surveys were disseminated to nurses and responses were received from 19% (13/69).

Participant profile

The majority 10/13 of the nurses that responded to the survey were registered nurses with the remaining three coming from an Enrolled Nurse background. The median time they had worked in the ED was three years (range: 0-17 years).

Recombinant tissue plasminogen activator usage and education

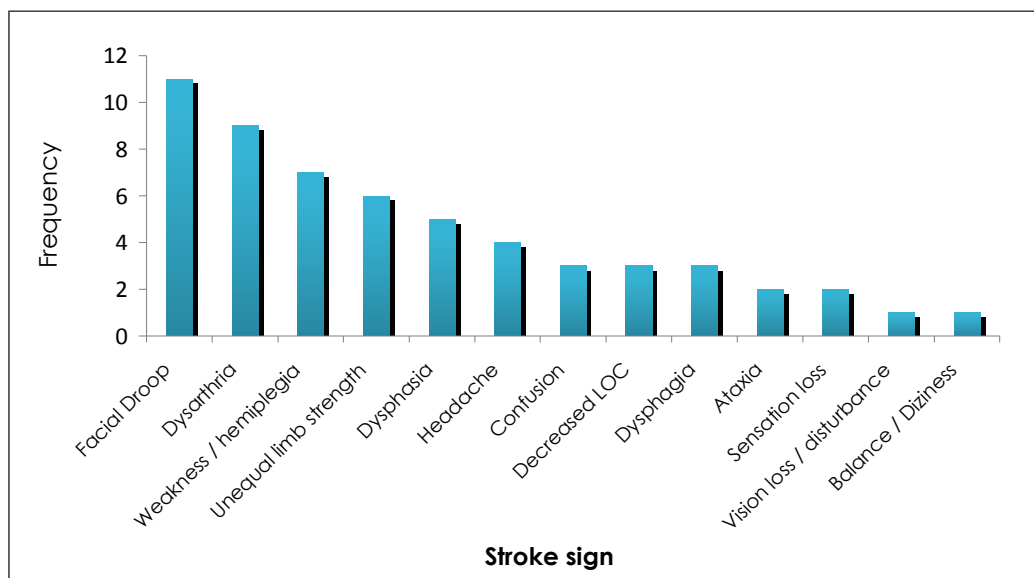
The most frequently reported level (6/13) of experience with the administration of rt-PA for either AMI or ischaemic stroke was "some experience (3-4 times a year)". This experience was most commonly gained treating a combination of both AMI and stroke (6/13) or in AMI alone (5/13). Only two nurses had used rt-PA exclusively in stroke.

The levels of education in utilising rt-PA for acute ischaemic stroke were low with only a single nurse being involved in clinical trials and one other nurse having received mentoring. Only 17% of the nurses who responded to this question were certified to use the National Institute of Health Stroke Score (2/12).

To examine the accuracy with which nurses correctly identified the signs of stroke, the nurses were asked to list six signs which may indicate a patient was having or had recently had stroke. Of the respondents 33% (4/12) could correctly list six different stroke signs, 42% (5/12) could list five signs whilst the remaining 25% (3/12) could correctly identify four.

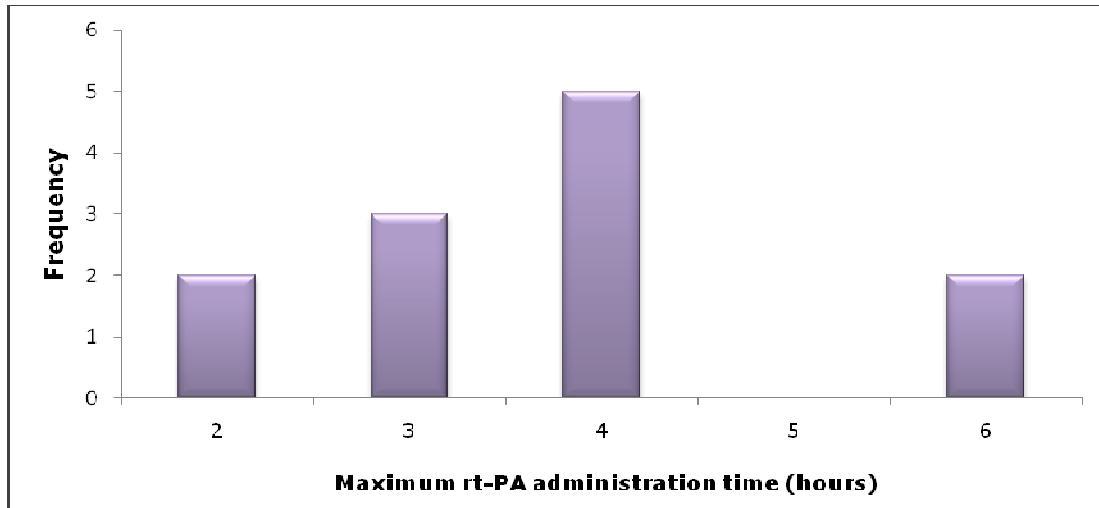
The three most common signs of stroke listed by nurses were facial droop (85%) dysarthria (69%) and hemiplegia (54%). See Table 3 for a full list of stroke signs responses and their frequency.

Table 3: Frequency distribution histogram of clinical signs of stroke listed by ED nurses in Armidale, Tamworth and Wagga Hospitals.



Nurses were asked to state what the time period from symptom onset to the administration of rt-PA was under its current licence. Table 4 highlights 25% (3/12) of nurses responded correctly with 3 hours.

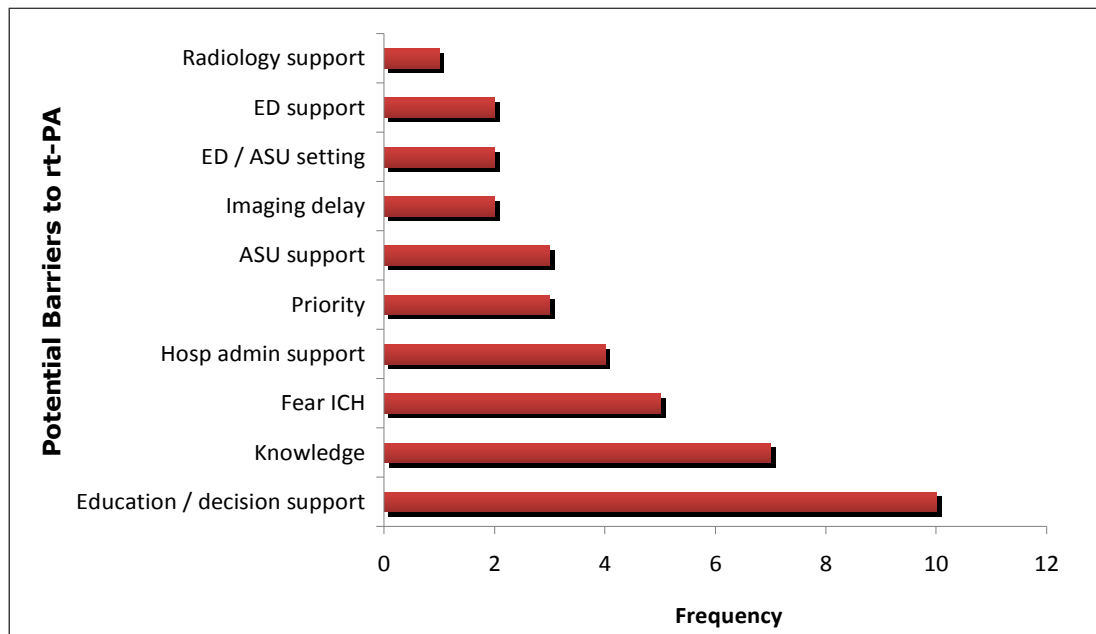
Table 4: Histogram of nurses beliefs of the maximum duration after the onset of stroke symptoms for which rt-PA is licensed at Armidale, Tamworth and Wagga Hospitals.



Barriers to use

Nurses ranked ten listed barriers by order of their significance as a barrier in their opinion to the use of rt-PA in ischaemic stroke. The frequency of the barriers ranked either first, second or third by nurses is graphed in table 5. Rankings were from one to ten. The barriers ranked most frequently in the top three of the ten listed were a lack of education and decision supports such as protocols and pathways (71%), their own knowledge of rt-PA (50%) and the risk of ICH (36%).

Table 5: Bar chart of nurses opinions at Armidale, Tamworth and Wagga of the potential barriers ranked as the first, second or third most significant barrier to rt-PA use from a list of ten potential barriers.



Besides the list of barriers given to the nurses 73% (8/11) identified barriers other than those listed, including: limited access to stroke specialist for liaison, no surgical support, high patient activity in the ED and locum physicians who are inexperienced in rt-PA utilisation.

Nurses identified that their institution was well organised enough with stroke care to support the use of rt-PA 58% (7/12). Of the 42% (5/12) of nurses who felt their institution was not well organised enough with stroke care to support rt-PA the reasons for their lack of confidence included: insufficient education in the ED, inadequate staff in ED, no experienced stroke nurses in ED and no notification from the ambulance service that a stroke patient who may be a potential rt-PA candidate was been transferred to their facility.

Discussion

Physicians

Treatment with rt-PA is both a powerful and proven effective treatment for acute ischaemic stroke (16). This treatment has been licensed for use in Australia for 17 years but is underutilised with approximately 3% of all acute ischaemic stroke patients receiving thrombolysis nationally (14), although some Australian centres have achieved best practise benchmarks of 20% (15,22). Despite this evidence physicians involved in acute stroke care and speciality societies, particularly those in rural areas, have identified significant barriers to rt-PAs and are not so positive about its use (1, 3, 4, 11-12, 28, 39-40).

Consistent with the literature physicians in the current study reported the strongest barrier to the use of rt-PA is pre hospital delays (91%). There are a number of factors that contribute to pre hospital delays. Poor public awareness of stroke symptoms and a delay in seeking medical advice remains a main challenge (7-8). An uncertainty in the time of symptom onset, for example if the patient woke with their symptoms is a contraindication to the administration of rt-PA (13). Delays in transport are also often barriers in Australia (5). Due to the geographical spread of populations patients are often taken to their nearest hospital first, this may be a smaller facility that does not offer thrombolysis (5) and the time taken to transfer them to a larger facility with rt-PA facilities will more than likely put them outside the time treatment window for rt-PA.

During 2009 and 2010 two survey studies examined 652 physicians' views on rt-PA utilisation in acute ischaemic stroke. Both were completed internationally in Michigan and Scandinavian countries, Norway, Sweden and Demark. These produced results indicating that physicians attitudes were considerably more favourable toward rt-PA as the most beneficial acute treatment for ischaemic stroke than had been previously reported (4, 17). The Michigan, United States survey reported 99% of physician's surveyed believed rt-PA in eligible patients was acceptable or ideal patient care (17).

However the results of this Australian rural study indicated 67% of rural physicians involved in acute stroke patient care agreed with the NSF's Clinical Guidelines for Acute Stroke Management 2007, (38) that when given with appropriate care and support intravenous rt-PA is effective and safe. This suggests that rural physicians have a less positive perspective toward rt-PA utilisation than is seen internationally.

Unexpectedly, rural physicians cited the risk and their fear of ICH as a primary barrier (73%). This was inconsistent with more recent literature which reported physicians had become convinced of the beneficial effects of thrombolytic treatment and felt that its risks were acceptable (4, 17). This may be explained as physicians working in rural areas have difficulty in accessing not only the same continuing professional development programs, but also the same facilities, equipment, supporting workforce infrastructure and professional support that are available to those practising in metropolitan areas (41). Also due to fewer stroke specialists and neurologists geographically distributed in rural areas (5, 12) physicians in rural areas would have limited opportunities for mentoring or observational experience with rt-PA to help convince them of its efficacy and increase their confidence in its administration.

This study suggests that rural physicians perceive their own knowledge base, education and the decision supports such as pathways and protocols in their facility as adequate to allow rt-PA utilisation (80%). However 60% still reported an uncertainty on clinical diagnostics of rt-PA administration as a barrier. Although only the minority (36%) reported this uncertainty was with the inclusion and exclusion criteria for rt-PA administration. There is no evidence available to compare rural rates of ICH with metropolitan (36), from the findings of this study we can conclude that fear of misdiagnosis and the secondary risk of ICH that may be preventing rural physicians from initiating rt-PA treatment for acute stroke patients.

Physicians involved in acute stroke patient care in larger metropolitan centres are more likely to have had exposure to rt-PA utilisation and its subsequent benefits than physicians in smaller facilities (41). This exposure would have enabled them to gain experience and confidence through observation prior to making clinical diagnostic decisions. Rural physicians involved in acute stroke patient care generally do not have the opportunities to gain this form of experience, due to the availability of local expertise and support services (5), which may help explain the ongoing fear of ICH and lower rt-PA utilisation rates in rural facilities.

In order to increase the utilisation rates of rt-PA both pre hospital intervention and the implementation of strategies to overcome barriers faced by physicians involved in acute patient care is crucial. Pre hospital intervention must involve both ambulance services to decrease transport delays and also target the community to improve stroke awareness. Physicians in rural facilities involved in acute stroke patient care require education on rt-PA efficacy, not in terms of the benefits of rt-PA but more specifically education regarding the calculated risk of ICH if the inclusion and exclusion criteria are adhered to. Physicians also require experience to improve their ability and confidence to clinically diagnose stroke patients who are eligible for rt-PA.

Nurses

Nurses are in a key position to reduce delays and to facilitate the administration of rt-PA in stroke patients who are eligible to receive it as they are the first point of contact for a patient on their arrival to the ED (6). No research could be identified on the barriers nurses encounter or their attitudes toward the administration of rt-PA treatment in acute ischaemic stroke.

The current license for rt-PA administration is four and a half hours from known symptom onset (13). However at the time of survey distribution and collection the licence for rt-PA remained at three hours. Despite this there was emerging evidence recommending an extension of the time window to four and a half hours and some facilities has began to implement this ahead of the change in clinical practise guidelines. A quarter of nurses responded with three hours, the official license approved at the time of survey distribution. If we take into account the extension to four and a half hours trialling in some centres, 67% (8/12) of nurses responded in the correct time range of up to four and a half hours.

When asked to list signs of stroke only 33% of respondents could correctly identify six different stroke signs. Amongst those nurses who could identify five or less different stroke signs some identified the same symptoms twice with different terminology, for example they may have listed weakness and hemiplegia or slurred speech and dysarthria. A patients first point of contact with a health service will be with a nurse during triage, the process of determining the priority of patients treatments based on the severity of their condition, hence it is crucial that nurses can recognise acute ischaemic stroke signs promptly and effectively to initiate the rt-PA assessment process. This would increase the patients chances of remaining within the eligible time window for rt-PA.

The three most common signs of stroke listed by nurses were facial droop (85%), dysarthria (69%) and hemiplegia (54%). These are the same three symptoms promoted in the NSF FAST campaign and may suggest that the national campaign is providing nurses with general knowledge.

Nurses themselves also perceived a lack of education as a primary barrier to rt-PA utilisation. The majority of nurses who responded to the survey had had minimal educational experience with rt-PA with only 8% having been involved in clinical trials or mentoring. Although 62% of nurses survey had been involved in rt-PA utilisation in acute ischaemic stroke.

Nurses also noted decision supports such as protocols and pathways to be a barrier and their fear and the risk of ICH. This indicates that nurses in the ED benefit from pathways to assist them in triaging stroke patients and in commencing eligibility for rt-PA assessments however they require further education on the implementation of these pathways.

The results of this survey strongly indicated that current stroke education to nurses in the ED is inadequate. In order to increase the utilisation of rt-PA in the ED nurses need to triage stroke patients as a priority, initiate the assessment of thrombolysis and activate appropriate pathways. To encourage and assist nurses in the ED on doing

these they need education on stroke signs, the use of rt-PA, its outcomes and ICH risk and to be involved in practical workshops on the use of rt-PA pathways and protocols.

Limitations and strengths of the study

In survey research, physicians have long been recognised as a professional group from which it is difficult to obtain high response rates (42). A limitation of this study was the small study population and a poor response rate. The small sample size increased the risk of bias being introduced, hence caution must be taken when generalising the results of this study. The poor response rate eliminated the possibility of conducting sophisticated statistical analysis on the results and only allowed descriptive reporting.

The short timeframe, necessitated by the time parameters of the CETI, did not allow the surveys to be distributed more broadly across Australia once the poor response rate was noted. Although a broader distribution may not have increased the response rate it may have improved the sample size.

A strength of this study was the use of saturation sampling during recruitment. All physicians and nurses with a role in providing health care to acute stroke patients across rural sites within rural NSW health facilities with thrombolysis therapy pathways for stroke patients implemented in their EDs and a specified SCC position were invited to participate. This eliminated the risk of selection bias and non-coverage errors (18).

To increase response rate in this study, the survey was kept short and follow up reminder letters including a second copy of the survey and reply paid addressed envelope were sent, as recommended in a 2007 Cochrane Systematic Review on survey methods (43). Further strategies that could have been employed to increase the response rate all required the survey to be identifiable, these included, monetary incentives, registered mail and contacting participants before sending surveys (42, 43).

Conclusion and recommendations

This study was the first to examine rural NSW physicians beliefs on the barriers and potential enablers to rt-PA therapy implementation in stroke. It was also the first study to examine nurses attitudes toward the utilisation of rt-PA treatment in stroke.

This study concludes that over and above the well documented barriers due to pre hospital delays, physicians fear of misdiagnosing a stroke patient as suitable for rt-PA therapy and the secondary risk of ICH is a primary barrier to the implementation of rt-PA in stroke patients. Inadequate stroke knowledge and education were strongly indicated as the primary barriers in rt-PA initiation for nurses.

To reduce these barriers and increase rt-PA utilisation rates in rural areas pre hospital intervention is required with both ambulance services and within the community to improve stroke awareness. This study demonstrates a need for physicians involved in acute stroke patient care in rural areas to be educated on the calculated risk of ICH

following intravenous rt-PA utilisation if the inclusion and exclusion criteria are adhered to. Exposure and experience is also required to improve physicians ability to clinically diagnose stroke patients who are eligible for rt-PA which will improve their confidence in its administration.

Nurses are first point of contact for a patient in the ED, hence to increase rt-PA treatment in stroke patients nurse activation of thrombolysis eligibility assessments and pathways needs to improve. To facilitate this increase nurses involved in acute stroke patient care require education on stroke signs, the use of rt-PA, its efficacy and ICH risk and the use of rt-PA pathways and protocols.

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Appendices

Appendix 1 – Survey Package: Physicians



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Information Statement for the Research Project Tele- tPA Stroke Project

Tissue Plasminogen Activator (tPA) for Acute Ischemic Stroke – A survey of the challenges/ barriers faced by physicians in the utilisation of tPA

You are invited to participate in the research project identified above which is being conducted by a team led by Assoc Prof Christopher Levi, Director of Acute Stroke Services, John Hunter Hospital which is been undertaken at Wagga Wagga Base Hospital (WWBH) and Tamworth Rural Referral Hospital (TRRH), in conjunction with the Acute Stroke Team at John Hunter Hospital (JHH). The project is trialling methods to facilitate and increase stroke thrombolysis rates in rural settings.

Part of the research project is to examine barriers to utilising tPA and support strategies required to increase the rate of tPA utilisation in rural referral hospitals in NSW. We are seeking emergency department (ED) physicians, Visiting Medical Officers, other medical officers involved in stroke patients, ED nurses and specialised stroke nurses from rural hospitals and Acute Stroke Units across NSW to participate in this research.

You have been identified a key informant who may be able to provide insight into the challenges/ barriers faced in the utilization of tPA. We are inviting you to participate in a survey that will take about 10 minutes to complete. Participation in the survey is entirely your choice. All data will be de-identified and reported in an aggregated form, but some specific quotes may be highlighted. The results may be presented in a peer reviewed journal and presented at conferences. A summary report will be provided to the hospitals included in this study.

If you would like to participate please complete the attached survey and return it in the reply paid envelope enclosed. This will be taken as your informed consent to participate. Please also feel free to attach any additional comments to the survey

This research has been approved by the Hunter New England Human Research Ethics Committee of Hunter New England Health. Reference number: 09/05/20/4.02.

Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to Dr Nicole Gerrand, Professional Officer (Research Ethics and Governance), Hunter New England Human Research Ethics Committee, Hunter New England Health, Locked Bag 1, New Lambton NSW 2305, telephone (02) 49214950, email HNEHREC@hnehealth.nsw.gov.au

If you have any questions please contact Jocelyn Dyde, Associate Researcher at WWBH by phone on 6938 6127 or email jocelyn.dyde@gsahs.health.nsw.gov.au.

Regards,

A handwritten signature in blue ink, appearing to read "Chris Levi".

Associate Professor Christopher Levi



On behalf of the research team

Dr Martin Jude and Ms Jocelyn Dyde- Wagga Wagga Base Hospital ph 6938 6127

Dr James Hughes and Ms Rebecca Hemmings- Tamworth Rural Referral Hospital ph 6767 7700

If you agree to participate please complete the following survey and return in the reply paid envelope to Jocelyn Dyde, Po Box 5492, Wagga Wagga, NSW, 2650.

Please circle yes or no and provide written responses where applicable.

Guidelines:

1. Are you aware of the National Stroke Foundation's Clinical Guidelines for Acute Stroke Management (2007) which indicate that when given with appropriate care and support iv tPA is effective and safe?
Y / N

1.1. Do you agree with these guidelines? Y / N

If no, please specify your concerns _____

iv TPA use:

2. Have you used iv tPA in acute ischaemic stroke? Y / N

2.1.1. Was this due to the implementation of a tPA clinical pathway at the facility? Y / N

3. Have you utilised iv tPA in AMI? Y / N

Research and education:

4. Have you been involved in clinical trials of stroke thrombolysis? Y / N

5. Have you had any mentoring, formal or informal education in the use of iv tPA in acute ischemic stroke? Y / N

If yes, please specify _____

Support

6. Do you feel you have adequate support in your hospital for the use of iv tPA in acute ischemic stroke patients in terms of:

6.1. Your own knowledge base, experience Y / N

6.2. Education and decision supports such as pathways and protocols Y / N

6.3. Support from the ambulance service Y / N

6.4. Support from acute radiology services Y / N

6.5. Support within the ED Y / N

6.6. Support of the stroke unit or equivalent inpatient care area Y / N

6.7. Support from quality improvement services Y / N

6.8. Support from hospital administration Y / N

6.9. Development level of the organised stroke care in your institution Y / N

If no, please specify why: _____

Barriers

7. Would the following barriers prevent you from administering tPA to acute ischemic stroke patients:

7.1. Your level of experience with stroke neurology Y / N

7.2. Your level of experience with iv tPA inclusions and exclusions Y / N

7.3. Clinical diagnostic uncertainty Y / N

If yes, is this due to

7.3.1. Interpretation of the CT Y / N

7.3.2. Uncertainty in the patient selection criteria Y / N

7.3.3. Other_____

7.4. Prehospital delays Y / N

7.5. ED delays Y / N

7.6. Cost of therapy Y / N

7.7. Administrative barriers Y / N

7.8. Risk of symptomatic intracerebral haemorrhage Y / N

7.8.1. Your approximate of the risk of symptomatic intracerebral haemorrhage_____

7.9. Uncertainly about evidence for the net benefits of tPA Y / N

7.10. Not in the "ideal" setting Y / N

If yes, what does your setting require in order to make it "ideal"?_____

7.11. Lack of support Y / N

If yes, what support do you require in order to administer tPA?_____

7.12. Other – please specify_____

Your background (please circle all that apply):

- VMO
- Registrar
- Staff Specialist
- Neurologist
- Geriatrician
- Stroke Physician
- ED Physician
- General Physician

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A survey of the challenges/ barriers faced by nurses in the utilisation of tPA**

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Part of the research project is to examine barriers to utilising tPA and support strategies required to increase the rate of tPA utilisation in rural referral hospitals in NSW. We are seeking emergency department (ED) physicians, Visiting Medical Officers, other medical officers involved in stroke patients, ED nurses and specialised stroke nurses from rural hospitals and Acute Stroke Units across NSW to participate in this research.

You have been identified a key informant who may be able to provide insight into the challenges/ barriers faced in the utilization of tPA. We are inviting you to participate in a survey that will take about 10 minutes to complete. Participation in the survey is entirely your choice. All data will be de-identified and reported in an aggregated form, but some specific quotes may be highlighted. The results may be presented in a peer reviewed journal and presented at conferences. A summary report will be provided to the hospitals included in this study.

If you would like to participate please complete the attached survey and return it in the reply paid envelope enclosed. This will be taken as your informed consent to participate. Please also feel free to attach any additional comments to the survey

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If you have any questions please contact Jocelyn Dyde, Associate Researcher at WWBH by phone on 6938 6127 or email jocelyn.dyde@gsahs.health.nsw.gov.au.

Regards,



Associate Professor Christopher Levi

On behalf of the research team

Dr Martin Jude and Ms Jocelyn Dyde- Wagga Wagga Base Hospital ph 6938 6127

Dr James Hughes and Ms Rebecca Hemmings- Tamworth Rural Referral Hospital ph 6767 7700

If you agree to participate please complete the following survey and return in the reply paid envelope to Jocelyn Dyde, Po Box 5492, Wagga Wagga, NSW, 2650.

Please circle as appropriate or provide written responses where applicable.

1. Are you a:
 - a. CNC
 - b. CNS
 - c. enrolled nurse
 - d. registered nurse
 - e. nurse practitioner
2. How long have you worked in the ED facility you are currently in? Years:_____ Months:_____
3. How do you assess your own experience in the administration of tPA for either AMI or Ischaemic Stroke?
 - a. Very experienced (at least 1 per month)
 - b. Experienced (at least 1 every 2 months)
 - c. Some experience (3-4 times a year)
 - d. Novice (less than once per year)
 - e. Never
- 3.1 Is most of your experience associated with:
 - a. AMI
 - b. Ischaemic Stroke
 - c. Combination of both the above
4. Have you been involved in clinical trials of stroke thrombolysis? Y / N
5. Have you had any mentoring, in administering iv tPA to acute ischemic stroke patients? Y / N
If yes, please specify:_____
6. List 6 signs of stroke:
 1. _____
 2. _____
 3. _____
 4. _____
 5. _____
 6. _____
7. What is the time period from symptom onset to the administration of tPA under its current licence?____
8. Are you certified to use the National Institute Health Stroke Scale (NIHSS)? Y / N
9. Please number the following in order of priority as 1 being the greatest barrier and 10 being the least important barrier for the use of iv tPA in acute ischemic stroke:
 - _____ Lack of own knowledge base/experience
 - _____ Lack of education and decision supports such as pathways and protocols
 - _____ Lack of support from acute radiology services
 - _____ Lack of support within the ED
 - _____ Lack of support from the Acute Stroke Unit
 - _____ Lack of support from hospital administration
 - _____ Fear of intracranial haemorrhage
 - _____ Other patients taking priority over stroke
 - _____ Imaging delays
 - _____ ED/ASU not the ideal setting
10. Do you feel your institutions organised stroke care is well developed enough to support tPA use? Y / N
If no, please specify why:_____
11. Do you feel that there are other barriers to the use of tPA in your hospital? Y / N
If yes, please specify:_____

Associate Professor Christopher Levi

Research Project Tele- tPA Stroke Project

**Tissue Plasminogen Activator (tPA) for Acute Ischaemic Stroke –
What are the barriers faced by physicians and nurses in the utilisation of tPA?**

Dear Health Professional

You have recently been sent a copy of a survey regarding your opinions on the barriers faced by your professional field in the utilisation of tPA.

This message has gone to everyone who was sent a survey. Since no personal data is retained with the surveys for reasons of confidentiality, I am unable to identify whether or not you have already completed the survey. If you have filled out the survey, thank you!

Participation is entirely your choice. If you would like to participate and have not had a chance to complete the survey yet, I would appreciate your reading the message below and completing the survey.

tPA is a highly effective and cost-effective therapy and national audits indicate efficacy and safety outcomes equivalent to international benchmarks. However less than one percent of patients are actually receiving tPA.

In order to identify the barriers preventing the utilisation of tPA and possible enablers, as a health professional working within a health service that utilises tPA, your opinions and suggestions are imperative.

Again, thank you for taking the time to consider this survey. If you have any questions about the project or the survey, or if you require additional copies of the survey, please phone Jocelyn Dyde on 6938 6127 or email Jocelyn.Dyde@gsahs.health.nsw.gov.au

Regards



Associate Professor Christopher Levi

On behalf of the research team
Dr Martin Jude and Ms Jocelyn Dyde- Wagga Wagga Base Hospital ph 6938 6127
Dr James Hughes and Ms Rebecca Hemmings- Tamworth Rural Referral Hospital ph 6767 7700

