

What is the nature of the disparity between the evidence-based practice and actual clinical practice for management of patients who present with suspected ST elevation myocardial infarction (STEMI) to smaller rural hospitals in the Northern Area of HNELHD?

What are the factors that are influencing clinical decision making by primary care providers in rural STEMI patients?



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“We must find time to stop and thank the people who make a difference in our lives.”
— John F. Kennedy

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ABBREVIATIONS

HNELHD	Hunter New England Local Health District
TRRH	Tamworth Rural Referral Hospital
ED	Emergency Department
ACS	Acute Coronary Syndrome
STEMI	ST Elevation Myocardial Infarction
ECG	Electrocardiograph
BIBA	Bought in by ambulance
MAMI	Missed Acute Myocardial Infarction
GP VMO	General Practitioner Visiting Medical Officer
EBM	Evidence based Medicine

TABLE OF CONTENTS	Page
Title Page	1
Acknowledgements	2
Abbreviations	2
Table of Contents	3
Abstract	4
Keywords	4
Executive Summary	5
Introduction	6
Rationale	7
Research Aim	9
Method	10
Results	11
Discussion	15
Limitations	16
Conclusion and recommendations	18
References	19
Appendices	20

ABSTRACT

Objective

1. What is the nature of the disparity between the evidence-based practice and actual clinical practice for management of patients who present with suspected ST elevation myocardial infarction (STEMI) to smaller rural hospitals in the Northern Area of HNELHD?
2. What are the factors that are influencing clinical decision making by primary care providers in rural STEMI patients?

Method

The study used a descriptive study design. All of the patients with STEMI that presented through Tamworth Rural Referral Hospital (TRRH) Emergency department (ED) for the 2 calendar years 2016-2017 were identified. They included both local presentations and transfers from outlying hospitals. The patient medical records were reviewed to create a local database that included all patients eligible for thrombolysis but were not lysed within 4 hours of triage. This database was then expanded to include other data points such as demographics and clinically relevant information. On completion of this database, statistical analysis informed us to the specifics of this population and identify any commonalities that may exist such as anatomical location of the STEMI

Relevant data was then included in the cover letter for a survey distributed to the General Practitioner Visiting Medical Officers (GPVMOs) in this area. Information from the database also informed questions for a survey. This survey was designed to ascertain factors that may contribute to delays in the care of the STEMI patient.

Results

Of the 139 STEMI patients over the two year period, 15% of eligible patients were not diagnosed as STEMI to receive thrombolysis within 4 hours of presentation to the Emergency Department. On surveying GP VMOs within these ED's on their management of STEMI patients, gaps were identified in clinical knowledge, operational processes and support mechanisms. This ranged from ability to interpret ECGs competently for all types of STEMI to lack of understanding of escalation and transfer processes.

Conclusion

Several barriers to timely STEMI management were identified despite the provision of appropriate equipment, evidenced based medicine policy, transfer process flowcharts and consultation availability. There is opportunity from here to address knowledge deficits around all aspects of the patient journey with the view to improve STEMI outcomes.

Implications

Without addressing the gaps in service delivery, the unacceptable delays in STEMI management in rural health services may continue to exist. Patients with missed STEMI are at higher risk of morbidity and mortality and increased length of stay. This in turn, can be added burden to the patient, carer and health service.

Keywords: *STEMI, Australia, rural, Acute Coronary Syndrome, evidence based practice*

Subject: Disparity of care for STEMI patients in Northern Hunter New England Health Service.
Audit performed 2018 on 01/01/2016-31/01/2017

Author: Helen Orvad CNC Cardiology Northern HNELHD

SITUATION: Recent auditing at TRRH has identified significant delay in the treatment for 15% of the Acute Myocardial Infarct patients' in the North of our District. Surveying the clinicians in these rural sites into the causes of these delays has identified both clinical and operational knowledge gaps in patient care as well as suggestions on how TRRH can contribute in improving these deficits.

BACKGROUND: In 2016 the HNELHD MAMI project identified a Missed AMI cohort of eligible patients who did not receive thrombolysis within a four hour period from presentation to the ED. This more recent audit of STEMI patients using a similar framework was performed across the three Northern sectors of HNELHD. The findings of this audit were then used to create a survey focusing on some of the deficit areas. This survey was then sent to our GP VMOs to ascertain their gaps in practice of STEMI management in our rural Emergency departments and their suggestions how HNE can support improvement in this practice.

ASSESSMENT: Of the STEMI patients audited in the 24 months of 2016-2017:

- 135 were identified as ED STEMI presentations.
- Of these 15% (n=21) were eligible for treatment and were not thrombolysed within four hours of presentation to the ED (best practice) despite having a positive ECG (Electrocardiograph), access to equipment, clinical support and transport.
- Review of the data identified that 64% (n=13) of these patients took more than 15 minutes to be seen in ED by a GP
- 76.2 % (n=16) of the initial ECGs were diagnosed inaccurately
- Over 32% of the GPs were not familiar with or did not use the chest pain pathway.
- Deficits in knowledge of the thrombolysis algorithm for patients \geq 75 years of age, how to manage a patient with failed thrombolysis and the mechanisms of transfer were reoccurring issues.
- The patients not thrombolysed had a 5.4 day mean length of stay, 33% longer than the HNE average for STEMI and had a 38.1 % readmission rate within 28 days.
- Nineteen percent died on this readmission

These results do not reflect the level of care as defined by the Hunter New England Local Health District Strategic Plan of excellent care to every patient every time (Hunter New England Local Health District Strategic Plan Towards 2018). With the advances in evidenced based medicine, technology and operational systems, the efficacy of care of a patient with potentially life threatening presentations should not rely on the time of day, the clinician involved, or the geographic location to ensure excellent care.

RECOMMENDATIONS:

1/ Triage skills should be routinely revisited with ED staff emphasising Triage 2 (review within 10 minutes) requirements for chest pain patients and triage course to be completed prior to working as Triage nurse in the ED to be reinforced with Health Service Managers (HSMs). This can be achieved with local Clinical Nurse Educators (CNEs) and Nurse Educators (NEs) as part of routine workload but will also require assistance from HNE Nursing and Midwifery to ensure accountability of process with HSMs.

2/ Additional support for the in smaller sites to aid in their skills in teaching triage and ACS management across the northern sectors. This can be addressed by the critical care and cardiology education teams as part of routine workload, but also requires support from local health service management to endorse. A CNE clinical skills forum would be the most effective way to achieve this

2/ Discussions to occur with the Emergency Medical Education Team (EMET) regarding survey outcomes and planning for how Cardiology and Emergency services can more regularly update GP Electrocardiograph (ECG) interpretation skills. Ideally this would occur in collaboration with the Primary Healthcare Network across HNE Northern Sector sites.

Ultimately, ELT support with an ECG reading service by either HNE Cardiology or ED FACEMs could ensure a more timely management of STEMI patients as part of our future planning.

3/ A comprehensive HNE implementation strategy be designed and implemented to promote understanding and usage of the latest chest pain pathway (PACSA) and escalation processes to rural sites including Locum agencies utilised by HNE.

4/ Follow up of clinical information of each STEMI patient admitted through TRRH shared with the Emergency FACEM to then provide phone call follow up to the clinician transferring the patient from the rural sites. This would be with the view to evaluate use of the pathways and discuss any challenges encountered with patient care.

5/An analogous audit in 2021 is required to evaluate the effectiveness of these recommendations

With Executive support, I recommend that a plan be developed to address the above points by the author of this paper by February 2020

INTRODUCTION

This report is designed to familiarise the reader with the variability in the provision of efficient timely care to the patients presenting with the symptoms of Acute Coronary Syndrome that progress to an Acute Myocardial Infarction (AMI) and the impact on the patient. In the context of this work, AMI will be referred to as ST Elevation Myocardial Infarction (STEMI). This study has been focused on the review of care of these patients within rural and regional hospitals in the northern areas of Hunter New England Local Health District (HNELHD). It will describe the current standard of care that is based on years of clinically evidenced treatment for the management of these patients and investigate some of the explanations as to why this may not occur.

Disparity in the care of STEMI patients became evident during routine auditing performed by Cardiology clinicians within HNELHD over a four year period leading up to 2015. It was observed that not all patients are treated the same way despite evidence based medicine (EBM) and support tools to guide this care. This warranted closer investigation and eventually a structured research undertaking occurred in 2016 with a retrospective review of patients flagged within Morbidity and Mortality meetings, Root Cause Analysis investigations and clinician referral. This research was termed the MAMI (Missed Acute Myocardial Infarct) project (Williams et. al 2019) and is the context from which this research has since developed. However investigating the clinician knowledge base and decisions behind the care processes of these patients is an additional aspect investigated with this research and is pivotal to improving patient care.

This research project has two components. Part 1 is the establishment of the database of patients not receiving care in a timely fashion within northern HNELHD sectors and the second is the creation, dissemination, analysis and summation of a survey sent to the GP VMOs caring for this patient cohort.

RATIONALE

Management of ST Elevation Myocardial Infarction

Understanding the implications of delaying treatment of a STEMI and how and why this can occur in the Emergency Department, is crucial to contextualising the significance of the timeliness of the treatment of these patients and the foundation of this project

ST elevation myocardial infarction occurs when an artery providing blood supply to the heart muscle (myocardium) is totally occluded by the development of thrombus. We have understood for almost thirty years that the delayed management of STEMI is associated with higher morbidity and mortality (Weaver et al 1993). This is a direct result of the artery not being opened (reperfusion) either by medication (thrombolysis) or percutaneous coronary artery intervention (PCI) and consequently risking the contractility of the myocardium. These patients have potential to have an increased length of stay, cardiac related readmissions and potentially poorer outcomes. It adds further burden to the both the patient and the health service.

Multiple national guidelines corroborate the importance of timely management of STEMI patients with the most recent update of the National Heart Foundation of Australia and Cardiac Society of Australia and New Zealand: Australian clinical guidelines for the management of acute coronary syndromes 2016 clearly defining the evidenced based tools required for reperfusion of STEMI patients and the time constraints recommended for reducing morbidity and mortality risk (National Heart Foundation 2016).

In recent years, the National Heart Foundation of Australia has developed the Acute Coronary Standard (ACS) Capabilities Framework and The Australian Commission on Safety and Quality in Health Care (2016) has released a Clinical Care Standard for ACS, which together also define minimum standards of care regardless of the patient's location. To commence STEMI management in a timely manner a Triage 2 category recommends the patient is to be seen within 10 minutes of presentation by a senior clinician and ECG at this time ready for review.

The update of the Chest Pain Pathway by the Ministry of Health 2011 provided an evidence based clinical tool that directs the care of ACS patients within the ED including triage, risk stratification, diagnostic test recommendations, time lines and medication dosages (Doherty 2009). It does not however include thrombolysis dosage for patients over 75 years of age - an addendum to care implemented nationally in 2016 from international evidence based recommendations. This is addressed in the latest version due for release late 2019.

All of these guidelines distinctly list the steps required to provide quality care to STEMI patients utilising many tools including clinical guides, timely ECG acquisition and interpretation by senior ED clinicians as examples to ensure expedient diagnosis and treatment. Nevertheless, delays to treatment continue to occur. In the absence of clinical cause, the question of knowledge and the impact of the decision making process being possible contributors to this situation were investigated.

Search strategy

Using the HNELHD library website, a search of the current literature encompassing ACS management was undertaken using CIAP and PubMed@hne databases. Initial search using the term ACS management located over 10,000 articles which were culled by adding the word 'STEMI', 'rural' and 'Australia'. This process narrowed the results to 15 and 11 articles respectively of which 5 had relevance to this project. Expanded search term 'evidence based medicine' reduced the relevant count to zero, as did the term 'barriers' and 'timeliness'. An appreciation of the hesitancy to utilise EBM literature in the ED was identified within local thesis work titled 'Evidence – Based implementation of evidence based asthma guidelines in rural hospital Emergency Departments (Doherty). These articles were read and summarised under relevant topics of discussion.

Little is documented regarding EBM and its consistent utilisation for STEMI management rurally in Australia. Nadel et al (2014) in their review of Australian ACS management challenges acknowledge that the geographic accessibility and "evidence-practice gap" continues to exist in the rural setting and are major factors contributing to poorer outcomes. They did not however investigate the reasons behind the practice gap, only that it exists.

Tideman et al (2014) suggests that the disparity between AMI mortality rates for rural patients is an issue and the delivery of evidenced based care in these regions contributes to this. Chew et al identified that variations in clinical decision making, service availability, guideline recommended investigations and therapies were provided less frequently to cardiac patients in rural hospitals potentially contributing to higher in hospital mortality and recurrent cardiac failure (2016). Huynh (2010) concedes the need for collaboration with cardiology/regional hospitals in the instance of these high risk patients where extra support is crucial in accurate and prompt care. However, again minimal reference was made to the fundamental causes of the disparities of care.

The 286 sites in Australia and New Zealand reviewed in the SNAPSHOT ACS study of 2012 stated “health service design and workforce provision have been found to be associated with variations in clinical outcomes in Australia” of the ACS patient which acknowledges a potential cause of disparity but not investigate the specifics of these challenges and why they occur.

HNELHD has several clinical support tools in place to ensure appropriate management of STEMI patients. This includes using contemporary ECG machines with advanced interpretative algorithms, chest pain pathways, telehealth support from emergency physicians and cardiologists and transfer/retrieval mechanisms. However, routine quality audits of STEMI patients in Northern Hunter New England and the MAMI project have supported this view that not all rural EDs providing appropriate clinical service delivery.

Geographic isolation from centres capable of delivering PCI to STEMI patients necessitates most rural STEMI patients requiring thrombolysis as the recommended treatment. This evidenced based process is an intravenous medication (Tenecteplase®) only administered once a definitive diagnosis is made using ECG results, patient symptoms and history. Timely reperfusion is understood to mean “those receiving thrombolysis within 30 minutes of presentation to first medical contact “. This requires attendance of clinical assessment, ECG acquisition and interpretation, intravenous cannulation, patient examination and patient consent.

Muscle damage begins to occur within 2 hours of STEMI symptom onset with significant heart damage and minimal muscle salvage at 4 hours from symptom onset (Heart Foundation 2016). Four hours from ED triage to Tenecteplase administration (door to needle time) was the period used in both the MAMI data and this database as the threshold in which eligible patients should receive their thrombolysis.

The definition by Chew et al (2016) of successful thrombolysis is for the patient to have reduced ST segments, be haemodynamically stable and symptom free. If the thrombolysis is not successful ie: failed thrombolysis – evidence based practice is to transfer patient expediently to a PCI capable centre as the only option for opening the coronary artery .: Again this is timing crucial.

In his review into improving clinical outcomes using the implementation of EBM, Doherty identified four barriers to this process

1. The individual clinician
2. The Health Care team
3. The organisation providing care
4. The wider health care system

These four areas are also identified in this paper as potential barriers to EBM utilisation.

In view of the literature and local observation it was essential that further enquiry occurred into the mechanisms influencing the failure to provide evidenced based care to a potentially life threatening clinical conditions.

To achieve this, the records of the STEMI patients of more recent years required auditing to determine that rural patients were still not being managed expediently. This then provided evidence to demonstrate to the ED clinicians there are gaps in rural service delivery as percentages of our totals. A survey was then created for GP VMOs and Locum practitioners to invite opinions on their knowledge, actions and recommendations around this activity and the role that TRRH plays in this process.

RESEARCH AIM

The aim of this study was to identify patients not thrombolysed within a timely manner and identify barriers to this process within those rural hospitals with the GP VMO model of care. Despite many well

established clinical tools existing to detect and treat STEMI the evidence-practice gap continues to exist in the rural settings but there is minimal understanding of the cause of this phenomenon.

The researcher took a twofold approach to the query:

1. What is the nature of the disparity between the evidence-based practice and actual clinical practice for management of patients who present with suspected ST elevation myocardial infarction (STEMI) to smaller rural hospitals in the Northern Area of HNELHD?
2. What are the factors that are influencing clinical decision making by primary care providers in rural STEMI patients?

METHOD

Part 1

A descriptive research method was utilised for this study. The audit aspect of this research was created from a retrospective review of the STEMI presentations admitted within the two calendar years of 2016 and 2017. Ethics application for Part 1 was deemed a non- research activity by the Human Research Ethics Committee (HREC) in 2018.

The patient data was identified as those coded as acute transmural myocardial infarcts as a discharge diagnosis using the International Statistical Classification of Diseases and Related Health Problems (10th Revision) codes of I21.0-I21.4 and I21.9 via interrogation of the HNELHD Information Patient Management System (IPMs). The password protected database was created using these patients during the two calendar year period of 2016-2017. The data was then filtered to exclude patients who had secondary STEMI whilst already admitted with any other principal cause. Remaining data were those patients who presented through Tamworth Rural Referral Hospital ED as either a primary presentation or transferred in from any other health facility with STEMI

The primary data endpoint were those patients who were confirmed STEMI (through ECG) but were not thrombolysed or identified as STEMI for management within four hours using the time stamped triage score as the commencement of this time period. This was clarified by both digital and where required, manual interrogation of the patient medical record to ensure all opportunities to treat patients had been, or not been, identified. Any complex STEMI ECG diagnoses had a blinded review by a Cardiologist for clarification that ECG changes were clinically significant for treatment. Some patients who were not diagnosed within the 4 hours were initially included but once a contraindication to treatment was identified, no further data was collected.

Patients who had absolute or relative contraindications to thrombolysis documented early, were not for active treatment or who had an explainable delay, were excluded. Patients with complex STEMI ECG that the Cardiologist believed to be above the diagnostic capabilities of a rural GP were also excluded.

The creation of this dataset included identification of the missed STEMIs as a percentage of the whole STEMI cohort as well as the proportion of secondary endpoints. Secondary measures to the dataset also includes gender, age, Aboriginality, character of symptoms, initial hospital location, length of stay, ECG pattern, mortality and readmission within 28 days with an illness relating to their primary admission.

Results from the analysis informed the basis of the cover letter that accompanied the GP VMO survey.

This data was analysed through the IBM Statistical Package for the Social Sciences (SPSS Version 22 Chicago Illinois USA).

Part 2

The second component of the research was commenced after attaining eligibility as Low and Negligible risk research in December 2018 (NSW REGIS Reference No: 218/ETH00643).

The survey was based on a descriptive correlational design using a combination of categorical closed declarative statements and free response questions with the clinically relevant questions at the beginning.

The survey was piloted with two experienced GPs who do not have a current clinical role in any of the participating hospitals. Their feedback has been incorporated into the survey so that it is clinically and intellectually appropriate.

The statements focused on diagnostic capabilities, operational responsibilities and the role of other stakeholders in supporting the care of the STEMI patient. The responses were designed using a five option Likert scale ranging from 'very much agree' to 'do not agree'. The two concluding open ended questions focused on participants' subjective needs.

The cover letter introduced the Researcher, explained the background of the project and utilised the local missed STEMI data to contextualise the survey (APPENDIX 1).

The survey was posted through regular mail directly to 58 GP VMOs with a replied paid envelope to their medical practice street address identified from HNELHD database cross referenced with Telstra data to clarify accurate mailing address. Doctors who do not work in EDs (not GPVMOs) were excluded (n=21). Health Service Managers' at all rural sites were contacted regarding Locum doctor service provision. Surveys (n=8) were sent to those hospitals directly affected via internal mail to be delivered to the Locums working in the month of March 2019.

The survey responses were deemed anonymous and not compulsory.

Ordinal categorical data from the survey questionnaire was analysed using descriptive statistics and the proportions of responses in each category for all questions were tabulated.

RESULTS

PART 1

The audit identified 139 STEMIs who presented through TRRH in the 24 month period eligible for treatment. Of these, 15 % were identified as either not thrombolysed or received delayed thrombolysis more than 4 hours after presentation. This 15 % were then retained to create the Northern Missed AMI password protected database. The remainder of patients were deleted from record.

Timing of the patient journey was reviewed using the data points of -

- Time of symptom onset to ambulance call for those brought in by ambulance (BIBA)
- Triage category – all chest pain patients should be at Triage 2 or less.
- Time of ECG to senior medical officer review- should be less than 10 mins as defined by Triage 2 clinical requirement
- Time of day arrived in the ED
- Total time in ED in initial hospital

Data for timing of the patient journey are found in Table 1.

Table 1: the patient journey

Variable	Missed AMI patient (n=21)
Time of symptom onset to ambulance call (mins)	158
Patients who called ambulance (%)	19
Triage ≥ 3 (%)	18.6
Time for ECG to be reviewed by senior clinician > 15 mins: m (%)	64
Presented out of office hours (%)	42.9

m: Mean ECG: Electrocardiograph

Time spent in minutes in the initial ED before transfer or admission of all patients was also collected as below (Figure 1). This was done with the view of identifying patients with longer than expected time in an ED. If we consider the EBM recommendation of thrombolysis within half hour of presentation and then transfer to larger facility, it would be optimal for patients to only remain 60-90 minutes in the initial ED. We know from the medical records that delays in decision making contributed to the data in Figure 1. What was not investigated was the wait for ambulance for transfer and how it impacted this data. Local evidence suggests that this could be a contributing factor. Over 85% of the patients in this study came from outlying hospitals.

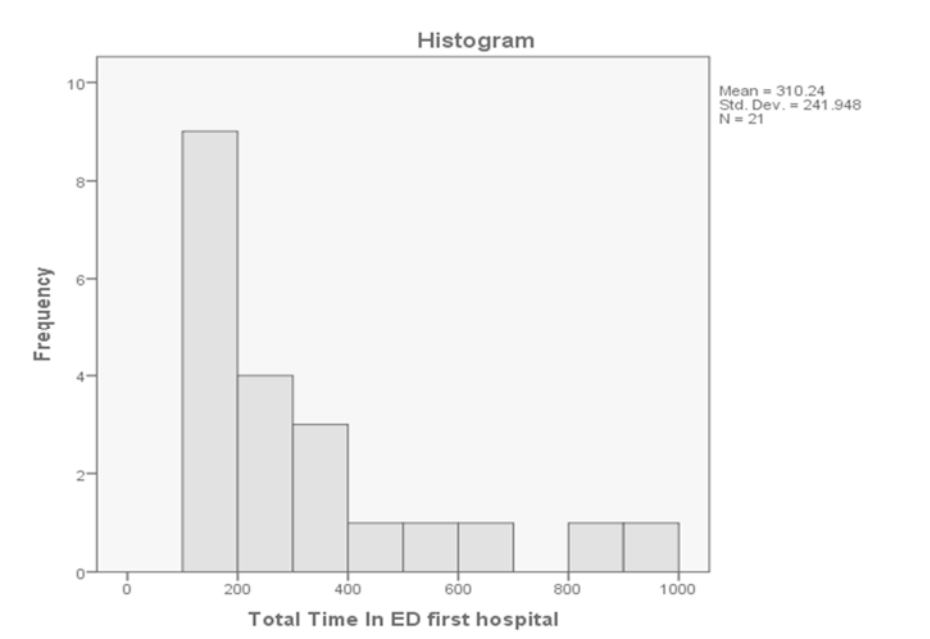


Figure 1: Histogram of time spent in initial hospital emergency department

Characteristics of the patients identified as missed AMI are shown below in Table 2. Several results are comparable to the parent MAMI project such as age (67.8 versus 66.3), average length of stay (5.5 versus 5.4), and Aboriginality (4.8 versus 4). Inaccurate ECG interpretation by ED clinician and myocardial location of infarct as Anterior were also prevalent in both groups with this northern group being 76.2% and 57.1 % respectively. Of the 81% of patients who survived their missed AMI, 38.1% were readmitted within 28 days with a cardiac related cause.

Location of the patient on initial presentation has the majority (85.7%) being from hospitals within a Remote Area 3 site (RA3) in Northern HNELHD.

Only 52.4% of patients had their ECG performed on an ECG machine utilising the Glasgow algorithm software (Burdick ECG machine). MAMI identified the Glasgow Algorithm in the research as having 93% accuracy of diagnosis which is printed on the topmost portion of the ECG once completed. During the time period of these patient presentations, all rural EDs had access to this equipment

The mortality rate of this group was 19%.

Table 2: Characteristics of patients with missed AMI

<i>Variable</i>	<i>Missed AMI patients</i>
<i>Female (%)</i>	42.9
<i>Age (years)</i>	67.8
<i>Indigenous patients (%)</i>	4.8
<i>Symptoms not chest pain (%)</i>	24
<i>Troponin not attended 1st hospital (%)</i>	19
<i>Initial ECG interpretation incorrect (%)</i>	76.2
<i>Patient had PCI or CABGs (%)</i>	52.4
<i>Average length of stay m (days)</i>	5.4
<i>Required ICU admission (%)</i>	23.8
<i>Died this admission (%)</i>	19
<i>Readmitted <28 days (%)</i>	38.1

CABG: Coronary Artery Bypass Graft M: Mean

Part 2

Surveys were returned over a three week period from rural GP VMOs. Of the 66 posted, 22 were returned completed (33%).

The response options were 'Very much agree', 'Somewhat agree', 'Neither agree or disagree', 'Somewhat disagree' and 'Do not agree'.

The results in Table 3 below are divided into the participants' reflections of competency, local support and recommendations for system improvements.

Table 3: Survey results

<i>Knowledge and competency of the clinician</i>	<i>% very positive</i>
I feel competent in my knowledge of STEMI management	54.5
I feel competent in diagnosing an Anterior STEMI	68.2
I feel competent in diagnosing an Inferior STEMI	63.6
I feel competent in diagnosing a posterior STEMI	22.7
I feel I can competently use the protocol of thrombolysis for patient <75yrs of age	63.6
I feel I can competently use the protocol of thrombolysis for patients >75 yrs	54.5
I care for patients with a primary STEMI more than 6 times per year	22.7
I feel competent in the diagnosis and management of a failed thrombolysis	22.7
I routinely complete the NSW Chest Pain pathway when it is indicated	50.0
I fully understand the transfer process for STEMI in Northern HNE and know where and when to send patients	50.0
<i>Support mechanisms in organisation</i>	<i>% very positive</i>
I feel supported with the care of the STEMI patient by nursing staff at my hospital	40.9
I feel supported with the care of the STEMI patient by my medical colleagues at my hospital	40.9
I feel supported with the care of the STEMI patient by staff at larger hospitals	68.2
I feel confident to contact a larger facility for advice	77.3
I feel like I get feedback from my patient care	27.3

Almost 70% of participants did not think fatigue contributed to their decision making processes for STEMI patients, however of the remaining 30% we should consider that tiredness can potentially influence clinical decision making.

When questioned if it was helpful to receive feedback from larger centres, 90.9% agreed it would be very beneficial and suggestions were then encouraged to be imparted.

Recommendations of how HNE can assist?

The final two questions were open-ended regarding the ways they would like to receive feedback from the larger centres and the ways in which HNE could support them with the management of the STEMI patient.

All participants responded stating feedback on patient progress from larger centres would be appreciated in a “written report”, “telephone call”, “verbal handover”, “electronic mail” or “maybe a summary of what happened addressed to the clinician at the rural ED involved”

More than half the comments also requested support from HNE on their clinical care for example “opinion from the larger centre if the patient was managed well”, “a call from a senior clinician if need to improve treatment of STEMI or diagnosing same” and “feedback if delays contribute to poorer outcomes”. Subjective information from Locum doctors included this comment “As a Locum in ED I do not often receive a discharge summaries for my referrals. The only practical immediate feedback would be a phone call - not necessary on every patient”.

Concerns in delays in transfer within HNE were also voiced with comments such as “After thrombolysis finding it difficult to transfer patients out” and for HNE to “properly support timely transfers so less time is spent on the phone chasing patient flow so we can actually be with the STEMI patient to treat them”. This theme was repeated with having access to “24 hour Cardiologist or Advanced Trainee” to expedite diagnoses and patient care.

Education updates were also mentioned as support options from HNE with requests for “On-site refresher for medical nursing staff of acute coronary syndrome management”, “clinical day with cardiologist or presentation of latest info/knowledge” and “Train the GPs for Dx STEMI and thrombolysis and complication management”.

DISCUSSION.

Part 1 and part 2 of this study identified evidence and concerns across the spectrum of care of the rural patient with STEMI. Several aspects of timeliness of care were highlighted as challenging from multiple views which we know translates to delayed treatment and poorer outcomes

For example, guidelines describe how Triaging 2 for any patient presenting with chest pain or ischaemic sounding cardiac symptoms begins the fast-track care of the potential cardiac patient. With more than 18% being triaged 3 or 4, this automatically slows the response time required for the practitioner to review the patient. This may well explain the 64% of patients who did not have their ECG reviewed within half hour of presentation to ED which is already outside the recommended time to thrombolysis.

From this point, the compounding issues of competency, and support mechanisms can further contribute to delays in care. This means we have patients with unnecessary myocardial damage and possible heart failure.

When reflecting on the comments by Doherty on the barriers to the use of EBM (2009), this study identifies similar aspects in that the individual clinician, the Health Care team, the organisation

providing care and the wider health care system are potentially all barriers to provision of EBM. It is recognised that to use EBM well, we need the judicious use of the best available evidence applied to the individual patient.

Knowledge and competency of clinician

The survey informs us that just over half of the participants felt competent in their knowledge of STEMI management yet 76.2% of patients' ECGs were inaccurately diagnosed - this is the fundamental component to progressing adequate treatment of these patients. When compounded with the variability of AMI location (anterior, inferior, posterior), this adds another layer of complexity to the diagnoses. With some rural sites indicating they are receiving less than six STEMI per year it is difficult to remain competent in the setting of marginal exposure.

With the survey highlighting a significant number of clinicians not proficient in recognizing patients with failed thrombolysis, this again is another layer of and expedient care of an even more vulnerable patient. This is compounded again in rural sites isolated from PCI capable centres.

Even with the latest diagnostic algorithm equipment, communication technologies and pathways whereby consultation is encouraged, there are still evidently diagnostic difficulties. For some clinicians, consideration must be given to the behaviours around the decision making processes and prioritisation of care ie: the choice to use evidence based medicine.

Support mechanisms of organisation

Collaborative care in this patient type is paramount between nursing, medical and operational staff. The survey informs us that for the most these relationships are adequate but rely on individuals being knowledgeable, available and discerning to the task at hand. In the setting of busy ED/ambulance/retrieval services with conflicting priorities and staff skill mix, this is not always achievable. This reflects the clinician barrier noted by Doherty in 2009. It is compounded also by other stakeholders not appreciating the severity of the situation and the isolation felt by the rural clinicians and how that impacts patient care. This is evident with the difficulties identified in time to senior medical officer review, time in the initial ED and the disclosure that not all staff feeling supported by staff at larger hospitals- potential clinician and organisational barriers

Literature concedes the need for collaboration with Cardiology/regional hospital EDs in the instance of these high risk patients where extra support is crucial in accurate and prompt care. This is well documented in policy and guidelines and defined in the chest pain clinical pathway as a priority in the course of care of this patient type. As previously mentioned, ambulance arrival times also contributes to some delay but this is data not included in the scope of this study and would need further investigation

Encouragement within the community to call an ambulance when experiencing chest pain may lead to improved outcomes. This conclusion is based on the NSW ambulance system of Pre-Hospital Thrombolysis (PHT). This process facilitates paramedics who acquire and ECG that declares STEMI in the embedded Glasgow algorithm to directly transmit the ECG to the ED FACEMs at TRRH ED twenty four hours per day. With 81% of the missed AMI group presenting with private transport, the opportunity to engage a regional hospital for support early has been missed.

Can HNE assist?

It is evident that not all staff feel clinically supported for every patient every time. This is primarily an operational challenge although, however as mentioned previously, may also be behavioural responses to an unrecognised situation. Patience and understanding of the challenges of the rural clinician appears to go sometimes unappreciated - easily done when surrounded with myriads of support in regional and metropolitan settings. Is there time for empathy?

There are more opportunities to build these relationships and support mechanisms in a structured and inclusive manner. With survey results inviting more support and feedback from larger centres, it would be remiss of the researcher to overlook this opportunity to engage relevant stakeholders for improvement.

LIMITATIONS

The audit component of this research relied on accurate clinical coding to discern the patients with STEMI and transferred to TRRH. What we may not have seen were undiagnosed STEMI discharged home from rural sites who were missed AMI. These patients may present later with heart failure or deceased and could be an area for further revision. Heart failure as a cause of missed AMI could only be measured if the patient had pre-STEMI echocardiogram results to demonstrate a pre and post STEMI discrepancy which is not addressed in this study. The small sample size of the patients also limits the information we can glean from an audit such as this however, in this situation it would be preferable if there were no patients in an audit such as this.

Not all medical records are concise or complete causing difficulty in following the patient journey and ascertaining delay specifics. It is crucial to maintain an objective record interrogation process when confronted with gaps in patient information. The researcher engaged other clinical staff where necessary to assist in this process objectively. Researcher bias was also considered when reviewing patients at hospitals with a record of poorly or very well managed patients.

The survey results were rich but subjective. Reflective practice is a skill not all clinicians display and the results may well be influenced by personal bias. The response rate of 33% understandably leaves gaps in our results and contributions from the other clinicians would have been very valuable. Hopefully a face to face training scenario may bring the opportunity for the disclosure of other clinical challenges, build rapport with larger site clinicians and address the hesitations to request assistance

As previously discussed further work would be needed to ascertain if some of the total time in first hospital is due to wait time for NSW ambulance for transfer.

Researcher bias is always a limitation when interpreting subjective open ended questions however in this instance the majority of respondents provided similar themed answers which appear to be more than coincidence

The strengths of this study was to have a parent MAMI study to guide the need for this research to be done at a more local level. Despite years of national research into the disparities of care of the STEMI patient and identification of clinical and operational barriers, it appears staff involved in these disparities have not been engaged for their opinion of the possible causes or been asked to reflect on their knowledge and practice. To improve a process firstly we first must understand the fundamentals of the barriers. This study addresses these fundamentals

RECOMMENDATIONS and CONCLUSION

This study has demonstrated gaps in clinical knowledge, tool utilisation and support mechanisms. Addressing these issues would have a positive implication for practice and improved patient outcomes.

Recommendations therefore are as follows-

1/To communicate the outcomes with the HNELHD Cardiology Stream to invite specialists' views and support for proposed recommendations.

2/ Presentation of the brief to the Executive Leadership Team to also inform and garner further counsel.

3/ Recurrent education and assessment of nursing Triage skills should be pursued on a structured annual basis in conjunction with current First Line Emergency courses by local emergency educators and nursing consultants

4/ Communication of the survey results to the Emergency Medical Education Team to alert them to the needs of our rural clinicians with the view to create an ECG interpretation program with a STEMI diagnostic focus with regular collaboration and follow-up of skills would be beneficial to improving this process.

5/Ultimately, the establishment of an ECG reading service could reduce many of these variables by engaging centralised consistent ECG interpretation provision that is skilled, timely and can be monitored for patient progress and transfer.

6/ Discussions with relevant stakeholders on how to improve timely feedback to rural sites after transfer of STEMI patients will also assist in building the knowledge and confidence of these clinicians. There are several avenues to pursue with this proposal involving TRRH ED senior staff, HNE Cardiology and medical records management to ascertain the most efficient method to create and embed this model of care.

7/The eminent role out of the latest chest pain pathway in 2020 requires structured and monitored processes to ensure this tool is embedded into the practice of current and future medical and nursing staff of HNELHD. This will involve communications with the Primary Healthcare Network, Locum employment agencies and individual Health Service management to ensure effective dissemination

8/To identify if recommendations have been appropriately identified and enacted, it would be prudent of the author to repeat the identical audit, after a determined period, to ascertain improvements in practice gained from the recommendations. Again, support by the Cardiology Stream and Executive would be sort to accomplish this process.

Embedding EBM in to variable clinical situations is challenging. By identifying these operational and clinical deficits, this study has taken the first steps in recognising the factors contributing to the disparity of care of STEMI management in rural sites in Northern Hunter New England. It has given us a glimpse in to aspects that are influencing clinical decision making processes.

In time it is hoped that addressing these deficits through the aforementioned recommendations will lead to an improvement in patient outcomes. Further research is required to ascertain if clinicians can embrace EBM more habitually, effective communication processes are embraced and the disparity of STEMI patient management improves in the rural setting.

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APPENDIX 1

Cover letter and survey

Dear colleague

A review of STEMI management within HNELHD 2011-2016 identified that clinical variation resulting in delayed treatment of STEMI was more prevalent in smaller rural sites

*Auditing of the 165 patients coded for STEMI in the 2016-2017 calendar years who presented through Tamworth Rural Referral Hospital identified eligible for treatment, detected **15 %** that were either not thrombolysed or received delayed thrombolysis –more than 4 hours from presentation. This has resulted in poorer patient outcomes and potential health service burden. ECG interpretation confusion contributed to 76.2 % of these patients*

Rural Cardiology is attempting to clarify these clinical variations and is hoping to identify where HNE Health may contribute to improving patient outcomes and better support our clinicians in providing this care

You are invited to participate in a research project investigating contributing factors to the disparity of care for the STEMI patients in rural Northern HNE.

It would be appreciated if you could take 5 minutes from your busy day and complete the survey included.

A reply paid envelope has been provided.

This survey is voluntary and anonymous.

Thank you for your commitment to the improvement of our patient outcomes and ensuring HNE is contributing all it can to facilitate this process

Kind Regards

Helen Orvad

Clinical Nurse Consultant Cardiology HNELHD

	To what extent do you agree with these statements (please circle one)					
1	I feel competent in my knowledge of STEMI management	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
2	I feel supported with the care of the STEMI patient by nursing staff at my hospital	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
3	I feel supported with the care of the STEMI patient by medical colleagues at my hospital	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
4	I feel supported with the care of the STEMI patient by staff at larger hospitals	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
5	I fully understand the transfer process for STEMI in Northern HNE and know where and when to send patients	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
6	I feel confident to contact a larger facility for advice	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
7	I am aware of the current NSW Chest Pain pathway	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
8	I routinely complete the NSW Chest Pain pathway when it is indicated	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
9	I feel I can competently use the protocol of thrombolysis for patient <75yrs of age	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
10	I feel I can competently use the protocol of thrombolysis for patient >75yrs of age	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
11	I care for patients with a STEMI more than 6 times per year	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
12	I feel competent in diagnosing an Anterior STEMI	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
13	I feel competent in diagnosing an Inferior STEMI	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree

14	I feel competent in diagnosing a posterior STEMI	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
15	I feel competent in the diagnosis and management of a failed thrombolysis	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
16	I feel I could be more supported with the care of the STEMI patient from my GP college	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
17	I feel fatigue contributes to my decision making processes for STEMI patients	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
18	I feel like I get feedback from larger centres my patient care	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
19	Would it be helpful to receive feedback from the larger centres?	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree
20	I feel I could be more supported with the care of the STEMI patient from within HNE	Very much agree	Somewhat agree	Neither agree or disagree	Somewhat agree	Do not agree

If you answered positively to question 19 could you please list ways you would like to receive feedback from the larger centre

If you answered positively to question 20 could you please list ways that HNE could support you with the management of the STEMI patient

Thank you for your time