Cardiovascular Health Network

The Model of Care for Acute Coronary Syndromes in Western Australia

Prepared by the Acute Coronary Syndromes Project Group
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Acknowledgements

The model of care for Acute Coronary Syndromes has been developed by the Project Group and the contribution of many individuals.   Dr Alan Whelan is acknowledged as the Chair of the project.

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Kim Goodman, Development Officer, Health Networks Branch, office of the Chief Medical Officer, Department of Health Western Australia, developed this model of care.

Executive Summary

Cardiovascular disease (the main cause of Acute Coronary Syndromes) is the leading cause of death and disability in Australia – in 2007 there were 40,888 major coronary events that accounted for 30% of all deaths [3]. In Western Australia, ACS accounts for almost 20% of all deaths. Mortality can be reduced by treatment including immediate access to automated external defibrillators and to early coronary reperfusion.

The model of care for ACS in Western Australia provides the policy framework for the diagnosis, risk assessment and initial management of patients with ACS. The model draws together the evidence in relation to best practice and in consultation with key stakeholders makes recommendations to ensure people with ACS receive prompt appropriate care.

The term acute coronary syndromes is used to collectively describe acute myocardial infarction (heart attack) and unstable angina (chest pain occurring at rest, new onset of pain with exertion, or angina that is more frequent, longer in duration or lower in threshold than before) [4].

People experiencing symptoms of ACS are considered medical emergencies. Retrieval, transport and hospital emergency services play an important role in the delivery of care for patients with ACS. These services are the focus of the document. It is not a model of care for coronary artery disease (the most common cause of ACS) therefore it does not deal with the disease across the continuum from prevention to community care and palliation.

This model of care for ACS aims to ensure patients receive the right care, at the right time, by the right team and in the right place. The document describes the current services and gaps for people with ACS and proposes a model of care to ensure:

- Early recognition by the patient (and others) of ACS symptoms and immediate contact with emergency medical services to enable transport to the nearest appropriate facility preferably by ambulance..
- Early diagnosis and risk stratification to reduce delays in treatment and access to appropriate services.
- Formalised strategies of care with systemwide coordination and integration based on two tertiary centres operating a 24 hour cardiology interventional service.
- Adoption and development of guidelines and protocols for statewide implementation of best practice for ACS.
- Information and communication technology solutions that promote patient centred care, determine the minimum data needed to monitor ACS and the need for ACS patient registers.
- A focus on disadvantaged and high risk populations in order to improve patient outcomes.

The transition from current service provision to the recommended model of care will involve the implementation of a number of strategies across the various settings of care.

Social marketing campaigns will be implemented to increase awareness of ACS symptoms and encourage people experiencing symptoms to contact the emergency medical services by calling Triple Zero -000. This is currently one of the priority areas of work for the National Heart Foundation.

Emergency services will be redesigned to expedite the flow of patients with chest pain through the system to obtain timely diagnosis and treatment. Key ingredients of this process will be –

- The establishment of a data registry to track patient flows through the system to identify delays and monitor effectiveness of the redesign process.
- A trial of pre-hospital 12-lead ECGs in WA ambulances as well as other strategies to minimise the delay from first contact with the medical system to the initiation of appropriate therapy.
- The enhancement of existing regional and remote services through a single point of contact to supply treatment advice and coordinate retrieval.

In line with current demand, two tertiary centres with cardiac catheter laboratories will act as the hub for the peripheral hospitals in an integrated hospital network to ensure that patients receive timely care within the most appropriate facility based on their level of risk. In line with this, transfer to hospitals with 24 hour access to a cardiac catheter laboratory may involve emergency department bypass, conduct of procedures as a day case and patient transfer back to the originating hospital where appropriate. These processes may be facilitated by nurses in advanced nursing roles in some centres.

To support a timely diagnosis and provision of best practice care for patients with ACS a number of tools will be employed to improve statewide communication and coordination. Structured clinical support will be coordinated statewide through 24 hour access to cardiology advice in line with agreed guidelines. Improvements in the capacity to undertake pathology testing at the bedside and access to pharmaceuticals for the initial management of patients with ACS are supported.

Information and Communication Technologies should enable seamless high quality care through the sharing of previous and current investigation results across and within hospitals. Ongoing multicentre data collection will be established to improve outcomes for patients with ACS and the establishment of patient registries explored.

Partnerships are key to driving the implementation of the Model of Care for Acute Coronary Syndromes. Key organisational partners include the St John Ambulance, The Royal Flying Doctor Service, Heart Foundation (WA Division) and Area Health Services.

Recommendations have been developed to support the implementation of the principles and components of the Model of Care for Acute Coronary Syndromes.

Methodology

The Cardiovascular Health Network identified as an area of priority the improvement of services statewide to reduce death and disability from ACS. The project group comprising a multi-disciplinary team of health professionals was established in September 2007 to develop the model of care for acute coronary syndromes for Western Australia. They analysed the current service provision, service utilisation over time, gaps in service and literature pertinent to acute coronary syndromes.

The Cardiovascular Health Network Executive Advisory Group endorsed the dissemination of the DRAFT model of care for Acute Coronary Syndromes for consultation in February 2009.

The model is informed by and builds on the following guidelines and quality management initiatives for acute coronary syndromes.

- National Heart Foundation of Australia and the Cardiac Society of Australia and New Zealand Guidelines for the Management of Acute Coronary Syndromes 2006
- 2007 addendum to the National Heart Foundation of Australia Cardiac Society of Australia and New Zealand Guidelines for the management of acute coronary syndromes 2006
- WA Health Operational Circular OP 1707/06. Reperfusion Therapy for Acute STEMI
- Royal Perth Hospital Emergency Department Chest Pain Assessment Protocol
- Fremantle Hospital Guidelines for Management of ST Elevation Myocardial Infarction (non STEMI in development)
- Safety and Quality Investment in Reform (SQuIRe) Acute Myocardial Infarction Initiative and associated health service projects
- Armadale-Kelmscott Memorial Hospital and Joondalup Health Campus Process Redesign Project
- The Clinical Governance Management System (CGMS) – Developed from the 'Documenting and Improving Cardiac Care in Teaching Hospitals' Project; initiated in 2001

The model of care for acute coronary syndromes should be read in conjunction with the draft Clinically Coordinated Patient Transfer-Model of Service Delivery for secondary retrieval developed by the Acute Care Health Network.

1. Acute coronary syndromes

1.1 Definition of acute coronary syndromes (ACS)

The term acute coronary syndromes is used to collectively describe acute myocardial infarction (heart attack) and unstable angina (chest pain occurring at rest, new onset of pain with exertion, or angina that is more frequent, longer in duration or lower in threshold than before)[4].

- Acute myocardial infarction or heart attack occurs when a plaque within one of the coronary arteries ruptures and forms a clot that completely blocks blood flow to the heart muscle (myocardium)[4].
- Angina occurs when a plaque or blood clot only results in narrowing the blood vessel, and may happen as a precursor to a heart attack or remain stable for long periods [4].

The definition of ACS that has been applied to the Model of Care is in line with the 2006 Australian and New Zealand guidelines for the management of ACS[1] and the subsequent 2007 addendum.

> "a broad spectrum of clinical presentations, spanning ST-segment-elevation myocardial infarction, through to an accelerated pattern of angina without evidence of myonecrosis". [2]

ACS (angina and acute myocardial infarction) are manifestations of coronary heart disease. The common underlying cause is atherosclerosis which is due to plaque build up on the inside of the arteries.

1.1.1 Categorisation of ACS

ECG interpretation is complex and requires specialised skills. A critical distinction between types of ACS is made on 12 lead ECG to differentiate patients with ST segment elevation myocardial infarction (**STEMI**) from those with non ST segment elevation acute coronary syndromes (**NSTEACS**).

Patients presenting with NSTEACS are subsequently diagnosed as either unstable angina or non ST elevation myocardial infarction. This differentiation depends on patient history, examination and cardiac enzyme biomarkers eg troponin, released when the myocardium sustains injury.

1.1.2 The importance of early categorisation

Identification of patients with **STEMI** is crucial for early treatment decisions since they require time critical reperfusion strategies via thrombolysis or primary percutaneous coronary intervention (PCI) to open a blocked coronary artery. Successful reperfusion if delivered promptly following symptom onset can prevent further death of cardiac tissue (myonecrosis) which considerably improves prognosis

People with **NSTEACS** do not require emergency reperfusion however risk stratification to determine the most suitable treatment is paramount[1]. Myocardial infarctions may evolve and become more critical in nature so a

person with an initial NSTEACS on ECG may develop ST-elevation at which time an immediate reperfusion strategy is usually considered.

Given that risk stratification impacts on ACS, separate pathways have been developed to guide management. Patients presenting with symptoms indicative of myocardial infarction and demonstrating ST elevation on their ECG require a pathway that includes time critical reperfusion, when appropriate. All others presenting with ACS follow a general chest pain or NSTEACS pathway and can be stratified as High, Intermediate or Low risk. The implications for management are dealt with in the model of care section.

1.2   The current burden of coronary heart disease

1.2.1   Mortality & morbidity data

Cardiovascular disease (the main cause of Acute Coronary Syndromes) is the leading cause of death and disability in Australia – in 2007 there were 40,888 major coronary events that accounted for 30% of all deaths [3]. In Western Australia, ACS accounts for almost 20% of all deaths.[7] Although, the death rates from coronary heart disease have declined by around 40% over the past decade, the mortality rate in males remains about twice that of females.[8] Among Australians having a heart attack, about 40% die within a year. Over 50% of all heart attack deaths occur before the person reaches the hospital, about 25% of those deaths occurring within an hour of the onset of symptoms. Mortality from coronary heart disease is higher in rural and remote areas compared with major cities.[9]

In specific population groups the burden of coronary heart disease is more pronounced both in terms of morbidity and mortality. The risk of sudden death is greatly increased in individuals with known coronary heart disease having a second heart attack.[8]

Aboriginal Australians have three times the rate of major coronary events, more than twice the rate of in-hospital mortality and 1.4 times the rate of out of hospital death related to coronary heart disease compared with non-Aboriginal Australians.[10] Significantly coronary heart disease death rates for Aborigines between the ages of 25-54 years are between seven and twelve times that of non-Aborigines.[11] Aborigines are also less likely to receive standard care including invasive and non-invasive cardiac investigations.

1.2.2   Prevalence

The WA Health and Wellbeing Surveillance System surveys at least 6,500 people of all ages across WA each year. In 2007 the reported prevalence of heart disease was 25.6% and 18.2% for males and females 65 years and older respectively. [12] Of this, the prevalence of people in WA who reported living with heart disease was three times higher for people already known to have diabetes mellitus compared with those without the condition, and was higher for people from metropolitan compared with remote areas. [13]

1.2.3 Risk factors for coronary heart disease

Many of the major risk factors for coronary heart disease are preventable or reversible. A significant proportion of the burden of coronary heart disease is attributed to behavioural or lifestyle factors including poor diet, physical inactivity/ sedentary lifestyle, obesity and tobacco use. Biomedical risk factors such as hypercholesterolaemia, hypertension, obesity and diabetes are also known to contribute to the development of the disease.

In addition there is consistent evidence that people who experience depression, or who are socially isolated or do not have quality social support are at greater risk of developing coronary heart disease. For people who already have coronary heart disease, these additional risk factors can affect their recovery and future health.[14]

Table 1.   Risk factor prevalence in Australia [15]

Behavioural Risk Factors	
Poor Diet	46% inadequate fruit consumption 85.6% have inadequate vegetable consumption
Physical inactivity	34% of adults are not sufficiently active
Tobacco Smoking	15.4% of adults are current smokers
Biomedical Risk Factors	
Excess weight	53.5% of adults are overweight or obese
High cholesterol	51.2% of adults
Hypertension	28.8% of adults

1.2.4 Co-morbid conditions

Coronary heart disease (CHD) is 2-3 times more prevalent in people with diabetes and carries a worse prognosis.[16] For people with diabetes, coronary artery disease accounts for 50% of all diabetes-related mortality. For those with chronic kidney disease there is a direct association between cardiovascular disease and mortality.[17] In those diagnosed only with peripheral arterial disease the relative risk of death from cardiovascular causes is the same as for those with coronary or cerebro-vascular disease, but they are four times more likely to die within 10 years than patients without the disease[18].

All patients with the above conditions require medical management to reduce the risk of future coronary and cerebro-vascular events.

1.3   Hospitalisations for acute coronary syndromes

People experiencing symptoms of ACS are considered clinical emergencies. They are one of the most common causes for patient presentation and admission to hospital in Australia[15]. This trend is consistent with the hospitalisation figures within WA Health.

Figure 1.   Number of hospital separations for angina and MI, WA [1999-2008][19]
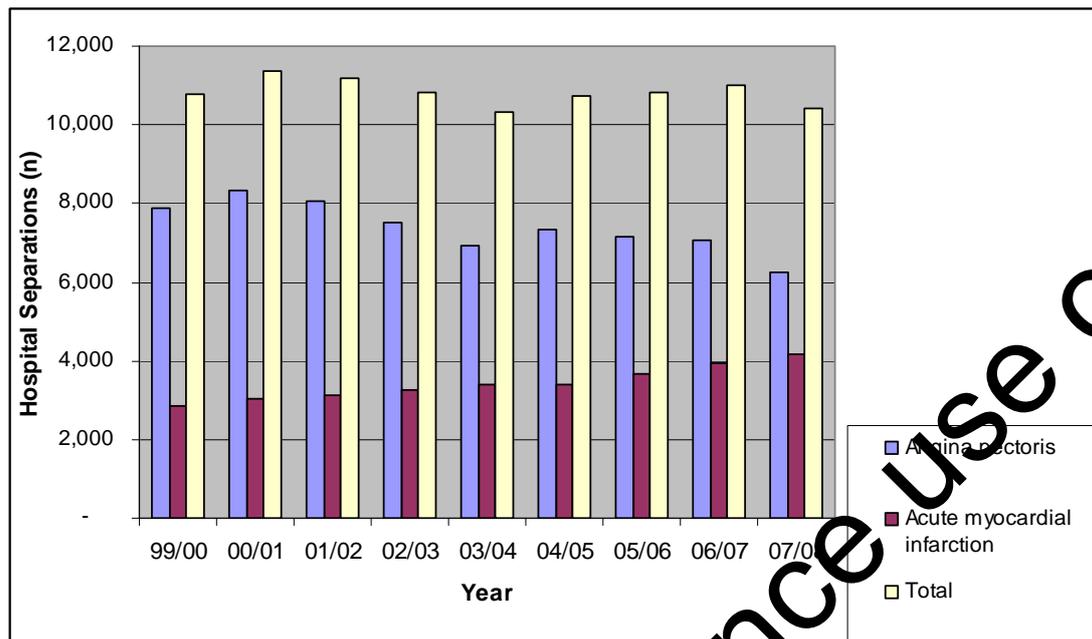
Hospital separations for ACS have remained stable for the period between 1999 and 2008. However the ageing population profile and increasing incidence of diabetes and obesity mean that these rates are likely to plateau or increase over the next decade

The apparent decline in separations for angina and increase for MI between 1999 and 2008 may be explained by changes in the definition of MI, based on sensitive and specific markers of myocardial injury (primarily the troponins).[20,21] Cases that were previously diagnosed as angina are now defined as non-ST elevation myocardial infarction (NSTEMI).

Figure 2.   Separations and rates of separations for acute coronary syndromes WA, 1999- 2006 [19]

Hospital Separations with a Principal Diagnosis of Acute Coronary Syndrome
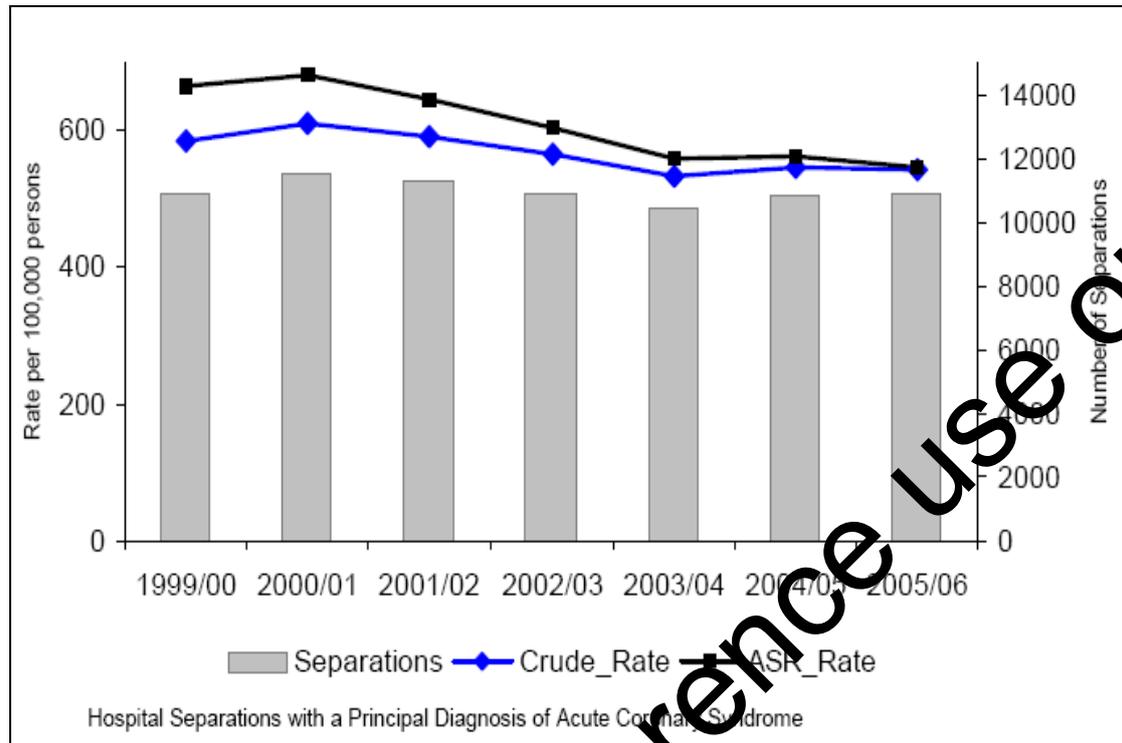
* Acute coronary syndromes are defined as angina, acute myocardial infarction, subsequent myocardial infarction and other acute ischaemic heart disease unless indicated otherwise.

ASR_rate: age specific rate

Due to this change in the definition of MI it is extremely difficult to interpret the data. Further changes in coding and in the management of ACS exacerbate the situation. The apparent declining trend in the crude and age specific rates of hospital separations for acute coronary syndromes between 1999 and 2006 must therefore be interpreted with caution.

Figure 3.   Hospital separations for angina by type of hospital, WA [1999 – 2008] [19]
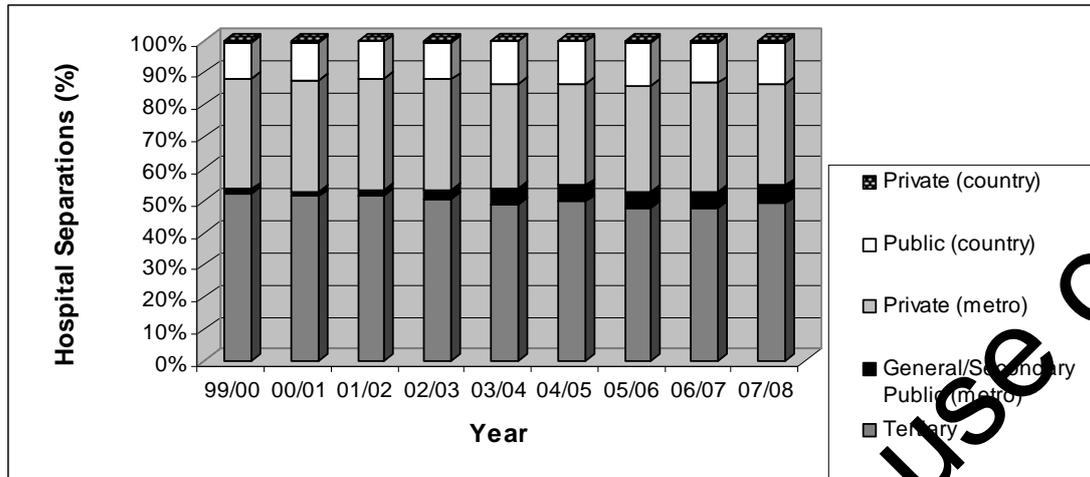
Figure 4.   Hospital separations for acute myocardial infarction by type of hospital, WA [1999 – 2008] [19]
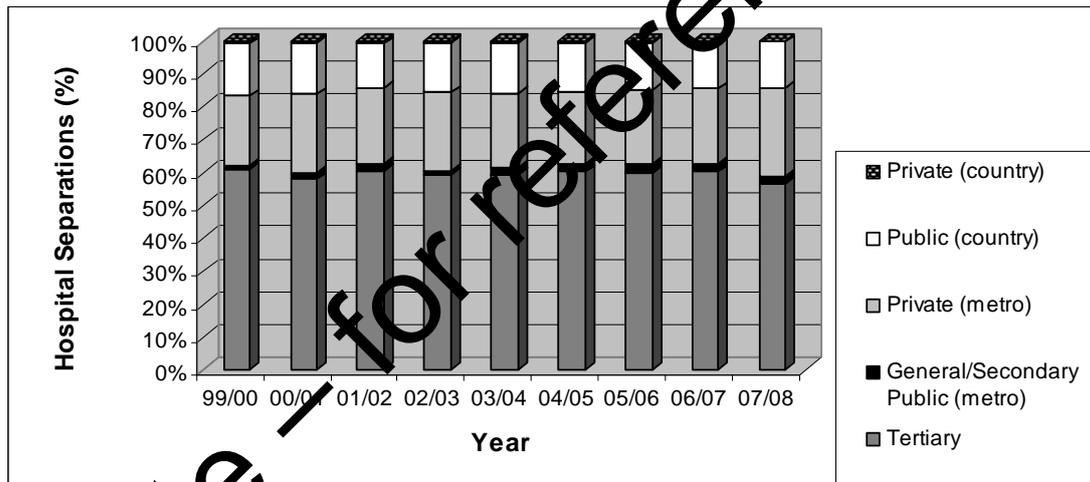
In WA overall trends in the type of hospital for separations for MI and angina have not changed since 1999.

It is clear that most separations for MI are to tertiary hospitals. This may be due to the development of emergency PCI services at these hospitals and transport of patients in the metropolitan area with suspected MI to these hospitals by ambulance. In addition, rural patients requiring coronary care admission or acute cardiology intervention are transferred to a tertiary facility.

Patients with angina are more likely to be admitted to a private hospital in metropolitan Perth than those with an MI. Use of general (secondary) public hospitals in metropolitan Perth shows an increase particularly for angina but overall usage remains low.

Figure 5. Number of percutaneous coronary interventions (PCIs) performed and emergency* PCIs as a proportion of total in the public sector in Perth 2000/01-2007/08
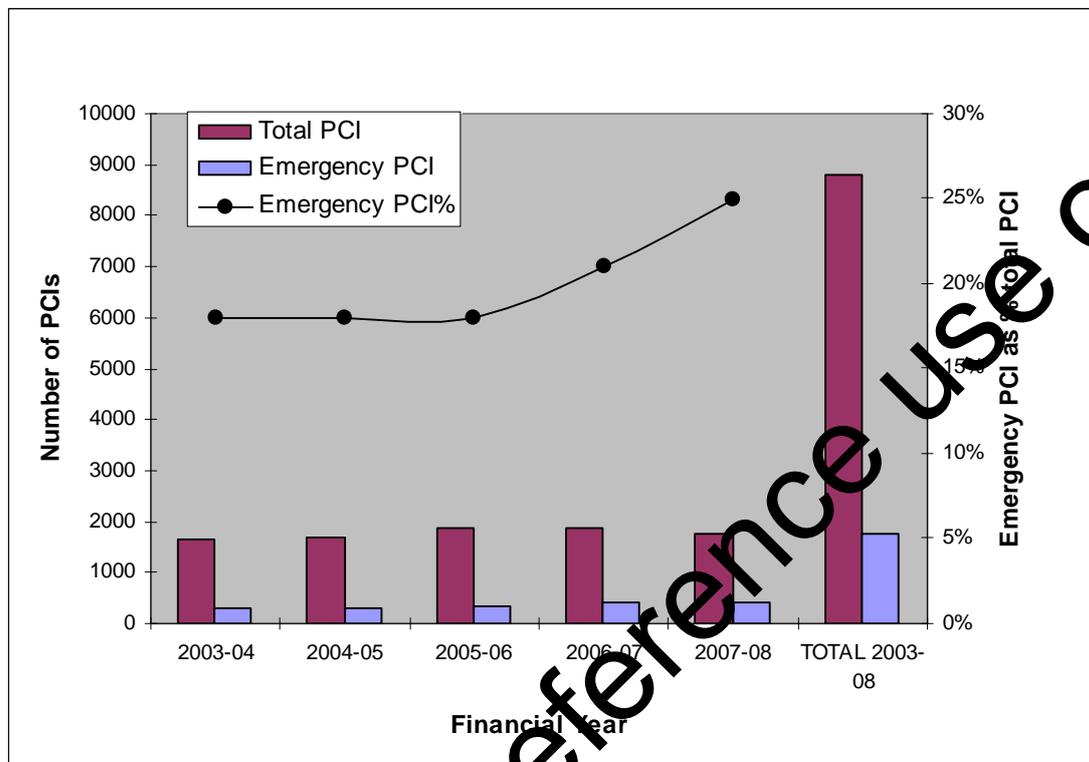
* Emergency PCIs consist largely of Primary and Rescue PCIs

The number of PCIs provided as an emergency shows a steady increase from 18% of total provided in 2003/04 to 25% in 2007/08. This is due to the inclusion of emergency PCI in the management of STEMI.

Costs associated with coronary heart disease

Allocated direct health care expenditure on cardiovascular diseases amounted to $5.94 billion in 2004–05 representing 11% of total allocated resources. [22] Between 2000–01 and 2004–05, inflation-adjusted expenditure on cardiovascular diseases increased by 18%. The high costs associated with coronary heart disease are represented by direct financial cost to the health system, indirect financial cost (including informal care and productivity losses) and non financial cost (relating to pain, suffering and premature death). [23] The 2005 Access Economics report shows:

- Substantially more is spent on males ($321 per person) than on females ($261 per person). Much of this difference is due to higher rates of cardiovascular disease among males than females. However, some may reflect differences in the diagnosis, treatment, care and course of the disease between sexes.

- Expenditure per person increases with age, with those aged over 85 years attracting the most expenditure.
- Spending on hospital-admitted patients accounted for approximately half of all expenditure on cardiovascular diseases. Devices account for a growing portion of total. These include intra-coronary stents.

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2. Current services for acute coronary syndromes and gaps in service provision

"Effective management of ACS requires collaborative systems of care to ensure that patients have access to the services they need in a timeframe commensurate with their clinical condition and the potential benefit of treatments available in larger or specialised centres" [1] [S9]. Integration between all types of hospitals and primary care service providers including ambulance services is an essential element of the collaboration needed, as is the prompt identification of ACS by appropriately trained and skilled staff [24]. Elements of the system include: clear lines of communication to facilitate early decision-making and transfer to the appropriate facility, clear and agreed triage, acute interhospital transfer and treatment protocols, effective and timely feedback and program quality monitoring [1]. "A more systematic approach to the delivery of care can ensure that all those likely to benefit do gain access to appropriate services" [24] [S7].

2.1 Current services

In WA a variety of services for ACS are provided across the continuum from prevention through to rehabilitation by the public, private and non-government health sectors in Western Australia (Appendix 2).

Primary prevention of cardiovascular disease and therefore of ACS, is crucial to reducing the overall burden of the disease. Health promotion programs targeting reduction of risk factors in the general population have been an effective feature of the health landscape in WA for over twenty years. These programs are funded by the Department of Health, Healthway and non-Government health agencies. Key campaigns targeting physical inactivity, healthy weight and youth smoking prevention are conducted by the Heart Foundation and other bodies. Primary prevention methodology will be utilised by the Heart Foundation to raise public awareness of the warning signs for heart attack and awareness of the prompt action required in calling triple zero. Population focused programs are complemented by more targeted risk management initiatives such as Lifescripts[25] a program emphasising the importance of incorporating absolute risk assessment in to early detection strategies.

There is currently a range of transport and **retrieval services** available for people presenting with ACS. These include the St John Ambulance (SJA), the Royal Flying Doctor Service (RFDS), the Emergency Rescue Helicopter Service, ambulances run by 'local' medical services and private transport. SJA and RFDS have separate communication centres, separate management structures, different point-of-contact telephone numbers and no shared policies. [27].

Trained paramedics staff ambulances in Metropolitan Perth. Performing and interpreting a 12 lead ECG is not routinely part of their training. Dr Garry Wilkes, Medical Director, St John Ambulance WA indicated (February2009) that in rural areas fewer than 10% of ambulances are staffed by trained paramedics, the bulk use volunteers who may be on call from home. They usually reside in the small towns so the response rate within the town is

relatively rapid (10-15min). The closest access to services is usually the hospital. According to Dr Wilkes ambulance response times in metropolitan and rural WA are similar.

All tertiary and major general hospitals in the Perth metropolitan area have **emergency departments** but only those departments in the tertiary hospitals currently are configured around a dedicated chest pain management area in the public sector.

All the **WA Country Health Services** perform an emergency function but many are not open daily for 24 hours due to staff needing to cover health service delivery across a number of sites. Those services with an emergency role are:

- Regional Hospitals – Albany, Broome, Bunbury, Geraldton, Kalgoorlie, Port Hedland
- Integrated District Health Services – 15 services
- Small Hospitals – 50 hospitals
- Multi Purpose Centres – 5 centres which AMS/ ACCOs
- Nursing Posts – 16 nursing posts

Various level of staffing, confidence and skill exist at those sites.

Currently there is a 24 hour **cardiac catheter laboratory** at three of the tertiary hospitals in Perth that provide primary PCIs. Four private hospitals have cardiac catheter laboratories providing a 24 hour service.

Public **pathology** services are provided by PathWest with wide distribution throughout the State. Private pathology is carried out by various providers. Many hospitals have on-site laboratories that provide rapid 24 hour services.

At many sites particularly in rural areas initial cardiac enzyme biomarkers are assessed by a test carried out at the patient's bedside and verified by a laboratory blood test later. The rapid results obtained by bedside pathology assist in the adoption of early treatment strategies and in rural and remote areas particularly can be a powerful support to ECG interpretation.[28] Pathology testing at the bedside is not yet accredited in Australia by the National Association of Testing Authorities (NATA).

The time taken from initial presentation to hospital triage to the opening of the target vessel in the cardiac catheter laboratory at primary PCI (if available) is known as the door–to–balloon time. For those who are eligible for thrombolysis the door-to-needle time is measured from initial presentation to hospital triage to the time the thrombolytic agent is administered. Both are currently internationally recognised as critical indicators of the **health system's performance** for patients presenting with a STEMI. Currently data is collected by cardiac catheter laboratories but is not standardised nor collated across the state.

The **Safety and Quality** Investment in Reform (SQuIRE) initiative in WA collects indicators on acute myocardial infarction mortality rates and three evidence based management criteria for acute MI as a complete Clinical Practice Improvement Program.

Secondary prevention strategies are essential to **prevent disease progression and further complications**. In this regard all patients with cardiovascular disease need access to evidence based ongoing management and active referral including optimum pharmaceutical management, a chest pain action plan and cardiac rehabilitation. While there are no national figures available in Australia, a Queensland study showed that 70% of ACS patients did not access cardiac rehabilitation programs[29]. Overall the biggest contributor (accounting for 74%) to non-completion of cardiac rehabilitation has been found to be lack of referral[30]. Other barriers include lack of available programs, distance and transport issues, inconvenient times, poor motivation and issues related to age and ethnicity.

2.2   Critical points for service provision

Critical points for service provision can be classified as follows:

- Lack of early recognition by the patient of ACS symptoms and delays making immediate contact with emergency medical services.
- Delays in diagnosis and risk stratification that limit prompt access to treatment and appropriate services.
- Lack of system-wide co-ordination and integration.
- Lack of statewide guidelines and protocols to optimise patient flows and delivery of evidence based practice.
- Specific needs for high-risk groups, including disadvantaged population groups.

2.3   Delays in early recognition of ACS symptoms by the patient

Timely treatment in both the pre-hospital and hospital phases of care may decrease the extent of cardiac damage and save many lives[5]. People experiencing symptoms of ACS should seek help promptly and activate emergency medical services to enable transport to the nearest appropriate health care facility preferably by ambulance. Transport by ambulance ensures immediate assessment and access to emergency treatment including an automated external defibrillator, oxygen therapy and medication.

Early reperfusion using thrombolyis or PCI may halve the death rates due to ACS in select patients but the effectiveness of these therapies diminishes with time [5]. Furthermore immediate access to defibrillation substantially improves survival from the heightened risk of cardiac arrest. Although delays due to transport and initiation of reperfusion therapy in hospital may contribute to late treatment, the major component of delay is the actual time patients take deciding to seek help." [19]

In Australia patient response times have not changed over time. Significantly patients with a history of ACS who have a higher risk than the general population of re-infarction and sudden cardiac death respond no more quickly[10]. Recent studies[10, 31] found patients with ACS require education and continued reinforcement about the nature of cardiac symptoms, the benefits of early treatment, and their risk status. Response times for Aboriginal patients are significantly longer than non-Aboriginal patients. Those from culturally and linguistically diverse backgrounds and those who live in a rural location may also postpone accessing emergency services.

A large proportion of patients continue to show prolonged pre-hospital delay. Factors known to contribute to unsafe delays in presenting for treatment are:

- The patient's inability to recognise the symptoms of ACS when they experience them, to ignore symptoms or wait for them to go away or attribute symptoms to an innocuous cause, commonly indigestion.
- Transportation to hospital by private car rather than by ambulance.
- Seeking help from a General Practitioner when experiencing ACS symptoms instead of calling for an ambulance.[32]

The Heart Foundation is implementing mass media and broad reach education strategies to help all Australians identify and understand the warning signs of heart attack and to influence change to systems that contribute to patient delay. The strategies target three groups: patients with coronary heart disease, Aboriginal and Torres Strait islander people and men and women aged over 45 years.

Symptoms of ACS [1] S9

- Typical presentation of ACS (considered medical emergencies): Chest discomfort at rest or for a prolonged period (more than 10 minutes, not relieved by sublingual nitrates), recurrent chest discomfort or discomfort associated with syncope/acute heart failure.
- Other presentations of ACS may include back, neck, arm or epigastric pain, chest tightness, dyspnoea, diaphoresis, nausea and vomiting.
- Very atypical pain, including sharp and pleuritic pain, is more common in women, people with diabetes and older people.

2.4 Delays in diagnosis and risk stratification.

Early diagnosis is necessary in order to ensure that people follow the appropriate path and that those with STEMI who are eligible for time-critical reperfusion receive the best chance of getting it. This requires accurate assessment and risk stratification of people with ACS to ensure best practice. Early reperfusion via thrombolysis or PCI may halve the death rates due to ACS in select patients but this quickly diminishes with time[5].

Trials of pre-hospital ECG assessment, including studies from elsewhere in Australia, have shown that this technology speeds the triage of those with STEMI facilitating (depending on the system studied) pre-hospital thrombolysis or direct transfer to a PCI equipped hospital, thereby allowing "greater use of reperfusion, faster reperfusion times and a suggested trend for a lower risk of mortality"[33].

The major challenges are:

- There are currently no facilities to record and transmit 12 lead ECGs from WA ambulances, nor are WA Paramedics routinely trained in performing and interpreting 12 lead ECGs. Indeed in many rural areas ambulances are staffed by volunteers. As such, it is currently not possible to select patients for time critical reperfusion until they have an ECG recorded and interpreted at a receiving emergency department or local hospital.
- Whilst of proven benefit in other regions, the effectiveness of pre-hospital ECGs in reducing treatment delay in WA has not yet been

determined. To ensure efficacy in the local environment, such evaluation would be important during a phased introduction of this technology.

Currently **metropolitan** patients are transported to the closest emergency department where the ECG is performed pending transfer to a hospital with a cardiac catheter laboratory if the patient is diagnosed with a STEMI. The North Metropolitan Area Health Services has trialled performing the ECG on the ambulance trolley while the ambulance waits to transfer the patient if reperfusion is necessary. Unpublished evidence from this project[34] shows a reduction in door-to-balloon times when this process is followed with a rapid 'Door In – Door Out' time in the 'First Door' Hospital.

In **rural and remote** areas the patient is transported to the closest facility with an emergency service and the ECG is performed. If a STEMI is diagnosed the reperfusion strategy of choice is thrombolysis which is administrable at any site by staff functioning within their scope of practice, clinical competence and expertise. Since selective diversion is not available in rural and remote areas and pre-hospital thrombolysis is outside the scope of practice for volunteer ambulance officers, 12 lead ECGs would have limited application by these ambulances.

- Lack of access to **bedside pathology services** results in additional delays in risk differentiation and prognosis. In rural and remote areas bedside pathology results could confirm or strengthen a diagnosis leading to action.
- Lack of timely access to direct real time **cardiology advice** results in delays transferring people and to lack of ongoing support in the management of people with ACS.

2.5   Lack of system-wide co-ordination and integration

In Western Australia there is no **formalised system wide linkage** and communication between tertiary centres and hospitals in outer metropolitan, regional, rural and remote areas. Notably there is a/are:

- Lack of clinically coordinated systems of **retrieval** of patients from outer metropolitan, rural and remote areas and transport to the hospital with capacity to accept the patient. This leads to delays transferring people with suspected STEMI to the most appropriate centre for reperfusion although in most of the outer metropolitan secondary hospitals protocols exist to keep patients on the ambulance trolley, perform an ECG and to send them immediately to the tertiary hospital with the cardiac catheter laboratory if a STEMI is diagnosed.
- Poorly defined **roles and responsibilities** of individual health professionals in patient retrieval across the state.
- Lack of a central referral unit to **coordinate retrievals and transfers**. Current responsibility rests with the referring medical practitioner and referral patterns can be ad hoc or based on collegial relationships.

- There are no existing **Information and Communication Technologies (ICT)** to enable sharing of results across, within and between hospitals, particularly emergency departments.
  - There is no capability for ECG transmission from ambulances and emergency departments.
  - ECGs are often transmitted from peripheral hospitals to the tertiary centres by fax resulting in poor quality copies that are difficult to interpret.
  - There is limited information sharing between public and private providers.
  - Variable support for health care providers needing advice to support risk stratification and management decisions.
  - Absence of technologies to standardise data collection and to set up specific patient registries.

2.6   Ineffective systems to maximise patient flows and care

The current **practices of bed and patient flow management** often create blockages, leading to further delays in accessing appropriate treatment. These practices include:

- Lack of bed availability due to the current requirements at many sites that a final medical consultation is needed prior to patient **discharge.**
- Infrequent transfer of stable patients from the **tertiary centres back to the referring hospital** in cases where this would not extend the overall length of stay.
- Lack of dedicated **intermediary facilities to monitor** patients such as dedicated chest pain units for early differentiation of risk status and monitoring pending a decision to admit or discharge the patient. [1]
- **Variation in level of service** and capacity based on time of day, including access to consultant cardiologist advice, time critical cardiology intervention (after hours primary PCI), unacceptable delays in transfer due to poor traffic flows at times and lack of capacity for inpatient education and post discharge follow up.
- Lack of **community based** ambulatory care cardiology services, to prevent disease progression, and an approach where cardiac rehabilitation is seen as an 'add-on' and not an integral part of the patient pathway.

2.7   Lack of state wide consistent guidelines, protocols and processes

- While there are national evidence based guidelines for the management of ACS[1], these are **inconsistently applied**. This results in variations in practice, some of which are avoidable, particularly between metropolitan and rural settings and therefore in patient outcomes.
- Audits carried out to monitor **adherence** to evidence based management protocols show a lack of optimum evidence based medication regimes following ACS particularly according to diagnosis [2] and appropriate, timely interventions

2.8 Specific service needs for disadvantaged or high-risk groups:

Disadvantage applies to those who reside in rural and remote locations and those who are from Aboriginal and culturally and linguistically diverse populations. For people who are both geographically and culturally disadvantaged, the effects are cumulative. Issues include:

Rural and remote areas**:**

- **Inequity of access and care** due to distances, worsened by variable workforce experience, skills and shortages.
- Range of **treatment protocols** for thrombolysis. Variable availability of thrombolytic medications (the reperfusion technique of choice for rural populations). In some areas there is a stock rotation system that sends the furthest to expiry stock to the most remote site.
- **Variable access** to intravenous antiplatelet medication, support systems and processes for replacement of expired medications.
- **Variable key performance indicators** like door-to-needle times.

Aboriginal and CALD communities:

- Lack of community based **culturally appropriate** services for follow-up and cardiac rehabilitation.
- Lack **of engagement with the health services** by Aboriginal & culturally and linguistically disadvantaged (CALD) populations. This can be attributed to low levels of health literacy regarding disease risk factors, warning signs of ACS, adherence to treatment and the importance of follow up. The paucity of culturally appropriate Aboriginal staff and secure services and programs is a major contributor.

2.9 Workforce issues

Knowledge, skills and workforce confidence levels are variable and roles and responsibilities in some cases, not clearly defined. These contribute to the gaps in service delivery for people with ACS. The level of skill and confidence in interpretation of results is varied.

3. Model of Care

The Model of Care for ACS builds on existing service delivery models and is strengthened by best practice strategies to address the gaps in acute service provision. It is guided by the principles from the 2006 Guidelines for the management of ACS [1] 'ensuring equity of access and care, in line with the evidence base while taking account of patient preferences'.

> **The model of care aims to ensure the right patients receive the right care, at the right time, by the right team and in the right place**.

3.1 Prevention and early identification of cardiovascular disease

The WA Health Promotion Strategic Framework 2007-2011 [35] sets out the key strategic approaches for the promotion of healthy lifestyles and environments to reduce the risk of cardiovascular and other chronic diseases. The primary prevention strategies of social marketing and community education focus on smoking, healthy eating, physical activity and healthy weight. Secondary prevention strategies require a multifaceted approach across the primary, secondary and tertiary health settings to target at risk populations and programs to reduce health risk. These include healthy lifestyles programs and weight loss clinics, blood pressure, lipid screening and control and smoking cessation programs. All patients with cardiovascular disease should have access to and be actively referred to comprehensive ongoing prevention and cardiac rehabilitation programs.

Comprehensive detail and recommendations regarding prevention are deemed beyond the scope of this model of care as it is the focus of an "Optimising vascular health through prevention Model of Care" that will be developed by the Cardiovascular Health Network in conjunction with other networks. It will inform and complement the ACS Model of Care.

3.2 Proposed ACS patient pathways

The following diagrams set out the proposed patient pathway for ACS. Starting with the patient in the community, they emphasise the need for early recognition of the symptoms of ACS by the patient, family and carers. The importance of immediate access to emergency medical services preferably via ambulance for urgent assessment and initial management is stressed. Presentation to General Practitioners or Aboriginal Medical Services is included in the pathway because this is often the quickest route to emergency care particularly in the rural areas. Calling 000 for ambulance is recommended.

The preferred pathway identifies roles of staff and the clinical assessment, risk stratification and initial management of patients. It provides a path for those diagnosed as STEMI or as NSTEACS (high, intermediate or low risk groups) to be stratified at all presenting sites. A 12 lead ECG is performed as soon as practicable in the episode of care to enable early risk stratification and expedite patient flow though emergency departments, through designated chest pain management areas for those with intermediate or low risk.

If time and clinical eligibility criteria are met, patients with STEMIs will be preferentially transferred to a tertiary centre with a cardiac catheter laboratory for a primary PCI. If estimated time to the cardiac catheter laboratory exceeds the recommendation these patients, if suitable, receive reperfusion by thrombolysis at one of the outer metropolitan, rural or remote health services/ hospitals.

Certain rural residents will be able to meet time critical eligibility criteria for reperfusion by PCI. Alternatively there are those from the metropolitan and outer metropolitan areas who would not. In consultation with the cardiology/ retrieval advice line the most suitable pathway should be followed.

Patients classified as NSTEACS are risk stratified and managed at tertiary, general or regional hospitals according to management guidelines and the model of care.

All WA Health sites can access

- Emergency clinically co-ordinated support by telephone to confirm a diagnosis of STEMI, recommend treatment and co-ordinate retrieval.
- Cardiology advice 24/7 to provide decision support regarding management and to arrange for transfer for further investigation if appropriate.

This process is underpinned by the adoption and modification for statewide use of national evidence based guidelines, processes and protocols to govern all aspects of the pathway.

Patients are discharged back to the community, GP based care and. where appropriate, follow up by cardiology.

Figure 6. Proposed acute coronary syndromes patient pathways
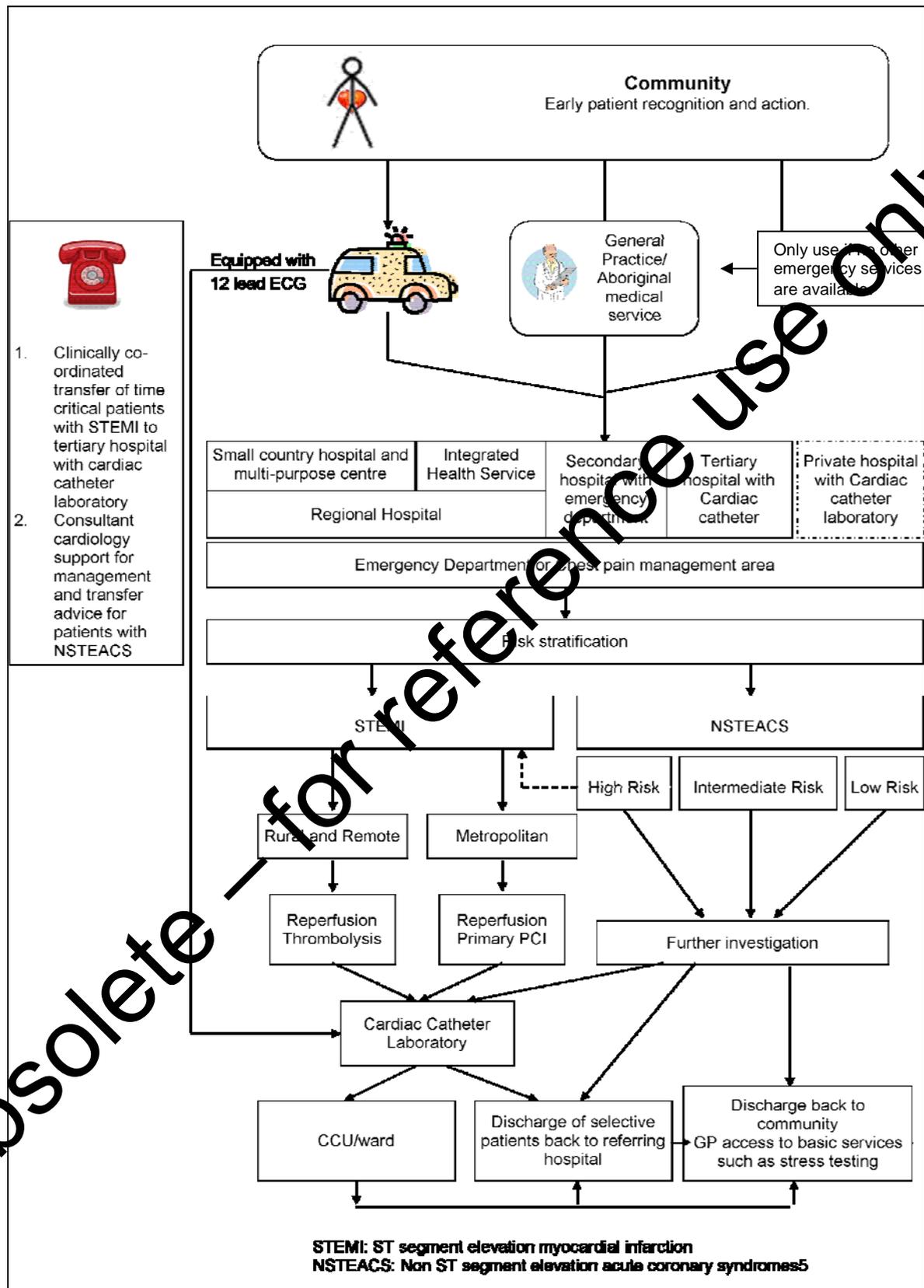
NOTE: The introduction of 12 lead ECGs in WA will be trialled and evaluated prior to consideration as a statewide process.

Figure 7. Metropolitan patient pathway and acute coronary syndromes management

People experiencing symptoms to seek medical assistance early

Equipped with 12 lead ECG

If ambulance equipped with 12 lead ECG technology and transmission, risk assessment by ambulance in consultation with clinically co-ordinated patient transfer advice line

Patient risk stratification assessment in chest pain management area with reference to guidelines and clinical pathways. Expert clinical advice and support is available 24/7.

STEMI

NSTEACS

High Risk | **Intermediate Risk** | **Low Risk** | **Very low risk**

Patient initially managed. Time critical reperfusion strategy determined as PCI

Patient presents to a hospital without PCI

Patient initially managed in chest pain management area. Liaise with expert cardiology advice line. Where appropriate transferred to hospital with PCI facilities by presenting ambulance

Patient initially managed in chest pain management area.

Further investigation

Liaise with expert cardiology advice line for patient transfer to hospital with PCI facilities

Patient is assessed, observed and discharged for GP care; access to further risk stratification, eg exercise stress testing

Patient transferred to hospital with PCI facilities with bed retained at the hospital

Transferred patient to bypass ED/ chest pain management area

Patient initially managed in chest pain management area.

Cardiac Catheter Laboratory

Patient presents to a hospital with PCI

Patient admitted to CCU/Ward

Patient admitted for PCI as a day case then to originating hospital bed for observation

STEMI: ST segment elevation myocardial infarction
NSTEACS: Non ST segment elevation acute coronary syndromes5

NOTE: The introduction of 12 lead ECGs in WA will be trialled and evaluated prior to consideration as a statewide process

Figure 8. Rural, remote and outer metropolitan patient pathway and acute coronary syndromes management
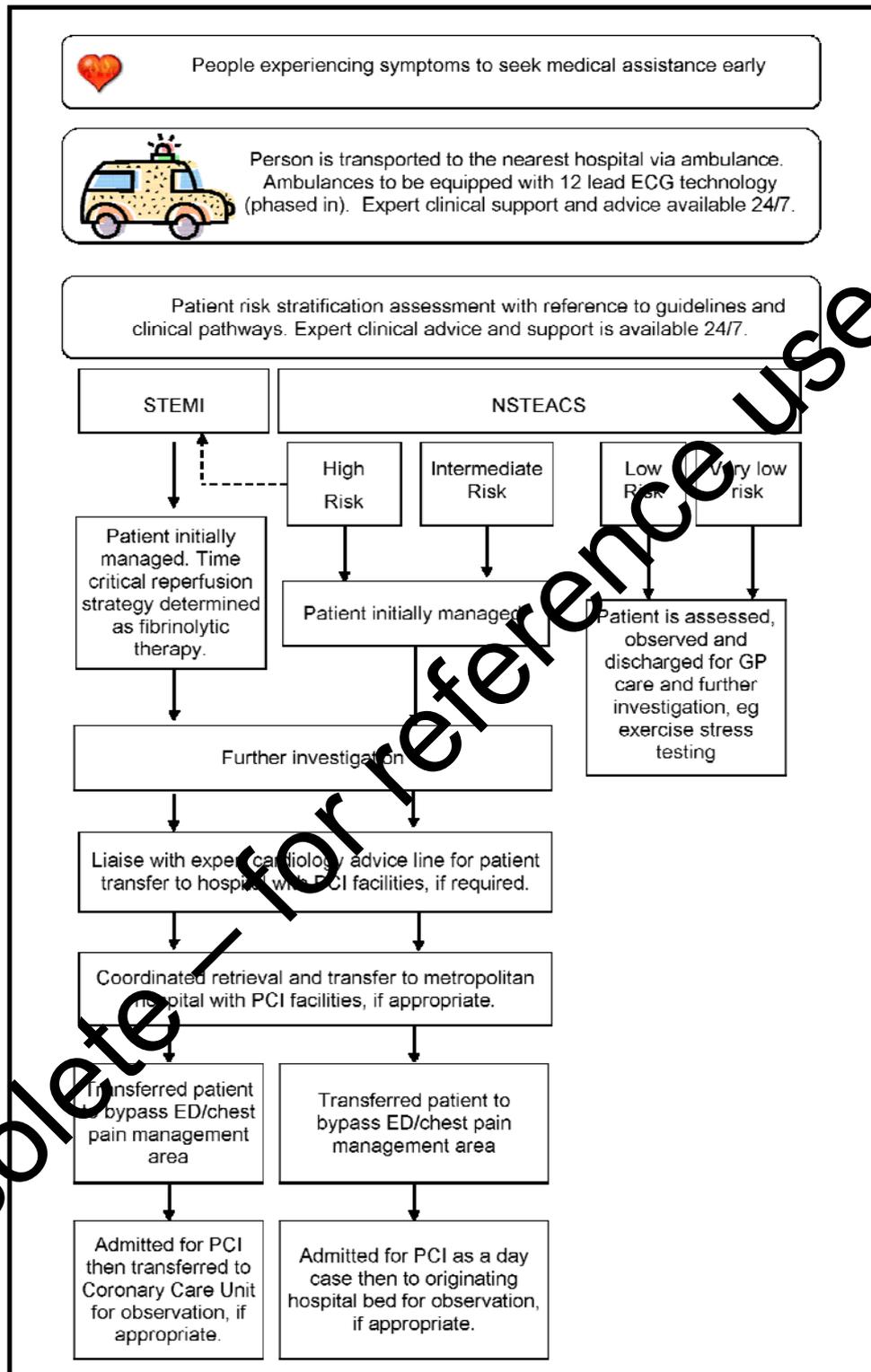

NOTE: The introduction of 12 lead ECGs in WA will be trialled and evaluated prior to consideration as a statewide process

3.3 Overview of Model of Care

Emerging from the analysis of current services are key areas for implementation to improve service delivery and outcomes for people with ACS:

- Early recognition by the patient of ACS symptoms and immediate contact with emergency medical services to enable transport to the nearest appropriate facility preferably by ambulance.
- Early diagnosis and risk stratification to reduce delays in treatment and access to appropriate services.
- Formalised strategies of care with systemwide coordination and integration based on two tertiary centres operating a 24 hour cardiology interventional service.
- Adoption and development of guidelines and protocols for statewide implementation of best practice for ACS.
- Information and communication technology solutions that promote patient centred care, determine the minimum data needed to monitor ACS and the need for ACS patient registers.
- A focus on disadvantaged and high risk populations in order to improve patient outcomes.

3.4 Encouraging early recognition of ACS symptoms by the patient and the need for making immediate contact with emergency medical services

A state wide social marketing campaign and community education programs targeting the general population about the **warning signs and symptoms** of ACS and the importance of seeking **immediate emergency assistance** by calling triple zero will be developed and implemented.

- Strategies to improve understanding and acceptance of messages through :
  - Development of culturally sensitive education resources and the routine use of simplified language for the general population.
  - Development of social marketing campaigns that are comprehensive, ongoing and directed to groups at highest risk of a possible ACS event[5]. This includes women, Aboriginal and CALD groups, those who have had a previous ACS episode and those with familial hypercholesterolaemia. Members of the patient's household will be targeted in the campaigns.[5]
  - Identification and breakdown of the behavioural and psychosocial barriers to early action.
  - Implementation of opportunistic and planned screening to alert and inform people of their risk of cardiovascular disease particularly in rural and remote areas.
  - Development and popularization of a simple and clear plan for emergency action[5] such as call triple zero and the willingness to seek out and use community based external defibrillators.

- Development of positive messages about the benefits of retrieval by ambulance such as early access to oxygen, medication and the availability of an external cardiac defibrillator if needed.
- Increasing the proportion of trained Aboriginal and CALD staff members in the health workforce and developing retention strategies.

3.5 Encouraging early diagnosis and risk stratification to promote access to appropriate services

Ensuring timely access to appropriate services is dependant on accurate recognition, assessment and risk stratification of people with ACS.

The outcomes of risk stratification processes will determine whether the patient undergoes reperfusion, remains for further evaluation and monitoring within the Chest Pain Management Unit, is admitted to the ward or is discharged back to the primary care setting.

The Model of Care supports and recommends:

- Access to the **earliest possible 12 lead ECG** for all patients to facilitate identification of patients with STEMIs who require time critical reperfusion by PCI.
- Support and training for health professionals at all sites to encourage **interpretation of 12 lead ECGs**, supported by the emergency advice line and clinical governance protocols.
- Support and training to promote **time-critical administration of thrombolysis.**

  In metropolitan Perth (patients who meet time eligibility criteria for reperfusion by PCI):

  - To trial phased introduction into WA ambulances of technology to perform and transmit 12 lead ECGs in conjunction with appropriate training of ambulance officers and the support of a central clinically coordinated emergency advice line. If after an initial run-in and trial period, effectiveness is established roll-out of this technology and training should continue to include all metropolitan ambulances and crews.
  - Redesign of patient flow though the emergency department to ensure speed. This starts when the health professionals at the nearest emergency department are advised of the retrieval and expected arrival of a patient with probable ACS.[1, 12] Extend the ambulance on hold strategy to all outer and metropolitan sites to facilitate speedy transfer of those with a time critical need for transfer to an interventional cardiology service. The benefits of this strategy have been demonstrated in Perth{Finn, 2008 #30} although the uptake is patchy. This low cost strategy should immediately be rolled out in the metropolitan and outer metropolitan area.
  - When the General Practitioner identifies patients with ACS, obtaining an early 12 lead ECG and commence initial management (administration of aspirin, oxygen and GTN) while waiting for the ambulance to transport the patient saves time and can lead to a

prompt decision (supported by the cardiology advice line) about whether reperfusion is necessary or not.

In rural/remote WA (patients who are unlikely to meet the time critical eligibility criteria for reperfusion by PCI)

- 12 lead ECGs are needed to facilitate identification of patients with STEMIs who can undergo **reperfusion via thrombolysis** at any of the receiving hospitals or health centres, if appropriate.
- Clinical governance protocols covering scope of practice and administration to be developed
- Centralised stock rotation and management systems for thrombolytic therapy and other pharmaceuticals to be implemented.
- Earliest reperfusion by pre-hospital thrombolysis can improve patient outcomes but requires 12 lead ECG equipment and staff trained and competent to perform, interpret or transmit ECGs and administer thrombolysis. Protocols are needed to promote compliance with best practice. A project to trial pre-hospital thrombolysis in selected rural areas may be considered once satisfactory systems for capture, transmission and interpretation have been set up and evaluated.

It is possible for certain rural residents to meet time critical eligibility criteria for reperfusion by PCI. Alternatively there are those from the metropolitan and outer metropolitan areas who would not. In consultation with the cardiology/ retrieval advice line the most suitable pathway should be followed.

- Pathology results must be provided by the facility with the highest level of technology available on-site. Frequently in the metropolitan area this is a laboratory. In outer metropolitan and rural areas **bedside pathology** provides early information for assessing risk status.
  - Protocols are needed for the standardised equipment procurement, use and quality control for 'bedside' testing.
  - From conversation with Rosy Tirimacco from South Australia's Integrated Cardiovascular Clinical Network (*i*CCnet) they are conducting a quality assurance trial which might lead to accreditation protocols that could be adopted by WA Health.
  - As tests become more sensitive, referrals to cardiology increase. Ongoing review by a multi-disciplinary team of biochemists, cardiologists and emergency department physicians is needed into the interpretation and use of cardiac enzyme biomarkers, haematology and biochemistry in ACS in the clinical setting.

3.6 Establishing formalised systemwide coordination and integration

Formalised systemwide linkages will be developed and implemented to ensure a consistent approach including clinical pathways and co-ordination between and across all aspects of the health system. ICT solutions are critical to improving and optimising the clinical pathways and management of ACS. It is recommended that the service delivery structure includes:

- Clear processes setting out **lines of communication and health professional roles and responsibilities.**

- Interventional cardiology centres operating as the **hub** for peripheral hospitals (**spokes**), with overflow to one another when necessary, are envisaged. The interventional centres are governed by the interventional cardiology guidelines of the CSANZ[36] that stipulate laboratories performing coronary angiography require access to CCU/ICU while those performing PCI preferably require access to cardio-thoracic support if required. Maintenance of best practice and quality patient outcomes depends on sufficient volumes. International annual operator volumes recommended for experienced physicians performing PCI procedures are greater than 75 elective PCI procedures per year and at least 11 emergency PCIs at high-volume centres[37]. It is strongly recommended that in the short term there are **two centres** servicing the metropolitan northern and southern area health services respectively. Maintaining a centre with primary PCI capabilities requires a highly **demanding on call roster** with specialised nurses, interventional cardiologists, technicians and radiographers. Currently it is unlikely that adequate staffing levels could be provided at more than two centres. It is anticipated that additional centres may be required in line with population growth in WA.

- Establishment of an operational **state wide cardiology support** service to ensure access to advice 24/7. This will enhance the capacity for decision-making, increase the efficacy of after hours interventional cardiology and facilitate transfer of patients seven days a week for cardiac catheter laboratory investigations. Those where PCI is contraindicated and who require a cardiothoracic surgical assessment will be identified via this service.

- Linkages to the **emergency** clinical co-ordination number proposed by the Acute Care Network for all conditions statewide to provide advice, disposition arrangements and emergency department bypass for time critical access to cardiology intervention. This network will communicate directly with the appropriate cardiologist on call and will include direct admissions from the primary care sector where General Practitioners have encountered a patient with ACS.

3.7   Maximising patient flows in a safe and consumer-focused manner

Improved systems are needed to maximise patient flows and care supported by the adoption of statewide guidelines, protocols and processes. The formal linkages established enable efficient use of expertise, resources and beds at general hospitals where appropriate and prompt transfer to hospitals with interventional cardiac facilities when necessary.

Effective **bed and patient flow management across and within health services** ensures that only high risk or complex patients with acute coronary syndromes are treated within a tertiary hospital facility. The essential service requirements, processes and pathways are aimed at providing care seven days a week to reduce bed blockages in the coronary care unit/cardiology wards. Strategies include:

- **PCI Same Day Case Pathways** – Intermediate risk patients will undergo angiography/PCI at a hospital with a cardiac catheter laboratory as a day case and then be transferred back to the referring hospital for continuing care if appropriate and as long as overall length of stay is not increased.

Options include flagging the patient transferred from the general hospital as 'temporary' and retaining the bed for transfer back from the cardiac catheter laboratory providing this does not extend the overall length of stay.

■ **Criteria Led Discharge** – Guidelines to enable criteria led discharge will be in place to support timely discharge of patients. Criteria led discharge allows for patients to be discharged by registered nurses as part of the care team, with reference to a set of medically approved criteria and without the need for a final medical consultation.

■ **Minimising length of hospital** stay and promoting early discharge with appropriate support, two-way communication and follow-up and establishment and referral to cardiac rehabilitation programmes. The 'Opt-out' model will be used for programs known to reduce cardiac complications.

■ **Discharge summaries**, chronic disease management plans, the medication profile, shared information and training and support must be available to general practitioners, local health service providers and people with ACS. Patient education on the need to reduce delay to presentation, use of ambulance services, medication management and reinforcement of self-management principles is essential if the person with ACS is to be an active participant in secondary prevention programs such as cardiac rehabilitation and adopt positive lifestyle modifications

■ Development of site-based guidelines and protocols to ensure adequate human and physical resources are allocated to provide chest pain **evaluation and monitoring within chest pain management units** for low and intermediate risk patients, if available. They will facilitate rapid access to exercise stress testing, echocardiography and nuclear medicine, particularly in the context of the new strategic reform initiative where speedy decision making in the emergency department is required.

3.8   Adoption of state wide guidelines and protocols

The Australia's 2006 Guidelines for the Management of ACS[1] plus 2007 update, are widely accepted as best practice and cover ACS across the continuum of care assessment, risk stratification, triage and treatment. Methods and materials to disseminate these guidelines to ensure adoption will be developed. Protocols to facilitate implementation of the guidelines must be developed locally in conjunction with key stakeholders.

3.9   Information and Communications Technology (ICT)

ICT solutions are required to

■ Strengthen **communication and clinical support** systems and maximise the functioning of integrated clinical pathways and patient management.

■ **Share current and previous investigation results** leading to integrated data collection and storing between hospitals, General Practice and emergency patient retrieval providers. Priority will be placed on ensuring that emergency departments and hospitals have access to cardiology investigations. As a minimum electrocardiography,

echocardiography, biochemistry, cardiac biomarkers and haematology at the 'point of care', coronary angiography, the clinic letter and reports. Options to engage private sector providers in sharing information are required. This should minimise duplication of pathology tests and aim to improve referrals for rehabilitation purposes.

■ **Standardised data collection** will be implemented to improve management of ACS, allocate resources rationally and influence change. Registries recommended: an ACS registry to provide information about demand, delays and key indicators to procedures and reperfusion. A PCI registry to assist in tracking outcomes after interventional cardiology in accordance with the national agenda.

3.10. Service issues for disadvantaged population groups

There are a number of challenges in the delivery of services to disadvantaged groups, identified as women, Aboriginal and CALD populations and those residing in rural and remote WA.

These barriers will be addressed through implementation of strategies identified in the model of care and listed below.

■ The **cardiology advice line** will improve equity of access and help to improve the confidence and knowledge of the workforce in peripheral metropolitan and rural and remote area health services.

■ Improve **access to tests** in rural and remote areas e g. cardiac enzyme biomarkers through the use of 'point of care' and 'bedside' testing.

■ Assess opportunities and viability for enhanced **outreach** cardiology pre and post care.

■ Establish a **standardised medication kit** at all country services to improve access to services and to assist in training, advice and handover on transfer.

■ Address **thrombolysis availability and confidence** issues by introducing and implementing agreed protocols, stock management systems and providing support

■ Employment of **Aboriginal staff** and access to interpreters for all who require them in all tertiary hospital cardiology areas will:

  ▪ Improve communication including explanations of procedures/diagnosis.

  ▪ Give support to patients and family.

  ▪ Improve links to appropriate services on discharge and Integration with other chronic disease programs.

  ▪ Promote adherence to treatments and appointments.

  ▪ Provide routine cultural awareness training for staff.

■ Provide funding for **culturally appropriate community based** services including prevention services. Improved referral pathways to culturally appropriate community based ongoing prevention/cardiac rehabilitation following an ACS event to ensure that Aboriginal and CALD patients receive ongoing optimal treatment and are not lost to care.

3.11   Workforce education and professional development

The model of care has implications for the current staffing levels, knowledge and skills of the workforce. These will be addressed through a number of strategies including reconfiguration of existing service delivery, revised roles and responsibilities, development of new services requiring additional resources and ongoing professional development programs for all health professionals including ambulance staff.

- Health service providers in all settings and locations require **education in the warning signs and symptoms of ACS**, the importance of seeking immediate emergency assistance and access to clear pathways and protocols of the shortest route to facilities for the diagnosis, risk stratification and management of people with suspected ACS.

- Competency based **education and training for all health professionals** delivering ACS care is critical to an educated workforce and ensures maintenance of best practice standards of care.
    - Minimum competencies:
        - Application of clinical guidelines and protocols including patient disposition pathways and transport.
        - Diagnosis, risk stratification and management of ACS.
    - Advanced competencies:
        - Administration of thrombolytic medication /anti-platelet regimes
        - Interpretation of 12 lead ECGs

    Improved access to education and training including on line self directed learning, Telehealth and specialist clinical support especially for rural health providers will be developed and implemented.

- The project to trial the introduction of 12 lead ECG capabilities into ambulances will map out the training implications.

- Investigate extending the use of **advanced practice nurses or a dedicated team** to manage chest pain. The absence of immediate medical staff in attendance should not delay the appropriate treatment for ACS by competent registered nursing staff.
    - Nurse administered drug therapy including the administration of thrombolysis and/or Intravenous Glycoprotein IIb/IIa Inhibitors will be trialled once support mechanisms such as protocols, training and advice lines are in place.
    - Nurse led secondary prevention clinics will be supported if the necessary clinical criteria have been met. Referral to appropriate cardiac rehabilitation services as part of the continuum of patient management.

- Structured mentoring, support and viable career pathways will be provided for Aboriginal and CALD workforce members to promote retention.

4. Model of care recommendations and implementation

4.1 Recommendations

Recommendation 1: Encourage early recognition of ACS symptoms by the patient

Raise community awareness of the warning signs of ACS to encourage early first contact with medical services. Promote emergency ambulance use via a 'call 000' campaign. Conduct research into the psychosocial and behavioural blocks to action.

Recommendation 2: Early diagnosis and risk stratification

■ Earliest possible access to a 12 lead ECG:
  ▪ To trial phased introduction into WA ambulances of technology to perform and transmit 12-lead ECGs in conjunction with appropriate training of ambulance officers and the support of a central clinically coordinated emergency advice line. If after an initial run-in and trial period, effectiveness is established then roll-out of this technology and training should continue to include all metropolitan ambulances and crews with the possibility of extension into appropriate rural areas to facilitate pre-hospital thrombolysis.
  ▪ Extend to all metropolitan and outer metropolitan sites , the redesign of patient flow through emergency departments where the ECG is performed on the ambulance trolley and the patient transferred immediately if eligibility criteria are met for PCI.
■ Ensure protocol driven blood tests for ACS are available at the "point of care". Where there are no on-site laboratories, uniform equipment, tests, quality control systems and protocols for bedside pathology will be made available.

Recommendation 3: Formal statewide coordination and integration

Formalised statewide linkages will be developed to ensure a consistent approach and co-ordination across all aspects of the health system. Based on a hub and spoke model access will be provided to:

■ Enhancement of existing services through a 24 hour, 7 day a week telephonic cardiology support line to provide treatment advice.
■ Clinical protocol driven retrieval service in collaboration with the Acute Care Network's clinical co-ordination and transfer service.
■ Standard medication kit, accompanying protocols and stock management systems for ACS patients at regional and remote centres
■ Improve the standardised administration of reperfusion via thrombolytic therapy
■ Bed and patient flow management system that ensures appropriate allocation of resources using strategies like PCI day case pathways, criteria led discharge and discharge summaries. Ensure sufficient

access to monitored beds in an area appropriately staffed by nurses who are able to interpret ECGs and act accordingly.

■ Chest pain management protocols will be established in all hospitals to guide chest pain evaluation and monitoring, particularly in low or intermediate risk patients. The use of advance practice nurses or a dedicated team to manage and assess chest pain is supported.

Recommendation 4: Coordination through two tertiary cardiology intervention centres

Based on the current realities of workforce scarcity in WA and supported by the evidence, two public tertiary centres running a 24 hour emergency cardiology intervention service are recommended, with the possibility of expansion to meet further population growth.

Recommendation 5: Guidelines, protocols and patient pathways

Protocols to facilitate implementation of the National guidelines for the management of ACS[1] will be developed in conjunction with key stakeholders (Appendix 3: list of proposed guidelines and protocols).

Guidelines and protocols that impact on the flow through emergency departments will rely on the evidence and attempt to meet the objectives of WA Health's new four hour emergency department strategic reform initiative.

Recommendation 6: Information and communication technology

Support the development of information and communication technology to enable the electronic sharing of investigations and results across and within hospitals. Investigate the minimum dataset for uniform data collection across the State. Develop ACS and PCI patient registries to monitor practice and patient outcomes.

Recommendation 7: Disadvantaged populations

Develop strategies in partnership with non government organisations and the Aboriginal Medical Services to address the disadvantage faced by Aboriginal and culturally and linguistically disadvantaged populations through the use of Aboriginal staff, Telehealth and interpreter services.

Provide support to WA Country Health Services though the clinically co-ordinated patient retrieval service, 24 hour cardiology advice line, the establishment of clear pathways and protocols to guide management of patients with ACS.

Recommendation 8: Workforce

Determine the workforce needed and develop and implement a statewide ACS workforce education and training plan to provide the requisite knowledge and skills. Pilot and extend the use of nurse-led models, where appropriate, to provide aspects of care such as: criteria led discharge, administration of thrombolysis particularly in remote areas without onsite medical cover.

Recommendation 9: Research needs

Identify research needs to inform and enhance care for acute coronary syndromes in WA. Some specific investigations needed are the:

- Impact of social marketing campaigns to promote early access to care and further research.
- Interpretation of cardiac enzyme blood biomarkers in a clinical setting.
- Effectiveness of the early access to 12 lead ECG strategies.
- Resource requirements to establish and maintain PCI and ACS registries.
- Development of key performance indicators for ongoing review, audit and evaluation of the impact of the ACS model of care.

4.2   A strategy for implementation

The acute coronary syndromes working party recognises that the recommendations require different levels of resources and length of time for implementation. It is envisaged that the Cardiovascular Health Network will form a working group/s to assist the Area Health Services with the implementation of the ACS model of care. A strategy for the phased implementation of recommendations is proposed below:

Phase 1: Achievable within existing resources and current service provision.

- In consultation with key stakeholders delineate areas from which patients with ACS should be transferred to the cardiac catheter laboratory.
- In consultation with key stakeholders map out the project scope for trialling 12 lead ECGs by ambulances, for improved bed management and criteria led discharge for patients with ACS.
- In consultation with WACHS develop guidelines for ACS interventions based on level of cover/staffing and equipment at the presenting site.
- Redesign flow for patients presenting with ACS through emergency departments to support the strategy of 'ambulance on hold till ECG results are available'.
- Review existing protocols at state and national level to determine areas of commonality amongst protocols and the ACS model of care.
- Ensure ACS specific input is provided to the clinically co-ordinated patient retrieval model.
- Form a data working group and determine what ACS related data is currently collected and establish a minimum dataset specifically focusing on reperfusion registries.
- Introduce two cardiac intervention centres onto the statewide planning agenda

Phase 2:   Require further planning and development.

- Establish formalised systemwide coordination and integration to ensure a consistent approach across all aspects of the health system and that appropriate patients are directed to facilities with the correct capacity
- Support Heart Foundation in their targeted social marketing campaigns
- Investigate procurement and stock management protocols with the relevant pharmaceutical companies to arrange a stock management system for rural and remote medication.
- Extend criteria led discharge to rural sites.
- Develop protocols in conjunction with key stakeholders to implement the 2006 national guidelines for ACS and 2007 addendum.
- Establish a business case for PCI and ACS registries.

Phase 3:   Require additional human resources, funding and endorsement.

- Design, funding and dissemination of standardised medication kit for rural areas
- Other projects will be determined as the process of consultation and prioritisation is established.
- Further expansion into appropriate rural areas to facilitate pre-hospital thrombolysis.
- Enhance Cardiac Rehabilitation capacity within the state through in-Hospital education, 'opt-out' status for rehabilitation and appropriate follow up at primary care level. Rehabilitation information and follow up should include various forms of media, focusing on cardiovascular disease, risk factors and other disease states impacting on the patient, family and carer.

Acronyms

| ACS	Acute Coronary Syndromes
CAD	Coronary artery disease
CCU	Cardiac Care Unit
ECG	Electrocardiogram
ICU	Intensive care Un
MI	Myocardial infarction
NATA	National Association of Testing Authorities
NSTEACS	Non ST segment elevation acute coronary syndromes
PCI	Percutaneous coronary intervention
PPCI	Primary percutaneous coronary intervention
STEMI	ST-segment elevation myocardial infarction
WACHS	WA Country Health Services

Glossary

Angina	Ongoing chest pain
Door-to-balloon time	Time taken from initial presentation to hospital triage to the opening of the target vessel, if feasible in the cardiac catheter laboratory at primary PCI is known as the door–to–balloon time
Coronary angiography	Coronary angiography is a procedure that uses a special dye (contrast material) and x-rays to see how blood flows through the heart
Echocardiogram (ECG)	An electrocardiogram is a test that records the electrical activity of the heart
Exercise stress testing	An exercise stress test is a screening tool to test the effect of exercise on your heart. It provides an overall look at the health of your heart
Episode of care	
Familial hypercholesterolaemia	Familial hypercholesterolemia is a condition passed down through families in which a person has high levels of "bad" cholesterol (low density lipoprotein) beginning at birth. The condition can cause heart attacks at an early age
Hospital separation	The term used for the completion process at the end of a patient's episode of care, be it a discharge home, death, transfer to another hospital or change of type of care
Myocardial infarction	Heart attack
Myocardium	Heart muscle
Myonecrosis	Death of cardiac (heart) tissue
Percutaneous coronary intervention	Angioplasty is a medical procedure to open narrowed or blocked blood vessels of the heart. These blood vessels are called the coronary arteries. Angioplasty is not considered to be a type of surgery. It is called a percutaneous coronary intervention (PCI). Primary PCI Rescue PCI
Pathology at point of care	Pathology provided on-site at the institution. If there is a 24 hour laboratory on-site testing is carried out there.
Pathology at 'bedside'	Pathology results available where the testing was done, at the bedside, within a short time
Reperfusion	Therapy to restore blood flow to the heart

Appendices

Appendix 1. Normal ECG complex and complex showing ST elevation
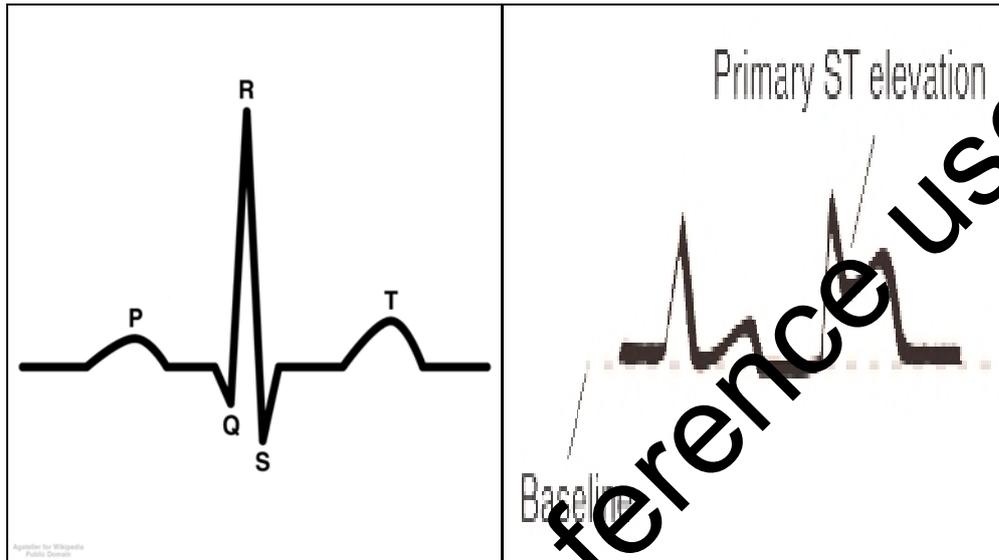
The ST segment refers to the section on the ECG between the point labelled S and that labelled T (Figure 1). If the ST segment is elevated (Figure 2) in two or more contiguous leads the diagnosis of ST-segment elevation myocardial infarction (STEMI) may be made. The distinction is made only on ECG but is crucial for early treatment decisions.

Appendix 2. Current service provision for acute coronary syndromes

Hospital with a Cardiac Catheter Laboratory	• Tertiary Hospitals – Royal Perth Hospital, Fremantle Hospital and Health Service, Sir Charles Gairdner Hospital • Private Hospitals – The Mount Hospital, Hollywood Private Hospital, St John of God Subiaco & Murdoch
Hospital providing emergency PCI service	• Tertiary Hospitals – Royal Perth Hospital, Fremantle Hospital and Health Service, Sir Charles Gairdner Hospital • Hollywood Private Hospital, St John of God Murdoch
Hospital with Emergency Departments	• General Hospitals - Peel Health Campus, Swan Districts Campus, Armadale-Kelmscott Memorial, Rockingham General Hospital, Joondalup Health Campus • Tertiary Hospitals • Private Hospitals - St John of God Murdoch
Country Health Services with an emergency role	• Regional Hospitals – Albany, Broome, Bunbury, Geraldton, Kalgoorlie, Port Hedland • Integrated District Health Services – 15 services • Small Hospitals – 50 hospitals • Multi Purpose Centres – 6 centres which AMS/ ACCOs • Nursing Posts – 16 nursing posts
Hospital with chest pain units	• Tertiary hospitals? • Private hospitals – The Mount, others??
Pathology services	• State laboratories and private providers
Patient Transport	• St John Ambulance • Other private ambulance providers • Royal Flying Doctor Service • Private Transport

Appendix 3: Suggested guidelines and protocols needed to implement the ACS model of care

System wide protocols customised for local conditions:

- Differentiating integrated patient pathways in different geographic settings and in relation to level of emergency care that is accessible
- Classifying the health care facilities based on medical and nursing cover, availability to ICU/CCU/HDU. Develop guidelines for each healthcare facility based on this information with regards to treatment, immediate and ongoing management
- When to use telephonic or electronic cardiology advice
  - Emergency decisions regarding time critical cardiology intervention
  - Indications for Contacting Cardiologists
  - Secondary decisions regarding ongoing management and transfer and retrieval in a coordinated manner – in liaison with the Acute Care Health Network initiative
- Ambulances
  - Pre-hospital 12 lead ECG use, transmission and interpretation
  - Emergency department bypass
  - Establish pathway where ambulance waits for ECG results to ensure transport to reperfusion if applicable and eligible
- Thrombolysis
  - Indications / Contraindications and use
  - Procurement of one form of thrombolytic agent to be utilised across the state
  - Use of Glycoprotein 11b/111a
  - By various levels of workforce including general practice, nurses, ambulance personnel
- Point of care testing
  - Interpretation and use including standardisation of equipment across the rural and remote areas.
  - Guidelines for the use, quality checks and calibration of the various point of care testing devices (in hard copy and, via the internet, electronic and video streaming) for biomarkers, biochemistry, haemoglobin and INR testing
- Use of chest pain management units
- Bed management strategies including PCI day cases, criteria led discharge
- Reperfusion Registry - recording and electronic transmission with a basic dataset for PCI (Primary and Rescue) and thrombolysis
- PCI Registry - recording and electronic transmission with a basic dataset to allow for comparison of 'real world' research and outcomes analysis. Principally (1) To establish a collaborative PCI registry with 30-day, 12-month and 5 year clinical follow-up and (2) facilitation of multicentred randomised clinical trials targeted at interventional cardiology.

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