



STEMI Annual Report 2016-2017



This Annual Report is produced by the Clinical Governance Department for St John Ambulance Western Australia to provide an overview of the STEMI pathway currently active in the Perth metropolitan area.

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Foreword

Deon Brink – General Manager Clinical Services St John Ambulance WA

Amazing things can happen when a group of passionate and talented professionals get together with a common goal. Lives change. Things we never thought possible happen. Aspirational targets become a reality. Our STEMI pathway is a shining example of the above. I am still constantly amazed by the incredible results our pathway has achieved for many patients since its inception in 2012. As will be seen in this report, our reperfusion times are on par with the best in the world - and in many cases better.

Although it looks like a simple process, in reality it is incredibly complex. There are so many parts (many occurring behind the scenes) that need to work synergistically to make it successful. This report is dedicated to all our clinical on-road staff, technical staff and the doctors and nurses from the Emergency Department and Cardiac Catheterisation laboratory who made this incredible pathway possible. This is improving outcomes for STEMI patients across Perth.

We are in the process of selecting our next generation of Cardiac monitor / ECG devices, and these will bring further opportunities for us. I am looking forward to the continuation of innovation and progression in the way our ambulance service deals with complex emergency and unscheduled care, as well as seeing the positive effect this will have on the community of Western Australia. It gives me great pleasure to introduce this report.

Dr Richard Alcock – Interventional Cardiologist, Royal Perth Hospital

Chest pain remains common and places a significant burden on healthcare services. Chest pain incorporates a spectrum of conditions; from life threatening heart attacks (STEMI), presentations with acute coronary syndromes who require emergent assessment and treatment, through to those with symptoms that require rapid outpatient management.

ST elevation myocardial infarctions (STEMI heart attacks) are acute life-threatening presentations that must be treated immediately. International guidelines recommend the benchmark of 90 minutes “door to balloon time”; that is the patient must have definitive treatment (by way of coronary angiography and stent deployment) within 90 minutes of presentation to an equipped hospital.

Historically, chest pain services were provided through locally agreed protocols and pathways, which led to inconsistent standards of care between centres and a disjointed, inefficient network through which patients were managed. A rationalisation and co-ordination of service delivery allows for more streamlined, efficient and safer pathways of care. The STEMI activation pathway provides a clear and concise framework for which urgent presentations should be managed.



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AMBULANCE
PARAMEDIC

PHILIPS

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Pulse RRM -? -? -? -? -? -?
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Monitor On Off AED Shock

UTC

HEARTSTART MRA

5



6
PULL RING
TO OPEN

Executive Summary

In 2012 St John Ambulance WA (SJAWA) introduced a new monitor defibrillator into service on paramedic ambulances. These Philips MRx devices are capable of performing a 12-lead ECG on patients who we suspect are having a heart attack. Its advanced diagnostic capabilities help with the interpretation of the ECG, identifying which patients will benefit from early Percutaneous Coronary Intervention.

This enabled us to develop our STEMI pathway in the Perth metropolitan area. The pathway identifies patients suitable for urgent intervention in the cardiac catheterisation lab to have their blocked artery opened. This saves valuable minutes and reduces the damage to their heart muscle.

Key results	2016	2017
Number of chest pain patients treated:	11,490	12,230
Number of STEMI patients:	282	285
Average call to hospital delivery:	53.3 Min	52.4 Min
Average contact-to-delivery time:	43.8 Min	43.1 Min
Average hospital door to balloon time (RPH):	38 Min	36 Min
Average call to balloon time:	91 Min	89 Min
Average on-scene to balloon time:	82 Min	79 Min
% Success rate for door to balloon time (RPH):	100%	100%

The above results are very encouraging and show a slight improvement in 2017 compared to 2016. This compares favourably with other states in Australia and the rest of the world. We are continually working with our partners in the health system to improve this pathway to have a positive impact on our patients' outcome.





Abbreviations

ALS	Advanced Life Support
AED	Automated External Defibrillator
AO	Ambulance Officer
Cath Lab	Coronary Catheterisation Laboratory
CPR	Cardiopulmonary Resuscitation
CSP	Clinical Support Paramedic
DoH	Department of Health
ECG	Electrocardiogram
EMS	Emergency Medical Services
EMT	Emergency Medical Technical
FSH	Fiona Stanley Hospital
FMC	First Medical Contact
MI	Myocardial Infarction (Heart Attack)
OHCA	Out-of-Hospital Cardiac Arrest
PCI	Percutaneous Coronary Intervention
PCR	Patient Care Record
RPH	Royal Perth Hospital
SJAWA	St John Ambulance WA
SJOGM	St John of God Murdoch Hospital
SCGH	Sir Charles Gairdner Hospital
STEMI	ST-Segment Elevation Myocardial Infarction
VF	Ventricular Fibrillation
WA	Western Australia

Definitions

Adults

Patients aged greater than 15 years of age, or where the age is missing/unknown.

Ambulance Officer

Crew member studying towards a degree in paramedicine.

Cardiac Catheterisation Laboratory

An examination room in a hospital with diagnostic imaging equipment used to visualise the arteries of the heart and the chambers of the heart and treat any stenosis or abnormality found.

Contact-to-Delivery Time

Time from a 12-lead ECG arriving at the patient to delivery to the hospital.

Defibrillation

Providing an electrical shock to a patient in a shockable rhythm.

Door-to-Balloon Time

International guideline recommending that the patient must have definitive treatment (by way of coronary angiography and stent deployment) within 90 minutes of presentation to an equipped hospital.

Emergency Medical Services

Denotes St John Ambulance WA paramedics, Volunteer Ambulance Officers or first responders, including community emergency response.

Metro

Denotes the Perth metropolitan area.

Paediatrics

Patients aged less than 15 years.

Paramedic

ALS Qualified Ambulance Officer.

PCI-capable hospital

Denotes a hospital with part-time or full-time Percutaneous Coronary Intervention (PCI) capabilities.

Percutaneous Coronary Intervention (PCI)

A non-surgical procedure used to treat narrowing (stenosis) of the coronary arteries of the heart. Also known as stenting. Performed in a Catheterisation lab.

Regional WA

Denotes areas outside the Perth metro area.

State Operation Centre

Triple zero (000) and non-urgent call centre.

Shockable Rhythm

Rhythms which are appropriate to receive defibrillation, including ventricular fibrillation and pulseless ventricular tachycardia, by EMS or a bystander with a public automated external defibrillator.

Transport Officer

Basic Life Support transport officers.

Volunteer Ambulance Officer

Unpaid Ambulance Officer providing emergency services to their community to emergency medical technician level.







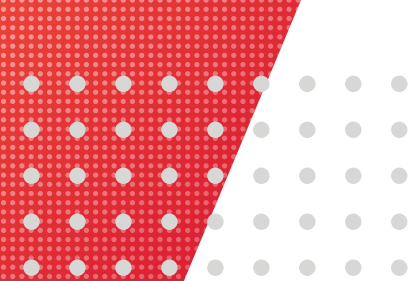
Introduction

Since 2012, St John has used the Philips MRx monitor/defibrillator on all paramedic ambulances. Using this device we can perform a 12-lead ECG on patients we suspect of having a heart attack. And in using its advanced diagnostic capabilities we can identify patients who could benefit from Percutaneous Coronary Intervention. We transport suitable patients directly to hospitals with cath labs to have their blocked artery opened sooner and thus saving valuable minutes.

In STEMI patients “Time is Muscle” - meaning that every minute delay in opening the artery increases the damage to the heart muscle. Once muscle dies, it does not further contribute to the function of the heart. The larger the area of damage, the more significant long-term dysfunction will become. Cath labs are currently available at these hospitals: Royal Perth, Sir Charles Gairdner, Fiona Stanley and St John of God Murdoch.

This report showcases and compares the 2016 and 2017 STEMI data and reperfusion times. It was compiled using data from Royal Perth Hospital and the SJAWA Performance and Planning department.





Heart Attack vs Cardiac Arrest

It is important to understand the difference between a heart attack and a sudden cardiac arrest. Unfortunately in popular media these terms are used interchangeably which is incorrect. Although both these events involve the heart (and the one can result in the other), they have different pathology and treatments.

Sudden Cardiac Arrest (SCA)

In Sudden Cardiac Arrest the victim's heart stops beating and fails to adequately pump blood around the body. This is predominantly caused by an electrical pathway fault and can happen without any symptoms or previous cardiac disease history. Survivors often describe the following

symptoms: sudden onset of severe chest pain; severe headache, rushing of blood in their ears; or simply no symptoms except blacking out. Survival often depends on the speed of recognition by bystanders, early interventions like effective chest compressions and the availability of a defibrillator.

In most cases the heart starts to fibrillate, that is, it starts to “quiver” instead of the organised, rhythmic contractions needed for maintaining circulation. The victim soon loses consciousness due to a lack of oxygen delivery to the brain and needs immediate CPR and early defibrillation. Every minute delay reduces the chance of survival by approximately 10 per cent. The delivery of an electrical shock “stuns” the heart muscle and allows it to reset itself into an organised perfusing rhythm.

In the best systems in the world, survival of this type of event is still only around 60 percent. In Western Australia this rate currently is approximately 37 percent. Survivors are often fitted with an implantable cardiac defibrillator that will automatically deliver a shock in case this event reoccurs. Please see the SJAWA Annual Cardiac Arrest Report for more details on the above.

Myocardial Infarction (MI)

A myocardial infarction or heart attack occurs where a coronary artery gets blocked. This blockage could be due to either a plaque forming over time, a blood clot forming somewhere else and then gets stuck in the artery, or a combination of both. Coronary arteries supply blood to the heart muscle, and the blockage reduces or cuts off the blood supply and thus oxygen delivery to that part of the heart. As time passes the heart muscle becomes injured and eventually dies due to a lack of oxygen. This could take minutes to hours depending on which vessel is affected. Once the heart muscle dies, it does not function as before and leads to long-term effects like cardiac failure.

Victims sometimes have warning episodes called Angina, where they experience chest discomfort on exertion, but it most often resolves with resting. This could be caused by a narrowing of the artery restricting blood flow to the heart during increased activity causing oxygen debt resulting in chest pain. They are often prescribed nitrates – a medication that dilates the artery during such an event, restoring the blood flow earlier and relieving the pain. Risk factors include high blood pressure, high cholesterol, sedentary lifestyle and family history of cardiac disease.

During a myocardial infarction, the pain usually starts suddenly, often without any strenuous activity, and is not relieved by resting. In general, the pain is quite severe and is often described as a crushing feeling in their chest (but could be in the jaw and arm). This is caused by a complete blockage in a coronary artery resulting in no blood flow to a part of the heart. Early emergency care access is essential in limiting the damage caused to the heart. Not all myocardial infarctions are the same, and for the purpose of this report we will be focusing on the ST-segment Elevation Myocardial Infarction – or STEMI.

Once in the cath lab, the Interventional Cardiologist opens the affected artery and places a stent to keep it open thus restoring normal blood flow to the heart muscle.





Our Guidelines

SJAWA follows internationally recognised standards of care for myocardial infarction patients. Treatment includes early identification using a 12-lead capable ECG, early administration of aspirin, nitrates and opiate pain medication. In addition to this, if the device indicates a potential STEMI, we transmit the ECG tracing to the closest PCI capable hospital for review by the emergency department physician. If a STEMI is confirmed (in most cases this occurs before we leave the scene), Heparin is administered to prevent the clot from getting bigger and the patient is transported directly to the cath lab.

This greatly reduces the time to intervention as the cath lab is activated prior to arriving at hospital. Early notification gives the cardiac team time to

prepare during the transport phase of the patient journey. Due to the quality of the ECGs obtained in the field, in most cases, there is no need to repeat them in the Emergency Department prior to taking the patient to the lab for PCI.

International standards for Door-to-Balloon time recommendations are as follows:

That the patient must have definitive treatment (by way of coronary angiography and stent deployment) within 90 minutes of presentation to an equipped hospital.

We have set ourselves a target of >90 minutes from call to device time. To achieve this, we are striving to deliver the patient within 60 minutes of the call to the hospital.

Results

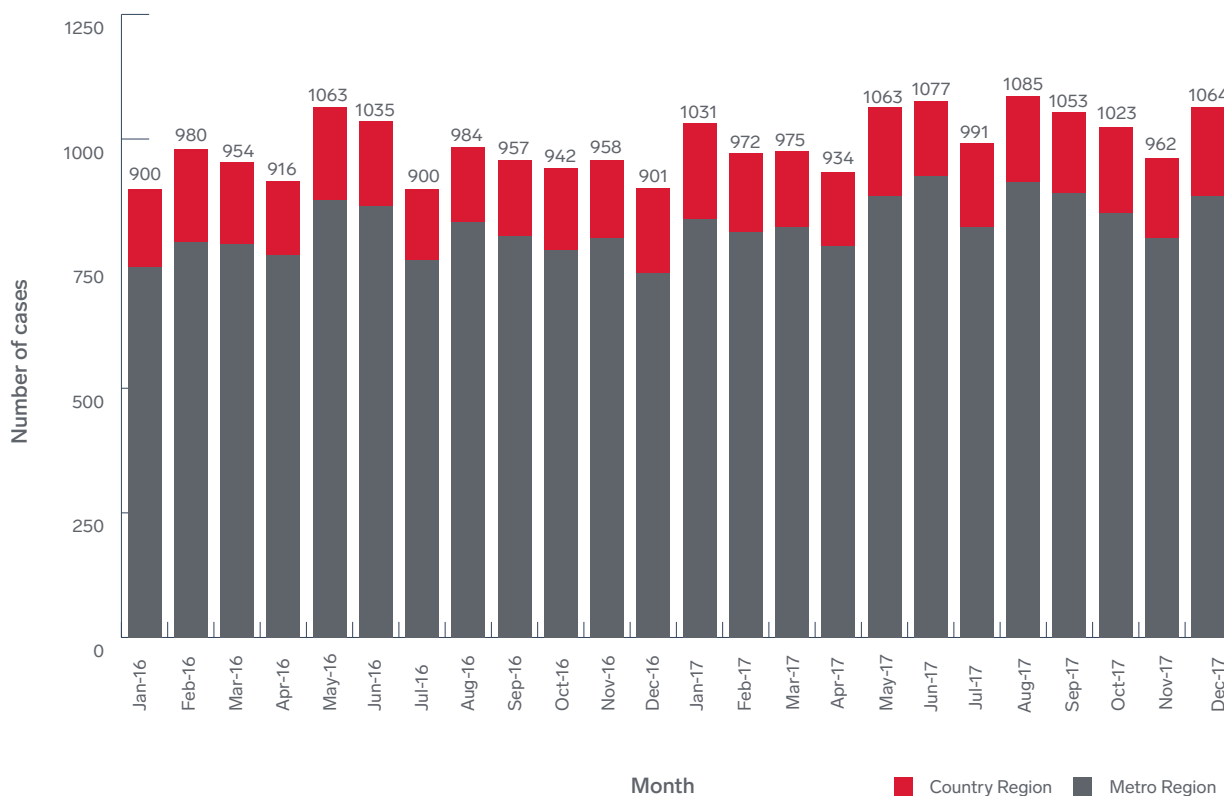
Many states in Australia now have a STEMI pathway in place. Some centres measure pre-hospital STEMI times from the time a 12-lead capable ECG arrives at the patient until the patient's artery is opened in the Cath lab (Contact-to-Device time). We believe that a more patient-centred time interval starts when the phone call is first received by the ambulance tasking authority (in our case the State Operations Centre) until delivery of the patient to the lab. By adding the Call-to-delivery time to the hospital door-to-balloon time, we have the total STEMI reperfusion time. All SJAWA paramedic ambulances are 12-lead ECG capable. We accept that this puts more pressure on us to achieve the guideline times, but we believe that this is better for patient outcomes.

Our pathway is continually reviewed to ensure it complies with contemporary practices. Fortunately for us this is made easy as there is great interagency collaboration between SJAWA and our partner cardiologists.

Number of chest pain patients in Western Australia

As can be seen from the below graph we treated around 11,490 chest pain patients in 2016. This increased by almost 7 per cent in 2017 when we attended 12,230 chest pain patients.

Number of chest pain patients in Western Australia

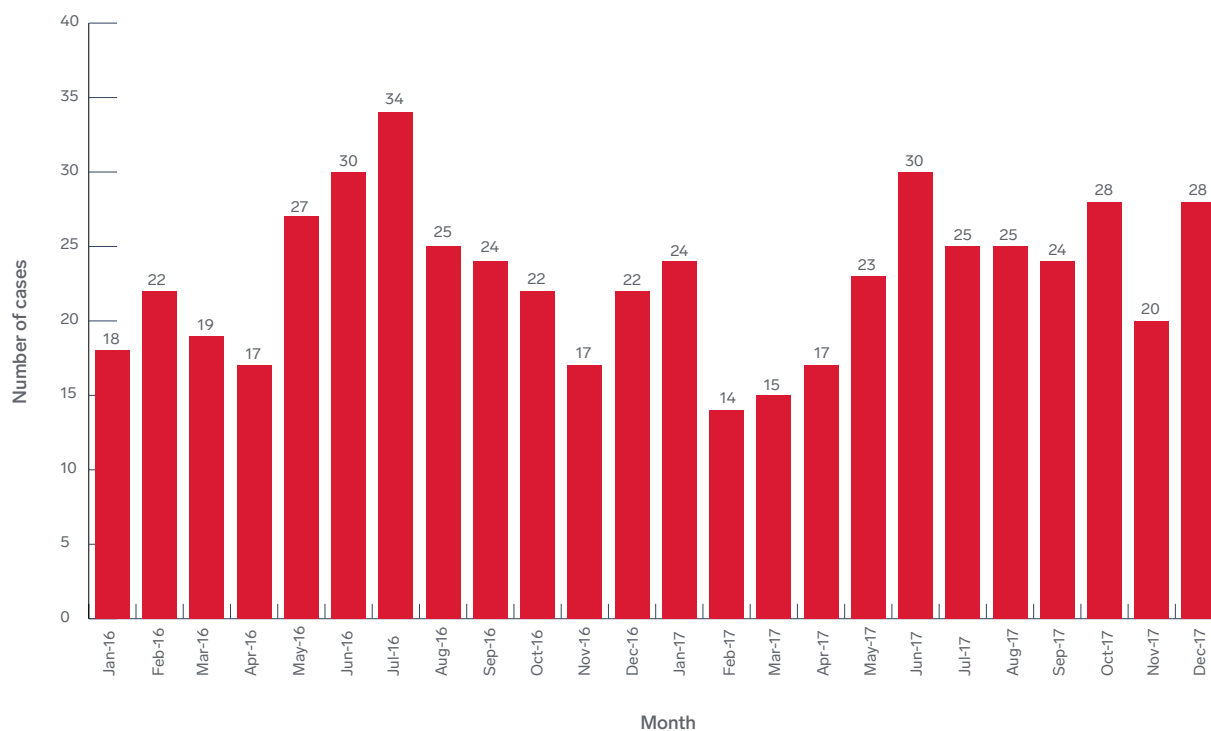


STEMI pathway activations

As cath labs are currently only available in the Perth metropolitan area, we can only focus on metropolitan based chest pain patients in this report. In 2016, 282 patients benefitted from this pathway and were transported directly to a PCI capable hospital. This essentially remained unchanged in 2017, with 285 patients.

This does not mirror the 7 per cent increase in chest pain patients. Even though our pathway is very accurate, not all STEMI patients can be identified in the pre-hospital setting. This could account for the almost no increase in STEMI patients. Reasons for this will be discussed in greater detail later in the report. The graph below shows the monthly variability in STEMI cases for 2016 and 2017.

Number of STEMI patients transported directly to cath lab 2016/2017

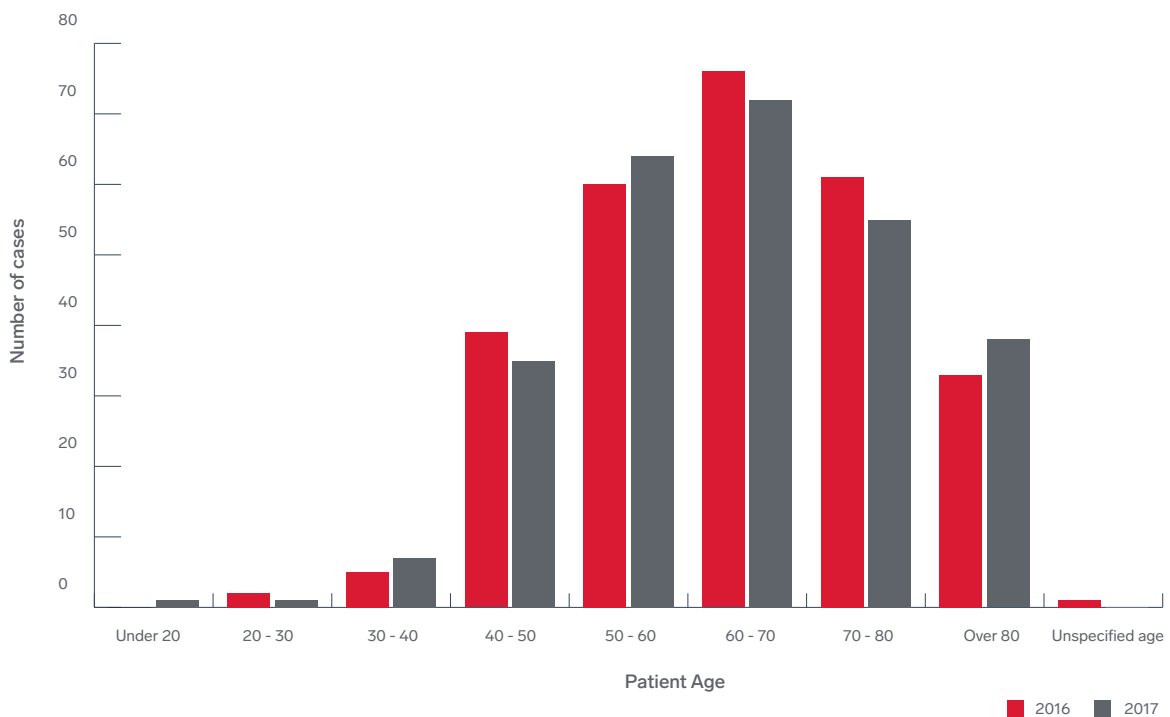




Age Distribution

There has not been a significant change in the age distribution of STEMI patients between 2016 and 2017. The age distribution is showed below. The mean age for STEMI patients in Perth has increased slightly from 62.2 to 62.4 years. This was mainly due to the increase in the 50-60 and over 80 age groups.

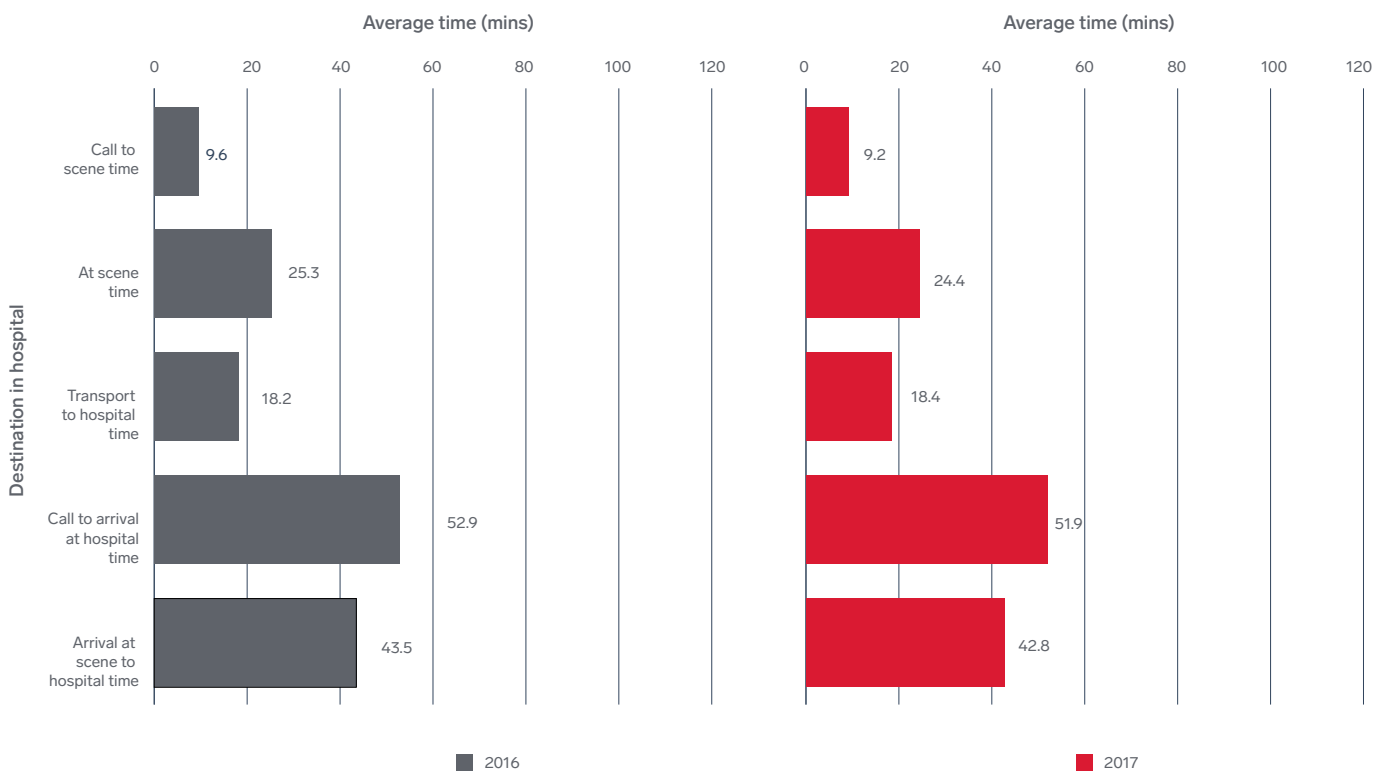
Age distribution for patients entered into the STEMI pathway



Times achieved

On average, we deliver a STEMI patient to hospital within 52 minutes from the emergency call. When adjusting this for Contact-to-Delivery time, STEMI patients arrive at hospital within 43 minutes after a 12-lead capable ECG equipped ambulance arrives at the patient. When comparing 2016 to 2017, we have reduced our average delivery to hospital time by almost a minute. We are continually striving to improve this time and it can be seen in the graph below.

Time breakdown for STEMI patients 2016/2017

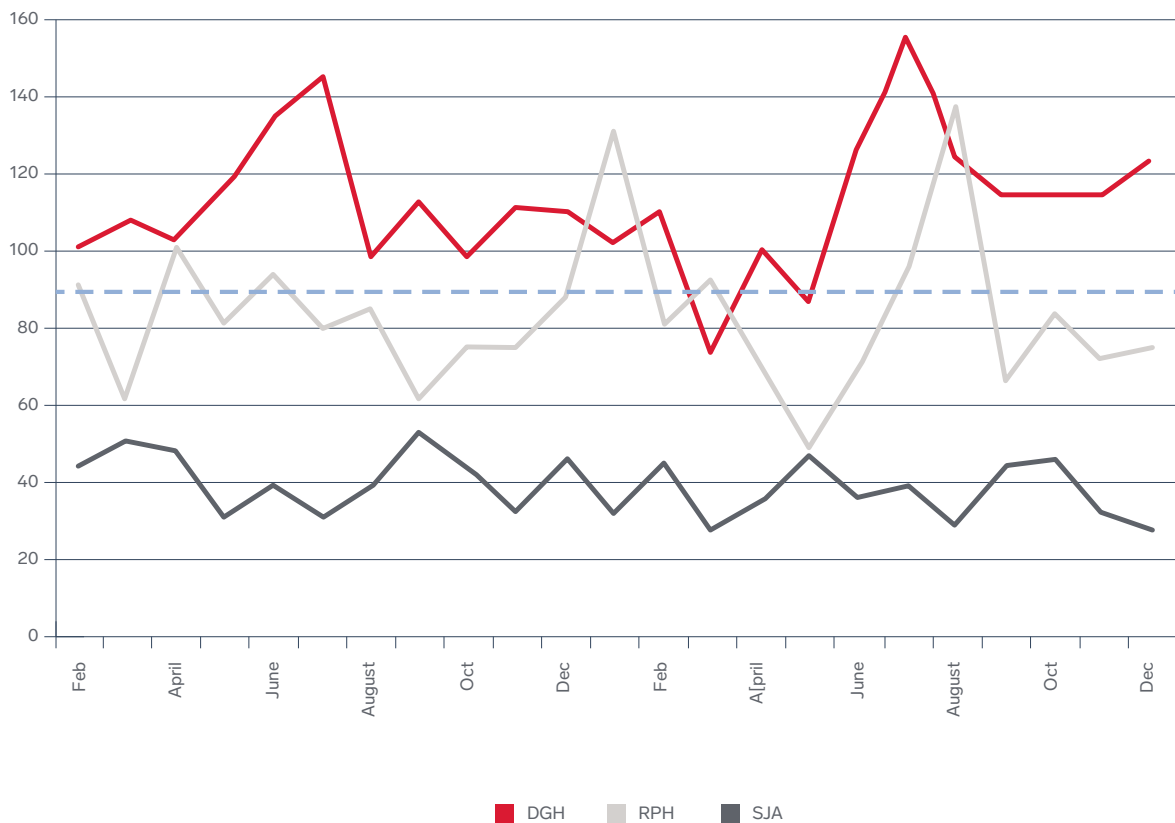


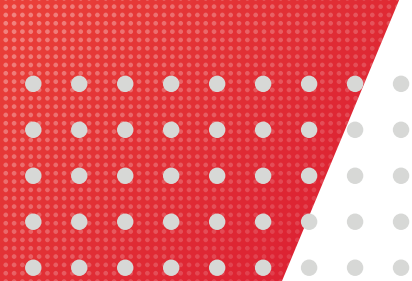
RPH Door-to-Balloon times

Delivering the patient to the PCI capable hospital is only one part of the equation. As stated previously, the main success of this pathway is the early identification and notification allowing cath lab preparation during the transport phase. We are fortunate to have access to the Royal Perth Hospital data as can be seen in the graph below.

If we compare the in-hospital STEMI group to the ambulance STEMI group, we can see a significant time saving for door-to-balloon time in the ambulance group. Furthermore, it also displays patients from district general hospitals (DGH) who are transferred to Royal Perth Hospital after first attending their local ED.

Door-to-Balloon times at Royal Perth Hospital, Perth, Western Australia





As can be seen from the above, the pre-hospital STEMI pathway has had a significant time saving over all other means of arrival at hospital. When combining the two times (pre-hospital and in-hospital) together we see that on average, a STEMI patient will have their artery opened within 91 minutes after making the triple zero (000) call, or within 82 minutes after a 12-lead capable device arrives at their side, well within the 90 minute target. This is due to the following:

- Early recognition of a STEMI.
- Early activation of the cath lab.
- Time taken to prepare the lab and the team is done while the patient is being transported to hospital.
- Rapid transport using lights and sirens to the appropriate facility, often bypassing the local district hospital's Emergency Department.
- Delivering the patient directly to the cath lab (bypassing the Emergency Department) as the lab is already activated and ready.

It must be noted that in a few rare instances we might still be accessing the cath lab through the Emergency Department. Most often this is due to the following:

- Very short transport time, and the lab is not ready.
- The cath lab team is performing a procedure on another patient and not ready for our patient yet.
- The patient is too unstable to go directly to the lab and needs further emergency intervention first.

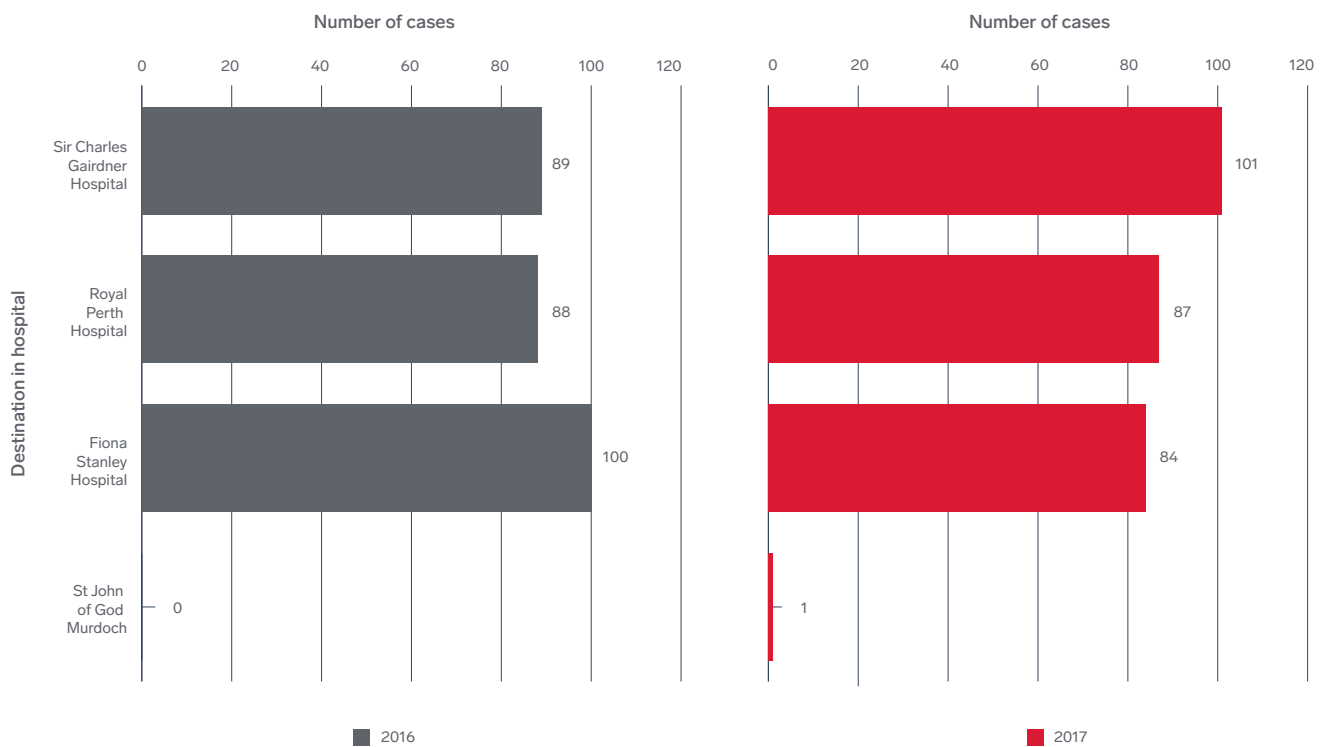
The above mentioned patient cohort is included within the delivery-to-hospital time, but then would be excluded from the St John STEMI pathway time, as they did not enter the pathway.

Although the above in-hospital times are only presenting the RPH data, we are confident that the other three hospitals will have similar times.

Hospital Distribution

Hospital distribution has changed slightly between 2016 and 2017. While Royal Perth Hospital (RPH) has remained stable, Sir Charles Gairdner Hospital (SCGH) has received the most STEMI pathway patients in 2017 compared to Fiona Stanley Hospital in 2016. St John of God Murdoch, the only private hospital offering this pathway, had 1 pre-hospital activated patient in 2017.

Hospital distribution for STEMI patients



As stated previously, in some instances, STEMI patients can deteriorate en-route and bypassing a peripheral hospital is not possible. This occurred in 11 cases in 2017.



Conclusion

As technology improves more options become available for patients with correctable/reversible conditions such as STEMI. Improved communication and collaboration between all role-players as well as advanced pre-hospital diagnosis of these events makes these pathways possible.

This report highlights the many lives that have been positively effected as a direct result of the timely intervention delivered by paramedics and hospital based teams. This is a direct result of the timely interventions they received due to the dedication of countless medical professionals. At SJAWA we are incredibly proud of these results and our involvement in this process. As an ambulance service, we have been committed to improving patient care and outcomes in WA for almost 100 years, and this pathway is only one of many such initiatives to achieve this.

We continue to work with our partners in health, hospitals and the community to achieve this. We have commenced a replacement program for our MRx devices on all of our ambulances. This will provide us with new opportunities of improvement due to newer technology. Next year we are looking forward to expand this report to include our incredible work around stroke patients.

Acknowledgements

We would like to acknowledge and thank the following people and departments for their assistance in providing the data and input that made this report possible:

- 1) St John Ambulance WA Clinical Governance Department.
- 2) St John Ambulance WA Performance and Planning Department, in particular Olivia Turton and Ellie Balson.
- 3) Dr Richard Alcock, Interventional Cardiologist, RPH.

We would also like to acknowledge all of our clinical on-road staff for wholeheartedly embracing this pathway, as well as our Technical and IT staff for their behind-the-scenes expertise in making it a resounding success. Finally, without the support and dedication of all the various cath lab and Emergency Department staff, this pathway would not have been possible.





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