

Department of Human Services

Review of Chest Pain Evaluation Areas

Final Report

KPMG Consulting
14 December 2000

This report contains 1 pages
Appendices contain 9 pages
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1 Executive Summary

1.1 Overview

The Department of Human Services (the Department) provided funding to establish pilot Chest Pain Evaluation Areas (CPEAs) at three Melbourne metropolitan acute care hospitals. The aim of the CPEA model of care is to identify and evaluate chest pain patients with low to moderate risk of myocardial infarction, enhancing patient outcomes and utilisation of hospital resources by improving the time to accurate diagnosis and management of ischaemic causes of chest pain.

Two aims were established for the pilot projects:

- to improve outcomes for patients who experience chest pain that is not immediately attributable to AMI or non-cardiac origin following initial physician assessment, and who have a low to moderate risk of Coronary Heart Disease, and death or non-fatal myocardial infarction; and
- to improve the utilisation and cost effectiveness of hospital and system resources through improved management of cardiac patients with chest pain.

A methodology to evaluate the pilot programs was developed and refined by a Project Working Party consisting of representatives of the Department and participating hospitals¹.

KPMG was initially engaged to undertake a costing analysis for the CPEA pilot programs. The scope of engagement was then extended to include an overall evaluation of the CPEA model of care, synthesising the findings of evaluations conducted by the three participating hospitals together with the KPMG costing study, to determine hospital and system level impacts resulting from CPEA implementation, by identifying:

- the overall impact of the CPEA model of care at each hospital, including major differences and the reasons underlying these differences; and
- the impact of the CPEA model at the system level, including whether CPEAs are recommended for incorporation into the Victorian hospital system and, if so, what funding model should be adopted

Overall findings are detailed in the current report².

¹ Members of the Working Party are listed in Appendix 1.

² Individual hospital reports can be obtained by contacting the emergency physician or cardiology representatives on the Project Working Party listed in Appendix 1.

1.2 Protocol differences

Two different CPEA models were established across the three hospitals, with The Alfred adopting an integrated Emergency Department-CPEA model of care and, the Royal Melbourne Hospital (RMH) and Monash Medical Centre Clayton (MMC) adopting stand-alone facilities.

Whilst admission criteria were generally comparable across the three hospitals, differences were observed at MMC, where normal cardiac enzymes and absence of chest pain at time of admission were required.³ Variations in average duration, number and frequency of cardiac enzyme measurement, provision of inpatient investigations were observed and are reported in Section 3.2.2.2.

Inpatient admission criteria to the CCU, monitored or non-monitored beds also varied slightly and were consistent with differences in inpatient bed configurations between the three hospitals.

1.3 Key findings

1.3.1 Patient outcomes

Evidence available from the hospital evaluations indicated support for the first aim of the pilot projects:

“to improve outcomes for patients who experience chest pain that is not immediately attributable to AMI or non-cardiac origin following initial physician assessment, and who have a low to moderate risk of Coronary Heart Disease, and death or non-fatal myocardial infarction”

- a large proportion of CPEA patients received a diagnosis of “non-cardiac” or “unknown” chest pain, indicating that more serious underlying causes could be excluded prior to discharge. Home discharge was particularly high for the CPEA group of patients. These findings were consistent with previous literature in which CPEA units have been implemented and evaluated, and suggest that the high rate of home discharge may be attributed to the operation of the CPEAs.
- substantial improvement (reduction) in the time to outpatient investigations was also observed, representing a significant outcome for patients who can be informed of the nature of their medical condition.
- evidence available at 30-day follow-up indicated that there was no increase in the number of missed AMI’s following introduction of the CPEA protocols.
- re-presentations remained constant in the context of a (likely) increase in the number of patients discharged home, indicating appropriate provision of ongoing care. Examples of such care are evident in the higher number of outpatient appointment bookings.

³ These differences were attributed to the lower average level of CPEA patient acuity (using triage category as a proxy measure) observed for the MMC compared to the RMH and The Alfred.

- the number of planned outpatient investigations was also observed to increase, especially where appointments were booked directly from the CPEA.
- a significant reduction in the time to positive or negative outpatient investigation results for Exercise Stress Testing (EST) and Nuclear Imaging was observed following implementation of the CPEAs.
- incorporation of EST as part of CPEA protocol appeared to contribute to a higher proportion of “non-cardiac chest pain” diagnoses at discharge from RMH, followed by MMC and then the Alfred.
- differences in patient outcome between the three hospitals, attributed to CPEA protocol or the experience of nursing staff, were not apparent.
- only two deaths were observed during the project period. Both events were not attributed to CPEA protocol failure. One death occurred for a re-presenting CPEA patient, who was diagnosed with AMI and who suffered a further fatal AMI 26 days following discharge. The second death occurred for a patient, who was taken off the CPEA protocol and was awaiting an Inter-Hospital Transfer (IHT) to a monitored bed at another hospital for further investigation and management.
- qualitative reports from the participating hospitals indicated:
 - a positive benefit from introduction of standardised protocol-driven assessment and management;
 - a positive benefit for low-moderate risk chest pain patients from early investigation and follow-up.

1.3.2 Hospital and system resources

Evidence available from the hospital evaluations and the costing study also indicated support for the second aim of the pilot projects:

“to improve the utilisation and cost effectiveness of hospital and system resources through improved management of cardiac patients with chest pain”

Regarding hospital resources:

- a higher number of chest pain patients were discharged home and a lower number were admitted to an inpatient bed following implementation of CPEA, indicating improved efficiency in allocation of hospital resources.
- an overall reduction in the cost of treating chest pain patients was apparent at each hospital, demonstrating efficiency gains following the introduction of the CPEAs. The greatest efficiency gains were associated with significant reductions in ward utilisation.

- in general a smaller number of CPEA patients were admitted to the CCU and to non-monitored beds in comparison to the total group of chest pain presentations.
- as expected, a higher proportion of patients with a diagnosis of AMI or Unstable Angina were admitted to CCU or monitored beds, and a higher proportion of patients with a diagnosis of "non-cardiac" or "unknown" chest pain were admitted to non-monitored beds.
- with specific regard to the CCU, bed utilisation of ED chest pain patients was also observed to decrease in line with the overall decrease in the use of inpatient beds. Qualitative reports have also indicated that more "appropriate" patients had been admitted to the CCU following the implementation of the CPEAs.
- on average, between 1 and 1.5 patients were admitted to the CPEAs per day, and maximum occupancy of CPEA beds was achieved between 3 and 5 occasions over the 15-month period.
- costing approaches indicated that a more efficient approach to resourcing the CPEA is to regard it as a part of the ED rather than a separate unit and to take a flexible approach to staffing based upon occupancy.
- qualitative reports from the participating hospitals indicated:
 - increased collaboration between medical and nursing staff. Formalised arrangements facilitated shared medical responsibility and specialist nursing staff positively contributed to skill mix in the Emergency Department (ED);
 - a negative perception of increased work load for ED staff, particularly relating to provision of "inpatient" care and data and administrative requirements; and
 - a need to reconsider the separate location of CPEA from the ED, as difficulties were reported to occur when CPEA staff relief was required from the ED.

Regarding system resources:

- an increase in the number of chest pain presentations was not observed between baseline and comparison group periods for the hospitals with pilot projects, and future monitoring is required to investigate whether chest pain presentations increase at hospitals with CPEAs, due to a greater public awareness of the CPEAs.

1.4 Recommendations of the evaluation

The overall evaluation of CPEAs supports the continuation (and future development) of the CPEA model of care in the Victorian hospital system.

In order to enhance the ongoing development of this approach to evaluation and management of low to moderate risk chest pain patients, three additional recommendations are presented, including:

1 Hospitals intending to implement CPEAs should consider adopting prospective investigations

In order to gain a further understanding of the impact of CPEAs for hospitals wishing to implement this model of care, a prospective evaluation design is recommended in order to:

- capture a broader range of tailored information from all CPEA patients and minimise the occurrence of missing data; and
- administer protocols to identify low to moderate risk chest pain patients who receive standard ED management, and compare this group of patients with patients receiving treatment from an operational CPEA unit.

1.2 Hospitals with CPEAs should establish and refine indicators for ongoing CPEA evaluation.

Based upon the current project outcomes the following indicators might be considered as a basis for further development:

- the percentage of CPEA patients discharged home;
- the percentage of CPEA patients admitted for further inpatient care;
- the average time to positive/negative outpatient investigation results;
- the number of CPEA patients discharged home with a definitive “non-cardiac” diagnosis; and
- the number of CPEA patient re-presentations.

A broadening of future indicators is also recommended, to include regular follow-up of patients discharged directly home from the CPEA, and consideration of the use of satisfaction measures.

3. The Department of Human Services should adopt a casemix funding model

Following an evaluation of the clinical and costing outcomes for the CPEA pilot projects, it is our view that casemix payment of CPEA patients is an appropriate approach. However it is noted that:

- an assessment is required of the viability of ensuring that the case weight for CPEA does not differentiate between patients designated as “same day” and those whose stay spans midnight;
- CPEAs require up-front capital for equipment and infrastructure;
- each hospital needs to ensure that ED/CPEA funding flows through to the ED/CPEA;
- “investment returns” may accrue in terms of additional patients treated rather than cost savings.

Specific details supporting this approach to ongoing funding are presented in Section 8.1.3.

1.5 Disclaimer

Please note that, in accordance with our Company's policy, we are obliged to advise that neither the Company nor any member nor employee undertakes responsibility in any way whatsoever to any person or organisation (other than the Department of Human Services) in respect of information set out in this report, including any errors or omissions therein, arising through negligence or other wise however caused.

In the course of our work, projections have been prepared on the basis of assumptions and methodology which have been described in our report. It is possible that some of the assumptions underlying our projections may not materialise. Nevertheless, we have applied our professional judgement in making these assumptions, such that they constitute an understandable basis for estimates and projections. Beyond this, to the extent that certain assumptions do not materialise, then you will appreciate that our estimates and projections of achievable results will vary.

2 Introduction and approach

2.1 Background to the pilots

In accordance with the recommendations of the Ministerial Review of Coronary Care Services in Victoria (1997), the Department of Human Services provided funding to commence pilot testing of Chest Pain Evaluation Areas (CPEAs) in Victorian public hospital Emergency Departments. CPEAs were trialed to evaluate patients with low to moderate probability of myocardial infarction, in order to establish whether the quality of patient care and use of hospital resources for this group of patients could be further enhanced.

A review of the medical literature has indicated that, in the absence of a CPEA protocol, standard treatment in the Emergency Department for patients presenting with chest pain has been susceptible to two undesirable outcomes:

- a large proportion of chest pain patients may be admitted to acute hospital beds in order to rule out AMI or significant cardiac ischaemia. Fortunately, only a few of these patients are subsequently identified to have an AMI. However, in order to identify these few, costly resources are devoted to excluding significant cardiac disease for many patients; and
- a small proportion of patients with atypical signs and symptoms may inadvertently be discharged home from the Emergency Department and subsequently have an AMI, placing them at significantly higher risk of mortality than patients with AMI who are admitted to hospital.

Accordingly, the CPEA model of care has been implemented in other countries to improve the efficacy of patient assessment in order to maximise health outcomes for individual patients, and to promote efficient use of hospital resources devoted to investigation of chest pain.

The Department sought expressions of interest and submissions to establish a pilot CPEA unit from four Victorian metropolitan acute care hospitals with Level 1 Emergency Departments and Level 4 Coronary Care Units. Three hospitals participated in the pilot project:

- The Alfred Hospital;
- The Royal Melbourne Hospital; and
- Monash Medical Centre, Clayton.

Two general aims were established for the CPEA pilot projects at each hospital:

- to improve outcomes for patients who experience chest pain that is not immediately attributable to AMI or non-cardiac origin following initial physician assessment, and who have a low to moderate risk of Coronary Heart Disease, and death or non-fatal myocardial infarction; and
- to improve the utilisation and cost effectiveness of hospital and system resources through improved management of cardiac patients with chest pain.

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Additional aims relating to the CPEA pilots were established for each facility and are outlined below.

■ For the Alfred Hospital, centre-specific aims were:

- to assess the safety and efficiency of a risk based protocol for patients presenting to the Emergency Department with chest pain; and
- to improve the provision of patient diagnosis by investigating chest pain in a timely way.

■ For the RMH, centre-specific aims were:

- to assess the effectiveness of implementing a rapid diagnostic protocol, to rule out low-moderate risk acute coronary syndrome (ACS) in patients who present to the emergency department with chest pain that is not attributable to AMI or non-cardiac origin;
- to alter the traditional process of investigation of patients, resulting from ED presentation of chest pain not directly attributable to ACS or non-cardiac origin, to a rapid diagnostic protocol that dictates the most appropriate form of investigation and the timing of it;
- to provide a protocol driven risk-stratifying process that determines the most appropriate form and timing of cardiac follow up for patients diagnosed with ACS; and
- to introduce Troponin-I as an additional cardiac bio-marker to rule out ACS.

For the MMC, centre-specific aims were:

- to improve the efficiency of patient assessment on presentation to the emergency department with chest pain;
- to determine the impact of a chest pain evaluation area on the rate of inter-hospital transfers from the emergency department that is due to bed block; and
- to enhance cardiology involvement within the emergency department through improved communication and facilitation of opportunities for ongoing education of emergency department staff.

Each of these hospital-specific aims were to be assessed by the respective facilities to determine additional benefits arising from the introduction of the CPEAs and are not specifically reviewed in the current evaluation⁴.

A Project Working Party was appointed to assist in project development and evaluation. This approach was designed to ensure consistency in significant aspects of the pilots, such as the evaluation methodology, and data collection.

⁴ The reader is referred to Section 4.3 in each hospital report for an evaluation of hospital-specific aims.

The responsibilities of the Working Party included:

- assessing options for evaluation of pilot projects and determining the most appropriate evaluation methodology;
- determining information required for evaluation, including clinical (minimum data set) and financial data;
- developing mechanisms for collection of information required for evaluation; and
- monitoring the implementation of the projects.

Members of the Working Party are presented in Appendix 1.

In order to evaluate the aims of the CPEA pilot projects, the Working Party established minimum data requirements and timelines for evaluation. Three components of the pilot projects were to be reported, including:

- a baseline group of patients, who presented to the Emergency Department of each hospital with chest pain. A subgroup of these patients received telephone follow-up from the Emergency Department (ED) to establish clinical outcomes and treatment-related costs associated with existing management of chest pain (CP). The duration of baseline data collection was approximately 2 months for each of the three facilities. Baseline data was entirely prospective at RMH (N=611), entirely retrospective at MMC (N=516), and a combination of prospective and retrospective at The Alfred Hospital (N=412);
- patients presenting to the Emergency Department with chest pain who fulfilled specified criteria and were admitted to the CPEA unit for investigation and monitoring. The duration of CPEA operation was approximately 15 months for each of the three facilities⁵; and
- a comparison group of patients, who presented to the Emergency Department of each hospital with chest pain, some of whom fulfilled specified protocol criteria and were admitted to the CPEA unit for investigation and monitoring. The number of comparison group patients at RMH (N=605), MMC (N=557), and The Alfred (N=408) approximated baseline samples at each hospital. A subgroup of all comparison patients received telephone follow-up from the ED to identify changes in clinical outcome and treatment-related costs following the introduction of the CPEA protocol.

2.2 Objectives of the evaluation

KPMG was initially engaged to undertake a costing analysis of the CPEA pilot programs. The scope of engagement was then extended to include an overall evaluation of the CPEA model of care, synthesising the findings of evaluations conducted by the three participating hospitals together with the KPMG costing study, to determine hospital and system level impacts resulting from CPEA implementation.

⁵ CPEA pilots were funded for an 18-month period. Clinical data included in this report relates to a 15 month period of CPEA operation.

In accordance with these terms, and the constraints of the existing framework established for evaluation, the current report presents a review of:

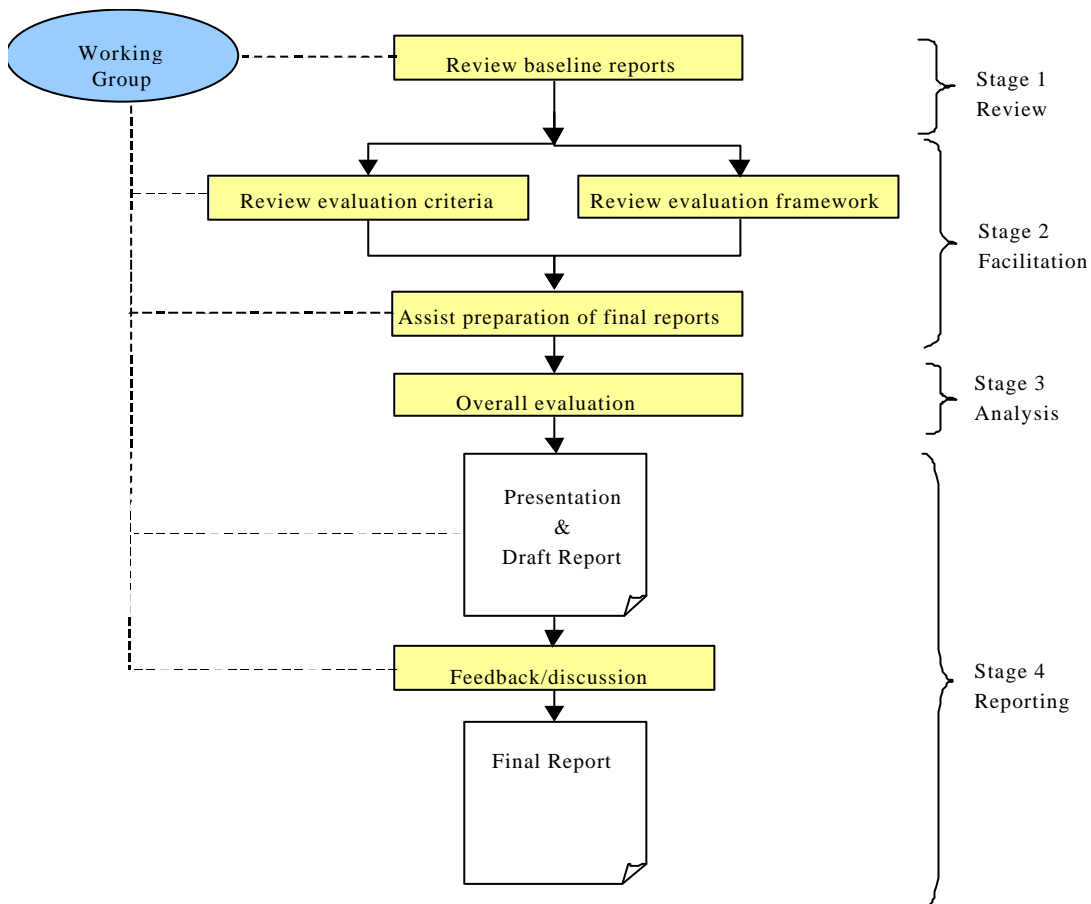
- the overall impact of the CPEA model of care at each hospital, including major differences and the reasons underlying these differences; and
- the impact of the CPEA model at the system level, including whether CPEAs are recommended for incorporation into the Victorian hospital system and, if so, what funding model should be adopted.

Overall findings are detailed according to:

- the characteristics of CPEAs established at each hospital;
- the impact of the CPEA upon the Emergency Department at each hospital;
- the impact of the CPEA upon each Hospital;
- the costing analysis; and
- an overall evaluation.

2.3 The approach

The review was undertaken in four stages, outlined in the following diagram. Our approach to the costing analysis is presented in Section 7.



2.3.1 Stage 1 Review baseline reports

At the commencement of the overall evaluation, the baseline reports prepared by the three CPEA projects on their first six months of operation were reviewed. These reviews were used to inform the development of a framework for the final hospital evaluation reports. The focus of the framework was to ensure that hospitals were providing consistent data in areas of interest to the evaluation.

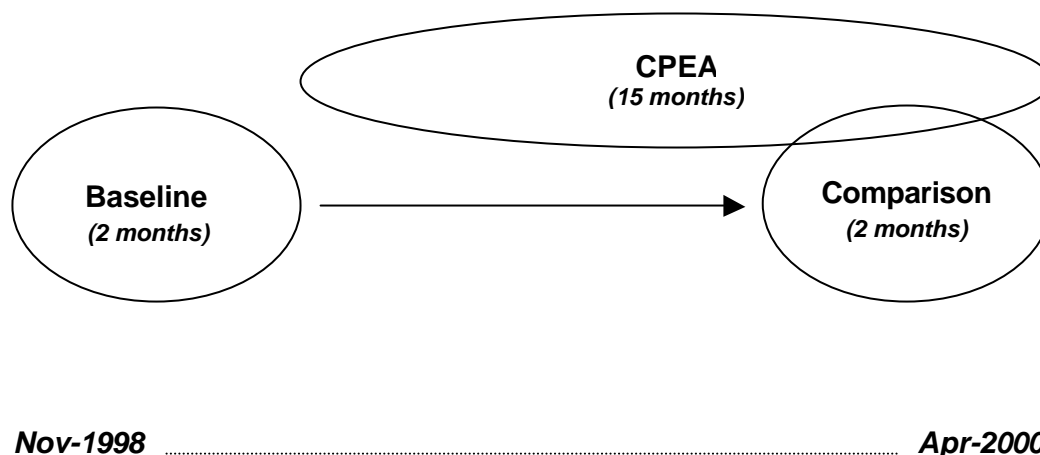
2.3.2 Stage 2 Facilitate production of centre-specific reports

Facilitation of centre-specific reports comprised three components:

- a review of the evaluation criteria, focusing upon those for which data were collected at baseline and during the period of CPEA operation. These criteria were then circulated to all pilot project groups within each hospital for discussion, refinement and agreement;
- a review of the evaluation framework, comparing processes and protocols established for the CPEA units in each of the three hospitals. This was undertaken to clearly delineate where differences may impact upon clinical outcomes or costing. Again, similarities and differences in CPEA protocol were circulated to all pilot project groups for discussion, refinement and agreement; and
- establishing a framework for the final reports. This framework was constructed to outline differences in process or protocol at each facility and report key evaluation criteria consistently across the three hospital sites. A pro-forma report structure was constructed and refined through feedback between the consultants, the pilot project participants and the Department. The specific structure of, and rationale for, the reporting framework is presented in the following section.

2.3.3 Stage 3 Analysis of findings

The evaluation was conducted following receipt of the final reports from each hospital. Given the structure and set-up of the pilot programs, as determined by the Working Party, the approach to evaluation was conducted in three phases, depicted in the (Venn) diagram below.



Firstly, differences between all chest pain presentations to the ED reported in the pre-CPEA and post-CPEA groups were examined. The arrow between *baseline* and *comparison* groups in the above diagram represents this analysis. Due to the evolving nature of the CPEA pilots⁶ and practical constraints upon data collection during the project period, patients in the baseline group were not classified according to CPEA protocols to identify those who would have been eligible for CPEA admission. As such, direct comparisons between CPEA-eligible patients receiving standard ED/Hospital treatment and CPEA-eligible patients receiving CPEA protocol/hospital treatment were not available.

Secondly, where differences between baseline and comparison groups were apparent, the subgroup of comparison data for patients who underwent the CPEA protocol was examined. This group was examined separately in an attempt to estimate whether the magnitude of the change observed between the pre-CPEA and post-CPEA groups may be similar to the characteristics of the CPEA patients in the comparison group. This analysis is represented in the above diagram by the *comparison-CPEA* intersection.

Finally, data relating to the subgroup of CPEA patients in the comparison group were evaluated against data for the entire CPEA operational period, in order to estimate the representativeness of the findings related to CPEA patients evaluated in the comparison group. The *comparison-CPEA* intersection and *total CPEA* group in the above diagram represent this analysis.

In accordance with these constraints upon data analysis, each pilot project was requested to simultaneously report results for the baseline group, comparison group, CPEA patients in the comparison group, and all CPEA patients.

2.3.4 Stage 4 Reporting

A draft report was prepared and circulated to the Department and pilot project groups for feedback, and a final report submitted.

⁶ CPEA protocols were developed during baseline data collection.

3 Hospital management of patients with chest pain

3.1 Pre-CPEA Emergency Department protocols

Minor differences were reported in ED/Baseline management protocols for chest pain patients across the three hospitals⁷:

- The Alfred Hospital regularly utilised Troponin-I as a cardiac enzyme measurement.
- RMH routinely incorporated Hot Sestamibi Studies (during working hours).
- MMC intermittently utilised Troponin-I during baseline data collection period.

3.2 Implementation and characteristics of pilot CPEA units

3.2.1 Infrastructure and staffing

Differences in infrastructure and staffing were observed between the three facilities⁸:

- The Alfred Hospital's CPEA comprised 4 beds integrated into the existing ED staffing and infrastructure. An additional 1.5 EFT nursing position was funded to enable the ED nursing staff to cover the CPEA when required. Additional funding was provided for the use of nuclear imaging (Sestamibi), and Troponin-I.
- The RMH CPEA comprised a 5 bed stand alone facility, necessitating an additional 5.5 EFT nursing positions to enable 24 hour 7 day operation. CPEA staff assisted the ED when the CPEA unit was unoccupied. Exercise Stress Testing was incorporated as a routine part of the inpatient CPEA protocol. The cardiac enzyme marker Troponin-I was also incorporated into the CPEA protocol. Additional funding was provided for the use of Troponin-I.
- The MMC CPEA comprised a 4 bed facility located amidst lower acuity ED beds, necessitating an additional 5.5 EFT nursing positions to enable 24 hour 7 day operation. CPEA staff assisted the ED when the CPEA was unoccupied (or administration tasks not required). Additional funding was provided for the use of Troponin-I.

⁷ Common elements of ED admission protocol, investigations, and discharge criteria for chest pain patients are presented in Tables 1.1, 1.2, and 1.3 of individual hospital reports.

⁸ Specific details of CPEA infrastructure and staffing are presented in Table 1.7 of individual hospital reports.

3.2.2 CPEA protocols

3.2.2.1 Admission criteria

Differences were also observed between admission criteria for the CPEA, particularly between MMC and the other hospitals⁹:

- The Alfred Hospital's admission criteria did not require initial cardiac enzyme results to be known (providing ECG criteria were met). In addition, chest pain patients with comorbidities requiring inpatient admission may have been admitted to the CPEA to determine the level of inpatient care required. Admission to the CPEA was ultimately dependent upon ED consultant/cardiology registrar opinion.
- The RMH admission criteria did not require initial cardiac enzyme results to be known (provided other criteria were met). Admission to the CPEA was ultimately dependent upon consultation with the Cardiology registrar.
- The MMC admission criteria required initial enzymes to be within normal limits (which were then considered with other diagnostic criteria). Initially, admission was also contingent upon total resolution of chest pain, however this changed within the first month to exclusion of patients who required ongoing management via repeated narcotics, GTN, or infusions (GTN or narcotic). Admission to the CPEA was ultimately dependent upon consultation with senior ED physician.

3.2.2.2 Observation protocol

Salient differences in the CPEA observation protocols for the three hospitals are presented in the table below¹⁰.

Table 2. Salient differences in CPEA protocol between the three facilities.

| | Duration (estimated average hours) | ECG (hours) | Right & Posterior leads | Cardiac enzymes | Timing of enzymes (hours) [†] | Inpatient EST [‡] | MIBI |
|---------------------------|--|----------------|-------------------------------|-----------------------------|--|-------------------------------|------|
| Alfred[#] | 9 (24 max) | 3,6,9 | As req | CK, CK-MB, Troponin-I | 3,6,9 3,6,9 3,6,9 | Yes | Yes |
| RMH[#] | 12 (24 max) | Adm,6,12 | As req | CK CK-MB Troponin-I | 6,12 6,12 12 | Yes | Yes |
| MMC | 9 (24 max) | Adm,6 | Adm | CK CK-MB Troponin-I | Adm,6 Adm,6 Adm,6 | Yes | No |

[#]Admission cardiac enzymes (and for The Alfred, ECG) part of ED protocol not CPEA protocol.

[†]Alfred & MMC enzyme measurements timed post ED presentation; RMH enzyme measurements timed post worst pain.

[‡]Alfred & MMC inpatient Exercise Stress Testing (EST) available via Cardiology Department; RMH inpatient EST available in CPEA.

⁹ Common elements of admission criteria are presented in Table 1.8 of individual hospital reports.

¹⁰ Elements of CPEA protocols are listed in Table 1.9 of individual hospital reports.

- The Alfred Hospital: Cardiac enzymes were obtained at three time periods post ED presentation (compared with two at other facilities). Sestamibi scanning, whilst available, was logistically difficult to implement and was thus substituted for stress thallium requested directly from CPEA. One inpatient EST booking was available to the CPEA within cardiology department. Accordingly, in practice most patients received EST via outpatient bookings. Decisions to undertake nuclear imaging or EST were made on a case by case basis following medical review.
- The RMH: CPEA protocol comprised a longer average duration to accommodate routine inpatient EST conducted in the CPEA. Only one Troponin-I measurement was taken at 12 hours (compared with two or three measurements at other facilities). All cardiac enzymes were taken at time periods post worst pain (compared to time periods post ED presentation). Decisions to nuclear imaging or EST were made according to protocol criteria in addition to medical review.
- The MMC: Cardiac enzymes were obtained at two time periods post ED presentation. Routine inpatient EST was not initially incorporated into the protocol, but received increasing use over the project period. Sestamibi scanning facilities were unavailable. Right and posterior leads were obtained routinely upon admission. Decisions to EST or nuclear imaging were made on a case by case basis following medical review.

3.2.3 Home discharge and inpatient admission criteria

3.2.3.1 Home discharge

Criteria were generally comparable for home discharge from the CPEA across the three hospitals, with each organising planned follow-up¹¹. The most notable difference in home discharge criteria was observed for CPEA patients at the RMH, where patients with unstable angina who had elevated Troponin-I measurements (within specified levels) may be discharged with planned follow-up, following review by the cardiology or general medical registrar.

3.2.3.2 Inpatient admission

Inpatient bed configurations (outlined in Section 3.3) differed between the three facilities. Accordingly, despite generally comparable inpatient admission criteria to CCU, monitored beds or non-monitored beds at the three facilities, several differences were observed¹².

- The Alfred: admission to CCU for AMI or other acute cardiac condition (either suspected or diagnosed). Admission to a ward-monitored bed was the preferred disposition for other cardiac-related diagnostic groups. Patients with unstable angina without high-risk stratification, non-cardiac pain for further investigation, or significant comorbidities of non-cardiac origin were admitted to non-monitored beds.
- RMH: admission to CCU for acute coronary syndrome. Admission to a monitored bed was preferred for patients with unstable angina without high-risk stratification, or cardiac conditions requiring ongoing monitoring (e.g. congenital cardiac condition, arrhythmia). Patients with non-cardiac pain for further investigation or significant comorbidities of non-cardiac origin were admitted to non-monitored beds.

¹¹ Home discharge criteria are outlined in Table 1.11 of individual hospital reports.

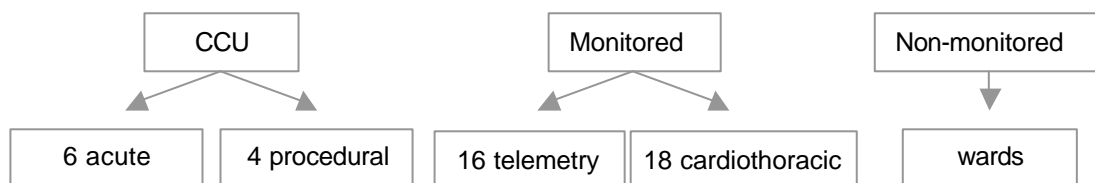
¹² Admission criteria to CCU, monitored and non-monitored beds are outlined in Tables 1.12 and 1.13 of individual hospital reports.

- MMC: admission to CCU for any condition requiring ongoing monitoring. Patients with non-cardiac pain for further investigation or comorbidities of non-cardiac origin requiring ongoing nursing care or observation were admitted to non-monitored beds.

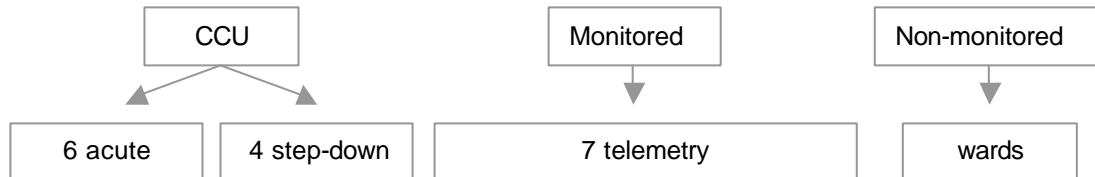
3.3 Inpatient bed configurations

Differences in the configuration of inpatient beds were also observed between the three hospitals. Given the potential for these differences to impact upon the cost of admission, and rate of inter-hospital transfers (IHT: resulting from CCU bed block) between the three hospitals, they are presented below¹³.

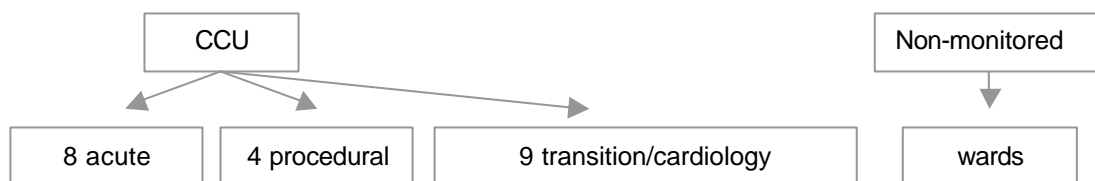
- For The Alfred Hospital, chest pain patients requiring ongoing cardiac monitoring, may be admitted to the CCU or a monitored bed on one of two wards¹⁴:



- For RMH, chest pain patients requiring ongoing cardiac monitoring, may be admitted to the CCU or a monitored bed on one ward¹⁵:



- For MMC, chest pain patients requiring ongoing cardiac monitoring may only be admitted to the CCU¹⁶:



¹³ Common criteria for inpatient admission are presented in Tables 1.4 and 1.5 of individual hospital reports.

¹⁴ Alfred: CCU procedural beds may be available for any monitored patients on weekends. Cardiothoracic beds occasionally available for chest pain patients requiring monitoring.

¹⁵ RMH: 7 telemetry beds are for cardiology admissions only. Step-down beds rarely receive direct admission.

¹⁶ MMC: CCU acute and procedural beds rarely utilised for chest pain patients. Procedural beds closed over the weekend.

3.4 **Bed block to the Coronary Care Unit**

In the event of bed block to the Coronary Care Unit (CCU), patients requiring CCU services at the three hospitals are transferred to the following units¹⁷:

- The Alfred: chest pain patients receive an inter-hospital transfer, and are only admitted to the Intensive Care Unit in exceptional circumstances (unless requiring ventilatory support);
- RMH: chest pain patients are admitted to the Intensive Care Unit; and
- MMC: chest pain patients receive an inter-hospital transfer, and are not admitted to the Intensive Care Unit (unless requiring ventilatory support).

Differences in inpatient bed configuration and inter-hospital transfer criteria for chest pain patients remained the same throughout the baseline and comparison periods and require consideration when interpreting findings across the three hospitals.

¹⁷ Specific criteria for inter-hospital transfers are presented in Table 1.6 of individual hospital reports.

4 Impact of the CPEA upon the Emergency Department

The daily average numbers of chest pain presentations to the three hospitals were consistent with reports from overseas literature, ranging between 5% and 14% of all presentations¹⁸. The highest daily percentage of chest pain patients was reported by the MMC (10.22%; 9.2 presentations/90 total presentations), followed by the RMH (8.47%; 10 presentations/118 total presentations), and The Alfred (6.96%; 7.1 presentations/102 total presentations)¹⁹.

4.1 ED/CPEA Admissions

The total number of chest pain patients admitted to the CPEA at all three facilities, together with the number of daily admissions, and number of actual (or estimated) periods of maximum CPEA capacity are presented below²⁰.

- Alfred: 397 total admissions, 0.90 daily admissions, all CPEA beds occupied on 3 occasions.
- RMH: 552 total admissions, 1.34 daily admissions, all CPEA beds occupied on 5 occasions (estimated).
- MMC: 620 total admissions, 1.50 daily admissions, all CPEA beds occupied on 5 occasions (estimated).

Interestingly, the percentage of all ED patients admitted to CPEA appears lower than international studies, which report that between two and six percent of all ED patients are admitted to an observation unit²¹. In the current pilot, the percentage of ED patients admitted to each CPEA unit was:

- 0.88% at The Alfred;
- 1.14% at RMH; and
- 1.66% at MMC

These findings would indicate that admission criteria in the current pilot projects have been more stringent than those used in overseas studies.

4.1.1 Demographics

Demographic characteristics were generally comparable across the three pilot projects for baseline, comparison and CPEA patient groups²². The average age of chest pain patients approximated 60 years, with females tending to be older than males. A trend was also apparent for more males to present with chest pain and be admitted to the CPEAs for observation. This pattern was particularly evident at MMC. CPEA patients at

¹⁸ Graff et al (1997). Impact on the care of the emergency department chest pain patient from the Chest Pain Evaluation Registry (CHEPER) study. *American Journal of Cardiology*, 80, 563-568. Joseph (1997). Chest pain centres. *Clinics in Laboratory Medicine*, 17 (4), 685-699.

¹⁹ Patterns of presentation to the ED are outlined in Section 2.1.1.1 of individual hospital reports.

²⁰ Daily number of chest pain presentations and CPEA admissions are outlined in Section 2.1.1.2 of individual hospital reports.

²¹ Brillman et al (1995), Management of observation units. *Annals of Emergency Medicine*, 25 (6), 823-830.

²² Demographic characteristics of patients are presented in Table 2.1 of individual hospital reports.

the RMH were generally younger than the other facilities, reflecting the exclusion of older patients (greater than 70 years) from CPEA admission.

Between 40% and 50% of chest pain patients were born in Australia or New Zealand. Of the remaining patients, minor demographic differences were observed, appearing consistent with population catchments of each facility.

4.1.2 Acuity

Direct measures of patient acuity were not collected as part of the CPEA studies. Accordingly, triage classification at arrival to the ED was utilised as a proxy measure for patient acuity at each hospital. Triage classification of chest pain patients in baseline, comparison and CPEA groups are presented below²³.

Table 3. Triage classification of chest pain patients (percent).

| Cat | Baseline | | | Comparison | | | | | | Total CPEA | | |
|-----|----------|-----|-----|------------|-----|-----|---------------|-----|-----|------------|-----|-----|
| | Alfred | RMH | MMC | All | | | CPEA subgroup | | | Alfred | RMH | MMC |
| | | | | Alfred | RMH | MMC | Alfred | RMH | MMC | | | |
| 2 | 50 | 54 | 32 | 47 | 54 | 45 | 69 | 72 | 40 | 67 | 69 | 46 |
| 3 | 36 | 31 | 57 | 39 | 30 | 46 | 29 | 23 | 56 | 31 | 27 | 49 |
| 4 | 12 | 12 | 11 | 13 | 12 | 6 | 2 | 5 | 3 | 3 | 3 | 4 |

For the Alfred and RMH, a higher proportion of triage category 2 patients was observed for baseline and comparison groups, and approximated 70% of admissions to the CPEA units of each hospital. By contrast, MMC reported a higher proportion of triage category 3 patients in baseline and comparison groups, with a marginally higher proportion of these patients admitted to the CPEA particularly in the comparison group period (56%).

These findings suggest that patients presenting to MMC with chest pain were, on average, of lower acuity compared with the other facilities (to the extent that triage classification may represent patient acuity). Whilst protocol differences at the MMC may have contributed to the relatively lower proportion of category 2 patients admitted to the CPEA (i.e. requirements for normal cardiac enzymes, and resolution of chest pain), other factors would appear to be responsible for the lower levels of triage classification. Differences in triage classification, and/or incidents of ambulance bypass (reducing the number of more acute presentations) between the three facilities are worthy of future investigation in order to account for these differences.

Overall, approximately 40% of chest pain patients (including those admitted to the CPEA) arrived by ambulance across the three facilities. One exception to this pattern was observed for the RMH baseline group, where approximately 50% of chest pain patients arrived by ambulance.

²³ Triage categories and method of ED arrival are presented in Table 2.2 of individual hospital reports.

4.1.3 Risk factors and past history

Significant risk factors for cardiovascular disease, examined during the CPEA pilots included:

- Hypertension;
- Hypercholesterolaemia;
- Diabetes Mellitus;
- Smoking (current or past); and
- Positive family history of ischaemic heart disease.

Baseline and comparison group data indicated that, across the three hospitals, smoking (22%-41%), hypertension (17%-43%) and hypercholesterolaemia (16%-40%) were the most prevalent risk factors identified in chest pain presentations²⁴. The percentage of risk factors (other than diabetes) was higher for CPEA patients, and consistent with the criteria for CPEA admission. A higher proportion of patients with no past history reported, indicated or observed, were also admitted to the CPEAs reflecting admission protocols at the three hospitals.

It is important to note that between 17% and 27% of data relating to risk factors and past history were unavailable for baseline or comparison periods across the three sites. Accordingly, definitive conclusions regarding the presence or absence of specific risk factors for patients presenting with chest pain can not be drawn from the current data.

4.2 ED/CPEA Discharge

4.2.1 Discharge disposition

The disposition of ED/CPEA patients at the three hospitals is presented in the table below²⁵. A higher number of chest pain patients at the Alfred and RMH were discharged home in the comparison group period. For these hospitals, the higher number of home discharges in this period appeared to be influenced by the particularly high percentage of CPEA patients discharged home. A reduction in the number of patients receiving inpatient admission was also observed for these hospitals between baseline and comparison periods.

Table 4. Discharge disposition of ED/CPEA patients (percent).

| Discharge disposition | Baseline | | | Comparison | | | | | | Total CPEA | | |
|--------------------------|----------|-----|-----|------------|-----|-----|---------------|-----|-----|------------|-----|-----|
| | Alfred | RMH | MMC | All | | | CPEA subgroup | | | Alfred | RMH | MMC |
| | | | | Alfred | RMH | MMC | Alfred | RMH | MMC | | | |
| Home | 51 | 40 | 53 | 59 | 54 | 46 | 85 | 89 | 65 | 82 | 81 | 73 |
| In-patient admission | 39 | 56 | 29 | 28 | 40 | 31 | 13 | 8 | 26 | 14 | 17 | 19 |
| IHT due to CCU bed block | 0 | 1 | 5 | 1 | 1 | 5 | 0 | 0 | 3 | 0 | 1 | 2 |
| IHT due to other reasons | 9.5 | 3 | 12 | 12 | 5 | 18 | 2 | 3 | 6 | 4 | 1 | 5.6 |

²⁴ Risk factors and past history of chest pain patients are presented in Table 2.3 of individual hospital reports.

²⁵ Discharge disposition of ED/CPEA patients is presented in Table 2.7 of individual hospital reports.

Interestingly, a slightly lower number of patients were discharged home in the MMC comparison group, and the number of patients receiving inpatient admission at MMC did not change between the two data collection periods. These findings were reported in the context of a higher number of inter-hospital transfers, due to CCU bed block and “other reasons”, experienced for both baseline and comparison periods. “Other” reasons for inter-hospital transfer at MMC were characterised by patients receiving private hospital transfers (at either patient or cardiologist request), and appeared to account for the majority of variation in home discharges between MMC and the other hospitals. The higher number of MMC transfers due to CCU bed block was not surprising, given inpatient bed configurations (outlined in section 3.1.2).

Notwithstanding the observed differences in home discharges and inpatient admissions between baseline and comparison group periods for the three hospitals, the CPEAs at all facilities reported a high percentage of home discharges, ranging between 73% and 82%. These findings are directly comparable with overseas studies that report between 66% and 83% of patients are discharged directly home, and between 15% and 34% of patients receive inpatient admission from chest pain observation units²⁶. Thus, the current findings are consistent with previous literature indicating a positive impact from the introduction of the CPEAs by increasing the number of home discharges and reducing the number of inpatient admissions.

4.2.2 Discharge diagnosis

Physician diagnosis of baseline, comparison and CPEA patients at discharge is presented in Table 5 below²⁷. The number of patients diagnosed in each category was similar between baseline and comparison periods for each hospital. A smaller percentage of CPEA patients were diagnosed with cardiac conditions, and a larger proportion of CPEA patients were diagnosed with non-cardiac or “unknown” conditions requiring further investigation, supporting the effective stratification of chest pain patients using the CPEA protocols.

Of the non cardiac-identified diagnostic groups, the majority of RMH CPEA patients (57%) were diagnosed with “non-cardiac” chest pain. This finding is contrasted with a higher percentage of CPEA patients diagnosed as “chest pain unknown” and requiring further outpatient investigation at The Alfred (65%) and MMC (60%). These differences may be attributable to the use of inpatient EST to rule out cardiac ischaemia at the RMH as a routine part of inpatient CPEA protocol. Interestingly, MMC reported using an increasing number of inpatient EST procedures over the study period. This may at least partially account for the relatively lower percentage of patients with “unknown” chest pain in comparison with the Alfred. In general however, the hospital protocols for The Alfred and MMC meant that the majority of their EST was conducted as planned outpatient investigations.

²⁶ De Leon et al (1989). Chest pain evaluation unit: a cost-effective approach for ruling out acute myocardial infarction. *Southern Medical Journal*, 82 (9), 1083-1089; Gaspoz et al (1991). Outcome of patients who were admitted to a new short-stay unit to “rule out” myocardial infarction. *American Journal of Cardiology*, 68, 145-149; Gibler et al (1995). A rapid diagnostic and treatment centre for patients with chest pain in the emergency department. *Annals of Emergency Medicine*, 25 (1), 1-8.

²⁷ Physician diagnosis of ED/CPEA patients at discharge are presented in Table 2.4 of individual hospital reports.

Table 5. Physician diagnosis of ED/CPEA patients at discharge (percent).

| Discharge diagnosis | Baseline | | | Comparison | | | | | | Total CPEA | | |
|---------------------|----------|-----|-----|------------|-----|-----|---------------|-----|-----|------------|-----|-----|
| | Alfred | RMH | MMC | All | | | CPEA subgroup | | | Alfred | RMH | MMC |
| | | | | Alfred | RMH | MMC | Alfred | RMH | MMC | | | |
| Cardiac | | | | | | | | | | | | |
| ▪ AMI | 8 | 11 | 10 | 7 | 8 | 10 | 4 | 3 | 3 | 2 | 5 | 2 |
| ▪ Unstable angina | 12 | 25 | 23 | 13 | 23 | 25 | 4 | 14 | 18 | 6 | 14 | 15 |
| ▪ Stable angina | 7 | 3 | 4 | 4 | 2 | 5 | 0 | 0 | 3 | 3 | 0 | 4 |
| ▪ Other | 8 | 6 | 8 | 7 | 8 | 8 | 0 | 0 | 1 | 4 | 1 | 3 |
| Non-cardiac | 38 | 23 | 17 | 39 | 29 | 19 | 13 | 61 | 27 | 20 | 57 | 16 |
| Unknown | 27 | 30 | 39 | 29 | 29 | 33 | 79 | 22 | 48 | 65 | 23 | 60 |
| Death | 0.2 | 1 | 0.6 | 0.5 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0.2 |

Specific diagnoses for patients discharged home and those admitted to an inpatient bed are presented in Table 6 below²⁸.

Table 6. Physician diagnosis by discharge disposition of ED/CPEA patients (percent).

| Discharge diagnosis and disposition | Baseline | | | Comparison | | | | | | Total CPEA | | |
|-------------------------------------|----------|-----|-----|------------|-----|-----|---------------|-----|-----|------------|-----|-----|
| | Alfred | RMH | MMC | All | | | CPEA subgroup | | | Alfred | RMH | MMC |
| | | | | Alfred | RMH | MMC | Alfred | RMH | MMC | | | |
| Cardiac (AMI) | | | | | | | | | | | | |
| - Home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Admitted | 18 | 20 | 26 | 20 | 17 | 19 | 33 | 40 | 5 | 12 | 26 | 9 |
| Cardiac (Unstable Angina) | | | | | | | | | | | | |
| - Home | 1 | 4 | 7 | 0 | 8 | 11 | 0 | 14 | 2 | 0 | 13 | 5 |
| - admitted | 22 | 38 | 38 | 29 | 41 | 38 | 33 | 20 | 60 | 30 | 25 | 41 |
| Cardiac (Stable Angina) | | | | | | | | | | | | |
| - home | 9 | 7 | 4 | 6 | 3 | 7 | 0 | 0 | 2 | 4 | 0 | 5 |
| - admitted | 6 | 0 | 1 | 3 | 0 | 2 | 0 | 0 | 5 | 0 | 1 | 4 |
| Cardiac (Other) | | | | | | | | | | | | |
| - home | 3 | 4 | 6 | 5 | 7 | 2 | 0 | 0 | 2 | 2 | 0 | 2 |
| - admitted | 13 | 7 | 8 | 9 | 10 | 9 | 0 | 0 | 0 | 16 | 2 | 5 |
| Non-cardiac | | | | | | | | | | | | |
| - home | 47 | 36 | 22 | 47 | 42 | 26 | 12 | 67 | 29 | 18 | 67 | 18 |
| - admitted | 28 | 16 | 15 | 32 | 17 | 21 | 17 | 20 | 25 | 33 | 16 | 15 |
| Chest pain unknown | | | | | | | | | | | | |
| - home | 40 | 49 | 61 | 42 | 40 | 53 | 88 | 19 | 65 | 76 | 20 | 70 |
| - admitted | 12 | 17 | 11 | 6 | 14 | 9 | 17 | 20 | 5 | 9 | 30 | 25 |
| Death | | | | | | | | | | | | |
| - home | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - admitted | 1 | 3 | 1 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 1 |

²⁸ Physician diagnosis for ED/CPEA patients discharged home or admitted to an inpatient bed are presented in Tables 2.8 and 2.9 of individual hospital reports.

All patients with identified AMI's were admitted to inpatient beds across the three facilities. Similarly, the majority of patients with unstable angina or "other cardiac" conditions also received inpatient admission. Patients who were discharged home were characterised by diagnoses of stable angina, non-cardiac, or unknown chest pain for follow-up²⁹.

Importantly, no deaths were reported for patients discharged home from the CPEA protocol, and only one death occurred for an ED patient at MMC who was discharged from the CPEA protocol and awaiting a planned transfer to a monitored bed at another hospital for further investigation and management³⁰. A trend for younger patients to be discharged home was observed across the baseline and comparison group for the three facilities. This trend was also apparent for patients admitted to the CPEA units at each facility.

4.3 ED/CPEA³¹ Length of stay

A significant increase in the ED/CPEA combined length of stay from the baseline period was observed following the introduction of the CPEAs in the comparison group period. The average time for ED/CPEA patients was appreciably higher for RMH patients (16 hours) compared with The Alfred and MMC (12 hours), and consistent with previously stated differences in duration of CPEA observation for the RMH protocol³².

4.4 ED/CPEA Re-presentation

A slight reduction in the total number of re-presentations to the ED/CPEA for patients subsequently admitted to an inpatient bed was observed across the three facilities³³. Re-presentation rates for patients discharged home were not observed to increase, despite indications of an increase in the number of patients discharged directly home from the ED/CPEA (previously reported in Section 6.2.1)³⁴. These findings suggest that CPEA protocols for selection, management and follow-up of patients may be beneficial in preventing an increase in the number of re-presentations.

4.5 ED/CPEA Follow-up

4.5.1 Planned outpatient appointments

An increase in planned cardiology follow-up and the number of planned investigations was observed for The Alfred and RMH between baseline and comparison periods³⁵. The higher percentage of CPEA patients receiving planned cardiology follow-up and investigations may have contributed to these findings. Interestingly, a slight reduction in

²⁹ The relationship between "non-cardiac" and "chest pain unknown" for CPEA patients at the RMH versus The Alfred and MMC has been previously discussed.

³⁰ This death was not thought to be preventable (see footnotes 40 and 44 in MMC Report).

³¹ ED length of stay includes time spent in CPEA for comparison group patients.

³² Average length of stay for ED & ED/CPEA patients are presented in Table 2.6 of individual hospital reports.

³³ Re-presentations are reported in Table 2.11 of individual hospital reports.

³⁴ Data for low-moderate risk chest pain patients who were discharged home at baseline was not available, and thus direct comparisons can not be made.

³⁵ Planned outpatient appointments & investigations are presented in Table 2.13 of individual hospital reports.

planned cardiology follow-up, and comparable levels of planned investigation were observed between baseline and comparison periods for the MMC. These findings however, must be interpreted with some caution. The implementation of risk stratification criteria following the introduction of the CPEAs may have enabled more appropriate targeting of outpatient referrals and investigations. For MMC, it was reported that approximately 63% of all CPEA patients received a cardiology review prior to discharge lending some support to this interpretation.

4.5.2 Time to obtain planned positive/negative outpatient investigations

The average time taken to obtain a positive or negative result for planned outpatient investigations following discharge from the CPEA units are presented below³⁶. Given that CPEA inpatient investigations were performed as a part of individual protocols, these results were not separately reported.

Table 7. Time to positive/negative results for outpatient investigations

| Investigation | Baseline | | | Comparison | | | | | | Total CPEA | | |
|-------------------------|----------|-----|-----|------------|----|---|---------------|---|-----------------|------------|-----|-----|
| | Alfred | RMH | MMC | All | | | CPEA subgroup | | | Alfred | RMH | MMC |
| Nuclear Imaging | | | | | | | | | | | | |
| ▪ Time (days) | 15 | 16 | 10 | 8 | 10 | 8 | 6 | 3 | na [†] | 8 | 5 | 12 |
| Exercise Stress Testing | | | | | | | | | | | | |
| ▪ Time (days) | 14 | 13 | 7 | 5 | 5 | 6 | 3 | 3 | 2 | 4 | 3 | 8 |

[†]No patients received planned outpatient investigations in this category.

A reduction in the time to obtain positive/negative nuclear imaging and EST investigation between baseline and comparison group periods was apparent in each hospital. Moreover, the magnitude of the reduction appeared to be related to the time to investigation for the CPEA subgroup of comparison patients. Interestingly, for The Alfred and RMH, the time to investigation for the CPEA subgroup of comparison patients was equivalent to the total CPEA patient group.

For MMC, time to investigation for the CPEA subgroup of comparison patients did not appear to represent the average time taken to investigate the total group of CPEA patients. Differences for MMC are attributed to protocol characteristics. For The Alfred and RMH, outpatient bookings were made from the CPEA prior to patient discharge. For MMC, outpatient bookings were made via the patients LMO (following written notification sent with the patient at discharge), and would appear to account for the increase in average time to positive/negative investigation when compared with the other hospitals.

It is important to note however, that the numbers of patients received planned outpatient investigations in each facility was small, implying caution when interpreting differences between the two data collection periods.

³⁶ Time to positive/negative investigation findings for planned outpatient investigations are presented in Table 2.6 of individual hospital reports.

4.5.3 30 day follow-up

Follow-up of baseline and comparison group patients discharged home from the ED or inpatient units was considered to be an important part of the pilot protocols in order to:

- identify whether the CPEA model of care had resulted in a reduction of deaths due to AMI in the comparison group period, and
- identify any change in presence of recurrent chest pain following discharge for comparison group patients.

Patients who had received a definitive diagnosis (cardiac or non-cardiac) upon hospital or ED/CPEA discharge were not targeted for follow-up³⁷.

Telephone follow-up of a subgroup of chest pain patients at 30 days suggested minimal change in the presence of recurrent chest pain between baseline and comparison periods³⁸. Only one CPEA patient at MMC who had re-presented to the ED and was diagnosed with an AMI, died from a repeat AMI 26 days after initial CPEA assessment. This death was not attributed to CPEA protocol failure. The representativeness of these findings however cannot be guaranteed, given the relatively small proportion of all chest pain patients receiving follow-up at RMH, and the absence of baseline data for comparison with low-moderate risk chest-pain patients at all hospitals.

4.6 Qualitative outcomes

4.6.1 For the Emergency Department

Qualitative reports of positive and negative outcomes for the ED following implementation of the CPEA are reported in the Table 8³⁹, which suggests that in general, a greater number of positive outcomes were reported across the three hospitals following introduction of the CPEA model of care.

³⁷ Criteria for follow-up are reported in Appendix I of individual hospital reports.

³⁸ 30 day follow-up data are reported in Table 2.14 of individual hospital reports.

³⁹ Qualitative outcomes relating to the impact of the CPEA upon the ED are presented in Section 2.2.1 of individual hospital reports.

Table 8. Qualitative outcomes upon the ED following CPEA implementation.

| Positives | Negatives |
|--|---|
| Admission <ul style="list-style-type: none"> ■ Low-moderate risk ACS patients transferred out of RESUS area, freeing beds for more appropriate patients, where chest pain patients are admitted to RESUS. | |
| Protocol <ul style="list-style-type: none"> ■ Introduction of standardised protocol driven assessment tool for risk stratification. ■ Provision of routine inpatient EST without additional workload on cardiology department where EST was conducted in the CPEA. ■ Early investigation and follow-up. ■ New focus on low-moderate risk ACS patients. | Protocol <ul style="list-style-type: none"> ■ Potential to encourage unnecessary retention of patient who may be safe to discharge home. ■ Perceptions of change of focus to in-patient care in ED. |
| Staffing <ul style="list-style-type: none"> ■ Increased collaboration between cardiology and ED departments. ■ Enabled nursing staff to work independently following a protocol. ■ Provided extra staff member to assist in ED when CPEA unoccupied, for stand-alone units. ■ CPEA nursing staff enhanced ED skill mix. For stand alone/ increased skill of all ED staff for integrated unit | Staffing <ul style="list-style-type: none"> ■ Perceived as increased nursing workload. ■ Difficult to provide CPEA cover from ED when units not integrated. |
| Patient education <ul style="list-style-type: none"> ■ Opportunity to provide patient education relating to modification of risk factors. | |
| Additional benefits <ul style="list-style-type: none"> ■ Biochemistry turn around times improved ■ Increased staff awareness | |

4.6.2 Issues associated with CPEA implementation

Several issues required attention during the course of CPEA implementation relating to CPEA planning, location, protocol development, staffing, and data collection⁴⁰. Qualitative reports of these issues are presented below:

- Staff collaboration: Common goals regarding the purpose and functioning of a CPEA were considered essential to align staff expectations and facilitate smooth day to day operation.
- Location: Initial decisions regarding the location of the CPEA were based upon the need to have patient beds located away from the more acute ED beds to provide a more comfortable environment for patients requiring monitoring. Unfortunately, separate location of beds away from specialist nursing staff in the ED created difficulties when CPEA staff relief was required. ED nursing staff were required to leave the ED environment in order to monitor CPEA patients. The Alfred reported a

⁴⁰ Qualitative outcomes relating to issues associated with CPEA introduction are presented in Section 2.2.2 of individual hospital reports.

possible solution to this issue. Having CPEA beds integrated into the existing ED, two CPEA beds were located in the acute area to allow for closer observation, and two beds were located in a quieter area of the ED.

Where Exercise Stress Testing (EST) was conducted as part of routine CPEA protocol, a separate room adjacent to the ED was considered important to provide safe and private testing environment.

- **Protocols:** The importance of establishing protocols prior to commencing a CPEA were stressed, in addition to providing staff education to ensure that protocols were followed appropriately. Integrating CPEA education into ED staff orientation was considered to be valuable. An understanding by staff of the need to refine protocols was also considered important to mitigate frustration or confusion in the early stages of implementation. Areas requiring refinement were reported to include: accurate identification of CPEA patients; provision of ongoing investigations; and, ensuring continuity of care (e.g., LMO referral).

- **Staffing:** Formalised approaches to patient referral and review were reported to facilitate the sharing of clinical responsibility between participating medical units. However, the absence of specific funding for medical staff was observed to increase pressure upon current workloads.

From a nursing perspective, dedicated staff enabled closer attention to be paid to patient education, in addition to data collection and administration of the CPEA. However, other ED staff did not always understand this role. Where no dedicated staff were provided, data collection and administrative tasks were seen to compete with demands associated with clinical care already placed upon nurses, despite attempts to facilitate this process via assistance from a research nurse, and provision of data collection forms.

- **Data collection:** The process of data collection would be enhanced by capturing basic patient information from the existing ED information system, reducing duplication and increasing the accuracy of information. Feedback of information to staff on an ongoing basis was also considered important to maintain interest and support in the CPEA.

5 Impact of the CPEA upon hospital admissions

5.1 Characteristics of inpatient admissions from ED/CPEA

Inpatient admissions from the ED/CPEA are presented in the table below⁴¹. For The Alfred and RMH, a decrease in admissions from the ED/CPEA to CCU was observed between baseline and comparison periods, suggesting that fewer low to moderate risk Acute Coronary Syndrome (ACS: AMI and unstable angina) patients were being admitted for monitoring. These findings concur with the number of CCU admissions from the CPEA, and earlier observations indicating a large number of low-moderate risk patients were discharged directly home from the CPEA.

Table 9. Inpatient admissions from the ED/CPEA (percent).

| Inpatient discharge disposition | Baseline | | | Comparison | | | | | | Total CPEA | | |
|---------------------------------|----------|------|------|------------|------|------|---------------|-----|------|------------|-----|------|
| | Alfred | RMH | MMC | All | | | CPEA subgroup | | | Alfred | RMH | MMC |
| | | | | Alfred | RMH | MMC | Alfred | RMH | MMC | | | |
| CCU | 8 | 25 | } 21 | 5 | 19 | } 21 | 4 | 5 | } 23 | 3 | 9 | } 15 |
| Monitored bed | 24 | } 31 | | 17 | } 21 | | 8 | } 3 | | 10 | } 8 | |
| Non-monitored bed | 8 | | 9 | 7 | | 10 | 0 | | 3 | 2 | | 3 |

Data reported by The Alfred Hospital indicate a reduction in admissions to non-CCU monitored beds. For the RMH, admissions from ED/CPEA to non-monitored beds were not observed to change for patients requiring ongoing investigation for non-cardiac pain⁴². For MMC, a comparable number of admissions from ED/CPEA to both the CCU and to non-monitored beds were reported between baseline and comparison periods.

In general however, all three hospitals experienced a smaller number of CPEA patients admitted to the CCU and to non-monitored beds in comparison to the total group of chest pain presentations. As expected, a higher proportion of patients with a diagnosis of AMI or Unstable Angina were admitted to CCU or monitored beds, and a higher proportion of patients with a diagnosis of "non-cardiac" or "unknown" chest pain were admitted to non-monitored beds⁴³.

⁴¹ The disposition of patients admitted to hospital from the ED/CPEA are presented in Table 3.1 of individual hospital reports.

⁴² Personal communication 21/07/00 with RMH CPEA project manager.

⁴³ Characteristics of admitted inpatients are presented in Table 3.2 of individual hospital reports.

5.2 LOS for inpatient admissions from ED/CPEA

In general, a slight reduction (on average) in the LOS for patients admitted to inpatient beds from the ED/CPEA was observed between baseline and comparison periods across the three facilities. Differences in LOS according to patient sex and age varied across the three sites and were not readily interpretable⁴⁴.

5.3 Unplanned investigations and procedures

A small number of unplanned investigations and procedures resulting from unplanned readmissions were reported by the three facilities, precluding meaningful analysis⁴⁵.

5.4 Qualitative outcomes

Qualitative reports of positive and negative outcomes for the hospital following implementation of the CPEA are reported in the following table⁴⁶.

Table 10. Qualitative outcomes upon the ED following CPEA implementation.

| Positives | Negatives |
|--|--|
| Patient assessment <ul style="list-style-type: none"> ■ More structured approach to assessment for patients presenting with potentially cardiac-related chest pain. ■ Increased communication between ED and cardiology staff. | Patient assessment <ul style="list-style-type: none"> ■ Increased workload of medical staff. |
| Inpatient admissions <ul style="list-style-type: none"> ■ Perception of increased acuity/appropriateness of admitted inpatients. ■ Perception of lower patient admissions. | |
| | Nuclear Medicine <ul style="list-style-type: none"> ■ Increased pressure to provide investigations within specified time frame. |
| Outpatients/Follow-up <ul style="list-style-type: none"> ■ Increased use of non-invasive measurements. ■ Provision of more cost-effective services. ■ Follow-up provided opportunity for patient feedback. | Outpatients/Follow-up <ul style="list-style-type: none"> ■ Increased provision of outpatient EST necessitated review of organisational practices and workloads for EST staff. ■ Increased pressure upon outpatient bookings. |

A greater number of positive outcomes were spontaneously reported by all hospitals following CPEA introduction, with the most significant negative outcomes relating to increased workload pressures for medical, nuclear medicine, cardiology and outpatient staff.

⁴⁴ Length of stay according to age and sex of CPEA patients are presented in Table 3.3 of hospital reports.

⁴⁵ Unplanned investigations are presented in Section 3.1.3 of hospital reports.

⁴⁶ Qualitative outcomes relating to the impact of the CPEA upon the hospital are presented in Section 3.2.1 of individual hospital reports.

6 Costing Analysis

6.1 Introduction

One of the key questions for the CPEA pilot was:

Has there been improved utilisation and cost effectiveness of hospital and system resources?

The costing component of the study therefore aimed to establish the cost of CPEA care compared with traditional approaches and whether CPEAs offer a cost-effective alternative. In order to make this assessment it was necessary to:

- establish costing parameters;
- ensure that as far as possible, there was a consistent approach adopted at each site to collect and report relevant costs;
- identify the costs associated with the management of patients with chest pain both prior to and following the commissioning of CPEAs.

In November 1998, a report was prepared on the cost collection methodologies at each site⁴⁷. A number of costing issues were identified in preparation for the development of baseline costs.

In September 1999, KPMG provided an initial assessment of the costing methodologies to be used at each site and the outcomes of the costing of patients in the baseline data collection period. These were provided in a report to the Steering Committee and the Department of Human Services.⁴⁸ Since that time, there has been some refinement of the baseline data and each site has completed the process of costing for the comparative dataset.

In the latter report, it was noted that while patient costing guidelines had been established by KPMG to assist each site and to maximise the degree of uniformity, each agency essentially operates its own patient costing system. As a result, the cost-allocation methodology, of necessity, reflects what was possible and achievable for each hospital, rather than the "ideal"⁴⁹.

This section on costing:

- outlines the costing methodology used at each site for both the baseline and the comparative data set;
- discusses issues that have arisen and how they have been resolved; and

⁴⁷ KPMG, *Chest Pain Evaluation Areas – Costing Parameters and Collection System*, 10 November 1998.

⁴⁸ KPMG, *Chest Pain Evaluation Areas – Costing of Baseline Patients by CPEA Pilot Hospitals*, 16 September 1999

⁴⁹ KPMG, *Costing of Baseline Patients*, p2.

- reports on the outcomes of the costing and the conclusions that can be drawn from the data.

6.1.1 Collection periods

The three hospitals collected data to support a cost comparison of patients presenting with chest pain in the baseline and comparative periods. The collection periods are detailed in Table 11

Table 11. Baseline and Comparative Data Collection Periods

| Hospital | Collection | Period |
|----------|-------------|--------------------------------------|
| Alfred | Baseline | 1 Nov 1998 – 31 Dec 1998 (61 days) |
| | Comparative | 1 Nov 1999 – 31 Dec 1999 (61 days) |
| Monash | Baseline | 5 Oct 1998 – 29 Nov 1998 (56 days) |
| | Comparative | 27 Sept 1999 – 21 Nov 1999 (56 days) |
| RMH | Baseline | 14 Sept 1998 – 8 Nov 1998 (56 days) |
| | Comparative | 20 Sept 1999 – 14 Nov 1999 (56 days) |

6.1.2 Funding of pilots

As each hospital involved in the pilot intended to adopt a different approach to the staffing and operation of their CPEA, so the funding provided by the DHS varied. However, in terms of the total amount provided, Alfred Hospital received a lower amount of funding – reflecting its approach of staffing the CPEA as an integral part of the Emergency Department (ED). Details of the funding provided to cover the 18-month trial period are shown in Table 12.

Table 12. Funding Provided by DHS for CPEA Establishment and 18 months of operation

| | Alfred | Monash | RMH |
|--------------------------------|----------------|------------------------|----------------|
| Establishment Costs | 141,350 | 150,000 | 127,500 |
| Project Operational | | | |
| Project Management | 75,690 | 81,500 | 76,500 |
| Data Analysis | 30,000 | included in above cost | 5,000 |
| Total Project Operation | 105,690 | 81,500 | 81,500 |
| CPEA Operational | | | |
| Staffing | 122,268 | 474,614 | 474,614 |
| Investigations | 37,000 | 24,000 | 46,500 |
| Total CPEA Operational | 159,268 | 498,614 | 521,114 |
| Total Operational | 264,958 | 580,114 | 602,614 |
| Total Project Funding | 406,308 | 730,114 | 730,114 |

It should be noted that in addition to the above amounts, the hospitals received casemix payments for patients admitted to the CPEA.

6.1.3 Staffing

Reflective of the funding provided and the different approaches adopted, the pilot hospitals set the following staffing establishments for their CPEAs:

Alfred

- 1.5 EFT nursing positions to ED

Monash

- 5.5 EFT nursing to CPEA

Royal Melbourne

- 5.5 EFT nursing to CPEA

Staffing of the CPEA from the ED (Alfred) rather than as a separate unit (Monash and Royal Melbourne) had obvious potential cost implications that needed to be tested, principally in relation to the impact of staffing the CPEA as a separate unit independent of ED staffing.

It should be noted that the approach to staff employment also varied, particularly in relation to the use of Agency staff. Table 13 shows a wide divergence in the utilisation of agency nursing staff.

RMH had the highest utilisation of agency nursing, with a lower rate at MMC and the lowest at Alfred.

Table 13. Percentage of CPEA Nursing Staff Costs for Agency and Salaried Staff

| | Alfred | Monash | RMH |
|----------------|---------------|---------------|------------|
| Salaried Staff | 90% | 56% | 17% |
| Agency Staff | 10% | 44% | 83% |

Source: Monash Medical Centre payroll data for 12 months to 30 June 2000.

RMH payroll data for six months to December 1999

Alfred estimate supplied by the Coordinator (as area staffed from Emergency Department).

This again has significant cost implications due to the premium paid for agency staff relative to those directly employed by the hospital.

6.1.4 Comparability of data

In KPMG's report on the costing of Baseline patients, it was noted that as the objective of the study was to evaluate the-cost impact of the introduction of CPEAs in each of the

three pilot hospitals, the evaluation is essentially a “before and after” view rather than a cross-hospital comparison⁵⁰.

This point needs to be strongly reiterated in introducing the findings of this report. Cost comparisons between the participating hospitals need to be treated with caution due to differences in:

- approach to the operation of each CPEA (e.g., integrated vs stand alone units);
- protocols for the treatment of patients;
- employment arrangements;
- bed configurations in the CCUs and wards;
- patient mix; and
- approach to patient costing.

6.1.5 Patient grouping for costing purposes

The clinical evaluation of CPEA pilots has focussed on the “disposition” of patients following their presentation to the hospital with chest pain. This refers to the ward or area to which patients were referred, including the ED, CPEA, CCU or ward area (monitored and non-monitored beds).

However, costing systems generally group patients on the basis of their discharge area and this approach has been adopted in this analysis of the cost of treatment of patients presenting with chest pain.

Patients have been grouped on the basis of their point of discharge from the hospital into the following groups:

- CCU;
- Ward;
- CPEA;
- ED (Admitted)
- ED (Non-Admitted)

6.2 Business rules

At the commencement of the project a number of basic business rules were agreed with each of the sites including for the following:

- Approaches to costing should be consistent for both the baseline and comparative patient dataset.

⁵⁰ KPMG, *Costing of Baseline Patients*, p 2

- Costing should, as far as possible use a “bottom-up” patient costing methodology (rather than being a simple “averaging” or “cost-weighting” model), using a formal patient costing system such as Transition™ or an approach that emulates its methodology.
- Use of an episode or encounter number to identify and track all major costs to patients.
- Establishment of a payroll and general ledger cost centre for each CPEA.
- Baseline and comparison periods of identical duration at each site.
- Tracking and costing of the major cost items for patients using the CPEA including nursing care, medical consultations, procedures, diagnostic tests, pharmaceuticals, consumables and overheads.
- No charging of depreciation to the CPEA cost centre.

The methodology employed at each site has essentially followed these rules. Coupled with the fact that each site has either used or emulated the Transition patient costing methodology, considerable similarity of approach at each site has been achieved. However, some differences have occurred and these need to be understood in interpreting the data.

6.2.1 Differences

The differences that have occurred in the costing data have been less to do with differences in approach and more to do with the level of detail that each hospital has been able to collect for some items. This has, in turn, impacted on the costs reported.

6.2.1.1 Drug cost collection

For example Monash Medical Centre (MMC) was unable to collect and thus allocate the cost of imprest drugs in all ward areas for either the baseline or comparison period. Consequently the drug costs for MMC include only those drugs that were individually identified by the CPEA Coordinator. As a result, drug costs for MMC are understated.

6.2.1.2 CPEA Coordinator

In its first report on costing parameters and collection systems, KPMG noted that the salary cost for the Project Coordinator at each hospital would be charged to the CPEA cost centre and that it would “NOT be allocated to patients admitted to the unit. It is to be regarded as a cost of running the unit and not as a cost of providing patient care”. However, this cost was initially allocated at both Monash and Royal Melbourne.

It has therefore been necessary to make manual adjustments to the patient costs provided by these two hospitals.

6.2.1.3 Medical consultation costs

Another issue that was noted in the report on the baseline costing was the fact that MMC was unable to allocate ward medical costs for the baseline dataset⁵¹. In order to improve the comparability of data over the two periods, the baseline data set has been allocated costs per episode that match those in the comparative period.

6.2.1.4 CPEA nursing staff

Finally, it should be noted that the approach taken by Alfred and Monash in calculating CPEA nursing costs differed from that of the RMH.

Alfred and Monash determined an average cost per minute for nursing time in the CPEA and applied this rate to the time each patient was in CPEA. By contrast, the RMH costing system identified the total CPEA nursing costs and allocated this amount to all patients admitted to the unit. The RMH approach has meant that patients treated in the CPEA have fully absorbed all CPEA nursing costs.

6.3 Methodologies employed

A summary of the costing methodologies employed by each of the three hospitals is presented in the Table 14. Specific details for each hospital are presented in Appendix 2.

⁵¹ KPMG, *Costing of Baseline Patients*, p. 5 and p. 7.

Table 14. Summary of Cost Allocation Methodologies at the Pilot Hospitals

| Cost Component | Alfred | Monash Medical Centre | Royal Melbourne |
|----------------------------------|---|--|--|
| ED Medical | Direct feeder - actual cons time, patient identified | No direct feeder – standardised time, patient identified | Direct feeder - actual cons time, patient identified |
| ED Nursing | Direct feeder - actual nursing time, patient identified | Direct feeder - actual nursing time, patient identified | Direct feeder - actual nursing time, patient identified |
| Ward Medical | No direct feeder – standardised time x LOS, patient identified | No direct feeder- weighted bed days, patient identified | No direct feeder- uses LOS, patient identified |
| Ward Nursing | No direct feeder – average bed day cost x LOS, patient identified | No direct feeder- weighted bed days, patient identified | No direct feeder- weighted bed days, patient identified |
| Procedures | Direct feeder - actual procedure x 90% of CMBS, patient identified | Direct feeder - actual procedure x standard cost, patient identified | Direct feeder - actual procedure x standard cost or CMBS, patient identified |
| PTCA/Angio | Under Procedures | Direct feeder - actual procedure x 100% of CMBS, patient identified. Angio costs estimated in comparative data set | Under Procedures |
| Pathology | Direct feeder - actual test x 90% of CMBS, patient identified | Direct feeder - actual test x 100% of CMBS, patient identified | Direct feeder - actual test x RVU's based on CMBS, patient identified |
| Imaging | Direct feeder - actual examination x 90% of CMBS, patient identified | Direct feeder - actual examination x standard cost, patient identified | Direct feeder - actual examinations x RVU's based on CMBS, patient identified |
| Allied Health | No direct feeder – estimated cost /day, patients not identified | No data available - costs not captured | No direct feeder- estimated average costs per bed day/unit, patient not identified |
| Pharmacy- High Cost Drugs | Direct feeder – collected actual usage of high cost drugs, patients identified. | No direct feeder- some costs captured in ED, none in wards/CCU | Direct feeder - scripted items costed to patients, patient identified |
| Pharmacy Imprest Drugs | No direct feeder - total costs x LOS, patients not identified | No data available - cost not captured | No direct feeder- used weighted bed days, patients not identified |
| CPEA Nursing | Direct feeder - actual time in unit x cost/minute, patient identified | Direct feeder - actual time in unit x cost/minute, patient identified | Direct feeder- weighted bed days x actual time in unit, patient identified |

Notes:

1. "Direct Feeder" means that there is a system that routinely captures data about type and quantity of specific services provided to patients (eg a pathology tests report

provides data to the patient costing system). In general the existence of a direct feeder system coupled with identification of the individual patient receiving services should yield higher quality costing data.

2. The second item of information in each cell of Table 12 describes the type of product or service that has been identified and used as the basis for the allocation of costs to the individual patient.
3. "Patient identified" indicates that the patient receiving the specified service has been identified and reported to the costing system. For example under "Pharmacy Imprest Drugs", the normal method of cost allocation is to calculate the total cost of all imprest drugs issued to the cost centre and allocate these to all patients in that cost centre using their individual LOS (sometimes DRG weighted) as the relative value unit for allocation. In this example, an averaging process is used and the specific drugs issued and the volumes received by individual patient are "not identified".

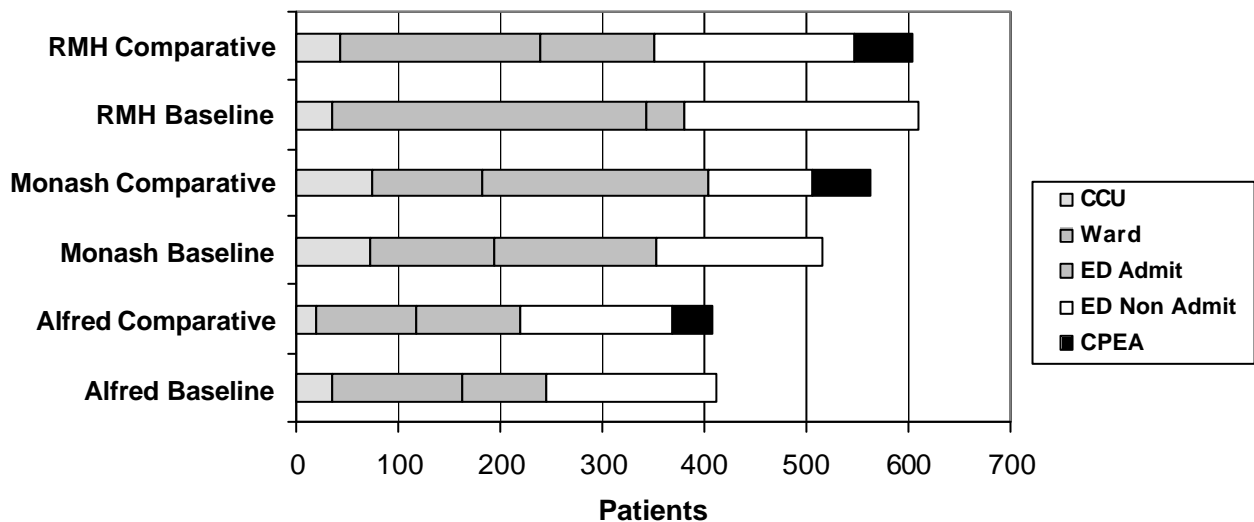
6.4 Findings

6.4.1 Overview

Figure 1 presents a profile of the number and distribution of chest pain patients in the baseline and comparative periods.

This indicates that both baseline and comparative period volumes were similar at both RMH and The Alfred. By contrast, there was a 9.1% increase in chest pain patients at Monash.

Figure 1. Chest Pain Patients x Discharge Area/Ward



In considering the volume of patients it is important to remember that the data collection period was slightly longer at Alfred (61 days) compared with the other two hospitals (56 days).

6.4.2 Length of Stay

One hypothesis to be tested was that with the treatment of patients for assessment in the CPEA environment, the average length of stay (as a proxy for average complexity) for patients admitted to inpatient wards would increase.

The results for this are inconclusive, with two hospitals showing a decline in average inpatient length of stay and one experiencing an increase (Table 15).

Table 15. Average Length of Stay - Chest Pain Patients Discharged from Inpatient Wards (including CCU)

| | Baseline | Comparative | % Change |
|--------|----------|-------------|----------|
| Alfred | 5.1 | 4.7 | -9.1% |
| Monash | 6.4 | 6.1 | -4.1% |
| RMH | 4.9 | 5.1 | 3.6% |

The other notable feature of the figures shown in Table 15 is the significantly longer length of stay at Monash. This difference appears to be due to differences in casemix. Figure 2 below indicates that while 66% of inpatients at Monash are in the "Circulatory" Major Diagnostic Category (MDC), this accounts for only 40% of patient days. A review of Monash patients indicates a number of long-stay patients with non-cardiac discharge diagnoses. The pattern is in stark contrast to the pattern at Royal Melbourne Hospital (Figure 3) where there is not only a higher proportion of patients in the Circulatory MDC, but a close match between patients and patient days.

Figure 2. Monash Medical Centre - Percentage of Ward Inpatients and Ward Inpatient Days x Major Diagnostic Category

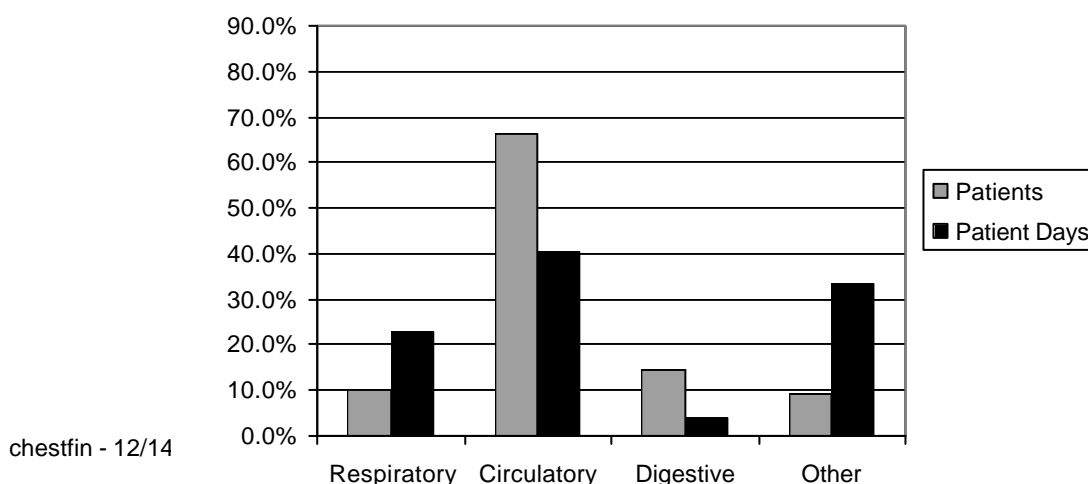
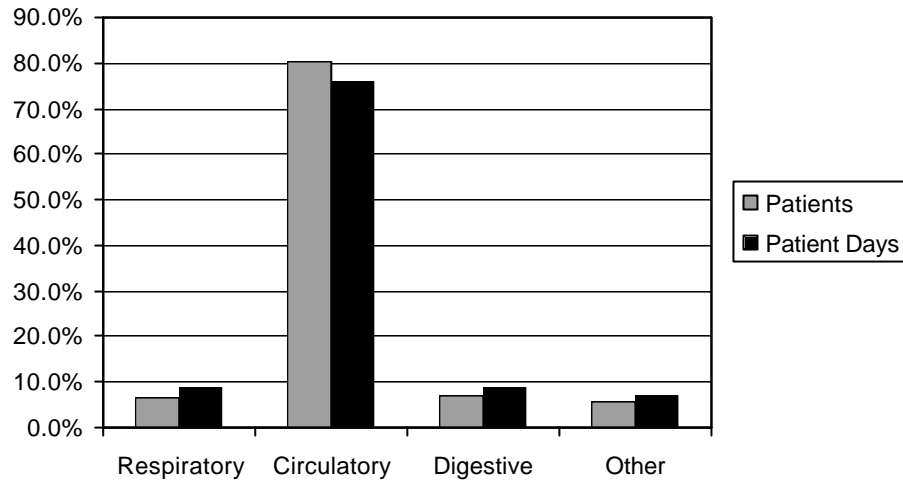


Figure 3. Royal Melbourne Hospital - Percentage of Ward Inpatients and Ward Inpatient Days x Major Diagnostic Category



6.4.3 Key trends

Following the introduction CPEAs, the following trends were apparent at all sites:

- fewer chest pain patients went home without admission (ie within 4 hours);
- fewer patients chest pain patients were admitted to an inpatient bed; and
- a higher proportion of patients were treated solely_in the ED/CPEA environment.

These broad and consistent trends across all sites are illustrated in Figure 4 and Table 16.

Figure 4. Percentage Change in Total Chest Pain Patient Discharges x Area

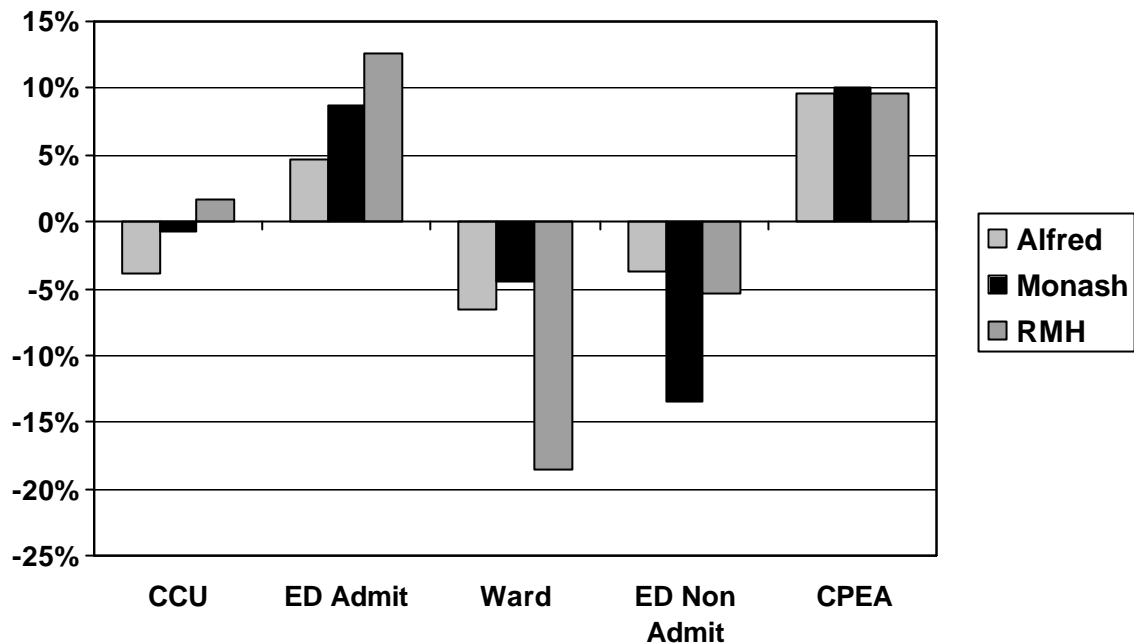


Table 16. Percentage Discharges and Percentage Change in Total Admissions x Ward Area

| Discharged From: | Alfred | | | Monash | | | RMH | | |
|------------------|-------------|-------------|-----------|-------------|-------------|-----------|-------------|-------------|-----------|
| | Base | Compar | Change | Base | Compar | Change | Base | Compar | Change |
| CCU | 8.5% | 4.7% | -3.8% | 14.0% | 13.2% | -0.7% | 5.6% | 7.3% | 1.7% |
| ED Admit | 20.4% | 25.0% | 4.6% | 30.7% | 39.4% | 8.7% | 6.1% | 18.7% | 12.6% |
| Ward | 30.8% | 24.3% | -6.6% | 23.7% | 19.1% | -4.5% | 50.7% | 32.1% | -18.5% |
| ED Non Admit | 40.3% | 36.5% | -3.8% | 31.7% | 18.2% | -13.4% | 37.7% | 32.3% | -5.4% |
| CPEA | 0.0% | 9.6% | 9.6% | 0.0% | 10.0% | 10.0% | 0.0% | 9.6% | 9.6% |
| Total | 100% | 100% | 0% | 100% | 100% | 0% | 100% | 100% | 0% |

These trends have significant implications for the overall cost effectiveness as they involve a move away from high-cost inpatient resources towards lower-cost ED-based facilities. The net effect of the changes in admission patterns for chest pain patients has been to lower overall cost per episode of treating chest pain patients at all hospitals.

Tables 17, 18 and 19 show the results for each hospital.

Table 17. Average Cost Per Patient x Ward Area – The Alfred Hospital

| Average Cost | Baseline | Comparative | Change | |
|-------------------|-------------|-------------|-------------|--------------|
| | \$ | \$ | \$ | % |
| CCU | 5118 | 5352 | 234 | 4.6 |
| Ward | 4340 | 4210 | -129 | -3.0 |
| ED (Admitted) | 427 | 508 | 80 | 18.8 |
| ED (Not admitted) | 206 | 179 | -27 | -13.2 |
| CPEA | | 618 | 618 | |
| TOTAL | 1943 | 1522 | -420 | -21.6 |

Table 18. Average Cost Per Patient x Ward Area - Monash Medical Centre

| Average Cost | Baseline | Comparative | Change | |
|-------------------|-------------|-------------|-------------|--------------|
| | \$ | \$ | \$ | % |
| CCU | 4093 | 4553 | 460 | 11.2 |
| Ward | 6648 | 5926 | -722 | -10.9 |
| ED (Admitted) | 494 | 586 | 92 | 18.7 |
| ED (Not admitted) | 286 | 251 | -35 | -12.2 |
| CPEA | | 820 | 820 | |
| TOTAL | 2344 | 2111 | -234 | -10.0 |

Table 19. Average Cost Per Patient x Ward Area - Royal Melbourne Hospital

| Average Cost | Baseline | Comparative | Change | |
|-------------------|-------------|-------------|-------------|-------------|
| | \$ | \$ | \$ | % |
| CCU | 3441 | 3372 | -69 | -2.0 |
| Ward | 4288 | 4858 | 570 | 13.3 |
| ED (Admitted) | 755 | 1074 | 320 | 42.4 |
| ED (Not admitted) | 222 | 204 | -18 | -8.2 |
| CPEA | | 2178 | 2178 | |
| TOTAL | 2493 | 2296 | -197 | -7.9 |

A reduction in the overall cost of treating chest pain patients is apparent at each hospital, with Alfred reporting the largest improvement at 21.6%. The figures for the other two hospitals also show an efficiency gain, although the figures tend to understate the potential of CPEAs. The reasons for this are:

- both Monash and Royal Melbourne staffed their CPEA unit with a higher proportion of agency nurses than Alfred, resulting in a higher cost for the CPEA unit than might apply if the unit was integrated into the ED;

- due to differences in approach to cost allocation (which are discussed below), the total CPEA unit cost at Royal Melbourne is substantially higher than the other two sites (\$2,178 compared with \$618 at Alfred and \$820 at Alfred).

6.4.4 CCU

An important issue for the pilot was the impact on the utilisation of CCU beds. Consideration therefore needs to be given to utilisation of these beds by patients who were discharged from both CCU and general ward beds.

Data was provided by two sites and indicated that CCU utilisation by chest pain patients presenting to the ED decreased in line with the overall decrease in use of inpatient beds.

Table 20 shows that at RMH, CCU days declined slightly as a proportion of Chest Pain inpatient bed days and decreased in absolute terms in line with the overall decline in inpatient admissions. At Monash, the number of CCU days remained almost constant within the already noted increase in patient volume of 9.1%. However, CCU bed days increased from 36% of chest pain inpatient bed days to 41%. This may be due to an increase in the average acuity of patients admitted to inpatient beds in the comparative period, but the data is not sufficient to be able to draw such a conclusion in this study given the potential impact of changes in patient mix.

Nevertheless, what can be said is that consistent with the decrease in overall bed utilisation, CCU bed days utilised by patients presenting to the ED with chest pain decreased at both hospitals (after adjusting for the increased number of patients presenting to Monash in the comparative period).

Table 20. CCU Bed Days – All Chest Pain Patients as Percentage of Total Bed Days

| | Monash | | RMH | |
|--------------------------|----------|---------|----------|---------|
| | Baseline | Compar. | Baseline | Compar. |
| Total Inpatient Bed Days | 1239 | 1109 | 1678 | 1206 |
| CCU Bed Days | 450 | 454 | 607 | 418 |
| Percent CCU/IP Days | 36% | 41% | 36% | 35% |

6.4.5 Chest Pain Unit

6.4.5.1 Cost allocation issues

The wide disparity in the per-patient cost of the CPEA units needs to be further examined. The major contributing factor in this result is the CPEA nursing costs component and in particular, the different approach taken by RMH in allocating the costs of CPEA nursing staff.

The approach taken by Alfred and Monash in calculating CPEA nursing costs was to determine an average cost per minute for nursing time in the CPEA (based on payroll/agency staff rates) and to apply this rate to the number of minutes each patient was in CPEA.

By contrast the RMH have identified the total nursing staffing costs associated with the operation of the CPEA for the two month period and allocated this cost across all patients admitted to the unit. While this cost allocation has been made on the basis of DRG weight and actual time in the unit, the RMH approach has meant that the patients treated in the CPEA have fully absorbed all of the nursing costs associated with the unit over the period.

Example – Alfred/Monash Approach

Employment cost of CPEA nurse = \$0.50 per minute

Patient stay in CPEA unit = 100 minutes

Total cost allocated to patient = \$0.50 x 100 = \$50.00

Example – RMH Approach

Total Employment Cost for CPEA Unit = \$25,000

Patients (all equivalent in terms of time in CPEA and DRG) = 250

Total cost allocated to patient = \$25,000/250 = \$100

It needs to be re-emphasised at this point that the purpose of the costing exercise was not to undertake comparisons between hospitals, but rather, to assess the “before and after” impact of their introduction.

Nevertheless, the two approaches that have been adopted highlight an important finding. The RMH figures reflect the fact that the per-patient costs of running a CPEA as a separate unit are high and that time spent by CPEA nurses working on other patients in ED is an important aspect of keeping costs down. In other words, the two costing approaches reflect what has been found in practice – the more efficient approach to resourcing the CPEA is to regard it as part of the ED rather than a separate unit and to take a flexible approach to staffing based on occupancy.

6.4.5.2 Adjusting for agency costs

As noted already, there were substantial differences between the sites in relation to the employment of agency nurses. In assessing the cost of operation of the CPEAs we have attempted to adjust for this factor. Table 21 shows the average cost per patient discharged from CPEA at each hospital before and after adjustment for agency costs.

Table 21. Average Cost per Patient Discharged from CPEA Unit - As Costed and After Adjustment for Agency Staffing Differences

| | As Costed | Adjusted |
|-----------------|------------------|-----------------|
| Alfred | \$618 | \$618 |
| Monash | \$820 | \$744 |
| Royal Melbourne | \$2,178 | \$2,027 |

It should be reiterated at this point that because costings have been based on the patient’s discharge point, there were other patients treated in the CPEA who were

subsequently discharged from and inpatient ward or transferred to another hospital (20 at Monash, 9 at Alfred and 6 at RMH during comparison period).

6.4.6 Impact on inpatient beds

It has already been noted that the main impact of the introduction of the CPEA units has been a decrease in utilisation of inpatient bed resources by ED chest pain patients. This section quantifies this impact in terms of bed days saved and increased bed availability.

Table 22 details the number of inpatient bed days recorded in the baseline and comparison periods and translates the reduction achieved into equivalent inpatient beds.

Table 22. Base Estimate of CPEA Pilot Impact on Bed Utilisation

| | Alfred | Monash | RMH |
|--|--------|--------|------|
| Inpatient Bed Days – Baseline | 834 | 1239 | 1678 |
| Inpatient Bed Days – Comparison | 552 | 1109 | 1206 |
| Reduction in Inpatient Bed Days | 282 | 130 | 472 |
| Estimated Reduction in Inpatient Bed Utilisation | 4.6 | 2.3 | 8.4 |

However, it has already been noted that while the number of patients presenting at Alfred and RMH in the baseline and comparative periods were similar, there was a growth in patients presenting to Monash. As a result, the reduction in bed days at Monash is understated because it has been accompanied by a growth in volume. Table 23 recalculates the reduction in bed utilisation based on an adjusted baseline volume.

Table 23. Adjusted Estimate of CPEA Pilot Impact on Bed Utilisation

| | Alfred | Monash | RMH |
|--|--------|--------|------|
| Inpatient Bed Days - Baseline (Adjusted) | 826 | 1345 | 1661 |
| Inpatient Bed Days – Comparison | 552 | 1109 | 1206 |
| Reduction in Inpatient Bed Days | 274 | 236 | 455 |
| Estimated Reduction in Inpatient Bed Utilisation | 4.5 | 4.2 | 8.1 |

6.4.7 Quantifying the efficiency gain

Given average bed day costs approaching \$1000, the saving of 4 and more beds has a significant impact in efficiency terms. To more accurately assess the impact, costs in each ward area have been modeled based on the shifts in utilisation patterns that have already been noted. The results are detailed in Tables 24, 25 and 26.

Table 24. Indicative Valuation of Annual Efficiency Improvements from CPEA - The Alfred Hospital

| | Percentage of Patients Discharged | | | Indicative Ave Cost (\$) | Total Cost (\$,000) | | |
|--------------|-----------------------------------|-------------|-----------|--------------------------|---------------------|--------------|-------------|
| | Pre CPEA | Post CPEA | Change | | Pre CPEA | Post CPEA | Change |
| CCU | 8.5% | 4.7% | -3.8% | 5,352 | 1,102 | 604 | -498 |
| ED Admit | 20.4% | 25.0% | 4.6% | 508 | 251 | 308 | 57 |
| Ward | 30.8% | 24.3% | -6.6% | 4,210 | 3,145 | 2,476 | -669 |
| ED Non Admit | 40.3% | 36.5% | -3.8% | 179 | 175 | 158 | -16 |
| CPEA | 0.0% | 9.6% | 9.6% | 618 | | 143 | 143 |
| Total | 100% | 100% | 0% | | 4,672 | 3,689 | -984 |

Based on 2423 estimated annual chest pain presentations

Table 25. Indicative Valuation of Annual Efficiency Improvements from CPEA - Monash Medical Centre

| | Percentage of Patients Discharged | | | Indicative Ave Cost (\$) | Total Cost (\$,000) | | |
|--------------|-----------------------------------|-------------|-----------|--------------------------|---------------------|-------------|-------------|
| | Pre CPEA | Post CPEA | Change | | Pre CPEA | Post CPEA | Change |
| CCU | 14.0% | 13.2% | -0.7% | 4553 | 2282 | 2161 | -121 |
| ED Admit | 30.7% | 39.4% | 8.7% | 586 | 644 | 826 | 182 |
| Ward | 23.7% | 19.1% | -4.5% | 5926 | 5033 | 4067 | -966 |
| ED Non Admit | 31.7% | 18.2% | -13.4% | 251 | 285 | 164 | -121 |
| CPEA | 0.0% | 10.0% | 10.0% | 820 | | 295 | 295 |
| Total | 100% | 100% | 0% | | 8244 | 7512 | -731 |

Based on 3585 estimated annual chest pain presentations

In each case, it would appear that CPEAs have enabled substantial efficiency gains to be achieved. The more significant the reduction in ward utilisation, the greater the gain. This is particularly the case for Royal Melbourne because the proportion of patients discharged from wards was much higher than the other two hospitals in the baseline period, enabling an 18.5% decrease in patients discharged from wards (offset by a 1.7% increase in patients discharged from the CCU).

However, a number of important points need to be made in relation to these results:

- they are based on a small sample size and may be influenced by casemix and other variability between the baseline and comparative samples;
- the resultant improvement in hospital utilisation may not enable reduced costs for the hospitals, because:
 - many costs are fixed (eg CCU availability);
 - reduced utilisation of wards by chest pain patients creates capacity to treat others.

Table 26. Indicative Valuation of Annual Efficiency Improvements from CPEA - Royal Melbourne Hospital

| | Percentage of Patients Discharged | | | Indicative | Total Cost (\$,000) | | |
|--------------|-----------------------------------|---------------|-------------|---------------|---------------------|-------------|--------------|
| | Pre CPEA | Post CPEA | Change | Ave Cost (\$) | Pre CPEA | Post CPEA | Change |
| CCU | 5.6% | 7.3% | 1.7% | 3372 | 741 | 969 | 228 |
| ED Admit | 6.1% | 18.7% | 12.6% | 1074 | 257 | 792 | 536 |
| Ward | 50.7% | 32.1% | -18.5% | 4858 | 9704 | 6153 | -3551 |
| ED Non Admit | 37.7% | 32.3% | -5.4% | 204 | 303 | 260 | -44 |
| CPEA | 0.0% | 9.6% | 9.6% | 2178 | | 825 | 825 |
| Total | 100.0% | 100.0% | 0.0% | | 11006 | 8999 | -2007 |

Based on 3943 estimated annual chest pain presentations

In other words, while the reduction in total costs shown in Tables 24, 25 and 26 can be regarded as “efficiency gains”, the capacity of hospitals to translate these into “cost savings” will depend on a range of other factors. For example, if a hospital is in a “downsizing” mode, changes in approach to clinical practice such as the use of CPEAs can be effective because many “fixed” costs (eg a whole ward) may become variable due to service closures. Similarly, if there are under-utilised resources (eg wards with low occupancy), efficiency gains can be translated into cost savings through the closure of beds.

However, if occupancy is high and there is pressure on the hospital to treat more patients, it can be expected that beds not used by chest pain patients treated in the CPEA will be quickly filled by other patients.

The other important issue in considering the viability of CPEAs is the extent to which they are resourced at the departmental level. While there are substantial efficiency gains in a hospital-wide sense, the CPEA/ED carries additional costs and workload and appropriate resourcing must be provided if they are to be viable.

7 Overall evaluation

7.1 Issues impacting upon the review

Two major issues were reported to impact upon evaluation of the pilot projects at the three facilities, including:

- IT changes/difficulties, which impacted upon the immediacy and the quality of data collection; and
- admission block due to staff shortages at all Melbourne hospitals from June to December 1999, leading to increases in ED length of stay figures and impacting upon comparison data collection period.

The extent to which these issues have impacted upon differences observed between the baseline and comparison periods (e.g., admissions to the CPEA) are difficult to ascertain.

A further limitation, impacting upon our ability to draw definitive conclusions from the pilot projects, relates to the absence of identified low to moderate risk chest pain patients in the baseline group. Without identifying these patients it is not possible to specifically isolate the impact of the CPEA upon the ED or hospital admissions. Given that these patients were identified after the commencement of the pilot projects, analysis of findings has resulted in a descriptive account of changes that are open to challenge, and active investigation in any future CPEA units that may be established is recommended. Issues relevant to undertaking an analysis of future CPEA units are reported in our recommendations below.

Notwithstanding these caveats, the descriptive findings of the current pilot projects have reported primary outcomes that appear consistent with previous studies, supporting the effectiveness of the CPEA model of care.

7.2 Indicators for the CPEA

The current projects have identified a series of indicators to monitor the impact of the CPEA model of care for low-moderate risk chest pain patients. These indicators together with considerations for future refinement are presented below, including:

- Hospital resource allocation: monitored by the percentage of CPEA patients discharged home and admitted for further inpatient care. International literature provides a benchmark for ongoing evaluation. This indicator also relates to patient outcomes;
- Efficiency of investigation: monitored by the average time to positive/negative outpatient investigation results. This indicator would be particularly beneficial where hospital protocols delineate that the majority of a specific type of investigation (e.g., EST) is conducted in an outpatient setting;
- Primary patient outcome: monitored by the number of CPEA patients discharged home with a definitive "non-cardiac" diagnosis. Regular measures of patient

satisfaction and methods to assess the incidence of missed AMI's would be of future benefit; and

- Continuity of care/ongoing management: monitored by the number of CPEA patient re-presentations. Further considerations should also be given to monitoring the compliance of CPEA patients referred for outpatient investigations and appointments, particularly where appointments are not made prior to CPEA home discharge.

Measures of throughput (e.g., daily number of CPEA admissions) and patient acuity (e.g., triage category) may also be considered by hospitals with CPEAs for inclusion in a future minimum data set established for ongoing monitoring of patient outcomes.

Other indicators reported in the current studies are either protocol dependent or heavily influenced by the configuration of inpatient beds at each hospital and thus have lower utility in evaluating CPEA outcomes, including:

- Length of Stay: which is dependent upon an individual hospital's CPEA protocol;
- Inter-hospital transfers: which are dependent upon inpatient bed configurations and system wide issues (eg. bed closures resulting from staff shortages); and
- Risk factors and past history: which are also dependent upon the criteria for assessing low to moderate risk chest pain patients.

7.3 Outcomes of the CPEA pilots

The two general aims established for the CPEA pilot projects at each facility were evaluated against the relevant primary outcome indicators. Evidence for evaluation of the primary aims is summarised in the table below.

Table 27. Evaluation of aims for CPEA pilot projects.

| | The Alfred | RMH | MMC |
|---|--------------|--------------|--------------|
| Discharge Disposition | | | |
| ▪ Home | ✓ increased | ✓ increased | ✓ increased |
| ▪ In-patient | ✓ decreased | ✓ decreased | ✓ decreased |
| Discharge Diagnosis | | | |
| - Non-Cardiac/Unknown | ✓ increased | ✓ increased | ✓ increased |
| Time to positive/negative outpatient investigations | ✓ increased | ✓ increased | maintained |
| Re-presentations | ✓ maintained | ✓ maintained | ✓ maintained |
| Number of planned outpatient investigations/appointments | ✓ increased | ✓ increased | maintained |
| Overall cost of treating chest pain patients | ✓ decreased | ✓ decreased | ✓ decreased |

In regard to the first aim:

- “to improve outcomes for patients who experience chest pain that is not immediately attributable to AMI or non-cardiac origin following initial physician assessment, and who have a low to moderate risk of Coronary Heart Disease, and death or non-fatal myocardial infarction”

Available evidence lends support to having achieved this aim. A large proportion of CPEA patients received a diagnosis of “non-cardiac” or “unknown” chest pain, indicating that more serious underlying causes could be excluded prior to discharge. Home discharge was particularly high for the CPEA group of patients. Unfortunately, this figure may have been just as high for low-moderate risk patients in the baseline group. However, to the extent that these findings are consistent with previous literature in which CPEA units have been implemented and evaluated, we might assume that high rate is can be attributed to the operation of the CPEAs.

Substantial improvement in the time to outpatient investigations was also observed, representing a significant outcome for patients who can be informed regarding the nature of their medical condition.

Evidence available at 30-day follow-up indicated that there was no increase in the number of missed AMI's following introduction of the CPEA protocols.

Re-presentations remained constant in the context of a (likely) increase in the number of patients discharged home, indicating appropriate provision of ongoing care. Examples of such care are evident in the higher number of outpatient appointment bookings.

The number of planned outpatient investigations was also observed to increase, especially where appointments were booked directly from the CPEA.

In regard to the second aim:

- “to improve the utilisation and cost effectiveness of hospital and system resources through improved management of cardiac patients with chest pain”

Cost analysis following the introduction of CPEA protocols shows that fewer chest pain patients went home without admission to the ED/CPEA, fewer patients were admitted to an inpatient bed, and a higher proportion of patients were treated in the ED/CPEA environment. Moreover, a reduction in the overall cost of treating chest pain patients was apparent at each hospital, demonstrating efficiency gains following the introduction of the CPEAs. The greatest efficiency gains were associated with significant reductions in ward utilisation.

With specific regard to the CCU, bed utilisation of ED chest pain patients was also observed to decrease in line with the overall decrease in the use of inpatient beds. Qualitative reports have also indicated that more “appropriate” patients had been admitted to the CCU following the implementation of the CPEAs.

At the commencement of the project, it was thought that observable differences in outcome between the three hospitals might have resulted from differing approaches to:

- CPEA protocols, and
- Nursing staff qualifications.

Differences in outcome between the three hospitals, attributed to CPEA protocol or the experience of nursing staff were not apparent.

It was also thought that an increase in the number of chest pain presentations may be observed for the hospitals with pilot projects, following greater public awareness of the CPEA model of care. Whilst a slight increase in the number of chest pain patients were observed for the MMC, a similar number of chest pain presentations were observed between baseline and comparison group periods for the RMH and The Alfred. Accordingly, it is not possible to establish that the presence of a CPEA has resulted in a higher number of chest pain presentations, and future monitoring is required to investigate this hypothesis.

8 Future directions and recommendations

Perceived directions for the CPEA units, reported by participating hospitals, are presented below.

Table 28. Perceived directions reported for CPEA pilot projects at participating hospitals.

| | The Alfred | RMH | MMC |
|-------------------------|---|---|--|
| Location | <ul style="list-style-type: none"> ▪ Maintain current integration with ED. | <ul style="list-style-type: none"> ▪ Maintain current location, with beds used by CPEA and ED. ▪ Future consideration to relocate alongside resuscitation area. | <ul style="list-style-type: none"> ▪ Relocation to higher profile ED area, closer to resuscitation. |
| Staffing | <ul style="list-style-type: none"> ▪ Maintain current staffing. | <ul style="list-style-type: none"> ▪ Integrated with ED, clinical nurse specialist to work in CPEA, 4.5 EFT added to existing ED nurse compliment. | <ul style="list-style-type: none"> ▪ Integrated with ED, 1.0 EFT added to the existing ED nurse complement. |
| Protocols | <ul style="list-style-type: none"> ▪ Maintain current protocols. | <ul style="list-style-type: none"> ▪ Minor changes to admission protocol (no age dependency). ▪ Minor changes to discharge protocol (removal of Troponin-I as stratification tool). | <ul style="list-style-type: none"> ▪ Maintain current protocols. |
| Investigations | <ul style="list-style-type: none"> ▪ Maintain as per protocol. | <ul style="list-style-type: none"> ▪ Additional EST service in cardiology department. | <ul style="list-style-type: none"> ▪ Maintain as per protocol. |
| Other directions | <ul style="list-style-type: none"> ▪ Implement new patient information leaflet. ▪ Review methods of providing information to LMO for patient follow-up. | <ul style="list-style-type: none"> ▪ Development of database for ongoing analysis. | <ul style="list-style-type: none"> ▪ Development of comprehensive self educational package |

Each participating hospital has indicated a wish to continue operation of the CPEA. In general, hospitals with stand-alone units have indicated a preference for adopting an integrated ED-CPEA model in which monitored beds are proximal to the resuscitation area and staffing is integrated with the existing ED nursing complement. Minimal changes to existing CPEA protocols, or investigation procedures have been anticipated, indicating a positive level of satisfaction with current operational criteria.

8.1 Recommendations

Overall evaluation of the three pilot projects would support ongoing development of new or existing CPEAs. In order to maximise patient outcomes and use of hospital resources, the following recommendations are presented for consideration.

8.1.1 Hospitals intending to implement CPEAs should consider adopting prospective investigations

In order to gain a further understanding of the impact of a CPEAs for hospitals wishing to implement this model of care, a prospective evaluation design is required. Two distinct advantages are associated with this approach to evaluation:

- Prospective data collection can capture a broader range of tailored information from all patients, rather than relying upon information currently documented in medical records or hospital data bases, minimising the occurrence of missing data; and
- Protocols for identification of low-moderate risk chest pain patients can be administered to identify a group of CPEA-eligible patients, for whom standard ED management can be evaluated and compared with patients receiving treatment from an operational CPEA unit.

By adopting this approach, comparisons can be made between homogenous patient groups to determine the specific clinical and costing implications of the CPEA model of care.

8.1.2 Hospitals with CPEAs should establish and refine indicators for ongoing CPEA evaluation.

Based upon the findings of the current projects, and previous literature, minimum indicators require specification for ongoing evaluation and accountability of existing (and future) CPEAs. A series of minimum clinical indicators have been presented and discussed in Section 7.2 for consideration including:

- the percentage of CPEA patients discharged home;
 - the percentage of CPEA patients admitted for further inpatient care;
 - the average time to positive/negative outpatient investigation results;
 - the number of CPEA patients discharged home with a definitive “non-cardiac” diagnosis; and
 - the number of CPEA patient re-presentations.
- A broadening of indicators to include regular follow-up of patients discharged directly home from the CPEA, and consideration of the use of satisfaction measures is also recommended.

8.1.3 The Department of Human Services should adopt a casemix funding model

As noted already, the CPEAs have been provided with pilot funding by the Department of Human Services. They have produced substantial gains in efficiency in the treatment of chest pain patients and their continuation and further development appears to offer opportunities for improved utilisation of healthcare resources.

A key issue now is how to encourage and support the development of these units in other hospitals where there are appropriate levels of support, facilities and service demand.

8.1.3.1 Capital

Initial capital is required to establish appropriate facilities with EDs. Consistent with current approaches, specified capital grants to individual hospitals based on funding applications for the establishment of CPEA facilities would be appropriate. Individual hospitals may also consider investment in these facilities given their potential to produce cost savings.

8.1.3.2 Operating

As each patient admitted to a CPEA receives a casemix payment, it is important to assess how these payments relate to cost.

Data provided by Monash on the discharge diagnosis for patients discharged from their CPEA indicate that they attracted a variable case payment of \$502. Included in this figure were patients classified "same day" and therefore received a lower payment than those classified as "overnight". In other words, those patients whose stay spanned midnight attracted a higher payment. Given that all CPEA patients are treated in accordance with a standard protocol and do not stay longer than one day, there maybe an argument to indicate that the distinction between "same day" and "overnight" should not apply. The number of patients admitted to CPEAs is small. Any change to case payments would therefore need to be considered in the context of the impact on other patients groups within the relevant DRGs. If the same patients at Monash were funded consistently as non-"same day" (ie receiving the full weight), the average variable case payment would have been \$660. This is more closely aligned with the costs in Table 21.

If the full WIES (ie including the fixed component) is calculated, the average funding increases to \$843 with same day categorisation applied and \$1,105 without. Table 29 summarises these results.

Other funding options have also been considered. For example, consistent with ED funding generally, CPEAs could (in addition to casemix) be funded on a block grant basis in recognition of the fact that there is a significant "availability" component. However, given their small size and the fact that the pilot hospitals are moving towards a model that incorporates the CPEA into the ED, payment on the basis of availability of a separate unit is not seen as the most appropriate approach.

Table 29. Estimated Average WIES Funding for Patients Discharged from Monash Medical Centre CPEA

| | Variable \$ per WIES7 @ \$1243 | Total \$ per WIES7 @ \$2088 |
|--|---|--|
| With differentiation of same day and overnight cases | \$502 | \$843 |
| Same weight for all cases using overnight weight | \$660 | \$1,105 |

The other issue that needs to be considered here is the likelihood that the pilot hospitals have turned the efficiency gains made through the CPEA pilot into additional inpatient throughput rather than reduced costs. This may therefore require some assessment of each hospital's position in relation to its WIES target.

In summary, it is our view that casemix payment of CPEA patients is an appropriate approach. However it is noted that:

- an assessment is required of the viability of ensuring that the case weight for CPEA does not differentiate between patients designated as "same day" and those whose stay spans midnight;
- CPEAs require up-front capital for equipment and infrastructure;
- each hospital needs to ensure that ED/CPEA funding flows through to the ED/CPEA;
- "investment returns" may accrue in terms of additional patients treated rather than cost savings.

Appendix 1 – Members of the CPEA Working Party

Department of Human Services

- Ms Sue Brennan, Acting Manager, Quality Branch
- Ms Jane McKercher, Project Officer, Access Unit

The Alfred Hospital

- Ms Linda Holsworth, Project Officer
- Dr Linas Dziukas, Senior Consultant, Emergency Department
- †Associate Professor Tony Dart, Deputy Director, Cardiovascular Medical Services
- †Professor Garry Jennings, Director, Cardiovascular Medical Services

The Royal Melbourne Hospital

- Ms Michelle Hunter, Project Officer
- †Associate Professor Peter Cameron, Director, Emergency Medicine.
- †Dr Leeanne Grigg, Cardiology.

Monash Medical Centre

- Ms Trish LeBrocq, Project Officer
- †Dr Tony Kambourakis, Emergency Medicine
- Dr Roger Peverill, Cardology

† Denotes individuals to contact (in writing) for copies of individual hospital reports.

Appendix 2 – Detailed costing methodologies for the three pilot CPEA hospitals

The Alfred Hospital

The Alfred has used a costing methodology similar to that of the Transition™ system. However, Finance Department staff carried out the costing using a database management system rather than the Transition system itself. The same costing methodology has been used for both the baseline and comparative periods unless specifically noted below.

The costing methodologies and major assumptions for each cost component at The Alfred are detailed on the following sections:

Emergency Medical Consultation Costs

Allocated on the basis of actual consultation time per patient using the actual salary cost of medical staff involved.

Emergency Nursing Costs

Allocated on the basis of minutes of nursing time for each patient using the actual cost of staff (per nurse classification).

Ward Medical Consultation Costs

Allocated on the basis of standardised ward consultation time and the average cost per bed day for the medical unit involved.

Ward Nursing Costs

Based on the average nursing cost per bed day for the ward involved and the individual patient length of stay (LOS).

Procedures

Based on the actual procedure at a cost of 90% of Commonwealth Medical Benefits Schedule (CMBS).

Pathology

Based on actual tests and costed at 90% of CMBS.

Imaging

Based on the actual procedure at a cost of 90% of CMBS.

Allied Health

No feeder systems were available to identify patient utilisation of allied health services. Allocation was therefore based on an estimated cost per day for same-day and multi-day patients and based on each patient's LOS.

Pharmacy

High-cost items were separately identified using each patient's drug chart. Cost/item information was supplied to the Finance Department and directly costed to each patient.

Imprest drug items supplied from ward drug cupboards were allocated on the basis of imprest cost per ward/area and length of stay (LOS) in ward/area.

Emergency department pharmaceutical supplies were allocated on the basis of cost of for the imprest and allocated on the basis of hours in the ED.

Emergency Consumables

Based on consumables cost for ED and allocated on the basis of actual LOS (hours).

Ward Consumables

Based on actual consumables cost for the ward/area and allocated on the basis of patient LOS.

Food

Average cost per meal calculated and applied at three meals per day for inpatients. No allocation was made for ED patients.

Overheads

Alfred used the standardised calculation applied to all business units. Costs were allocated to patients on the basis of LOS in wards. ED non-admitted patients were allocated a modified charge based on LOS (hours). AD Admitted patients were allocated a full daily rate on the basis of LOS.

CPEA Unit Nursing Costs

Actual time in ED and in the CPEA was calculated for each patient. For time spent in ED the patient was allocated nursing costs based on the standardised ED charging formula (dollars/minute).

As nurses working in the CPEA worked in both the ED and the CPEA, a figure of 1.5 full time (EFT) nurses (the establishment amount) was nominated as the time worked in CPEA. The total cost was calculated and then allocated to all CPEA patients based on the time spent in the unit.

Monash Medical Centre

The Monash Medical Centre (MMC) is a site that uses the Transition™ decision support system for patient costing. However, while this was the MMC preferred option to produce costing for baseline and comparative periods, the implementation of Transition was not sufficiently advanced to enable costing of individual patients at the time data was required for both datasets.

However, while detailed costing was not available from Transition for individual patients, it was able to provide the standard costs for a number of the “intermediate products”.⁵² Using the various departmental feeder systems, MMC was able to access the actual patient usage of each intermediate product, obtain the standard cost (or price) of each and allocate these costs to all patients in the baseline and comparative periods using a separate database.

The costing methodologies and major assumptions for each cost component at Monash Medical Centre are detailed on the following sections:

Emergency Medical Consultation Costs

Consultation costs for both data sets were based on an estimation of 70 minutes per patient using average times for Triage categories 2 and 3. The cost per minute used in the baseline was updated by 3% for inflation in the comparative costing data. The cost allocation to each patient was based on time in ED and the cost per minute.

Emergency Nursing Costs

Allocated on the basis of the actual time in ED and cost per nursing minute.

Ward Medical Consultation Costs

In the comparative dataset, these costs were allocated based on the average costs per bed day for the relevant Diagnosis Related Group (DRG), using data derived from the 1997/98 Cost Weights Study (CWS). This was updated by 2% for the elapsed time since the CWS.

MMC was unable to allocate these costs for the baseline. In order to improve the comparability of data over the two periods, KPMG allocated baseline patients a cost identical to that for the comparative period.

Ward Nursing Costs

Allocation based on the average cost per ward, ICU and CCU identified in the 1997/98 CWS, adjusted for cost increases by 3%.

This item covers the costs in wards other than the patient’s discharge ward. For example, ward nursing costs for patients discharged from the CCU include costs for nursing in other wards prior to admission to CCU.

CCU Nursing Costs

Allocation based on the average cost per ward, ICU and CCU identified in the 1997/98 CWS, adjusted for cost increases by 3%.

As patients have been grouped on the basis of discharge ward, CCU costs are also included under other headings such as “Ward Nursing Costs” where the ward was the final discharge point.

⁵² “Intermediate products” are services provided in patient-related departments. Examples include imaging services, theatre time, pathology tests etc.

Procedures

Based on time in theatre and allocated on the basis of a standard Transition™ cost per theatre minute.

Pathology

Based on actual tests and costed at the full CMBS rate.

Imaging

Details of tests were captured from the MMC Imaging system. The standard cost of each test from Transition™ was allocated on the basis of procedures performed.

Allied Health

MMC was unable to access the allied health feeder systems and consequently no costs for these services appear in the MMC data for either the baseline or comparative dataset.

Pharmacy

Costs allocated by Monash only covered patients in the ED and CPEA for whom the Coordinator identified specific drugs consumed. Access to data from the Pharmacy system in relation to drugs supplied from ward imprest stocks was not available. As a result, ward drug costs are not included in the costing and is under-stated relative to the other sites.

Consumables

Although The Alfred has reported these items separately they are usually absorbed in (and subsequently allocated with) ward costs by hospitals operating a costing system such as Transition (The RMH) or costing in a like manner.

Food

Based on average food cost per bed day and allocated on the basis of LOS to all inpatients other than those in ICU and theatre.

PTCA/Angio

This category covers stress tests, ECG, VQ and stents. These items are costed to individual patients at CMBS rates for both data sets. Angioplasty costing data was available from a feeder system for the baseline data set, but was not accessible for the comparative period. As a result, these costs were estimated.

Overheads

Overhead department costs are built into the various direct cost centres. These are estimated to be in the order of 20%, a similar rate to that applied at Alfred and RMH.

CPEA Unit Nursing Costs

Allocated to all patients who passed through the CPEA using actual time (minutes) in the CPEA. Costed using actual nursing cost per minute based on the cost of nursing staff in the CPEA cost centre.

The Royal Melbourne Hospital

The Royal Melbourne Hospital (RMH) used the Transition™ patient costing system to undertake the costing of the baseline and comparative databases.

The costing methodologies and major assumptions for each cost component at the RMH are detailed on the following sections:

Emergency Medical Consultation Costs

Allocation based on a combination of triage category and minutes in ED, calculated as a cost per minute.

Emergency Nursing Costs

Allocation based on a combination of triage code and minutes in ED, calculated as a cost per minute.

Ward Medical Consultation Costs (including Surgical)

Allocated on the basis of patient LOS in each ward using the cost per bed day for the relevant ward.

Ward Nursing Costs

Allocation based on costs for the individual ward, DRG weighted bed days⁵³ and the individual patient LOS.

Nursing Cost ICU and CCU

Allocation based on LOS in each ward and the cost per bed day for each ward (CCU or ICU).

Procedures

Costing to patients is based on the following:

- Salaries are costed on the basis of patient minutes in theatre and staff costs per theatre minute.
- Consumables costs are allocated using relative value units (RVUs) based on CMBS fees grouped into cost bands.
- Cardiac prostheses costs are allocated on the basis of product groupings and RVUs provided by RMH Cardiology.

⁵³ Using *The National Hospital Cost Data Collection 1996-97*

Pathology

RMH pathology systems used to identify tests for individual patients with cost allocation based on RVUs for items under the CMBS.

Imaging

RMH Imaging systems used to identify procedures for individual patients, with a cost allocated using RVUs based on the CMBS.

Allied Health

No feeder systems are currently available to track individual patient utilisation of allied health services. Allied health costs are allocated to wards/areas and from there to patients (whether they used allied health services or not) based on the patient's LOS in the ward.

Pharmacy

Prescription drug items allocated using the patient prescription, product grouping, and RVUs provided by the RMH Pharmacy department system. Drugs obtained from imprest cannot be tracked to individual patients (although administration details are recorded in the patient record). Allocation based on DRG weighted bed days using pharmacy cost data per DRG derived from data published in *The National Hospital Cost Data 1996-97*.

Consumables and Food

Not separately identified in the costing system. Allocated as part of ward-based costs (based on DRG-weighted bed days).

Overheads

These cost (eg Administration, Personnel, Engineering, Cleaning etc) are normally distributed in Transition™ to the patient-related departments based on a number of allocation methods. For example "number of staff" is used to allocate Personnel Department costs and "square metres of floor space" for cleaning services. These costs are subsequently distributed to the patients via the allocation process used in each of the patient-related or direct departments (eg as part of ward costs using weighted bed days). The RMH has identified these as indirect costs. At approximately 20% of total costs, they are comparable with the Alfred and MMC figures.

CPEA Ward Nursing Costs

Nursing costs in the CPEA are allocated on the same basis as other wards at RMH. The DRG weight for each patient, in conjunction with each patient's LOS (expressed as minutes in the CPEA ward) was used to allocate the nursing costs in the CPEA to each patient.

Appendix 3 – Hospital Cost Details

The Alfred Hospital

| | Disch. from CCU | | | ED Admit | | | Disch. from Ward | | | Non Admits | | | CPEA | | | Total | | |
|---------------------------------------|-----------------|-------------|------------|------------|------------|-----------|------------------|-------------|-------------|------------|------------|------------|----------|------------|------------|-------------|-------------|-------------|
| | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff |
| ED Costs (Med/Nursing/Consumables) | 100 | 174 | 74 | 166 | 208 | 42 | 137 | 272 | 135 | 86 | 76 | -10 | 0 | 141 | 141 | 119 | 167 | 48 |
| Ward Nursing & Consumables | 1796 | 1915 | 119 | 1 | 0 | -1 | 1383 | 1303 | -80 | 0 | 0 | 0 | 0 | 0 | 0 | 579 | 405 | -174 |
| Ward Medical | 423 | 461 | 37 | 1 | 2 | 1 | 273 | 263 | -10 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 86 | -35 |
| Theatre/Procedures | 806 | 537 | -269 | 77 | 35 | -42 | 672 | 456 | -215 | 42 | 0 | -42 | 0 | 20 | 20 | 308 | 146 | -162 |
| Pathology | 241 | 368 | 127 | 100 | 103 | 4 | 289 | 386 | 97 | 49 | 43 | -5 | 0 | 123 | 123 | 149 | 164 | 15 |
| Pharmacy | 366 | 564 | 198 | 0 | 11 | 11 | 286 | 225 | -61 | 0 | 9 | 9 | 0 | 9 | 9 | 162 | 87 | -74 |
| Radiology | 444 | 91 | -353 | 6 | 58 | 52 | 214 | 92 | -121 | 0 | 25 | 25 | 0 | 39 | 39 | 26 | 54 | 28 |
| Allied Health | 5 | 108 | 104 | 12 | 0 | -12 | 8 | 101 | 93 | 5 | 0 | -5 | 0 | 0 | 0 | 43 | 30 | -13 |
| Food | 61 | 71 | 10 | 6 | 6 | 0 | 71 | 70 | -1 | 0 | 0 | 0 | 0 | 12 | 12 | 28 | 23 | -5 |
| CPEA Nursing | 0 | 24 | 24 | 0 | 0 | 0 | 0 | 13 | 13 | 0 | 0 | 0 | 0 | 176 | 176 | 0 | 21 | 21 |
| Overheads & Other Costs | 876 | 1039 | 163 | 59 | 86 | 27 | 1007 | 1029 | 22 | 25 | 25 | 1 | 0 | 99 | 99 | 407 | 338 | -68 |
| Total | 5118 | 5352 | 234 | 427 | 508 | 80 | 4340 | 4210 | -129 | 206 | 179 | -27 | 0 | 618 | 618 | 1943 | 1522 | -420 |

Monash Medical Centre

| | Disch. from CCU | | | ED Admit | | | Disch. from Ward | | | Non Admits | | | CPEA | | | Total | | |
|---------------------------------------|-----------------|-------------|------------|------------|------------|-----------|------------------|-------------|-------------|------------|------------|------------|----------|------------|------------|-------------|-------------|-------------|
| | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff |
| ED Costs (Med/Nursing/Consumables) | 175 | 248 | 74 | 211 | 267 | 56 | 215 | 386 | 172 | 148 | 148 | -1 | 0 | 191 | 191 | 187 | 258 | 71 |
| Ward Nursing & Consumables | 2073 | 2057 | -16 | 0 | 0 | 0 | 3697 | 3488 | -209 | 0 | 0 | 0 | 0 | 0 | 0 | 1165 | 940 | -226 |
| Ward Medical | 770 | 917 | 147 | 50 | 22 | -28 | 973 | 1008 | 35 | 47 | 20 | -27 | 0 | 80 | 80 | 324 | 335 | 11 |
| Theatre/Procedures | 571 | 398 | -173 | 35 | 19 | -16 | 1092 | 265 | -827 | 0 | 0 | 0 | 0 | 0 | 0 | 349 | 111 | -238 |
| Pathology | 164 | 214 | 50 | 66 | 119 | 53 | 238 | 257 | 19 | 37 | 50 | 14 | 0 | 91 | 91 | 111 | 143 | 31 |
| Pharmacy | 33 | 7 | -27 | 3 | 3 | 1 | 19 | 42 | 22 | 2 | 2 | 0 | 0 | 2 | 2 | 11 | 11 | 0 |
| Radiology | 224 | 503 | 278 | 100 | 126 | 26 | 257 | 325 | 68 | 51 | 12 | -39 | 0 | 87 | 87 | 139 | 189 | 50 |
| Allied Health | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Food | 75 | 75 | 0 | 0 | 0 | 0 | 153 | 142 | -11 | 0 | 2 | 2 | 0 | 0 | 0 | 47 | 37 | -9 |
| CPEA Nursing | 0 | 134 | 134 | 0 | 0 | 0 | 0 | 9 | 9 | 0 | 13 | 13 | 0 | 341 | 341 | 0 | 71 | 71 |
| Overheads & Other Costs | 7 | 0 | -7 | 29 | 29 | 1 | 4 | 3 | -1 | 1 | 4 | 4 | 0 | 29 | 29 | 11 | 16 | 5 |
| Total | 4093 | 4553 | 460 | 494 | 586 | 92 | 6648 | 5926 | -722 | 286 | 251 | -35 | 0 | 820 | 820 | 2344 | 2111 | -234 |

Royal Melbourne Hospital

| | Disch. from CCU | | | ED Admit | | | Disch. from Ward | | | Non Admits | | | CPEA | | | Total | | |
|---------------------------------------|-----------------|-------------|------------|------------|-------------|------------|------------------|-------------|------------|------------|------------|------------|----------|-------------|-------------|-------------|-------------|-------------|
| | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff | Base | Compar | Diff |
| ED Costs (Med/Nursing/Consumables) | 261 | 297 | 36 | 307 | 429 | 122 | 320 | 593 | 273 | 136 | 125 | -10 | 0 | 58 | 58 | 247 | 338 | 92 |
| Ward Nursing & Consumables | 1339 | 1323 | -16 | 64 | 114 | 50 | 1424 | 1608 | 184 | 3 | 0 | -3 | 0 | 0 | 0 | 801 | 758 | -43 |
| Ward Medical | 477 | 472 | -5 | 51 | 56 | 4 | 589 | 663 | 74 | 1 | 0 | -1 | 0 | 84 | 84 | 329 | 266 | -63 |
| Theatre/Procedures | 219 | 144 | -75 | 0 | 51 | 51 | 559 | 276 | -282 | 0 | 0 | 0 | 0 | 0 | 0 | 295 | 109 | -186 |
| Pathology | 92 | 62 | -30 | 36 | 22 | -14 | 95 | 92 | -4 | 8 | 4 | -4 | 0 | 33 | 33 | 59 | 42 | -16 |
| Pharmacy | 248 | 214 | -34 | 30 | 52 | 22 | 243 | 318 | 75 | 10 | 11 | 0 | 0 | 78 | 78 | 143 | 138 | -4 |
| Radiology | 80 | 104 | 24 | 87 | 83 | -4 | 104 | 161 | 57 | 8 | 10 | 3 | 0 | 63 | 63 | 65 | 84 | 19 |
| Allied Health | 43 | 44 | 1 | 3 | 7 | 4 | 74 | 84 | 10 | 0 | 0 | 0 | 0 | 8 | 8 | 40 | 32 | -8 |
| Food | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CPEA Nursing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1145 | 1145 | 0 | 0 | 0 |
| Overheads & Other Costs | 682 | 712 | 30 | 177 | 261 | 85 | 879 | 1063 | 184 | 56 | 54 | -2 | 0 | 710 | 710 | 515 | 528 | 13 |
| Total | 3441 | 3372 | -69 | 755 | 1074 | 320 | 4288 | 4858 | 570 | 222 | 204 | -18 | 0 | 2178 | 2178 | 2493 | 2296 | -197 |

