WESTCOP: a disease management approach to coronary artery disease

Ian Scott, Catherine Harper, Aleesa Clough, and Malcolm West

Ian Scott is Director of Internal Medicine at Princess Alexandra Hospital, Brisbane and formerly Director of Medicine at Ipswich Hospital, Ipswich.
Catherine Harper is Epidemiologist and Aleesa Clough is CVD Project Officer at the West Moreton Public Health Unit, Goodna. Malcolm West is Professor of Medicine at the Prince Charles Hospital, Brisbane.

Abstract

Disease management is a systematic approach to improving care of populations of patients with specific clinical conditions. Critical to success are the formation of collaborative teams of health care stakeholders, development and promulgation of clinical practice guidelines, and performance measurement and feedback to providers as a process of continuous practice improvement.

This article describes a disease management program for patients with coronary artery disease in a provincial health district with a population of 180,000. It discusses the rationale and methods behind the operationalisation of the main program elements, benefits achieved to date and challenges confronted.

Introduction

Population-based disease management programs aim to provide effective care to all persons with a given disease across all clinical settings (Elwood 1998; Epstein and Sherwood 1996). Key program elements include use of evidence-based clinical guidelines and systematic reporting of care processes and outcomes (Epstein and Sherwood 1996; Ellrodt *et al* 1997). Chronic diseases such as asthma (Homer 1997), diabetes (McCullough *et al* 1994), and congestive cardiac failure (Rich *et al* 1995) have attracted widest attention to date.

In this article we describe our initial experience with a coronary artery disease (CAD) management program in the West Moreton Health District of Queensland – the *West Moreton Coronary Outcomes Program* (WESTCOP). The District serves a region of 180000 residents centred on the city of Ipswich, 30km south-west of Brisbane. Medical care is provided by 4 resident physicians in internal medicine, 150 general practitioners (GPs), and two community hospitals – a 300 bed public hospital and a 100 bed private hospital.

Program Methodology

A working group was convened in 1995 comprising the district consultant physicians, staff from the West Moreton Public Health Unit, and the Director of the regional Division of General Practice. This group considered the establishment of a population-based framework for improving quality of care and resultant outcomes for specific disease conditions.

1 Choosing CAD as a priority health problem conducive to a disease management approach

The criteria for choosing a particular health problem as the focus of the program were: 1) high prevalence and burden of disease; 2) existence of a substantial research evidence base for defining best practice; 3) perceived opportunity for improving current practice patterns; and 4) potential for integrating hospital (acute) with community (maintenance) care. Coronary artery disease (CAD) was considered a candidate disease.

Criterion 1: From 1984 to 1994 CAD accounted for 29.0% of all deaths in West Moreton compared to 27.1% for the state, equivalent to a standardised mortality ratio (SMR) of 1.2 (95% CI 1.16–1.25) and an age-standardised excess of 58 deaths per year (HIC, 1999). Annual mortality due to acute myocardial infarction (AMI) was 164 per 100,000 (95% CI 157–171) compared to the state figure of 129 (128–131), resulting in a SMR of 1.24 (1.17–1.31). In 1994, the standardised hospital separation rate for AMI as a principal diagnosis in West Moreton was 354 per 100,000 compared to 285 for the state, accounting for 1.7% versus 1.2% respectively of all occupied bed days.

Criterion 2: AMI is a well-defined event for which a number of effective acute care and secondary prevention interventions are available (see Table 1).

Criterion 3: Substantial under-utilisation of these interventions has been described in the literature (see Table 1).

Criterion 4: Ongoing risk factor modification, cardiac rehabilitation and management of comorbidities are important maintenance care functions that need to be integrated with acute care provided in hospital. Having met all above criteria, improving care of AMI patients was designated the first program priority.

2 Forming a stakeholder collaboration aimed at improving health outcomes

The mounting of effective disease management programs requires the involvement of local clinical opinion leaders in formulating and implementing clinical guidelines, evaluating practice, and feeding back results in ways that encourage practice improvement (Soumerai *et al* 1998); epidemiologists and data managers with expertise in collecting and analysing data (Simpson & Gordon 1998); and health care managers and consumer advocates to ensure program planning and implementation are aligned with managerial imperatives and community opinion (Backer 1995).

In late 1995 a steering committee was formed comprising representatives from the community hospitals, the West Moreton Public Health Unit, and the Ipswich and West Moreton Division of General Practice. Program goals were agreed (see Table 2) and a Council convened (members listed in the appendix) to which three working groups reported: 1) a primary prevention group

for co-ordinating population level prevention strategies; 2) a secondary and tertiary prevention group for overseeing community-based coronary rehabilitation and aftercare; and 3) an acute care group focussing on hospital management of acute coronary syndromes.

Table 1: Therapeutic Interventions for Acute Myocardial Infarction

Intervention	Effect	Examples of underutilisation
	(NNT)*	(% of eligible patients receiving intervention)
Thrombolysis	55	44% (Krumholz et al 1997)
Adjunctive treatments		
β-blockers		
Aspirin	170	21% (Soumerai et al 1997)
ACEIs	125	76% (Krumholz et al 1996)
LLAs	10–80+	45% (Krumholz et al 1997)
	33**	26% (Khong 1998)
Cardiac rehabilitation	32	58% (Melville et al 1999)
Coronary revascularisation	2++	74% (Leape et al 1999)

*Number needed to treat to save one life (Source: Yusuf et al 1998)
+ Patients with left ventricular dysfunction
** Patients whose serum cholesterol level was equal to or greater than 5.5 mmol/l
++ Patients with left main disease or triple vessel disease with left ventricular dysfunction

Table 2: Program goals and objectives

Goal:	To improve quality of care and health outcomes for patients with coronary artery disease in the West Moreton Health District
Objectives:	
1	To develop an integrated intersectoral model of acute care, rehabilitation and secondary prevention for patients with acute coronary events
2.	To construct a standardised database for the prospective collection of data on key processes and outcomes of care of such patients
3.	To develop and promulgate locally derived, evidence-based clinical practice guidelines relating to the acute and chronic care and rehabilitation of such patients
4.	To develop a set of clinical indicators and quality thresholds for the purposes of practice evaluation and feedback
5.	To assess the impact of clinical guidelines and indicator feedback in improving quality of care provided
6.	To obtain more precise estimates of the disease burden of coronary artery disease
7.	To formulate and trial innovative, multifaceted approaches to acute and chronic management of coronary artery disease

3 Implementing evidence-based clinical practice guidelines

Clinical practice guidelines (CPGs) serve two important functions: their development and implementation, if carefully undertaken, help to narrow evidence-practice gaps and improve clinical care (Grimshaw & Russell 1993); and they contain care recommendations which, according to the strength of associated evidence, can be translated into criteria for evaluating the quality of care provided (Baker & Fraser 1995).

Separate guidelines for the hospital and post-hospital management of AMI and unstable angina were developed and issued using recommended methods (NHMRC 1995). A guideline working group that included local lead clinicians and a senior cardiologist made adaptations to guidelines from the American College of Cardiology and American Heart Association (Ryan *et al* 1996).

Guideline recommendations were assessed by an end-user group to ensure applicability, flexibility and attainability given local clinical culture and resource constraints. Guideline format was also evaluated with respects to perceived clarity, brevity and utility in busy clinical settings. Following various revisions, the guidelines were distributed in August 1996 as booklets to all clinicians in the West Moreton region, were reinforced in workshops conducted by clinical opinion leaders, and publicised in the launching of a community-based cardiac rehabilitation service. As a result of end-user surveys, guidelines were updated, reformatted and re-issued with further workshops in mid-1999. At this time, all hospital clinicians were aware of and had used the guidelines at least once, as had 47% (70) of all GPs.

4 Defining performance measures for evaluating care

Optimal disease management requires systematic and prospective collection and feedback of data on processes and outcomes of care (Mugford *et al* 1991). In recent years, the measurement and reporting of clinical indicators has been promoted by medical colleges and other groups (ACHS 1996; National Hospitals Outcomes Program, 1997). Whilst indicators for hospital care have existed for some years, indicators for general practice and community health are only now being promoted (McColl *et al* 1998).

Developing quality indicators. Guideline recommendations relating to evidence-based processes of care (Table 3) formed the basis for sets of clinical indicators – statistics which reflect, directly or indirectly, the performance of the healthcare system in providing optimal care for target populations (National Hospitals Outcomes Program, 1997). We developed indicators for AMI which we considered fulfilled the following criteria:

- reliability given that medical records and self-report questionnaires were to be used as source documents (Lambert-Huber *et al* 1994);
- sensitivity for detecting care considered suboptimal in light of guideline recommendations (Mant & Hicks 1995);
- validity, relevance and interpretability in the eyes of practising clinicians (Hofer *et al* 1997);
- feasibility in terms of the opportunity costs to patient, clinician and program staff of collecting necessary data;
- robustness in that data within source documents were relatively immune to distortion or gaming effects; and
- responsiveness to changes in practice as a result of feedback and education.

Table 3: Eligibility Criteria and Process Indicators for Hospital Care

Indicators		'Indicative' threshold	Quality threshold
1.	**Thrombolysis**		
	Inclusion criteria: all AMI patients who present with chest pain >20 minutes AND ECG changes of ST segment elevation in two or more contiguous chest leads OR new left bundle branch block	N/A	N/A
	Exclusion criteria: late presentation (>12 hours after symptom onset), recent TIA/CVA, recent trauma or cardiopulmonary resuscitation, coagulopathy or concurrent warfarin therapy, active peptic ulcer disease uncontrolled hypertension	N/A	N/A
2.	**β-blockers**		
	Inclusion criteria: all AMI patients+	70%	60%
	Exclusion criteria: cardiogenic shock, past or current heart failure, asthma or chronic obstructive lung disease, bradyarrhythmia requiring pacing		
3.	**Aspirin**		
	Inclusion criteria: all AMI patients+	94%	85%
	Exclusion criteria: active gastrointestinal bleeding in hospital or concurrent warfarin therapy		
4.	**Angiotensin-converting enzyme inhibitors (ACEIs)**		
	Inclusion criteria: all AMI patients+ who have past history or current clinical features of heart failure OR have echo evidence of moderate to severe left ventricular dysfunction OR have had an anterior infarction	63%	55%
	Exclusion criteria: nil		
5.	**Lipid-lowering agents (LLAs)**		
	Inclusion criteria: all AMI patients+ whose random total serum cholesterol level on admission was 5.5 mmol/l or greater	64%	55%
	Exclusion criteria: nil		
6.	**Enrolment into post-discharge Cardiac rehabilitation (CR)**		
	Inclusion criteria: all AMI patients+	N/A	70%
	Exclusion criteria: very old age (<85 years), marked physical frailty, terminal illness, uncontrolled heart failure or unstable angina – not measured but estimated from trials to comprise approximately 70% of patients		
7.	**Stress ECG testing**		
	Inclusion criteria: all AMI patients+	N/A	70%
	Exclusion criteria: advanced age, locomotor incapacity, uninterpretable ECG – not measured but estimated from trials to comprise approximately 30% of patients		
8.	**Coronary angiography**		
	Inclusion criteria: all AMI patients+ who had re-infarction, post-infarct angina or strongly positive exercise ECG test – not measured but estimated from cohort studies to comprise up to 40% of patients	N/A	40%
	Exclusion criteria: nil		

* A=number of pre-intervention AMI patients who met process eligibility criteria ('indicative' threshold) with exception of CR, stress ECG testing and CA for which criteria were not measured; B= quality threshold for process indicators (with exception of lysis) calculated from 'indicative' threshold by subtracting 10% and rounding off to nearest 5%.
+ Patients discharged alive and not transferred to tertiary centre

Process and Outcome Measures for Hospital (Acute) Care. The clinical indicators of process and outcome relating to hospital care are listed respectively in Tables 3 and 4, and are expressed as the rate, proportion or mean applicable to the measure.

Process measures related to: 1) use of thrombolysis, and time between admission and administration ('door-to-needle' time); 2) prescribing rates at discharge of adjunctive drugs: β-blockers, aspirin, angiotensin-converting enzyme inhibitors (ACEIs), and lipid-lowering agents (LLAs); and 3) utilisation of cardiac rehabilitation (CR), stress ECG testing and coronary angiography (CA). Patient eligibility criteria for specific interventions are detailed in Table 3. Outcome measures (see Table 4) comprised in-hospital mortality rate, complication rates and length of stay.

Process and Outcome Measures for Post-hospital (Maintenance) Care. Process measures for post-hospital care comprised frequency of: 1) assessment of coronary risk factors; 2) provision of advice about smoking cessation, diet, exercise and lifestyle changes, and 3) ongoing prescription of adjuvant drugs. Outcome measures measured at 3 and 18 months post-discharge comprised: 1) proportions of patients achieving ideal levels of serum cholesterol, blood pressure and body weight; 2) readmission rates for cardiac events and procedures; 3) return to work; 4) quality of life scores (as measured by a validated disease-specific questionnaire [Valenti *et al* 1996]); and 5) all-cause and CAD-specific mortality.

Table 4: Outcome indicators for hospital care

Indicators	Quality Thresholds
1. In-hospital deaths	≤ 10%
2. In-hospital complications	
• re-infarction	≤ 4%
• overt CCF	N/A
• post-infarct angina	N/A
3. Length of hospital stay (mean)	≤ 6 days

5 Deriving and validating quality indicator thresholds

In evaluating practice, clinicians ask: 'Improve care in relation to what?' which leads to: 'What are realistic benchmarks/targets/'best practice' standards?' Quality of care was evaluated using explicit process and outcome indicators (see Table 3) for which evidence-based quality thresholds (or targets) were derived as explained below. This evaluation method was considered superior to implicit peer review (Hayward *et al* 1993) or comparative profiling of local practice patterns devoid of any external benchmarking (Balas *et al* 1995).

For purposes of provider feedback, process and outcome indicators (with the exception of thrombolysis) were respectively reported as the proportion of all patients in each consecutive 6 month cohort who received the intervention or demonstrated the particular outcome. Quality thresholds were linked to each of these indicators such that providers could accurately quantify threshold-practice gaps, and target efforts towards narrowing these gaps.

Quality thresholds for *process indicators* were derived in a 2-step procedure as follows: an 'indicative' threshold was calculated as the proportion of the first 133 AMI patients entered into the registry during a 6 month baseline period (derivation cohort) who met pre-specified eligibility criteria for each intervention based on a review of the literature published up to early 1996. Such patients should, by definition, receive that intervention. This indicative threshold was then adjusted downwards by 10% and rounded off to the nearest 5% to give a 'quality' threshold which represented an attainable standard of care that allowed for variation in patient characteristics that might occur between consecutive cohorts. On the basis of previously cited studies, it was hypothesised a *priori* (and confirmed subsequently) that under-utilisation rather than over-utilisation of effective interventions was the quality issue to be addressed.

Quality thresholds for *outcome indicators* were those observed in 'best practice' sites as reported in the literature, provided they were considered applicable to our program by virtue of similarities in patient demographics and community hospital setting. Separate sets of indicators were developed for hospital and post-hospital care.

Process indicators for hospital care

Thrombolysis: As thrombolysis has a low benefit-risk ratio (FTT Collaborative Group 1994), patient eligibility for thrombolysis was determined precisely using the criteria listed in Table 3. 'Door-to-needle' time was measured and deemed to be ideal if less than 1 hour (Boersma *et al* 1996).

β-*blockers:* On the basis of multiple trials (The Beta-Blocker Pooling Project Research Group 1988) and practice norms, 64% of the derivation cohort were considered eligible for β-blocker therapy.

Aspirin: Meta-analyses of anti-platelet trials (Anti-platelet Trialists' Collaboration 1994) suggested at least 90% of patients were eligible to receive aspirin.

Angiotensin-converting enzyme inhibitors (ACEIs): In different trials (Garg *et al* 1995; Lantini *et al* 1995), ACEIs were prescribed for all AMI patients, or only those 60% of patients with clinical and/or echocardiographic evidence of left ventricular (LV) dysfunction (Silver *et al* 1994) in whom mortality reduction was greatest. We decided that patient eligibility should depend on the extent of LV dysfunction as detailed in Table 3.

Lipid-lowering agents: Treatment with statin drugs was indicated in patients whose serum cholesterol level was above 5.5 mmol/l (Scandinavian Simvistatin Survival Study Group 1994). Population-based cholesterol profiles (National Centre for Health Statistics 1996) defined 50% of the derivation cohort as being eligible.

Cardiac rehabilitation: Results of a meta-analysis suggested 70% of AMI patients were eligible to participate in formal cardiac rehabilitation (CR) programs (Oldridge *et al* 1988). Given the multiple, often unrecorded patient variables which influence the decision to refer, patient eligibility was not measured in the derivation cohort. Instead the published figure of 70% was accepted as a surrogate measure of best practice.

Risk stratification procedures: For reasons similar to those stated above, the quality threshold for stress testing following AMI was taken to be 70% as observed in a large international trial population of lysis-eligible patients (Villello *et al* 1995). The threshold for post-AMI coronary angiography (CA) was, on the basis of an expert position paper (Peterson *et al* 1997) taken to be 40%, comprising those patients with spontaneous or provocable ischaemia who were considered to warrant this procedure.

Outcome indicators for hospital care

Quality thresholds for outcome indicators were obtained from a US AMI registry surveying multiple acute care hospitals involved in a regional quality improvement project (Maynard *et al* 1993; Every *et al* 1996). Thresholds consisted of an in-hospital mortality rate of 10%, reinfarction rate of 4%, and mean length of hospital stay (LOS) of 6 days.

Post-hospital care indicators

The quality thresholds for post-hospital process of care indicators were as follows: at least 85% of patients attending their GPs during the previous 3 months should have had risk factors assessed (smoking status, blood pressure, cholesterol level, body mass index), and appropriate advice given. Thresholds for prescription of adjuvant drugs were identical to those for hospital care as these therapies, once initiated, were intended to be administered indefinitely in virtually all patients. Thresholds for outcome indicators were not formulated given the paucity of literature concerning optimal indices of readmission, quality of life and mortality relevant to ambulatory care.

6 Implementing standardised data collection systems

Patient eligibility: A registry was set up for the prospective collection of data on hospital and post-hospital care of all patients who met the following criteria: 1) patients were residents of West Moreton; 2) AMI was the principal diagnosis at discharge; and 3) the diagnosis of AMI was confirmed using accepted diagnostic criteria.

Patient enrolment: Patients could be entered into the registry at three points: in hospital (the majority); at the time of commencement of CR; or when consulting a general practitioner. Informed consent to receive questionnaires and allow program staff to access medical records was obtained from participating patients. Program methods were approved by the West Moreton Clinical Research Ethics Committee.

Hospital Data Collection: Cardiology-trained nurses abstracted in-hospital data on baseline patient characteristics, clinical presentation, tests, treatments, complications, discharge medications and risk stratification procedures. Baseline quality of life questionnaires were also administered.

Post-hospital Data Collection: Patient progress at 3 and 18 months post-discharge was monitored by mail-out to all consenting patients of three instruments: repeat quality of life questionnaire and a personal profile – both for patient self-completion – and a clinical patient profile to be completed by the GP during a scheduled visit.

Central database: Data on hospital care contained within hospital databases were merged with post-hospital data contained within the GP Division database to create a central database located within the Public Health Unit for purposes of collation and analysis.

7 Feeding back indicator results to key stakeholders

Approximately every 6 months, comparative analyses of hospital care indicators were circulated to consultant physicians, hospital medical registrars, senior staff in emergency departments, and senior medical executives in all hospitals and the Division of GP. Indicators for the current period were compared with those of previous periods and with quality thresholds. Because of resource limitations and initial targeting of efforts to evaluating hospital care, feedback of post-hospital care indicators has only recently commenced.

Methodological issues

There were several issues regarding *clinical indicators* and *quality thresholds*. Reporting the proportion of all patients who received an intervention as a feedback indicator may be criticised as being too crude a measure of the extent to which specific interventions are provided to patients most likely to benefit. This format was chosen for several reasons: it simplified the process of analysis and reporting; it was readily understood by providers; and it was identical to that reported in similar evaluative studies performed elsewhere against which local figures could be compared. Such 'population-level' process indicators have both advantages and disadvantages compared to 'patient-level' indicators which are based on specific eligibility criteria (see table 5).

Table 5: Comparing two types of clinical indicator

	Advantages	Limitations
Population level	Easy to measure	Assumes homogeneous patient populations
	Availability of literature comparisons	Clinical credibility of quality thresholds
Patient-level	More accurate reflection of clinical need	Opportunity cost of more detailed measurement and analysis
	Distinguishes between over- and under-utilisation	Variation in clinical judgement of patient eligibility for specific interventions
	No need for risk adjustment	

However, the use of specific patient eligibility criteria to develop patient-level process quality thresholds also invites several criticisms. First, intervention-specific exclusion criteria may omit certain contra-indications and thus, by inflating the denominator of eligible patients, lead to calculated utilisation rates suggesting sub-optimal care. This concern was addressed in the Co-operative Cardiovascular Project (CCP) which evaluated the effects over 4 years of feedback on the use of reperfusion therapies, β-blockers, aspirin and smoking cessation programs in more than 250,000 AMI patients (Marciniak *et al* 1998). This project calculated two rates for each process indicator: one defining all AMI patients as being eligible (a population-level indicator); and another defining a subset of 'ideal' patients who demonstrated none of up to 22 pre-specified exclusion criteria (a patient-level indicator). The magnitudes of improvements in both indicator rates were similar, suggesting that either method is effective in detecting sub-optimal care.

Second, indicators based on overly stringent eligibility criteria may have the reverse effect of persuading clinicians to deny certain patients potentially beneficial treatment. A sub-study of the CCP found that post-infarct use of β-blockers in patients with conditions often considered contra-indications (such as heart failure, lung disease and older age) achieved similar or higher absolute reductions in mortality compared to similarly treated patients with no such risk factors (Gottlieb *et al* 1998). Newly published research results support more liberal use of thrombolysis (Jha *et al* 1996) and lipid-lowering agents (Lewis *et al* 1998) in elderly patients, of β-blockers in patients with overt heart failure (Cleland *et al* 1999), and of LLAs in patients with 'average' (4mmol/l or higher) serum cholesterol levels (The LIPID Study Group 1998).

Third, quality thresholds may assume that the statistically averaged benefit reported for trial populations is conferred equally on all patients deemed to be eligible. In real practice, patient subgroups exist for whom clinicians regard absolute benefits as being clinically negligible or outweighed by potential for harm (Oxman & Guyatt 1992). This was the rationale behind the selective definition of eligibility for the use of ACEIs.

Finally, our quality thresholds can only be regarded, at best, as approximate or semi-validated benchmarks. However, we reasoned that such explicit, achievable thresholds, based on readily measurable and widely accepted eligibility criteria, needed to be stated if actionable feedback is to be provided to clinicians.

Data quality must be ensured if results are to be accurate and clinically credible. Initial audits revealed breaches of entry criteria and inaccuracies as to time of symptom onset and ECG interpretation of type (Q-wave versus non-Q-wave) and site of infarct. More stringent vetting of cases by physicians and simplification of ECG coding resulted in acceptable ($\kappa>0.8$) abstractor-reviewer agreement. Hospital data entry is currently complete and associated with less than 3% error rate.

Benefits to Date

*Patient profiling:*The recording of patient characteristics and clinical course has allowed profiling of remediable risk factors and disease burden in this unselected AMI population. Such information informs efforts aimed at primary and secondary prevention, and deciding care for high-risk patients.

Benchmarking clinical practice: Reduced delays in administration of lysis, improved prescribing of lipid-lowering agents and lowering of in-hospital mortality and length of stay ($p<0.05$ for all results) were observed over a 2 year period as a result of indicator feedback and resultant practice reforms (Scott *et al* 1999). Regarding post-hospital care, analyses revealed a progressive rise in the proportion of patients enrolled in CR programs (from 23 to 45%; $p=0.001$), a substantial fraction (at least 80%) undertaking regular exercise and adhering to diet, and no lowering of compliance rates for adjunctive treatments and smoking cessation (unpublished data).

Planning and resourcing of services: The district health service and the public health unit have begun lobbying the state health department for additional funding for cardiac rehabilitation services to meet the estimated demand of 240 places per year compared to the current 96 funded places.

Exploring patient behaviour: Many AMI patients were observed to delay seeking medical assistance and present by private transport, both of which increased the risk of pre-hospital sudden death. The Division of General Practice has initiated efforts to educate at-risk patients in recognising and responding to AMI symptoms. The regional ambulance service is studying the reasons why a third of patients do not access this service following symptom onset.

Improving accuracy of discharge coding and admission diagnosis: In 19.4% of hospital records, AMI was not confirmed despite this being the coded discharge diagnosis. In addition, in 21.5% of cases of confirmed AMI, this diagnosis was not made on admission. These observations prompted development of an AMI verification algorithm for coding purposes, and more intense education of emergency staff in how to accurately and rapidly diagnose AMI.

Promoting professional partnerships: Senior hospital executives viewed program involvement as assisting institutional accreditation processes and drives for better care. Individual physicians earned credit points towards professional maintenance of standards and re-certification schemes. The Division of General Practice received accurate outcomes data for its federally funded cardiac rehabilitation service – a prerequisite for future funding applications. The West Moreton Public Health Unit and Queensland Health Department regarded WESTCOP as a pilot test of a transferable model for monitoring care and outcomes of patients with AMI. Such a model feeds into an indicator-driven framework for negotiating service agreements in cardiac care between central office and health district services throughout the state (Queensland Cardiac Care Advisory Panel 1998).

Challenges Confronted

No dedicated funding was obtainable during the first 3 years from institutional or Divisional operating budgets, or from state and federal agencies involved in outcomes and quality of care research. Whilst a pharmaceutical sponsor subsidised the costs of educational materials and cardiac rehabilitation services, the potential for conflicts of interest to arise between project program goals and commercial interests precluded any contractual arrangements (Harris 1996).

Funding was instead obtained from the Health Information Centre of Queensland Health ($50,000 pa), the West Moreton Health District ($8000 pa) and the West Moreton Public Health Unit ($20,000 pa). This funding paid for 1.8 FTE program staff, although short-term contracts conditional on annual reapplication for funding resulted in high staff turnover with consequent losses in efficiency.

The proportion of patients consenting to receiving post-discharge questionnaires was initially only 40% but is currently more than 80%. At 3 months the response rate amongst consenters was 63% but dropped to less than 20% at 18 months. Simplified information and consent forms, reminder letters, personalised cards, and patient recruitment undertaken by attendant clinicians are all currently increasing recruitment and response rates. Of interest, there were no significant differences in patient characteristics between consenters and non-consenters, or between responders and non-responders (unpublished data).

Reconciling the needs of patient privacy and confidentiality with the ability to access and link patient data for purposes of outcomes research is proving problematic (Gostin & Hadley 1998). Identified data relating to cause of death could only be obtained from death registries for consenting patients.

Some reluctance to assist in program activities was encountered from a minority of GPs who viewed the program as irrelevant to the quality improvement needs of their individual practices. Such concerns have been countered by focus group discussions wherein program results and strategies have been discussed, and circulation of newsletters which feedback data about AMI care relevant to the needs of GPs.

Conclusion

The key components of this community-based disease management projectprogram accord with those of successful disease management programs (Todd & Nash 1997; Meechan *et al* 1995), health outcome projects (Rissel *et al* 1998) and disease registries (Gray & Hampton 1993) described elsewhere. Longitudinal data on more than 700 AMI patients with follow-up extending to 6 months or more are currently being analysed. The program steps we have described are strongly recommended to others considering similar initiatives.

Ongoing priorities for WESTCOP include securing a more guaranteed long-term budget, developing better data collection methods, advancing research on derivation and validation of quality indicators, evaluating post-hospital care, and extending the current work to the care of patients with unstable angina. Such efforts will hopefully further optimise health care of patients with acute coronary syndromes in the West Moreton district.

Appendix: Membership of the WESTCOP Council

Ipswich Hospital Division of Medicine: Dr Ian Scott (Principal Investigator), former Director of Medicine, Ipswich Hospital (currently Director of Internal Medicine, Princess Alexandra Hospital); Dr Pamela Chick (Director of Clinical Services); Ms Helen Le Good, Mrs Shirley Jack and Ms Michele Bales (Research Officers).

St. Andrews Private Hospital, Ipswich: Dr Walter Mirosch (Consultant Physician); Mrs Kath Wieden (Nurse Practice Co-ordinator).

West Moreton Public Health Unit: Ms Margo Eyeson-Annan (Chair 1995–1998) and Ms Cathy Harper, (Chair 1999, Epidemiologists); Ms Sylvia Petrony and Ms Aleesa Clough (CVD Project Officers); Ms Tanya Sozanski (Administration Officer).

Ipswich and West Moreton Division of General Practice: Dr John Gritton (Director, 1995–1998), Dr Tony Jones (Director), Ms Carolyn Young (Executive Officer), Mr Garth Henniker (Primary Prevention)

Consumer Advocate: Ms. Lea-Anne Smith (Cardiac Rehabilitation Co-ordinator).

External Consultants: Dr Donald Staines, Director of South West Population Health Unit; Professor Malcolm West, University of Queensland Department of Medicine, Prince Charles Hospital, Brisbane; Dr Ian Ring (Director) and Dr Christine McClintock (Principal Analyst), Health Information Centre, Queensland Department of Health.

Acknowledgements

The authors wish to acknowledge the funding and support provided by Health Information Centre, Queensland Health, Ipswich Hospital, St. Andrews Hospital and Ipswich and West Moreton Division of General Practice; and all clinicians and patients in the West Moreton Health District who have assisted the project.program.

References

Anti-platelet Trialists' Collaboration 1994 'Collaborative overview of randomised trials of anti-platelet therapy: 1: prevention of death, myocardial infarction, and stroke by prolonged anti-platelet therapy in various groups of patients', *British Medical Journal,* vol 308, pp 81–106.

Australian Council of Health Care Standards Care Evaluation Program/ Australasian College of Emergency Medicine/Royal Australasian College of Physicians 1996, *Clinical Indicators.* ACHS, Sydney.

Backer TE 1995, 'Integrating behavioural and systems strategies to change clinical practice', *Journal of Quality Improvement,* vol. 21, pp 351–3.

Baker R & Fraser RC 1995, 'Development of review criteria: linking guidelines and assessment of quality', *British Medical Journal,* vol 311, pp 370–3.

Balas EA, Boren SA, Brown GD *et al* 1996, 'Effect of physician profiling on utilization. Meta-analysis of randomized clinical trials', *Journal of General Internal Medicine,* vol.11, pp 584–90.

Boersma E, Maas AC, Deckers JW, Simoons ML 1996, 'Early thrombolytic treatment in acute myocardial infarction: reappraisal of the golden hour', *Lancet,* vol 348, pp 771–775.

Cleland JF, McGowan J, Clark A, Freemantle N, 1999, 'The evidence for β blockers in heart failure', *British Medical Journal,* vol. 318, pp 824–825.

Ellrodt G, Cook DJ, Lee J, Cho M, *et al*, 1997, 'Evidence-based disease management,' *Journal of American Medical Association,* vol. 278, pp 1687–1692.

Elwood PM 1988, 'The Shattuck Lecture – Outcomes management. A technology of patient experiences', *New England Journal of Medicine,* vol. 318, pp 1549–1556.

Epstein RS & Sherwood LM 1996, 'From outcomes research to disease management: A guide for the perplexed', *Annals of Internal Medicine,* vol. 124, pp 832–837.

Every NR, Spertus J, Fihn SD, Hlatky M. *et al*, 1996, 'Length of hospital stay after acute myocardial infarction in the Myocardial Triage and Intervention Project registry', *Journal of American College of Cardiology,* vol. 28, pp 287–293.

Fibronolytic Therapy Trialists' (FTT) Collaborative Group 1994, 'Indications for fibrinolytic therapy in suspected acute myocardial infarction: collaborative overview of early mortality and major morbidity results from all randomised trials of more than 1000 patients', *Lancet,* vol. 343, pp 311–322.

Garg R, Yusuf S for the Collaborative Group on ACE Inhibitor Trials 1995, 'Overview of randomised trials of angiotensin-converting enzyme inhibitors on mortality in patients with heart failure', *Journal of American Medical Association,* vol. 273, pp 1450–1456.

Gostin LO & Hadley J 1998, 'Health services research: Public benefits, personal privacy, and proprietary interests', *Annals of Internal Medicine* vol. 129, pp 833–835.

Gottlieb SS, McCarter RJ, Vogel RA 1998, 'Effect of beta-blockade on mortality among high-risk and low-risk patients after myocardial infarction', *New England Journal of Medicine,* vol. 339, pp 489–497.

Gray D & Hampton JR 1993, 'Twenty years' experience of myocardial infarction: The value of a heart attack register', *British Journal of Clinical Practice,* vol. 47, pp 292–295.

Grimshaw JM & Russell IT 1993, 'Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations', *Lancet,* vol. 342, pp 1317–22.

Harris Jr JM 1996, 'Disease management: new wine in new bottles?', *Annals of Intern Medicine,* vol. 124, pp 838–842.

Hayward RA, McMahon LF, Bernard, AM 1993, 'Evaluating the care of general medicine inpatients: how good is implicit review?', *Annals of Internal Medicine*, vol. 118, pp 550–556.

Health Information Centre, Queensland Health, 1999.

Hofer TP, Bernstein SJ, Hayward RA, DeMonner S 1997, 'Validating quality clinical indicators for hospital care', *Joint Commission Journal on Quality Improvement*, vol. 23, pp 455–467.

Homer CJ 1997, 'Asthma disease management', *New England Journal of Medicine*, vol. 337, pp 1461–1463.

Jha P, Deboer D, Sykora K, Naylor CD 1996, 'Characteristics and mortality outcomes of thrombolysis trial participants and nonparticipants: a population-based comparison', *Journal of American College of Cardiology*, vol. 27, pp 1335–1342.

Khong TK, Missouris CG, Murda'h M, MacGregor GA 1998, 'The use of HMG Co-A reductase inhibitors following acute myocardial infarction in hospital practice', *Postgraduate Medical Journal,* vol. 74, pp 600–601.

Krumholz HM, Radford MJ, Ellerbeck EF, Hennen J, *et al* 1996, 'Aspirin for secondary prevention after acute myocardial infarction in the elderly: prescribed use and outcomes', *Annals of Internal Medicine,* vol. 124, pp 292–298.

Krumholz HM, Vaccarino V, Ellerbeck EF, Kiefe C, *et al* 1997, 'Determinants of appropriate use of angiotensin-converting enzyme inhibitors after acute myocardial infarction in persons greater or equal to 65 years of age', *American Journal of Cardiology,* vol. 79, pp 581–586.

Lambert-Huber DA, Ellerbeck EF, Wallace RG, Radford MJ, *et al* 1994, 'Quality of care indicators for patients with acute myocardial infarction: pilot validaton of the indicators', *Clinical Performance and Quality in Health Care*, vol. 2, pp 219–222.

Latini R, Maggioni AP, Flather M, Sleight P, *et al*, 1995, 'ACE-inhibitor use in patients with myocardial infarction. Summary of evidence from clinical trials', *Circulation* vol. 92, pp 3132–7.

Leape LL, Hilborne LH, Bell R, Kamberg C, Brook RH 1999, 'Underuse of cardiac procedures: Do women, ethnic minorities, and the uninsured fail to receive needed revascularisation?', *Annals of Internal Medicine,* vol. 130, pp 183–192.

Lewis SJ, Moye, LA, Sacks FM, for the CARE Investigators 1998, 'Effect of pravastatin on cardiovascular events in older patients with myocardial infarction and cholesterol levels in the average range: results of the cholesterol and recurrent events (CARE) trial', *Annals of Internal Medicine,* vol. 129, pp 681–689.

Mant J & Hicks NR 1995, 'Detecting differences in quality of care: the sensitivity of measures of process and outcome in treating acute myocardial infarction', *British Medical Journal,* vol. 311, pp 793–796.

Marciniak TA, Ellerbeck EF, Radford MJ, Kresowik TF, *et al*, 1998, 'Improving the quality of care for Medicare patients with acute myocardial infarction. Results from the Cooperative Cardiovascular Project', *Journal of American Medical Association*, vol. 279, pp 1351–57.

Maynard C, Weaver D, Litwin P, Martin JS, *et al* 1993, 'Hospital mortality in acute myocardial infarction in the era of reperfusion therapy (the Myocardial Infarction Triage and Intervention Project)', *American Journal of Cardiology*, vol. 72, pp 877–882.

McColl A, Roderick P, Gabbay J, *et al* 1998, 'Performance indicators for primary care groups: an evidence based approach', *British Medical Journal*, vol. 317, pp 1354–1360.

McCullough DK, Glasgow RE, Hampson SE, Wagner E 1994, 'A systematic approach to diabetes management in the post-DCCT era', *Diabetes Care*, vol. 17, pp 765–769.

Meehan TP, Hennen J, Radford MJ, Petrillo MK, *et al* 1995, 'Process and outcome of care for acute myocardial infarction among Medicare beneficiaries in Connecticut: A quality improvement demonstration project', *Annals of Internal Medicine*, vol. 122, pp 928–936.

Melville MR, Packham C, Brown N, Weston C, Gray D 1999, 'Cardiac rehabilitation: socially deprived patients are less likely to attend but patients ineligible for thrombolysis are less likely to be invited,' *Heart*, vol. 82, pp 373–377

Mugford M, Banfield P, O'Hanlon M 1991, 'Effects of feedback of information on clinical practice: a review', *British Medical Journal*, vol. 303, pp 398–402.

National Centre for Health Statistics, US Department of Health and Human Services 1996, *Third National Health and Nutrition Examination Survey, 1988–1994, NHANES III Household Adult and Laboratory Data Files* [CD-ROM]. Hyattsville, Md: Centres for Disease Control and Prevention.

National Hospitals Outcomes Program 1997, *Quality and Outcome Indicators for Acute Healthcare Services.* Department of Health and Family Services, Canberra: Australian Government Publishing Service.

NHMRC Quality of Care and Health Outcomes Committee 1995, *Guidelines for the Development and Implementation of Clinical Practice Guidelines.* 1st Edition. NHMRC,Canberra: Australian Government Publishing Service.

Oldridge NB, Guyatt GH, Fischer ME, Rimm AA 1988, 'Cardiac rehabilitation after myocardial infarction. Combined experience of randomised clinical trials', *Journal of American Medical Association,* vol. 260, pp 945–950.

Oxman AD & Guyatt GH 1992, 'A consumer's guide to subgroup analyses', *Annals of Internal Medicine,* vol. 116, pp 78–84.

Peterson ED, Shaw L J, Califf RM 1997, 'Risk stratification after myocardial infarction', *Annals of Internal Medicine,* vol. 126, pp 561–82.

Queensland Cardiac Care Advisory Panel 1998, *Health Outcomes Plan for Coronary Heart Disease 2000–2004 (draft)*. Queensland Health: Brisbane.

Rich MW, Beckham V, Wittenberg C, Leven CL, *et al* 1995, 'A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure', *New England Journal of Medicine,* vol. 333, pp 1190–1195.

Rissel C, Holt P, Ward J 1998, 'Applying a health outcomes approach in a health service unit', *Australian Health Review*, vol. 21, pp 168–181.

Ryan TJ, Anderson JL, Antman EM, Braniff BA, *et al* 1996, 'ACC/AHA guidelines for the management of patients with acute myocardial infarction: a report of the American College of Cardiology/American Heart Association Taskforce on Practice Guidelines (Committee on Management of Acute Myocardial Infarction)', *Journal of American College of Cardiology*, vol. 28, pp 1328–1428.

Scandinavian Simvastatin Survival Study Group 1994, 'Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S)', *Lancet*, vol. 344, pp 1383–1389.

Scott IA, Eyeson-Annon ML, Huxley SL, West MJ 1999, 'Optimising the care of acute myocardial infarction: Results of a regional quality improvement project', *Journal of Quality in Clinical Practice,* (in press).

Simpson K & Gordon M 1998, 'The anatomy of a clinical information system', *British Medical Journal,* vol. 316, pp 1655–1658.

Soumerai SB, McLaughlin TJ, Gurwitz JH 1998, 'Effect of local medical opinion leaders on quality of care for acute myocardial infarction. A randomized controlled trial', *Journal of American Medical Association*, vol. 279, pp 1358–63.

Soumerai SB, McLaughlin TJ, Spiegelman D, Hertzmark E, *et al* 1997, 'Adverse outcomes of underuse of beta-blockers in elderly survivors of acute myocardial infarction', *Journal of American Medical Association*, vol. 277, pp 115–121.

Silver MT, Rose GA, Paul SD, O'Donnell CJ, *et al* 1994, 'A clinical rule to predict preserved left ventricular function in patients after myocardial infarction', *Annals of Internal Medicine*, vol. 121, pp 750–756.

The Beta-Blocker Pooling Project Reserarch Group 1988, 'The Beta-Blocker Pooling Project (BBPP): subgroup findings from randomised trials in post-infarction patients', *European Heart Journal,* vol. 9, pp 8–16.

The Long-term Intervention with Pravastatin in Ischaemic Disease (LIPID) Study Group 1998, 'Prevention of cardiovascular events and death with pravastatin in patients with coronary heart disease and a broad range of initial cholesterol levels', *New England Journal of Medicine,* vol. 339, pp 1349–1357.

Todd WE & Nash D (eds) 1997, *Disease Management – A Systems Approach to Improving Patient Outcomes.* American Hospital Publishing Inc.:Chicago.

Valenti L, Lim L, Heller RF, Knapp J 1996, 'An improved questionnaire for assessing quality of life after acute myocardial infarction', *Quality of Life Research,* vol. 5, pp 151–161.

Villello A, Maggioni AP, Villello M, Giodano A *et al* 1995, 'Prognostic significance of maximal exercise testing after a myocardial infarction treated with thrombolytic agents: the GISSI-2 database', *Lancet,* vol. 346, pp 523–529.

Yusuf S, Cairns JA, Camm AJ, Fallen EL, Gersh BJ (eds) 1998, *Evidence-based Cardiology,* BMJ Books, London.