



Getting Started Kit: Improved Care for Acute Myocardial Infarction

Bibliography

Safer Healthcare Now!

We invite you to join the *Safer Healthcare Now!* Campaign (SHN) to help improve the safety of our healthcare system in Canada. *Safer Healthcare Now!* is a campaign to enlist Canadian healthcare organizations in implementing six targeted interventions in patient care. The campaign is supported by the Institute for Healthcare Improvement (IHI) and is patterned after IHI's *100,000 Lives* Campaign. Further details, including materials, contact information and discussions are available at

<http://www.saferhealthcarenow.ca>

These kits, based on those originally developed by IHI for its *100,000 Lives* Campaign, are designed to engage your teams and clinicians in a dynamic approach for quality improvement, and to provide a thorough basis for *getting started*. **Please note that although the SHN kits and the original kits developed by IHI are similar, there are also key differences in the content of the interventions and corresponding measures for some kits.** These differences are clearly noted in the body of the SHN kits themselves, and on the SHN website.

The information in these "Getting Started" kits is based on the current state of knowledge. Consistent with the dynamic nature of this campaign, which continues to evolve, emerging evidence may influence adaptation of the kits in the future. We remain open to working consultatively on updating the content as together we make healthcare safer in Canada.

Acknowledgement

We wish to thank and acknowledge the Institute for Healthcare Improvement (IHI) for their significant support and contributions to the *Safer Healthcare Now!* Campaign (SHN).

The references included in this Bibliography are those contained in the bibliography for IHI's 100K Lives Campaign, with additional references identified by SHN.

BIBLIOGRAPHY – IMPROVED CARE FOR AMI

Adams K, Corrigan JM, eds. *Priority Areas for National Action: Transforming Health Care Quality*. Washington, DC: The National Academies Press, 2003.

This publication is part of the Institute of Medicine (IOM) *Quality Chasm* Series. It presents recommendations of the IOM's Committee on Identifying Priority Areas for Quality Improvement and is a follow-up to the 2001 IOM report, *Crossing the Quality Chasm: A New Health System for the 21st Century*. "Ischemic heart disease – prevention, reduction of recurring events, and optimization of functional capacity" is one of 20 "priority areas for improvement in health care quality" identified in this report.

Antman EM, Anbe DT, Armstrong PW, et al. ACC/AHA guidelines for the management of patients with ST-elevation myocardial infarction – executive summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 1999 Guidelines for the Management of Patients with Acute Myocardial Infarction). Developed in collaboration with the Canadian Cardiovascular Society. *Circulation* 2004, available at <http://www.circulationaha.org>

Antman EM, Lau J, Kupelnick B, Mosteller F, Chalmers TC. A comparison of results of meta-analyses of randomized controlled trials and recommendations of clinical experts: treatments for myocardial infarction. *JAMA*. 1992;268:240-248.

The authors examine the temporal relationship between accumulating data from randomized control trials of treatments for AMI and the recommendations of clinical experts writing review articles and textbook chapters. Based on the results of a cumulative meta-analysis, they conclude that there are often discrepancies between the most current evidence of effective practice as derived from randomized trials and the recommendations of reviewers. Review articles often fail to mention important advances or exhibit delays in recommending effective preventive measures. In some cases, treatments that have no effect on mortality or are potentially harmful continue to be recommended. The authors conclude that finding and analyzing all therapeutic trials in a given field has become such a difficult and specialized task that clinical experts called on to summarize the evidence in a timely fashion need access to better databases and new statistical techniques to assist them in this important task.

Boissel JP. The European Myocardial Infarction Project: an assessment of pre-hospital thrombolysis. *Int J Cardiol* 1995; 49 Suppl:S29-37.

The use of thrombolytic agents in patients with suspected myocardial infarction has been shown to reduce early and long-term mortality by about 20%, and it has been suggested that since time is an important factor, pre-hospital treatment would give better results. However, health deciders need reliable data on which to base future policies concerning this. The European Myocardial Infarction Project was a European Economic Community-supported double-blind study designed to evaluate the efficacy and safety of pre-hospital early thrombolytic treatment in patients with suspected myocardial infarction compared with the same treatment given later in a hospital setting. A total of 5469 patients in 16 countries were randomised by 198 mobile emergency units to receive either pre-hospital treatment with anistreplase, the thrombolytic agent used, followed by placebo after hospital admission (pre-hospital group; 2750 patients), or placebo followed by anistreplase (hospital group; 2719 patients). The median time delay between the injections was 55 min. A non-significant decrease in 30-day mortality was observed in favour of the pre-hospital group (13%; P = 0.08), whereas the decrease in cardiac death observed, also in favour of the pre-hospital group, was on the borderline of significance (16%; P = 0.049). Although some complications occurred more frequently in the pre-hospital group in the pre-hospital period, the overall incidence for serious complications was similar for both groups. These results show that the pre-hospital thrombolytic strategy in patients with suspected myocardial infarction is both effective and safe when performed by well-equipped well-staffed mobile emergency units.

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Armstrong PW, Buller CE, Dorian P, O'Neill B. *The 2004 ACC/AHA Guidelines: A Perspective and Adaptation for Canada by the Canadian Cardiovascular Society Working Group*. [Downloaded from: <http://www.ccs.ca>]

Chan BTB, Brossart BD, Hudema NRL, Stevenson K, Walling E, Basky G, Xie H. *Improving the Quality of Heart Attack Care in Saskatchewan: Outcomes and Secondary Prevention*. Saskatoon: Health Quality Council, September 2004. (Available at www.hqc.sk.ca)

Clinical Quality Improvement Network Investigators. Influence of a critical path management tool in the treatment of acute myocardial infarction. *Am J Manag Care* 1998; 4(9):1243-51

Abstract: OBJECTIVE: The primary objective of this study was to determine the effect of implementing a critical path on use of proven efficacious therapies and outcomes in patients admitted to a hospital with acute myocardial infarction (AMI). The secondary objectives were to evaluate the use of unproven medications and to develop an understanding of the factors associated with adverse in-hospital outcomes in these patients. STUDY DESIGN: A nonrandomized before-after study design was used to evaluate the efficacy of a critical path instrument in patients admitted to hospital with AMI. PATIENTS AND METHODS: Consecutive patients admitted with AMI in nine participating hospitals were enrolled in the study. The critical path instrument consisted of a locally developed, preprinted physician order form. Practice patterns were determined before (n = 2305) and after (n = 2349) implementation of the critical path by primary chart review. Multivariate analysis of risk factors for mortality was performed on a combined database of 6088 AMI patients. RESULTS: The use of acetylsalicylic acid (ASA), nitrates, and beta blockers increased significantly by 3%, 2%, and 9%, respectively, after implementation of the critical path. Use of thrombolytics remained stable at 41%, and calcium channel blocker use decreased significantly by 8%. In-hospital mortality decreased by 1%. There was less use of ASA, nitrates, beta blockers, and thrombolytic therapy in women and the elderly. Multivariate analysis showed that advanced age was associated with increased mortality risk, whereas ASA, beta blockers, nitrates, and calcium channel blockers were associated with reduced mortality risk. CONCLUSION: Implementation of a critical path resulted in increased use of proven efficacious therapies, reduced use of noneffective therapy, and a trend toward reduced mortality

Collaborative meta-analysis of randomised trials of antiplatelet therapy for prevention of death, myocardial infarction, and stroke in high risk patients: Antithrombotic Trialists' Collaboration. *BMJ*. 2002;324:71-86.

The authors used collaborative meta-analyses (systematic overviews) to determine the effects of antiplatelet therapy among patients at high risk of occlusive vascular events. They included in these meta-analyses randomized trials of an antiplatelet regimen versus control or of one antiplatelet regimen versus another in high risk patients (with acute or previous vascular disease or some other predisposing condition) from which results were available before September 1997. The main outcome measure was "serious vascular event," defined as non-fatal myocardial infarction, non-fatal stroke, or vascular death.

Two hundred and eighty-seven studies involving 135,000 patients in comparisons of antiplatelet therapy versus control and 77,000 in comparisons of different antiplatelet regimens met inclusion criteria. Overall, among these high-risk patients, allocation to antiplatelet therapy reduced the combined outcome of any serious vascular event by about one quarter; non-fatal myocardial infarction was reduced by one third, non-fatal stroke by one quarter, and vascular mortality by one sixth (with no apparent adverse effect on other deaths). Absolute reductions in the risk of having a serious vascular event were 36 (SE 5) per 1000 treated for two years among patients with previous myocardial infarction; 38 (5) per 1000 patients treated for one month among patients with acute myocardial infarction; 36 (6) per 1000 treated for two years among those with previous stroke or transient ischaemic attack; 9 (3) per 1000 treated for three weeks among those with acute stroke; and 22 (3) per 1000 treated for two years among other high risk patients (with separately significant results for those with stable angina (P=0.0005), peripheral arterial disease (P=0.004), and atrial fibrillation (P=0.01)). In each of these high risk categories, the absolute

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benefits substantially outweighed the absolute risks of major extracranial bleeding. Aspirin was the most widely studied antiplatelet drug, with doses of 75-150 mg daily at least as effective as higher daily doses. The effects of doses lower than 75 mg daily were less certain. Clopidogrel reduced serious vascular events by 10% (4%) compared with aspirin, which was similar to the 12% (7%) reduction observed with its analogue ticlopidine. Addition of dipyridamole to aspirin produced no significant further reduction in vascular events compared with aspirin alone. Among patients at high risk of immediate coronary occlusion, short-term addition of an intravenous glycoprotein IIb/IIIa antagonist to aspirin prevented a further 20 (4) vascular events per 1000 ($P < 0.0001$) but caused 23 major (but rarely fatal) extracranial bleeds per 1000.

The authors concluded that aspirin (or another oral antiplatelet drug) is protective in most types of patient at increased risk of occlusive vascular events, including those with an acute myocardial infarction or ischemic stroke, unstable or stable angina, previous myocardial infarction, stroke or cerebral ischemia, peripheral arterial disease, or atrial fibrillation. Low-dose aspirin (75-150 mg daily) is an effective antiplatelet regimen for long-term use, but in acute settings an initial loading dose of at least 150 mg aspirin may be required. Adding a second antiplatelet drug to aspirin may produce additional benefits in some clinical circumstances, but more research into this strategy is needed.

Cox JL, Zitner D, Courtney KD, MacDonald DL, Pateson G, Cochrane B, Mathers J, Merry H, Howerdew G, Johnstone DE. Undocumented patient information: an impediment to quality of care. *Journal of Medicine*. 2003 February 15; 114(3):211-6.

The Division of Cardiology, Department of Medicine, Dalhousie University, Halifax, Nova Scotia, Canada, performed a retrospective cohort study involving direct chart audit of all consecutive hospitalizations for myocardial infarction ($n=2109$) or heart failure ($n=3392$) in Nova Scotia over a one year period. Documentation of important clinical information was found to be poor even in the hospital charts of patients with severe conditions. Information not documented in a high proportion of cases, ranged from 9% (smoking) to 58% (previous history of heart failure) in charts from patients hospitalized for AMI. The implications for quality care and good outcomes measurement were flagged.

Davies C, Christenson J, Campbell A *et al.* Fibrinolytic therapy in acute myocardial infarction: time to treatment in Canada. *Can J Cardiol* 2004; 20(8):801-5.

BACKGROUND: Fibrinolytic therapy has become the standard therapy for acute myocardial infarction with ST segment elevation. Many clinical trials have established that early administration of therapy correlates with improved outcomes. However, there are very few published data analyzing time to treatment in Canadian hospitals. **OBJECTIVES:** To examine all time intervals from onset of symptoms to treatment with fibrinolytic therapy in patients in Canada. **METHODS:** Using the FASTRAK II database, time intervals in 11,574 patients treated with fibrinolytic therapy in 106 contributing institutions across Canada from 1998 to 2000 were studied. Variables contributing to long delays in starting fibrinolytic therapy were analyzed. **RESULTS:** The mean time from onset of symptoms to arrival at hospital was 162 min (2.7 h). Only 6.3% of patients received fibrinolytic therapy within 1 h of symptom onset. Time from hospital arrival to acquisition of first 12 lead electrocardiogram was 14 min. Mean time from diagnostic electrocardiogram to decision to treat was 29.7 min, and time from decision to treat to administration of fibrinolytic therapy was 11 min. The overall average time from arrival at hospital to administration of fibrinolytic therapy was 69 min. **CONCLUSION:** In Canada, time from onset of symptoms to hospital presentation precludes early fibrinolytic therapy administration in the majority of cases. Time intervals from arrival in the emergency department to administration of fibrinolytic therapy are longer than the published and accepted standards. Strategies to alter health care seeking behaviour and to minimize in-hospital delays are needed.

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Ellison KE, Hafley GE, Hickey K *et al.* CORPORATE NAME: Multicenter UnSustained Tachycardia Trial Investigators. Effect of beta-blocking therapy on outcome in the Multicenter UnSustained Tachycardia Trial (MUSTT). *Circulation* 2002; 106(21):2694-9.

BACKGROUND: Beta-blockers are known to reduce total mortality and sudden death in survivors of recent myocardial infarction. The effects of these agents in patients at high risk for sudden death with remote infarction are not clear. **METHODS AND RESULTS:** We analyzed the effect of beta-blockers on outcomes in 2096 patients with coronary artery disease, ejection fraction < or =40%, and spontaneous nonsustained ventricular tachycardia enrolled in the Multicenter UnSustained Tachycardia Trial (MUSTT). Forty-five percent of 702 patients with inducible sustained ventricular tachyarrhythmia and 35% of 1394 patients without inducible tachycardia were discharged from hospital receiving beta-blockers. Patients treated with beta-blockers were younger and had higher ejection fractions, higher rates of recent angina, and more recent infarction. beta-Blockers were associated with decreased total mortality for the entire study population (5-year mortality 50% with beta-blockers versus 66% without beta-blockers; adjusted P=0.0001). The mortality benefit associated with beta-blockers was present in patients with and without inducible tachycardia, except those treated with implantable defibrillators. There was no significant effect of beta-blocker therapy on the rate of arrhythmic death or cardiac arrest (adjusted P=0.2344). **CONCLUSIONS:** beta-Blocking agents have beneficial effects on survival of patients having characteristics of those enrolled in the MUSTT trial. These effects do not appear to be due to a specific antiarrhythmic effect of beta-blockers. The beneficial effects of beta-blockers were demonstrable in all patients except those treated with implantable defibrillators.

Gupta M, Chang WC, Van de Werf F *et al.* CORPORATE NAME: ASSENT II Investigators. International differences in in-hospital revascularization and outcomes following acute myocardial infarction: a multilevel analysis of patients in ASSENT-2. *Eur Heart J* 2003; 24(18):1640-50.

Abstract: BACKGROUND: Revascularization rates vary substantially between countries in patients with acute ST-elevation myocardial infarction (STEMI). The impact of early revascularization on clinical outcomes in such patients remains uncertain. The ASSENT-2 fibrinolytic trial provides the opportunity to compare revascularization rates following STEMI in patients across 29 countries, and to explore the relationship between revascularization and clinical outcome. **METHODS:** Countries participating in ASSENT-2 were grouped into tertiles according to their in-hospital revascularization rates (<15%, 15-39%, >39%). Baseline characteristics, medication and procedure use, and clinical outcomes of the 16949 patients enrolled were compared. Multiple Cox regressions were used to assess the relationship between the tertiles and 30-day mortality, the primary endpoint of the ASSENT-2 trial. Multilevel logistic regression models were developed to validate and further extend the findings from the single-level analyses. **RESULTS:** Patients in highest tertile countries were younger, heavier, and more often diabetic or hypertensive. They were more likely to have had a previous myocardial infarction or revascularization procedure. Time to treatment and hospital length of stay were shorter in the highest tertile, and beta-blocker use was more frequent. Stroke rates were low and similar across tertiles, with no statistically significant difference in rates of intracranial haemorrhage. Recurrent ischaemia and reinfarction were less common in the highest tertile. Mortality rates at 30 days were lower for countries with the highest revascularization rates (5.1% vs 6.9% vs 6.5% for the lower two tertiles, P<0.001). At 1 year, mortality remained significantly lower in the highest tertile countries (8.4% vs 10.6% vs 9.9%, P=0.001). Following adjustment for baseline patient characteristics, Cox regression analysis confirmed an excess of 30-day and 1-year mortality in the lowest and intermediate tertiles compared to the highest tertile. The multilevel analyses validated these findings, and demonstrated that a country's life expectancy and the hospital volume were inversely related to both 30-day and 1-year mortality. **CONCLUSIONS:** The highest rate of in-hospital revascularization following fibrinolytic therapy for acute myocardial infarction in this international study was associated with a reduction in recurrent ischaemia, reinfarction, and improved survival at both 30 days and at 1 year. The optimal rates of revascularization in this setting remain to be determined.

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Haddad H, Searles G, Gillis A. The management of patients who have suffered an acute myocardial infarction in a tertiary centre. *Canadian Journal of Cardiology*. 2001 Feb; 17(2):179-83.

Chart reviews examined reasons why patients' discharge medications did not match optimal medical management, in a tertiary centre in Halifax, Nova Scotia. Findings: 89% discharged on a beta blocker, 40.3% on an ACE inhibitor, 16.2% on a calcium channel blocker and 89.2% on ASA. Age and gender differences were examined, as well as the assessment of contraindications.

Hennekens CH, Albert CM, Godfried SL, Gaziano JM, Buring JE. Adjunctive drug therapy of acute myocardial infarction – evidence from clinical trials. *N Engl J Med*. 1996;335:1660-1667.

The authors review current evidence from randomized trials and meta-analyses regarding the effectiveness of several categories of drugs in the treatment of patients with AMI, including beta-adrenergic antagonists, angiotensin-converting-enzyme (ACE) inhibitors, nitrates, calcium-channel blockers, antiarrhythmic drugs, and magnesium. They conclude that beta-adrenergic antagonists are effective in reducing mortality during and after AMI (relative risk 0.87 and 0.77) and that ACE inhibitors are effective in reducing mortality after AMI in patients with left ventricular dysfunction (relative risk 0.78).

Jackevicius CA, Otter D, Cox J, et al, for the Canadian Cardiovascular Outcomes Research Team. Acute Treatment of Myocardial Infarction in Canada 1999-2002. *Canadian Journal of Cardiology* 2005;21(2):145-152.

Therapy for management of acute myocardial infarction (AMI) varies according to patient prescriber and geographical characteristics. Four Canadian registries were used to identify patients with AMI in Canada and to measure in hospital reperfusion and medication use. Although Canadian and provincial rates of use of evidence based medications for the treatment of AMI have increased over time, there remains room for improvement.

Jencks SF, Huff ED, Cuerdon T. Change in the quality of care delivered to Medicare beneficiaries, 1998-1999 to 2000-2001. *JAMA*. 2003;289:305-312.

In an effort to assess the impact of the Medicare Quality Improvement Organization (QIO) program on the quality and safety of health care in the United States, the authors tracked national- and state-level changes in performance on 22 quality indicators for care of Medicare beneficiaries using observational cross-sectional studies of national and state-level fee-for-service data for Medicare beneficiaries during 1998-1999 (baseline) and 2000-2001 (follow-up). Absolute improvement was defined as the change in performance from baseline to follow-up (measured in percentage points for all indicators except those measured in minutes); relative improvement was defined as the absolute improvement divided by the difference between the baseline performance and perfect performance (100%). The median state's performance improved from baseline to follow-up on 20 of the 22 indicators. In the median state, the percentage of patients receiving appropriate care on the median indicator increased from 69.5% to 73.4%, a 12.8% relative improvement. The average relative improvement was 19.9% for outpatient indicators combined and 11.9% for inpatient indicators combined ($P < .001$). For all but one indicator, absolute improvement was greater in states in which performance was low at baseline than those in which it was high at baseline (median $r = -0.43$; range: 0.12 to -0.93). When states were ranked on each indicator, the state's average rank was highly stable over time ($r = 0.93$ for 1998-1999 vs. 2000-2001). The authors conclude that care for Medicare fee-for-service plan beneficiaries improved substantially between 1998-1999 and 2000-2001, but a much larger opportunity remains for further improvement.

Lappe JM, Muhlestein JB, Lappe DL, et al. Improvements in 1-year cardiovascular clinical outcomes associated with a hospital-based discharge medication program. *Ann Intern Med*. 2004;141:446-453.

The authors describe a nonrandomized before-after study comparing patients hospitalized before (1996-1998) and after (1999-2002) implementation of a discharge medication program (DMP) by the 10 largest hospitals in the Utah-based Intermountain Health Care system. The goal of the program was to ensure appropriate prescription of aspirin, statins, beta-blockers, ACE inhibitors, and warfarin at hospital discharge. Patients were followed for up to 1 year. Authors found that the rate of prescription of each medication increased significantly to more than 90% ($P < 0.001$);

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this rate was sustained. At 1 year, unadjusted absolute event rates for readmission and death, respectively, were 210 per 1000 person-years and 96 per 1000 person-years before DMP implementation and 191 per 1000 person-years and 70 per 1000 person-years afterward. Relative risk for death and readmission at 30 days decreased after DMP implementation; hazard ratios (HRs) for death and readmission were 0.81 (95% CI, 0.73 to 0.89) and 0.92 (CI, 0.87 to 0.99) ($P < 0.001$ and $P = 0.017$, respectively). At 1 year, risk for death continued to decrease (hazard ratio, 0.79 [CI, 0.75 to 0.84]; $P < 0.001$) while risk for readmission stabilized (hazard ratio, 0.94 [CI, 0.90 to 0.98]; $P = 0.002$), probably because survivors had more opportunities to be readmitted.

Le Feuvre CA, Connolly SJ, Cairns JA, Gent M, Roberts RS. Comparison of mortality from acute myocardial infarction between 1979 and 1992 in a geographically defined stable population. *Am J Cardiol* 1996; 78(12):1345-9.

Abstract: This study documents mortality from acute myocardial infarction (AMI), in hospital and at 1 year, for each of 3 selected 1-year periods in a stable community over a 13-year period beginning in 1979 and continuing into the thrombolytic era, to detect any changes occurring in conjunction with the introduction of new therapies. Every patient with AMI occurring in a geographically defined stable community (Hamilton, Ontario, Canada) in 3 1-year periods (1979 to 1980 [n = 816], 1986 to 1987 [n = 816], and 1991 to 1992 [n = 831]) was identified and clinically characterized by standardized criteria. Subsequent in-hospital and 1-year survival were ascertained prospectively. The 3 cohorts were similar in prognostic factors. Mean age was progressively greater over the study period from 63 years in 1979 to 1980, to 67 years in 1991 to 1992 ($p = 0.02$). There was no change in in-hospital mortality rates from 1979 to 1980 (17%) and 1986 to 1987 (16%). However, from 1986 to 1987 and 1991 to 1992, in-hospital mortality decreased from 16% to 9% ($p < 0.001$) and 1-year mortality decreased from 26% to 19% ($p < 0.001$). For patients who survived the hospital phase of AMI, 1-year mortality did not change and was between 11% and 12% in each of the 3 study periods. From 1986 to 1987 and 1991 to 1992, there was an increase in the use of thrombolytic therapy from 5% to 44% of patients. The acute use of aspirin increased from 30% to 88% and the acute use of beta blockers increased from 19% to 48% of patients. The observed increase in use of these agents could account for half of the actual mortality reduction observed. This prospective population-based survey demonstrates improved in-hospital survival after AMI associated with increased use of established effective therapies between 1987 and 1992. The 1-year mortality of hospital survivors of AMI was unchanged throughout the period of study, remaining at 11% to 12%.

McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States. *N Engl J Med*. 2003;348:2635-2645.

The authors telephoned a random sample of adults living in 12 metropolitan areas in the U.S. and asked them about selected health care experiences. They also reviewed medical records for the most recent two-year period to evaluate performance on 439 indicators of quality of preventive care as well as care for 30 acute and chronic conditions, including AMI. Overall, survey participants received 54.9 percent of recommended services. However, only 61 percent of persons presenting with AMI received aspirin and only 45 percent received beta-blockers.

Mehta SR, Yusuf S, Peters RJ *et al*. CORPORATE NAME: Clopidogrel in Unstable angina to prevent Recurrent Events trial (CURE) Investigators. Effects of pretreatment with clopidogrel and aspirin followed by long-term therapy in patients undergoing percutaneous coronary intervention: the PCI-CURE study. *Lancet* 2001; 358(9281):527-33.

Abstract: BACKGROUND: Despite the use of aspirin, there is still a risk of ischaemic events after percutaneous coronary intervention (PCI). We aimed to find out whether, in addition to aspirin, pretreatment with clopidogrel followed by long-term therapy after PCI is superior to a strategy of no pretreatment and short-term therapy for only 4 weeks after PCI. METHODS: 2658 patients with non-ST-elevation acute coronary syndrome undergoing PCI in the CURE study had been randomly assigned double-blind treatment with clopidogrel (n=1313) or placebo (n=1345). Patients were pretreated with aspirin and study drug for a median of 6 days before PCI during the initial hospital admission, and for a median of 10 days overall. After PCI, most patients (>80%) in

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both groups received open-label thienopyridine for about 4 weeks, after which study drug was restarted for a mean of 8 months. The primary endpoint was a composite of cardiovascular death, myocardial infarction, or urgent target-vessel revascularisation within 30 days of PCI. The main analysis was by intention to treat. FINDINGS: There were no drop-outs. 59 (4.5%) patients in the clopidogrel group had the primary endpoint, compared with 86 (6.4%) in the placebo group (relative risk 0.70 [95% CI 0.50-0.97], $p=0.03$). Long-term administration of clopidogrel after PCI was associated with a lower rate of cardiovascular death, myocardial infarction, or any revascularisation ($p=0.03$), and of cardiovascular death or myocardial infarction ($p=0.047$). Overall (including events before and after PCI) there was a 31% reduction cardiovascular death or myocardial infarction ($p=0.002$). There was less use of glycoprotein IIb/IIIa inhibitor in the clopidogrel group ($p=0.001$). At follow-up, there was no significant difference in major bleeding between the groups ($p=0.64$). INTERPRETATION: In patients with acute coronary syndrome receiving aspirin, a strategy of clopidogrel pretreatment followed by long-term therapy is beneficial in reducing major cardiovascular events, compared with placebo.

Pilote L, Beck CA, Karp I *et al.* CORPORATE NAME: Canadian Cardiovascular Outcomes Research Team. Secondary prevention after acute myocardial infarction in four Canadian provinces, 1997-2000. *Can J Cardiol* 2004; 20(1):61-7.

Abstract: BACKGROUND: Publication of population-based analyses of medication use after acute myocardial infarction (AMI) could encourage the use of effective secondary prevention medications. OBJECTIVE: To describe outpatient use of beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, statins, calcium channel blockers and nitrates in elderly survivors of AMI over the fiscal years from 1997/98 to 1999/2000 in Nova Scotia, Quebec, Ontario and British Columbia. METHODS: Linked administrative databases were used to identify all AMI patients 65 years of age or older admitted in Quebec ($n=14,880$), Ontario ($n=28,647$) and British Columbia ($n=7549$) over the study period, and to measure 90-day postdischarge utilization rates of cardiac medications for these patients. A population-based clinical registry was used to measure rates of prescription at discharge for elderly patients in Nova Scotia admitted to an acute care hospital from 1997 to 2000 ($n=1997$). RESULTS: Utilization rates for beta-blockers, ACE inhibitors and statins increased over time, while rates for calcium channel blockers and nitrates decreased only slightly. The largest increases were for statins (Nova Scotia: 26% to 42%, Quebec: 27% to 43%; Ontario: 28% to 40%; British Columbia: 30% to 42%) and for ACE inhibitors in Ontario (55% to 65%) and Nova Scotia (46% to 68%). Of the three drugs recommended for secondary prevention, overall utilization rates for beta-blockers were highest in Nova Scotia, lowest in British Columbia, and similar in Quebec and Ontario. Rates for ACE inhibitors were highest in Ontario and similar in Quebec, Nova Scotia and British Columbia. Rates for statins were slightly higher in Quebec and British Columbia than in Ontario and Nova Scotia. The proportion of patients without a prescription for any of the recommended drugs was highest in British Columbia (20%), lowest in Nova Scotia (8%), and similar in Quebec and Ontario (Ontario: 12%; Quebec: 13%). There was marked regional variation in utilization rates within the four provinces. CONCLUSIONS: Although utilization rates for recommended cardiac medications are increasing over time, there remains room for improvement. Overall utilization rates and temporal trends are generally similar in all four provinces, but there are wide regional variations within provinces.

Pilote L, Lavoie F, Ho V, Eisenberg MJ. Changes in the treatment and outcomes of acute myocardial infarction in Quebec, 1988-1995. *CMAJ* 2000; 163(1):31-6.

Abstract: BACKGROUND: Few studies have reported population-based information on the treatment trends and outcomes of patients who have had an acute myocardial infarction (AMI). We therefore examined patterns of care and outcomes for AMI patients in Quebec, Canada, between 1988 and 1995. METHODS: Longitudinal data files of hospital admissions in Quebec (Med-Echo database) and inpatient and outpatient services (Regie de l'Assurance Maladie du Quebec database) were used to construct cohorts of all AMI patients in the province between 1988 and 1995. Temporal trends in the use of cardiac procedures after an AMI, discharge prescriptions and mortality rates were examined. RESULTS: Between 1988 and 1995 the age- and sex-adjusted rates of AMI in the Quebec population declined (148 per 100,000 in 1988 to 137 per 100,000 in 1995). The use of intensive cardiac procedures increased in the same period; the 1-year cumulative incidence rate of catheterization increased from 28% in 1988 to 31% in 1994,

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that of angioplasty rose from 8% to 15% and that of coronary artery bypass surgery from 6% to 8%. Prescriptions for ASA, beta-blockers, lipid-lowering agents and angiotensin-converting enzyme inhibitors increased, and prescriptions for nitrates and calcium antagonists decreased. These temporal changes were paralleled by a decrease in mortality rates post-AMI. All-cause 1-year cumulative incidence mortality rates decreased from 23% in 1988 to 19% in 1994. INTERPRETATION: The decrease in AMI-related mortality in Quebec between 1988 and 1995 may be linked to changes in treatment strategies (i.e., increased use of cardiac surgical procedures and medications shown to increase survival).

Quan H, Cujec B, Jin Y, Johnson D. Acute myocardial infarction in Alberta: temporal changes in outcomes, 1994 to 1999. *Can J Cardiol* 2004; 20(2):213-9.

Abstract: BACKGROUND: The current survival trends in patients with acute myocardial infarction (AMI) are not known. A population-based study using administrative data to examine the short and long term survival of patients after AMI in Alberta between 1994 and 1999 was conducted. METHODS: AMI patients were identified from hospital discharge data. Temporal changes in the adjusted (age, sex, AMI anatomical location and comorbidities) fatality rate were analyzed in 19,928 AMI patients. RESULTS: The age- and sex-adjusted incidence of hospitalization for AMI in Alberta significantly declined from 169.6 per 100,000 population in 1994 to 160.8 per 100,000 in 1999 (P=0.03). The risk-adjusted in-hospital case fatality rate from all causes was 11.4% (95% CI 10.6% to 12.3%) in 1994 versus 9.2% (8.4% to 10.1%) in 1999; the 30-day case fatality rate was 12.6% (11.7% to 13.6%) in 1994 versus 10.1% (9.1% to 11.0%) in 1999; and the one-year case fatality rate was 19.0% (17.8% to 20.1%) in 1994 versus 14.9% (13.8% to 16.0%) in 1999. The percentage of hospitalized AMI patients who underwent coronary angiography within one year after admission rose from 48.2% in 1994 to 52.4% in 1999; percutaneous transluminal coronary angioplasty increased from 25.5% to 35.0% and coronary artery bypass surgery increased from 9.7% to 12.6%. Prescriptions for pharmacological drugs at discharge increased from 1994 to 1999 among patients aged 65 and older: from 29.5% in 1994 to 41.0% in 1999 for beta-blockers, from 5.2% to 18.7% for lipid lowering agents and from 14.0% to 20.5% for angiotensin-converting enzyme inhibitors. INTERPRETATION: There was a modest improvement in patient survival after AMI between 1994 and 1999. The improvements may be associated with increasing use of revascularization and pharmacological therapy provided in the management of AMI.

Rochon PA, Tu JV, Anderson GM *et al.* Rate of heart failure and 1-year survival for older people receiving low-dose beta-blocker therapy after myocardial infarction. *Lancet* 2000; 356(9230):639-44.

Abstract: BACKGROUND: Many older people do not receive beta-blocker therapy after myocardial infarction or receive doses lower than those tested in trials, perhaps because physicians fear that beta-blockers may precipitate heart failure. We examined the relation between use of beta-blockers, the dose used, and hospital admission for heart failure and 1-year survival in a cohort of all older patients surviving myocardial infarction in Ontario, Canada. METHODS: We collected data on a cohort of 13,623 patients aged 66 years or older who were discharged from hospital after a myocardial infarction and who did not receive beta-blocker therapy or received low, standard, or high doses. We used Cox's proportional-hazards models to study the association of dose with admission for heart failure and survival with adjustment for factors including age, sex, and comorbidity. FINDINGS: Among 8232 patients with no previous history of heart failure, dispensing of beta-blocker therapy was associated with a 43% reduction in subsequent admission for heart failure (adjusted risk ratio 0.57 [95% CI 0.48-0.69]) compared with patients not dispensed this therapy. Among the 4681 patients prescribed beta-blockers, the risk of admission was greater in the high-dose than in the low-dose group (1.53 [1.01-2.31]). Among all 13,623 patients in the cohort, 2326 (17.1%) died by 1 year. Compared with those not dispensed beta-blocker therapy, the adjusted risk ratio for mortality was lower for all three doses (low 0.40 [0.34-0.47], standard 0.36 [0.31-0.42], high 0.43 [0.33-0.56]). INTERPRETATION: Compared with high-dose beta-blocker therapy, low-dose treatment is associated with a lower rate of hospital admission for heart failure and has a similar 1-year survival benefit. Our findings support the need for a randomised controlled trial comparing doses of beta-blocker therapy in elderly patients.

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Spencer FA, Santopinto JJ, Gore JM *et al.* Impact of aspirin on presentation and hospital outcomes in patients with acute coronary syndromes (The Global Registry of Acute Coronary Events. *Am J Cardiol* 2002; 90(10):1056-61.

Abstract: The long-term use of aspirin (ASA) reduces the risk of subsequent acute coronary syndromes in patients with coronary artery disease (CAD). It is less clear whether ASA therapy benefits patients who develop an acute coronary syndrome despite its use. Baseline characteristics, type of acute coronary syndrome, and in-hospital events were compared on the basis of previous use of ASA in 11,388 patients with and without a history of CAD presenting to 94 multinational hospitals. A total of 73.0% of patients with a history of CAD (n = 4,974) were previously on long-term ASA therapy compared with 19.4% of patients without a history of CAD (n = 6,414). After multivariate regression analysis controlling for various potentially confounding factors, patients with a history of CAD who were previously taking ASA were significantly less likely to present with ST-segment elevation myocardial infarction (MI) (adjusted odds ratio [OR] 0.52, 95% confidence intervals [CI] 0.44 to 0.61) or die during hospitalization (OR 0.69, 95% CI 0.50 to 0.95) in comparison to patients who were not taking ASA. Patients without a history of CAD and who were previously taking ASA also had a lower risk of developing ST-segment elevation MI (OR 0.35, 95% CI 0.30 to 0.40) and a trend toward a decreased hospital death rate (OR 0.77, 95% CI 0.55 to 1.07). These results demonstrate that patients with a history of CAD who present with an acute coronary syndrome despite prior ASA use have less severe clinical presentation, fewer hospital complications, and lower in-hospital death rates than patients not previously taking ASA.

Stukel TA, Lucas FL, Wennberg DE. Long term outcomes of Regional variations in intensity of invasive versus medical management of Medicare Patients with Acute Myocardial Infarction. *JAMA*. 2005 Mar 16; 293(11):1329-37.

National cohort study of 158,831 elderly Medicare patients hospitalized with first episode of confirmed AMI in 1994-1995, followed up for 7 years (mean, 3.6 years) according to the intensity of invasive management (performance of cardiac catheterization with 30 days) and medical management (prescription of beta blockers to appropriate patients at discharge) in their regions of residence. More intensive medical treatment was found to provide survival benefits to the elderly.

Taylor LK, Teo KK, Cox J, Tymchak W, Tremblay G, Ashton T, Aher D, Montague T. Montreal, Hamilton, Halifax, Edmonds, Toronto, Quebec City, Penticton. Contemporary Physician Attitudes and Practice Patterns in Acute Myocardial Infarction – Results of a Large Canadian Survey.
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Tu JV, Cameron C. Impact of an acute myocardial infarction report card in Ontario, Canada. *Int J Qual Health Care* 2003; 15(2):131-7.

Abstract: OBJECTIVES: Acute myocardial infarction (AMI) 'report cards' are being developed using administrative databases in many jurisdictions, but little is known about their acceptance by

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and their usefulness to the medical community. The purpose of this study was to determine the impact of the publication of Cardiovascular Health and Services in Ontario: An ICES Atlas (Naylor CD, Slaughter P. (eds), 1999, Toronto: ICES), the first report featuring hospital-specific AMI performance measures to be published in Canada. DESIGN: We conducted a mail survey of physicians at Ontario hospitals to determine their views on the usefulness of various atlas performance measures for assessing and improving quality of care, the types of quality initiatives launched at their hospital in response to the atlas, and their views on the concept and limitations of reporting hospital-specific AMI mortality data. RESULTS: Respondents to the survey indicated that information on process of care measures such as post-infarction beta-blocker and angiotensin-converting enzyme (ACE) inhibitor use, and cardiac procedure waiting times were the most useful, and outcomes data (e.g. 30-day and 1-year risk-adjusted AMI mortality rates) the least useful of the multiple performance measures published in the atlas ($P = 0.0385$). Fifty-four percent of respondents reported launching one or more quality of care initiatives at their hospital in response to the atlas. The majority of respondents (65%) indicated that they support the public release of hospital-specific AMI mortality data, although many had concerns about potential miscoding in administrative databases and the adequacy of risk-adjustment methods. CONCLUSION: The publication of the first AMI report card in Canada stimulated quality of care initiatives at many Ontario hospitals. Inclusion of performance measures other than mortality in health care report cards may lead to greater acceptance and use by the medical community.

RESOURCES

ACC/AHA Practice Guidelines
(Developed in collaboration with the Canadian Cardiovascular Society)
<http://www.circulationaha.org>

American College of Cardiology Clinical Guidelines
www.acc.org/clinical/guidelines/stemi/index_pkt.pdf

CMS National Acute Myocardial Infarction Project
www.medqic.org/content/nationalpriorities/topics

Institute of Clinical Evaluative Sciences (ICES)
<http://www.ices.on.ca/webpage.cfm>

JCAHO Core Measures: Change Announcement
<http://www.jcaho.org/pms/core+measures/changeinaceforlvsdmeasuresincorparbs.pdf>