Canadian Cardiovascular Outcomes Research Team

CCORT

Quality of Cardiac Care in Ontario

September 2005

PHASE I REPORT 2

EFFECT (Enhanced Feedback for Effective Cardiac Treatment)

ICES Institute for Clinical Evaluative Sciences

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Quality of Cardiac Care in Ontario—Report 2

EFFECT (Enhanced Feedback for Effective Cardiac Treatment)

Phase I. Report 2—September 2005

Group B—Delayed Feedback Hospitals

Canadian Cardiovascular Outcomes Research Team

About the organizations involved in the EFFECT Study

Canadian Cardiovascular Outcomes Research Team (CCORT)

CCORT is a national group of leading researchers from five provinces (Nova Scotia, Quebec, Ontario, Alberta, and British Columbia) who have come together to study cardiovascular disease in Canada—specifically how disease risk-factors, mortality rates and care outcomes may differ across provinces, health regions and hospitals.

Established in 2001, CCORT is funded by operating grants from the Canadian Institutes of Health Research Interdisciplinary Health Research Team program and the Heart and Stroke Foundation of Canada. The CCORT national coordinating centre is located at the Institute for Clinical Evaluative Sciences in Toronto.

CCORT's innovative studies focus primarily on improving quality of care for acute myocardial infarction and congestive heart failure patients in Canada, and improving outcomes of patients undergoing invasive cardiac procedures such as cardiac catheterization, percutaneous coronary interventions, and coronary artery bypass graft surgery.

Institute for Clinical Evaluative Sciences (ICES)

ICES is an independent, non-profit organization that uses population-based health information to produce research on a broad range of health care issues. Our unbiased evidence provides fact-based measures of health system performance; a clearer understanding of the shifting health care needs of Ontarians; and a stimulus for discussion of practical solutions to optimize scarce resources.

Highly regarded in Canada and abroad, ICES knowledge is widely used by governments, hospitals, planners and practitioners, to make decisions about care delivery and develop policy. ICES research findings are also profiled in the media to bring health-related problems and potential solutions to the public's attention.

To ensure research and policy relevance, ICES collaborates with experts from a diverse network of institutions, government agencies, professional organizations and patient groups.

Heart and Stroke Foundation (HSF)

The Heart and Stroke Foundation is a federation of 10 independent provincial foundations and one national foundation, the Heart and Stroke Foundation of Canada (HSFC), led and supported by a force of more than 250,000 volunteers. The HSF is a leading funder of heart and stroke research in Canada.

The mission of the HSFC is to improve the health of Canadians by preventing and reducing disability and death from heart disease and stroke through research, health promotion and advocacy. The HSFC is Canada's international cardiovascular health ambassador, working with similar organizations worldwide to fight the growing threat of heart disease and stroke in all countries.

Working with Canada's cardiovascular health community to provide the tools it needs to give Canadians the best care in the world is another priority of the HSFC. Through the HSFC's many partnerships, including the Canadian Institutes of Health Research, Surveillance of Cardiovascular Disease in Canada, Canadian Cardiovascular Outcomes Research Team and the Canadian Heart Health Network, to name a few, the Foundation is helping shape the future of health research in Canada.

Canadian Institutes of Health Research (CIHR)

CIHR is Canada's major federal funding agency for health research. Its objective is to excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system.

CIHR is organized according to 13 "virtual" research institutes, which are organizational units that bring together and support researchers across Canada, according to their research focus. The research institutes are based on the four pillars of health research which include: biomedical sciences, clinical sciences, health services, and population health.

CCORT's home institute is the Institute for Circulatory and Respiratory Health, although CCORT's research is of relevance to many of the CIHR institutes.

Enhanced Feedback for Effective Cardiac Treatment (EFFECT) Study

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Acknowledgements

Participating Hospital Corporations

The CCORT EFFECT Study Team acknowledges the support and assistance provided by the 85 hospital corporations participating in the EFFECT Study including their Health Records departments and staff who provided access to the selected sample of acute myocardial infarction (AMI) and congestive heart failure (CHF) hospitalizations upon which this study is based.

Dr. Hui Lee

The CCORT EFFECT Study Team acknowledges the contribution of Dr. Hui Lee, who passed away March 26, 2004. Dr. Lee was a member of the CCS/CCORT CHF quality indicator panel, the EFFECT Technical Advisory Committee, and served as a reviewer for the EFFECT Study—Phase I. Report 1, released January 2004.

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The opinions, results and conclusions are those of the authors and no endorsement by any of the funding agencies is intended nor should be inferred.

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Executive Summary

Background

Cardiovascular disease continues to claim the lives of many Canadians and can create enormous disability for those who survive. While considerable progress has been made in developing effective treatment and therapies, significant opportunities remain to improve the quality of cardiac care provided.

It is well known that there is an unacceptable delay between the availability of conclusive clinical trial evidence and its application to patient care. At the same time, it is challenging for clinicians to stay current due to the rapidly increasing volume of available information. Improving the quality of care increasingly rests on the ability to assess and efficiently translate research knowledge into practice, so that patients may benefit sooner from the best available scientific evidence.

Many jurisdictions, including Canada, have identified goals for improving the quality of cardiac care by improving the use of evidence-based therapies. The **Enhanced Feedback For Effective Cardiac Treatment (EFFECT) Study** focuses on a number of well-defined quality indicators demonstrated to improve patient outcomes and can provide direction and focus to quality improvement efforts for cardiac care. The investigators hope that the EFFECT Study findings will assist Ontario health care organizations to reduce the gap between research and practice and to continue to improve the quality of cardiac care for all Ontarians.

EFFECT Study

The EFFECT Study is one of the largest and most comprehensive initiatives in the world to measure and improve the quality of cardiac care. A randomized trial of cardiac care report cards, the study's objective is to determine whether developing and publishing report cards based on clinical data collected from patient charts leads to greater use of evidence-based therapy at hospitals that receive them.

The three-phase study focuses on acute myocardial infarction (AMI) and congestive heart failure (CHF) and involves 85 hospital corporations (consisting of 103 acute care hospitals) in Ontario. As part of the study design, the hospitals were randomized into two groups: Group A–Early feedback hospitals (44 hospital corporations/53 hospitals) and Group B–Delayed feedback hospitals (41 hospital corporations/50 hospitals).

Phase I

A retrospective chart review of hospitalizations from 1999/00 and 2000/01 was conducted at each of the participating Ontario hospital corporations. Findings from Phase I were documented in two reports:

- Report 1. Report Cards on Group A–Early Feedback Hospitals, released January 2004;
- Report 2. Report Cards on Group B–Delayed Feedback Hospitals, released September 2005.

The study sample described in this report (Phase I. Report 2) consists of 5,552 AMI charts and 4,602 CHF charts from Group B–Delayed feedback hospitals. In addition to demographic and treatment information, data also focus on two sets of quality indicators—one for AMI care and one for CHF care. The quality indicators were specifically developed for use in the study by two expert panels whose membership included clinical leaders in cardiology, internal medicine, family practice, nursing, pharmacy and epidemiology.

Phase II

Report Cards for Group A–Early Feedback Hospitals and Group B–Delayed Feedback Hospitals based on a second phase of retrospective chart review of 2004/05 hospitalizations. (Release in 2006/07)

Phase III

Final Report—Impact Assessment: A comparison of results/improvement from Phase I to Phase II. (Release in 2006/07)

Key Findings for Group B–Delayed Feedback (DF) Hospitals

Discussion of key findings includes the term "ideal" patients. An ideal patient is one who has the condition of interest, e.g., AMI, has no contraindications to the specified intervention, and is alive at the time of intervention.

AMI Care

- **Most (80%) Group B–DF AMI patients have at least one modifiable cardiac risk factor**—similar to the rates reported in a recent U.S. study.[1*] Thirty-two percent of Group B–DF AMI patients in the EFFECT Study were current smokers, 47% were hypertensive, 30% had hyperlipidemia and 26% were diabetic.
- **Median door-to-needle time** for thrombolytic reperfusion therapy in Group B–DF hospitals is 40 minutes versus the target of ≤ 30 minutes.[2] The door-to-needle times were 14 minutes less when the Emergency physician made the decision to administer thrombolytic therapy and 18 minutes less when thrombolytic therapy was administered in the Emergency Department rather than in CCU/ICU. Just over one-third (36%) of Group B–DF AMI patients received thrombolytic therapy in ≤ 30 minutes.
- **Aggregate secondary prevention rate of 79%** in ideal patients is good overall (target is ≥ 85%). However, approximately one in five Group B–DF AMI patients did not receive acetylsalicylic acid (ASA), beta-blockers, angiotensin converting enzyme (ACE) inhibitors or statins at hospital discharge when they were clinically indicated.
- **Potential to save 178–250 lives** of the approximately 17,000 new AMI patients in Ontario each year, if we can further improve the secondary prevention rate, by ensuring all appropriate patients receive ASA, beta-blockers, ACE inhibitors and statins at hospital discharge.
- **The 30-day mortality rate was 12% and the one-year-mortality rate was 21%** for Group B–DF AMI patients in the EFFECT Study. The one-year AMI re-admission rate was 11%.

AMI Care Areas Identified for Continued Improvement

- **Reperfusion therapy** could be made available to more patients—42% of Group B–DF AMI patients presenting with ST-segment elevation MI (STEMI) did not receive this therapy.
- **Door-to-needle time** could be improved at a number of Group B–DF hospitals. Longer median times were associated with delays in obtaining baseline electrocardiograms (ECGs) and in ordering/preparing/administering thrombolytic therapy. By ensuring timely completion of 12-lead ECGs and that thrombolytic therapy is initiated by the Emergency physician in the emergency department (ED), rather than by a consultant or after transfer to CCU/ICU, access to this therapy can be improved.
- **Lipid testing within the first 24 hours** of admission could be improved from the current level of 36%—target level is ≥ 85%.
- **Early administration of ASA and beta-blockers** in ideal patients warrants improvement, as does the rate of secondary prevention (ASA, beta-blockers, ACE inhibitors and statins) at many Group B–DF hospitals. Increased use of standard admitting orders and/or discharge plans could lead to higher utilization rates.
- **Counselling** regarding smoking cessation could be provided to more Group B–DF AMI patients—42% of patients who smoked had no record of having received this counselling. It is recognized that physicians or other health care providers may have counselled patients but not documented this information within the patient charts.

*References are provided in Appendix A.

Key Findings (Continued)

CHF Care

- **Most (71%) Group B–DF CHF patients have at least one modifiable cardiac risk factor**. Thirteen percent of Group B—DF CHF patients were current smokers, 48% were hypertensive, 18% had hyperlipidemia and 34% were diabetic.
- **Most (82%) ideal Group B–DF CHF patients are receiving ACE inhibitor medications** which serve to improve survival and reduce hospitalization rates. The target level is ≥ 85%.
- **Less than half (41%) of ideal Group B–DF CHF patients are receiving beta-blockers at hospital discharge,** which improve survival and reduce hospitalization rates.
- **Potential to save 70–156 lives** of the 14,000 new CHF patients in Ontario each year, if all ideal CHF patients received ACE inhibitors and beta-blockers at hospital discharge.
- **The 30-day mortality rate was 10% and the one-year mortality rate was 33%** for Group B–DF CHF patients in the EFFECT Study. The one-year CHF re-admission rate was 25%.

CHF Care Areas Identified for Continued Improvement

- **More Group B–DF CHF patients could benefit from beta-blocker medications**, as current utilization of 41% among ideal patients at hospital discharge is below the target of ≥ 50%.
- **Improved access to and greater utilization of echocardiography** to measure left ventricular (LV) function would improve management of patients with CHF. Study data indicate 49% of Group B–DF CHF patients had documented LV function measurement, whereas the target level is ≥ 75%.
- **More Group B–DF patients with atrial fibrillation could benefit from warfarin therapy** as current utilization among ideal patients at discharge is 52% compared to the target level of ≥ 85%.
- **Provision and documentation of counselling (on topics such as diet, medications, symptoms, daily weights) for more Group B–DF CHF patients** could lead to improved patient outcomes. The current level is 70%, whereas the target level is ≥ 90%.

EFFECT Study Phase I. Report 2 Overview

This report provides data on Group B–Delayed Feedback Hospitals and consists of six sections and seven appendices:

1. Introduction—provides an overview of the burden of cardiac disease in Canada as well as a brief history of the use of report cards in health care.

2. Methods—provides an overview of the EFFECT Study, a major initiative of the Canadian Cardiovascular Outcomes Research Team (CCORT) and a description of the manner in which the data for the EFFECT Study were obtained and utilized.

3. Findings—provides the AMI and CHF report cards for the 41 organizations randomized to receive delayed clinical data feedback and a discussion of the major findings for this part of the study.

4. Quality Improvement—provides a brief description of quality improvement activities and identifies resources that may be of assistance to the study hospitals.

5. Interpretive Cautions—outlines the strengths and limitations of the EFFECT Study and some of the challenges encountered to support interpretation of the data.

6. Conclusion—briefly outlines the timeline for the EFFECT Study, including the next phase of data collection that will begin later in 2005.

Appendices

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Additional information on the EFFECT Study is available at www.ccort.ca/effect.asp.

EFFECT is one of the largest initiatives of CCORT. CCORT is funded by operating grants from the Canadian Institutes of Health Research (CIHR) Interdisciplinary Health Research Team program and the Heart and Stroke Foundation (HSF). CCORT's host institution is the Institute for Clinical Evaluative Sciences (ICES), located in Toronto.

1. Introduction

Cardiovascular Disease

Cardiovascular disease (CVD) is the leading cause of death in Canada, claiming over 78,000 lives (roughly 36% of all deaths) each year.[3] CVD accounts for 18% of all hospitalizations among men and women—more than any other health problem.[4]

Approximately 38,000 Canadians were hospitalized with acute myocardial infarction (AMI/heart attack) in 1996—of these about 15% died within 30 days of the event and 23% died within one year.[5] Many AMI patients who survive their index hospitalization go on to develop congestive heart failure (CHF). Heart failure patients* have an even poorer prognosis, with a one-year mortality rate of 33%—worse than that of most malignancies.[6]

At present, approximately 3% of all Canadians aged 35 to 64 years report having heart disease. CVD also represents enormous disability, with over 30% of those who report they have heart disease being unable to work due to their illness.[7]

The economic burden on the health care system is considerable and growing. In 1998, the estimated costs were approximately $19 billion, comprised of $6.8 billion in direct costs, plus $11.6 billion in indirect costs.[8] This figure is expected to increase as the population continues to age.

Despite these sobering statistics, there have been tremendous advances in the treatment of cardiac disease over the past two decades. Laboratory and clinical research have identified specific clinical strategies that are beneficial for both initial treatment and secondary prevention of AMI[9] and for the management of patients with CHF. These therapies include the use of acetylsalicyclic acid (ASA), thrombolytics, beta-blockers, angiotensin converting enzyme (ACE) inhibitors and statins for AMI[10–16] and beta-blockers and ACE inhibitors for CHF.[13,17,18] However, these proven therapies are often being underutilized in routine clinical practice in Ontario and Canada[19] and there is wide inter-hospital variation in their use. Increasing use of these therapies could lead to significant reduction in the mortality rates associated with these conditions.

Health Care Report Cards

The modern era of "scorecard cardiovascular medicine" began in the early 1990s.[20] A well-known American example, initiated in 1991, involved the publication of hospital and surgeon-specific report cards on in-hospital mortality after coronary artery bypass graft (CABG) surgery in New York State. The publication of this information stimulated quality improvement initiatives in several New York hospitals, and was associated with a 41% decline in the risk-adjusted in-hospital mortality rate after CABG surgery (from 4.14% to 2.45%).[21] Critics have charged that the mortality rate decline was, in part, the result of avoidance of high-risk patients and "gaming" of the data by involved physicians.[22,23] Other researchers have noted that CABG mortality rates were also declining in jurisdictions that had not instituted public reporting systems.[24] However, subsequent studies by Duke University researchers documented that mortality rates after CABG surgery declined fastest in New York State with its public reporting system and Northern New England with its confidential data feedback program.[25] There are conflicting studies as to whether patients preferentially migrated to low-mortality hospitals and surgeons in New York State.[26,27]

Report cards on hospital-specific AMI mortality rates have been developed in several jurisdictions including the United States (California, Pennsylvania), Scotland and Sweden.[28–31] These report cards have all been generated using routinely collected hospital discharge administrative data.

*Refers to hospitalized heart failure patients

Critics have questioned the accuracy of these administrative data, the quality of the risk-adjustment methods, the lack of associated process of care data, the timeliness of the data, and the level of disclosure (which has been physician-specific in some jurisdictions).[31–33]

The impact of these report cards on quality improvement activities appears to be limited, although few evaluative studies have been done.[34,35] Most AMI report cards have reported solely on AMI outcomes, rather than on the processes of care that contribute to the outcomes.

Despite these controversies, report cards are gaining increasing favour in Canada and elsewhere as a method to respond to the strong demand for accountability and improved quality of care by stakeholders, including the public, the media and policymakers. The Romanow Commission called for the addition of accountability as a pillar of the Canada Health Act and for regular reporting on the quality and performance of the health care system.[36]

The Ontario Experience

In February 1999, the Institute for Clinical Evaluative Sciences (ICES) and the Heart and Stroke Foundation of Ontario released the first public cardiac report card entitled *Cardiovascular Health and Services in Ontario: An ICES Atlas*.[37] This report was developed primarily using **administrative data** and demonstrated wide, unexplained regional and inter-hospital variations in all aspects of cardiac care in Ontario. For example, the 30-day mortality rate after an AMI varied from 11.2% to 22.2% among teaching and large-volume hospitals in the province. The variations among medium and small hospitals were even greater.[38]

Due to the absence of clinical data in *Cardiovascular Health and Services in Ontario*, in-hospital process of care measurements such as ASA use, thrombolytic use and thrombolytic door-to-needle times, which may have contributed to, or explained, hospital-specific outcomes, could not be reported.

To determine the impact of the *Cardiovascular Health and Services in Ontario* report card, a follow-up survey was sent to participating Ontario hospitals. This survey found that the majority of responding hospitals had implemented one or more quality improvement activities in direct response to information contained in *Cardiovascular Health and Services in Ontario*. These results were encouraging given the negative view of report cards in the United States.[39]

In addition to *Cardiovascular Health and Services in Ontario*, there have been a number of other health care report card initiatives including the Ontario Hospital Association's *Hospital Report* series and the Canadian Institute for Health Information's (CIHI) annual report on health care in Canada. Accordingly, hospitals in Ontario are becoming increasingly accustomed to public report cards.

Enhanced Feedback for Effective Cardiac Treatment (EFFECT) Study

Building on the work of the authors of *Cardiovascular Health and Services in Ontario*, one of the major initiatives being conducted by the Canadian Cardiovascular Outcomes Research Team (CCORT) is the EFFECT Study. This study, developed to further improve the quality of cardiac care in Ontario, is a randomized trial of cardiac report cards—the first such trial in the world. Its objective is to determine whether publishing report cards based on **clinical data** collected from patient charts leads to greater use of evidence-based therapy at hospitals that receive them.

CCORT is a national group of leading researchers from five provinces (Nova Scotia, Quebec, Ontario, Alberta, and British Columbia) who have come together to study cardiovascular disease in Canada—specifically how disease risk-factors, mortality rates and care outcomes may differ across provinces, health regions and hospitals. CCORT researchers from Ontario, based at ICES, are conducting the EFFECT Study.

The EFFECT Study consists of two phases of retrospective chart review focused on AMI and CHF. The report cards consist of multiple quality indicators providing information on in-hospital process of care measurements, such as the use of ASA, beta-blockers, and thrombolytic door-to-needle times, clinical information not previously available. The quality indicators were developed by two expert panels (one for AMI

and one for CHF) co-sponsored by CCORT and the Canadian Cardiovascular Society (CCS). While EFFECT is an Ontario-focused study, other CCORT projects are examining cardiac care nationally, including the CCORT Canadian Cardiovascular Atlas.

Value of Clinical Data

To support further improvement in cardiac care in Ontario, the EFFECT Study was initiated with a focus on gathering clinical information. Most previous report cards were developed using available administrative data. Administrative data have limitations when used to assess health care quality—not unexpected, given that this is not the primary purpose nor function of administrative data.[9] In contrast, data abstracted from health records can provide detailed clinical information not available in administrative data, which is more useful for quality improvement and may have greater acceptance among clinicians.

Funding

The EFFECT Study, under the CCORT initiative, is funded by operating grants from the Canadian Institutes of Health Research (CIHR) Interdisciplinary Health Research Team program and the Heart and Stroke Foundation. CCORT and EFFECT's host institution is ICES. *It should be noted that no pharmaceutical or biomedical companies were involved in the study.*

Additional Information

In addition to this report, the following supplementary information is available on the CCORT web site at www.ccort.ca/effect.asp:

- EFFECT Study Group B Delayed Feedback data slide show; and,
- EFFECT Study Group B Delayed Feedback data summary tables.

Use of this Report

This report's purpose is to document current performance and to serve as a guidepost for continued improvement in cardiac care—it is not intended for use as a consumer guide to selecting a hospital. Many cardiac conditions require urgent treatment and patients should continue to seek cardiac treatment at their local hospital.

References and Glossary of Terms

A list of references is provided in Appendix A and a Glossary of Terms follows in Appendix D.

2. Methods

Study Design

The EFFECT Study includes two phases of retrospective chart review of AMI and CHF hospitalizations and accompanying measurement of quality indicators. Phase I data collection involves AMI and CHF hospitalizations from 1999/00–2000/01 in 85 Ontario hospital corporations. Phase II data collection, beginning in late 2005, will involve review of AMI and CHF hospitalizations for 2004/05.

Randomization

As part of the study design, the 85 hospital corporations were randomized into two groups: Group A–Early feedback hospitals, where AMI/CHF report cards were provided in Phase I. Report 1 (44 hospital corporations/ 53 hospitals) and Group B–Delayed feedback hospitals (41 hospital corporations/50 hospitals), where AMI/CHF report cards are provided herein as part of Phase I Report 2. A computer-generated randomization schedule was utilized and hospital corporations were stratified by type: teaching, community, and small.

The investigators randomized the participating hospital corporations to different stages of feedback to allow evaluation of the effectiveness of this form of quality improvement activity. The research team understands that some participating hospitals may be disappointed to be receiving delayed feedback but hopes that participants understand the rationale for this type of study design and the need for careful evaluation of the usefulness of health care report cards.

The information in this report is based on the 41 hospital corporations in Group B randomized to receive **delayed** clinical data feedback.

Preliminary Data

All Group B–Delayed feedback (DF) hospitals included in this report were provided with an individual preliminary report in January 2005 (EFFECT Study Phase I Report 2—Preliminary Findings) for review. The preliminary report provided an overview of the EFFECT Study and the organization's individual data along with the appropriate overall and group averages. For example, teaching hospitals received the average for the teaching hospitals, community hospitals received the average for the community hospitals, and small hospitals received the average for the small hospitals. The preliminary reports were couriered to the hospitals on January 21, 2005.

Participating Hospitals

All hospitals in Ontario that treated 30 or more AMI and CHF patients in fiscal 1999/00 and 2000/01 were invited to participate in the EFFECT Study. A letter of invitation was sent to the Chief Executive Officer (CEO) and Chief of Staff at each of these hospitals. Eighty-five hospital corporations, consisting of 103 individual hospital sites, met these criteria. All consented to participate. The CEO at each hospital corporation identified a clinical and an administrative contact to act as CCORT/EFFECT liaisons during the study. Appendix B provides a list of the participating hospital corporations.

Hospital Peer Groups

The participating hospitals are grouped according to the Ontario Joint Policy and Planning Committee (JPPC)* defined peer groups of:

- Teaching Hospitals;
- Community (Large) Hospitals; and,
- Small Hospitals.

**The JPPC now refers to Community Hospitals as Large Hospitals*

Data Collection/Chart Abstraction

Study Sample

The patient cohort consists of a target sample of approximately 125 AMI and 125 CHF patients per hospital. The final sample size varies across hospitals, due to the number of available cases and the fact that some patient charts could not be located at the time of abstraction. For hospitals that had over 125 cases per diagnosis, a random sample was selected. For hospitals with less than or equal to 125 cases per diagnosis, all cases were selected.

At the start of the study, the target sample size was higher (n = 200) at each hospital. The sample size was subsequently reduced due to escalation in the cost of chart abstraction.

Patient charts were identified from hospital discharges in the Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD) for 1999/00 and 2000/01 with a most responsible diagnosis of AMI (ICD-9 code 410) or CHF (ICD-9 code 428). Group B–DF hospitals involved approximately 12,000 charts identified from the CIHI DAD for abstraction of clinical data (6,066 AMI charts and 5,706 CHF charts). Applying the exclusion criteria defined in Table 1 further refined the sample.

Table 1. Patient Identification Criteria *(based on CIHI administrative data)*

EFFECT Study—Patient Identification Criteria		
#	**AMI**	**CHF**
Inclusion Criteria		
1.	Most responsible diagnosis of acute myocardial infarction (ICD-9 code 410)	Most responsible diagnosis of heart failure (ICD-9 code 428)
Exclusion Criteria		
1.	Not admitted to an acute care hospital	Not admitted to an acute care hospital
2.	Age < 20 or > 105 years	Age < 20 or > 105 years
3.	Invalid health card number	Invalid health card number
4.	Admitted to non-cardiac surgical service	Admitted to surgical service
5.	Transferred from another acute care facility	Transferred from another acute care facility
6.	AMI coded as an in-hospital complication	CHF coded as an in-hospital complication
7.	AMI admission within the past year	CHF admission within the past three years

The exclusion criteria are similar to those used in the 1999 *Cardiovascular Health and Services in Ontario* report.[6,38] The rationale for these criteria are described in the literature.[40]

Additional criteria shown in Table 2 were applied to further confirm the diagnosis of AMI or CHF and its timing as part of the chart abstraction process.

Table 2. Additional Selection Criteria *(based on chart review)*

EFFECT Study—Additional Selection Criteria		
#	**AMI**	**CHF**
Inclusion Criteria		
1.	European Society of Cardiology/American College of Cardiology (ESC/ACC) clinical criteria indicating an MI[41] (ECG changes, symptoms, enzymes)	Meet Framingham criteria for CHF[42]
2.	Timing of the MI—must have occurred before the patient arrived at hospital	Timing of CHF—must have occurred before the patient arrived at hospital
Exclusion Criteria		
1.	Transferred from another acute care facility	Transferred from another acute care facility

After removal of cases determined not to be AMI or CHF according to the pre-defined study inclusion/ exclusion criteria identified in Tables 1 and 2, the final Group B–DF hospitals AMI sample size was 5,552 (91% of the original AMI charts identified from the CIHI DAD), and the final CHF sample size was 4,602 (81% of the original CHF charts identified from the CIHI DAD).

The investigators focused on achieving a high level of specificity (i.e., 100%) in constructing the cohort for the study. Hospitals with a low percentage of qualifying patients should consider reviewing their coding practices as this may indicate some patients coded as having an AMI or CHF did not in fact merit this diagnosis according to conventional clinical criteria. For example, if a hospital's study sample consisted of 135 charts but the percentage of qualifying charts was significantly lower, a review of coding practices may be warranted.

Clinical Data Collection via Chart Abstraction

CCORT cardiac research nurses completed the chart abstraction of the clinical data for Group B–DF hospitals from May 2002 through March 2004. To assist the nurse abstractors in the collection of data, the EFFECT Study team developed a detailed EFFECT chart abstraction manual. The nurse abstractors (24 in total) were trained to abstract demographic and clinical information by the lead EFFECT nurse research coordinator(s). In preparation for the training session, nurse abstractors reviewed the EFFECT chart abstraction manual and completed an intensive three-day EFFECT training program in Toronto. A number of the nurse abstractors had also worked on the prior pilot studies. New abstractors were assigned in the field with experienced abstractors for two to four days. Inter-rater reliability testing was performed for all abstractors on a common set of charts and demonstrated high reliability for all the indicators included in this report.

The abstracted information was directly entered into a notebook computer using the EFFECT Microsoft Access application and was compiled and analyzed by EFFECT Study statisticians. Data quality assessments were performed to ensure consistency of abstracted data elements.

Privacy and Data Security

In addition to obtaining approval from the CEO and the Chief of Staff to participate in the study, participating hospitals' Research Ethics Boards (REB) were approached to review and approve the study where required.

Data confidentiality and security were safeguarded throughout the EFFECT Study. To ensure patient confidentiality, **no** patient specific identifiers were abstracted. Each nurse abstractor utilized a password-protected notebook computer. All data obtained from chart review were entered directly into a password-protected, computer-based electronic data collection tool. Collected data were kept strictly confidential. All data were retrieved and maintained on a secure server at ICES.

The importance of maintaining the privacy and security of the collected data was emphasized within the EFFECT chart abstraction manual, during the abstractors' training program, and throughout the course of the study. Nurse abstractors were also required to sign an ICES confidentiality agreement before commencing work on the study and annually thereafter for the duration of the study.

Quality Indicators

Many of the variables documented in the EFFECT report cards consist of quality indicators. Quality indicators are defined as measurement tools for assessing structure, processes and outcomes of care.[43] In this context, structure refers to static or technical aspects of care (e.g., attributes of service providers or organizational characteristics), processes refer to the steps taken in caring for the patient and outcomes refer to the impact of the care or interventions on the health status of patients or populations.[44] It should be noted that indicators are distinct from practice guidelines. Indicators are intended to measure aggregate patterns; guidelines suggest optimal practice for individual patients.[44]

Quality indicators may be defined on the basis of scientific evidence or by clinical experts in the field and should be ultimately linked to improved patient outcomes.[45] They can be used to identify strengths and weaknesses in existing practice patterns and serve as a foundation for interprovincial, interregional

and interhospital comparative studies of the quality of care. Selected indicators may also assist in local hospital quality improvement initiatives and guide physician education programs.

Expert Panels

For this study, two national, multi-disciplinary expert panels were assembled to develop Canadian AMI and CHF quality indicators—the CCORT/CCS AMI Quality Indicator Panel and the CCORT/CCS CHF Quality Indicator Panel. The resulting quality indicators form the basis of the EFFECT AMI and CHF report cards. The nominating societies for the expert panels included the Heart and Stroke Foundation, the Canadian Society of Internal Medicine, the College of Family Physicians of Canada, the Canadian Society of Hospital Pharmacists and the CCS. The AMI panel consisted of nine members, including cardiologists, an internist, a family practitioner and a clinical pharmacist, and was supported by two co-chairs. The CHF panel had 11 members including cardiologists (with an interest in CHF), an internist, a family physician, a heart failure nurse and a clinical pharmacist and was supported by two co-chairs.

The AMI and CHF Quality Indicator Panels, initiated in April 2001, were convened over a 10-month period. Potential quality indicators were identified by a detailed search of published guidelines, randomized trials and outcomes studies. The panels followed a two-step Delphi process with an initial screening round of indicator ratings, followed by a national quality indicator panel meeting, where definitions of the indicators were developed using consensus methods.

The quality indicators used in the EFFECT Study are **process of care indicators,** not outcome indicators. Process of care indicators were selected because they are readily modifiable and are within the clinical team's control and influence. Process of care indicators are also more sensitive to variations in the quality of care across hospitals as compared to outcome indicators. Outcome indicators such as mortality rates may reflect factors outside a clinical team's control (i.e., time to hospital arrival, socio-economic status and random variation).

The process of care quality indicators developed by the two panels are provided in Tables 3 and 4 and have been published in the *Canadian Journal of Cardiology*.[44,45] The indicators were designed to be measurable using retrospective chart review and/or linkage with existing administrative databases.[44] For each quality indicator, the expert panel also determined the benchmark/target utilization level for ideal patients. The targets are set at less than 100% in recognition of the fact that contraindications to an intervention are not always captured in the indicator definitions. Further, it is recognized that suggested target levels may not be achievable at all hospitals. For example, lack of access to a service such as echocardiography or cardiac catheterization facilities may limit performance of some hospitals for some indicators. Benchmarks for appropriate levels of utilization may assist in identifying outlier organizations that require improvement and may help increase our understanding of factors contributing to variations in disease outcomes.[44]

Table 3. CCORT/CCS AMI Process of Care Quality Indicators

CCORT/CCS AMI Process of Care Quality Indicators		
#	Process of Care Quality Indicator*	Benchmark/Target Level for **Ideal Patients****
1.	ASA within six hours of hospital arrival	≥ 90%
2.	ASA prescribed at hospital discharge	≥ 90%
3.	Reperfusion with thrombolytics	≥ 85%
4.	Median door-to-needle time for thrombolytics	≤ 30 minutes
5.	Beta-blocker within 12 hours of admission	≥ 85%
6.	Beta-blocker prescribed at discharge	≥ 85%
7.	ACE inhibitors prescribed at discharge	≥ 85%
8.	Lipid measurement within 24 hours of admission	≥ 85%
9.	Statin prescribed at discharge	≥ 70%

* Quality Indicators are defined in the data dictionary found in Appendix C.

** Ideal patients are those without contraindications to the intervention—for more detail refer to the section entitled "Patient Groups" found later in this chapter.

Table 4. CCORT/CCS CHF Process of Care Quality Indicators

CCORT/CCS CHF Process of Care Quality Indicators		
#	Process of Care Quality Indicator*	Benchmark/Target Level for **Ideal Patients****
1.	ACE inhibitor prescription at discharge	≥ 85%
2.	Beta-blocker at hospital discharge	≥ 50%
3.	Warfarin for atrial fibrillation at hospital discharge	≥ 85%
4.	LV function evaluation before or during admission	≥ 75%
5.	Weights measured/recorded ≥ 50% of in-hospital days	≥ 90%
6.	Discharge instructions re discharge medications‡	≥ 90%
7.	Discharge instructions re salt/fluid restriction‡	≥ 90%
8.	Discharge instructions re daily weight monitoring‡	≥ 90%
9.	Discharge instructions re symptoms of worsening heart failure‡	≥ 90%
10.	Discharge instructions re follow-up appointment‡	≥ 90%

* Quality Indicators are defined in the data dictionary found in Appendix C.

** Ideal patients are those without contraindications to the intervention—for more detail refer to the section entitled "Patient Groups" found later in this chapter.

‡ Indicators #6–#10 were combined to form a single indicator in the EFFECT Study entitled Documented Counselling.

EFFECT Technical Advisory Committee

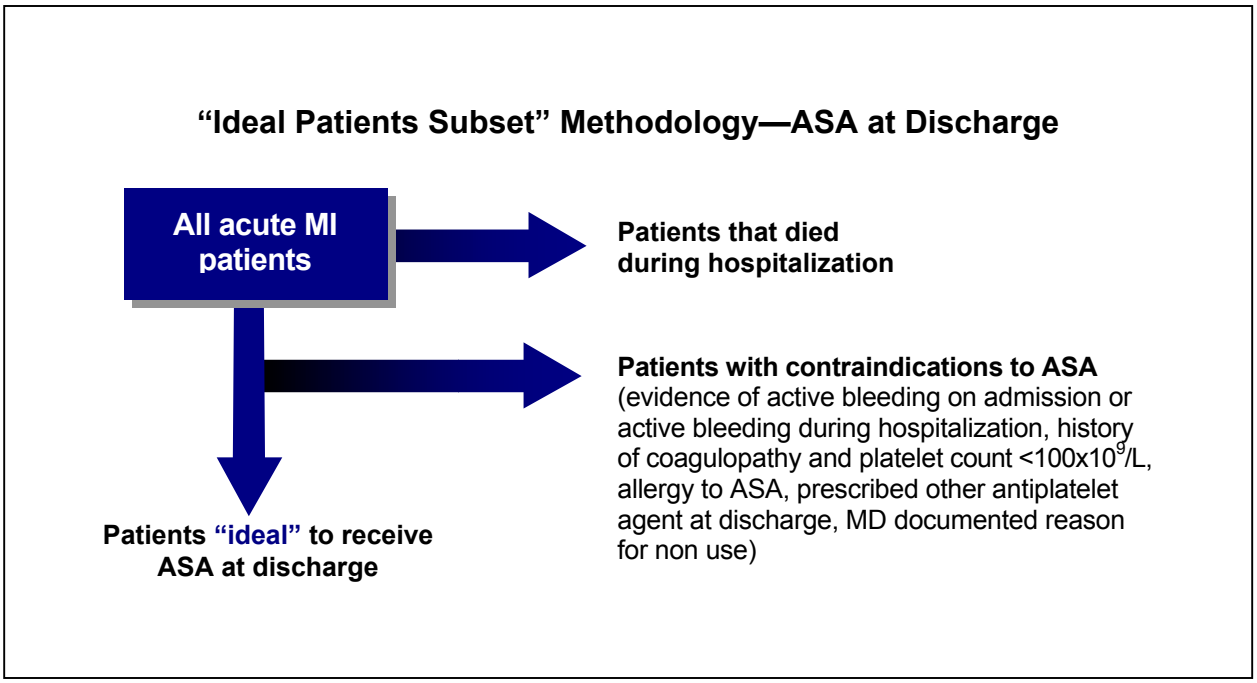
A Technical Advisory Committee was established in November 2002, to provide feedback on preliminary data findings and to provide input on the AMI and CHF quality indicators and their usefulness for Ontario physicians and hospitals. The committee reviewed all of the AMI and CHF quality indicators and recommended a final list of indicators for inclusion in the EFFECT report cards. Members of the committee also reviewed the contents of the preliminary findings report cards. The committee was comprised of eight physician representatives of hospitals participating in the EFFECT Study and also involved four ICES physicians/scientists: Drs. Jack Tu, Peter Austin, Doug Lee and Dennis Ko.

Patient Groups

Discussion of the quality indicators incorporates two patient groups. (See Figure 1, page 13.)

- **All patients**: Patients who have the particular condition of interest, e.g., AMI or CHF, and are alive at the point of intervention.
- **Ideal patients**: Patients who have the particular condition of interest, are without contraindications for a specific intervention, treatment or measured outcome and are alive at the point of intervention.

Figure 1. An Example of the "Ideal Patients Subset" Methodology Applied to the ASA at Discharge Indicator for AMI



Each of these patient groups is further described in the following example of AMI patients who received ASA at discharge—see Table 5.

Table 5. Patient Groups—AMI Example

AMI Patients Who Received ASA at Discharge	
All Patients	All patients who had an AMI according to the study inclusion criteria excluding those patients who died during hospitalization.
Ideal Patients	All AMI patients who qualified per the inclusion criteria, were alive at discharge, and were without contraindications to ASA therapy, e.g., excludes patients with active bleeding and patients with a sensitivity/allergy to ASA.

Detailed information regarding each quality indicator, the definitions for "all" and "ideal" patients and the exclusion criteria are provided in the data dictionary in Appendix C.

EFFECT Study Report Card Contents

The AMI and CHF report cards are comprised of the components outlined in Table 6.

Table 6. EFFECT Report Card Contents

#	AMI	CHF
1.	Demographics	Demographics
2.	Cardiac Risk Factors	Cardiac Risk Factors
3.	Standard Admitting Orders	Past Medical History
4.	Reperfusion Therapy*	Left Ventricular Function*
5.	Left Ventricular Function	Medication Utilization*
6.	Lipid Testing*	Daily Weights*
7.	Troponin Testing	Documented Counselling*
8.	Medication Utilization*	Hospital Care (Most Responsible Physician)
9.	Hospital Care (Most Responsible Physician)	Follow-up Care
10.	Documented Counselling	Length of Stay
11.	Length of Stay	

* Includes identified quality indicators

While additional data were collected as part of the chart review process, the data presented in the report cards were determined to be the most relevant and useful by the EFFECT Technical Advisory Committee and the practising physicians on the EFFECT Study team. Additional data will be reported from the study database in peer reviewed journals and other publications. See Appendix C—Data Dictionary for definitions of each report card variable and Appendix D—Glossary of Terms.

Reperfusion Therapy

In the AMI Report Card, the quality indicators for reperfusion therapy focus specifically on the subset of patients who suffered an ST-segment Elevation MI (STEMI). The admitting and diagnostic electrocardiograms (ECGs) were read by the nurse abstractors and were considered STEMIs if there was $\geq$ 1 mm of ST-segment elevation in two or more contiguous leads. All other AMI indicators refer to all AMI patients in the cohort.

Statistical Analysis

To improve readability of the report, confidence intervals have not been provided.

3. Findings—Group B–Delayed Feedback (DF) Hospitals

This section outlines results of the analysis of the clinical data collected from the chart abstraction process for the 41 organizations randomized to receive delayed feedback. These findings are summarized in the accompanying AMI and CHF report card tables. For multi-site organizations, the data are presented at the corporate level only. The information is presented collectively for the AMI portion of the cohort in the AMI Report Card, followed by the CHF portion of the cohort in the CHF Report Card.

AMI Report Card

The AMI Report Card for Group B–DF hospitals consists of eleven topics presented in the following four sections:

- Demographics, Cardiac Risk Factors and Standard Admitting Orders
- Reperfusion Therapy* and Diagnostic Testing*
- Medication Utilization*
- Hospital Care, Documented Counselling and Length of Stay

Those identified with an asterisk* involve quality indicators.

The key findings for AMI are presented below, followed by a description of each component of the AMI Report Card and the associated data.

Key Findings—AMI Care

- **Most (80%) Group B–DF AMI patients have at least one modifiable cardiac risk factor**—similar to the rates reported in a recent U.S. study.[1] Thirty-two percent of Group B–DF AMI patients in the EFFECT Study were current smokers, 47% were hypertensive, 30% had hyperlipidemia and 26% were diabetic.
- **Median door-to-needle time** for thrombolytic reperfusion therapy in Group B–DF hospitals is 40 minutes versus the target of $\leq$ 30 minutes.[2] The door-to-needle times were 14 minutes less when the Emergency physician made the decision to administer thrombolytic therapy and 18 minutes less when thrombolytic therapy was administered in the emergency department (ED) rather than in CCU/ICU. Just over one-third (36%) of Group B–DF patients received thrombolytic therapy in $\leq$ 30 minutes.
- **Aggregate secondary prevention rate of 79%** in ideal patients is good overall (target is $\geq$ 85%). However, approximately one in five Group B–DF AMI patients did not receive acetylsalicylic acid (ASA), beta-blockers, angiotensin converting enzyme (ACE) inhibitors or statins at hospital discharge when they were clinically indicated.
- **Potential to save 178–250 lives** of the approximately 17,000 new AMI patients in Ontario each year, if we can further improve the secondary prevention rate, by ensuring all appropriate patients receive ASA, beta-blockers, ACE inhibitors and statins at hospital discharge.
- **The 30-day mortality rate was 12% and the one-year-mortality rate was 21%** for Group B–DF AMI patients in the EFFECT Study. The one-year AMI re-admission rate was 11%.

AMI Care Areas Identified for Continued Improvement

- **Reperfusion therapy** could be made available to more patients—42% of Group B–DF AMI patients presenting with ST-segment elevation MI (STEMI) did not receive this therapy.
- **Door-to-needle time** could be improved at a number of Group B–DF hospitals. Longer median times were associated with delays in obtaining baseline ECGs and in ordering/preparing/ administering thrombolytic therapy. By ensuring timely completion of 12 lead ECGs and that thrombolytic therapy is initiated by the Emergency physician in the ED, rather than by a consultant or after transfer to CCU/ICU, access to this therapy can be improved.
- **Lipid testing within the first 24 hours** of admission could be improved from the current level of 36%—target level is ≥ 85%.
- **Early administration of ASA and beta-blockers** in ideal patients warrants improvement, as does the rate of secondary prevention (ASA, beta-blockers, ACE inhibitors and statins) at many Group B–DF hospitals. Increased use of standard admitting orders and/or discharge plans could lead to higher utilization rates.
- **Counselling** regarding smoking cessation could be provided to more Group B–DF AMI patients—42% of patients who smoked had no record of having received this counselling. It is recognized that physicians or other health care providers may have counselled patients but not documented this information within the patient charts.

Group B—DF hospitals' AMI Report Card findings are described below and presented in Tables 7 to 10. **The Group B–DF AMI Report Card summary table, including all variables, is provided in Table 11 (pull-out), following Appendix G**, and is also available as a four-page document entitled Exhibit B-3 on the CCORT web site (www.ccort.ca/effect.asp).

Demographics, Cardiac Risk Factors and Standard Admitting Orders

The first set of variables for AMI is presented in Table 7.

1. Demographics

For the Group B–DF AMI cohort, the median age was 69 years and 36% were female with relative similarities among the 41 hospital corporations.

2. Cardiac Risk Factors

Of the four major cardiac risk factors, 32% of Group B–DF AMI patients were current smokers, 47% were hypertensive, 30% had hyperlipidemia and 26% were diabetic. Overall, 80% of the AMI patients had one or more modifiable cardiac risk factors—similar to findings reported in two relevant North American population studies.[1,46]

3. Standard Admitting Orders

On average, 74% of Group B–DF AMI patients were managed using standard admitting orders. Utilization was lowest among teaching hospitals and highest among small hospitals. Thirteen organizations used standard admitting orders for ≥ 90% of their AMI patients. In Group B–DF hospitals, increased use of standard admitting orders was associated with increased a) use of lipid testing and b) administration of beta-blockers, and could help increase compliance with quality indicators. Lipid testing was, on average, 11% higher in patients admitted with standard admitting orders. Beta-blocker usage on admission, was on average, 7% higher in patients admitted with standard admitting orders and beta-blocker usage at discharge was 11% higher.

Table 7. AMI Report Card—Group B Delayed Feedback: Demographics, Cardiac Risk Factors and Standard Admitting Orders

CCORT EFFECT Study — AMI Report Card — Group B Delayed Feedback													
		1		2	3	4	5	6	7	8	9	10	11
						Patient Demographics		Cardiac Risk Factors (%)					
#	Hospital	Study Sample (n)		Qualified (n)	Qualified (%)	Age (Median)	Female (%)	Current Smoker	Hypertension	Hyperlipidemia	Diabetes	Patients with ≥ 1 Cardiac Risk Factor	Standard Admitting Orders Used (%)
	Quality Indicator Benchmark/Target												
Teaching Hospitals													
1	London Health Sciences Centre	213		191	90	70	36	43	53	42	18	86	61
2	*Ottawa Hospital, The	314		270	86	71	39	35	47	31	26	83	70
3	Sunnybrook & Women's College HSC, Toronto	130		118	91	74	42	21	51	34	26	77	70
4	University Health Network, Toronto	123		108	88	71	39	20	62	46	25	81	6
	Teaching Hospitals Total/Average	**780**		**687**	**88**	**71**	**38**	**33**	**52**	**37**	**24**	**82**	**57**
Community Hospitals													
5	*Chatham-Kent Health Alliance	224		193	86	70	36	31	52	28	33	85	94
6	Cornwall Community Hospital/Cornwall General	137		113	82	70	35	35	45	20	27	80	95
7	Grand River Hospital Corporation, Kitchener	134		124	93	69	39	30	54	34	28	82	96
8	Guelph General Hospital	135		131	97	67	33	34	37	27	18	78	64
9	Hawkesbury and District General Hospital	112		98	88	65	31	42	44	36	24	87	83
10	Hotel Dieu Health Sciences Hospital, St. Catharines	133		130	98	71	45	29	48	29	34	84	89
11	Humber River Regional Hospital, Toronto	122		118	97	71	38	26	51	32	26	82	36
12	Huntsville District Memorial Hospital	130		116	89	66	27	39	34	23	18	73	91
13	Huronia District Hospital, Midland	148		137	93	67	31	55	53	23	28	88	93
14	Joseph Brant Memorial Hospital, Burlington	137		132	96	68	36	26	52	33	23	82	10
15	Kirkland and District Hospital, Kirkland Lake	101		90	89	69	40	36	38	19	32	79	87
16	Leamington District Memorial Hospital	134		114	85	75	39	18	57	27	34	79	96
17	Markham Stouffville Hospital	137		121	88	65	26	25	45	26	24	79	98
18	*Niagara Health System	596		548	92	71	38	34	51	29	28	83	72
19	North York General Hospital, Toronto	130		129	99	72	38	29	46	36	24	77	83
20	Northumberland Hills Hospital, Cobourg	137		129	94	69	36	26	49	29	26	73	94
21	Perth and Smiths Falls District Hospital	143		134	94	72	43	37	49	28	20	78	72
22	Queensway-Carleton Hospital, Ottawa	131		120	92	69	24	31	40	28	20	76	88
23	Renfrew Victoria Hospital	95		82	86	69	39	32	32	18	20	68	9
24	Royal Victoria Hospital, The, Barrie	138		120	87	67	35	36	35	35	27	74	81
25	Bluewater Health/Sarnia General Hospital	135		121	90	68	36	32	52	33	25	83	77
26	Sault Ste. Marie General Hospital Inc.	132		115	87	67	38	37	35	30	34	78	78
27	Southlake Regional Health Centre, Newmarket	130		128	98	64	38	31	37	31	23	77	94
28	St. Joseph's General Hospital, Elliot Lake	97		89	92	68	37	27	38	21	26	75	58
29	St. Joseph's Health Centre, Toronto	136		125	92	73	37	22	49	29	26	71	59
30	St. Thomas-Elgin General Hospital	140		127	91	72	30	25	54	34	28	83	90
31	Temiskaming Hospital, New Liskeard	72		68	94	72	38	32	41	22	19	68	65
32	Thunder Bay Regional Health Sciences Centre	131		128	98	66	38	35	39	29	30	80	41
33	Tillsonburg District Memorial Hospital	136		130	96	71	40	36	48	18	26	80	95
34	Toronto East General Hospital	127		120	94	72	38	31	49	32	29	79	88
35	West Nipissing General Hospital, Sturgeon Falls	75		70	93	69	43	20	49	26	29	83	81
36	*William Osler Health Centre	352		334	95	67	39	27	46	26	25	76	82
37	York Central Hospital, Richmond Hill	129		125	97	68	34	33	53	38	28	86	14
	Community Hospitals Total/Average	**4,946**		**4,559**	**92**	**69**	**36**	**32**	**46**	**28**	**26**	**80**	**75**
Small Hospitals													
38	Campbellford Memorial Hospital	113		95	84	69	33	41	42	40	32	82	87
39	Carleton Place and District Memorial Hospital	68		60	88	68	32	35	37	18	13	75	90
40	Groves Memorial Community Hospital, Fergus	91		87	96	68	26	26	52	21	17	77	87
41	West Haldimand General Hospital, Hagersville	68		64	94	70	31	36	50	41	27	83	95
	Small Hospitals Total/Average	**340**		**306**	**90**	**69**	**30**	**35**	**45**	**30**	**23**	**79**	**90**
	Overall Total/Average	**6,066**		**5,552**	**92**	**69**	**36**	**32**	**47**	**30**	**26**	**80**	**74**

Report card based on 1999–2001 data.
Hospital Groupings: Categories as per JPPC peer groups. Multi-site organizations reported at the corporate level.
* indicates a multi-site corporation.
Study Sample: The number of charts reviewed as part of the chart abstraction process.
Qualified: The number of charts in the study sample that met the ESC/ACC & EFFECT AMI inclusion criteria.[41]

Reperfusion Therapy and Diagnostic Testing

The second set of variables, focusing on reperfusion therapy and diagnostic testing, is summarized in Table 8.

1. Reperfusion Therapy

a. Identification of eligible patients

The diagnostic work up for a patient presenting with suspected AMI includes assessing the patient's presenting symptoms, completing a 12-lead ECG, and drawing laboratory blood tests for cardiac markers such as creatine kinase (CK) and troponin. These steps form a critical path and should be completed in a timely manner to ensure appropriate diagnosis and treatment. The first or admitting ECG* is taken and read to determine if the patient is having an acute MI. Assessment focuses on two types of MI's: ST-segment elevation MI's (STEMI) and non-ST-segment elevation MI's (NSTEMI). For patients presenting with STEMI, the next key decision point is whether to employ reperfusion therapy.

b. Role of reperfusion therapy

Reperfusion therapy, treatment aimed at restoring blood flow through an acutely blocked coronary artery, focuses specifically on those patients with a STEMI. Timely administration of reperfusion therapy is associated with conservation of heart muscle and a substantial reduction in AMI patient mortality. Reperfusion therapy methods include:

- Thrombolytic therapy—administration of a medication intravenously to dissolve the blood clot blocking a coronary artery; and,
- Percutaneous Coronary Intervention (PCI also known as angioplasty or Percutaneous Transluminal Coronary Angioplasty)—insertion of a balloon catheter into the blocked coronary artery to re-open the artery and restore blood flow.

In Ontario, a small number of hospitals are able to provide advanced cardiac care including PCI, while the majority of hospitals provide the less invasive thrombolytic therapy. As a result, in terms of reperfusion therapy, the focus of this study is on thrombolytics.

The quality indicator for thrombolytic therapy is known as door-to-needle time, which represents the time period initiated by the patient's arrival in the ED (door) and completed at the time the thrombolytic medication is administered (needle) with the target being $\leq$ 30 minutes.[2] To achieve this target, it is imperative that each step in the process (e.g., first ECG, diagnostic ECG, identification of STEMI, decision regarding reperfusion therapy, delivery of thrombolytics) occurs in a timely manner.

c. Findings

- *Door-to-admitting ECG time* (median in minutes): Patient arrival in the ED (door) to the time of the first ECG was, on average, 8 minutes with a range of 3 to 27 minutes. The American College of Cardiology/American Heart Association Guidelines for AMI indicate a 12-lead ECG should be obtained within 10 minutes of arrival.[47,48]

- *Door-to-diagnostic ECG time* (median in minutes): Patient arrival in the ED (door) to the time of the diagnostic ECG was, on average, 10 minutes with a range of 3 to 28 minutes. While it is recognized that in some cases a series of ECGs may be needed for patients whose symptoms are evolving and that this will extend the diagnosis window, process delays involving completion or reading of an ECG that is diagnostic can also occur, and process improvement should focus on these delays.

- *Received acute reperfusion therapy:* Fifty-eight percent of Group B–DF patients with a STEMI received acute reperfusion therapy. Of these patients, 98% received thrombolytics and 4% received PCI within 24 hours of admission.

*In some cases a series of ECGs may be needed for patients whose symptoms are evolving.

As noted, a relatively small number of Ontario hospitals are able to provide PCI. The PCI rates in Table 8 include patients who received PCI as the only reperfusion method (primary PCI) and those who received rescue PCI following failed thrombolytic therapy.

The remaining 42% of STEMI patients did not receive reperfusion therapy. This could reflect later hospital arrival after symptom onset, contraindications to reperfusion therapy, concern about its use in the elderly, or missed opportunities to provide this therapy. Hospital-specific reperfusion rates in STEMI patients are not reported, as it was not always possible to determine the timeframe of symptom onset to hospital arrival from the chart review process. Thus, identification of ideal candidates that should have received this therapy was not possible.

As a comparison, the Global Registry of Acute Coronary Events (GRACE) involving 94 hospitals in 14 countries, found that 30% of AMI patients with STEMI did not receive reperfusion therapy.[49] GRACE investigators found that underuse of reperfusion therapy occurred in patients who were elderly (over 75 years of age), had diabetes, CHF or prior bypass surgery.[50] Similarly, the National Registry for Myocardial Infarction (NRMI) from the United States, reported that 30% of STEMI patients did not receive reperfusion therapy.[51]

The rates of reperfusion therapy reported in GRACE and NRMI may be higher than in the Group B—DF Ontario hospitals for two reasons. These two registries involve highly selected institutions and may not have captured all AMI patients, for example, non-CCU/ICU patients which represent approximately 22% of Group B—DF AMI patients.

- *Door-to-needle time* (median in minutes): For Group B–DF hospitals, the median hospital door-to-needle time for thrombolytic therapy was 40 minutes, with a range of 22 minutes to 97 minutes. Five organizations achieved a median door-to-needle time of less than 30 minutes with one hospital achieving a median door-to-needle time of 30 minutes. As noted in Table 8, the overall median time **is above** the recommended timeframe of less than or equal to 30 minutes, and represents an opportunity for some organizations to implement initiatives to improve delivery of this important therapy.

  Some have argued that the proportion of patients receiving thrombolytics within 30 minutes should be the preferred method of reporting on this indicator.[52] Both are used in this report.

- *Diagnostic ECG-to-needle time* (median in minutes): On average, the median time was 25 minutes, with a range of 15 minutes to 75 minutes.

- *Decision maker and location*: In two-thirds of the cases (66%), the Emergency physician made the decision to administer the thrombolytics. The majority of these patients (83%) received thrombolytic therapy within the ED. Group B–DF hospitals' door-to-needle times were:
  - 14 minutes less when the Emergency physician made the decision to administer thrombolytic therapy; and,
  - 18 minutes less when thrombolytic therapy was administered in the ED rather than in CCU/ICU.

  All hospitals with EDs should consider creating a policy to ensure that Emergency physicians have the authority and training to initiate thrombolytic therapy within the ED.

  This information demonstrates that delays can occur at various steps in the process of providing thrombolytic therapy. Analysis of the sub-steps of the process may prove helpful for hospitals encountering prolonged door-to-needle times.

Table 8. AMI Report Card—Group B Delayed Feedback: Reperfusion Therapy and Diagnostic Testing

CCORT EFFECT Study — AMI Report Card — Group B Delayed Feedback											
		1	2	3	4	5	6	7	8	9	10
		Quality Indicators									
		Reperfusion Therapy									Lab
#	Hospital	Method ** (%) Thrombolytics	Thrombolytics Decided By (%) Emergency MD	Thrombolytics Location (%) Emergency	Received Thrombolytics in ≤ 30 minutes (%)	Thrombolytics "Door to Needle" Time (Hours:Minutes, Median)	Method ** (%) PCI	Left Ventricular Function (%) LV Function Determined	Left Ventricular Function (%) Patients with Low LV Function	Lipid Testing Lipid Sample Obtained within 24 hrs of Admission (%)	Troponin Done (%)
	Quality Indicator Benchmark/Target					**≤ 30**		**≥ 75%**		**≥ 85%**	
Teaching Hospitals											
1	London Health Sciences Centre	95	73	93	58	0:27	21	49	57	71	99
2	*Ottawa Hospital, The	80	52	93	26	0:49	26	50	45	61	77
3	Sunnybrook & Women's College HSC, Toronto	70	30	96	38	0:41	45	67	50	51	99
4	University Health Network, Toronto	68	71	100	47	0:32	44	78	65	33	97
	Teaching Hospitals Total/Average	**80**	**57**	**94**	**39**	**0:40**	**30**	**57**	**53**	**58**	**90**
Community Hospitals											
5	*Chatham-Kent Health Alliance	100	38	39	33	0:43	0	11	28	69	82
6	Cornwall Community Hospital/Cornwall General	100	68	90	39	0:38	0	15	29	27	89
7	Grand River Hospital Corporation, Kitchener	100	84	100	55	0:28	0	77	44	49	2
8	Guelph General Hospital	100	88	100	64	0:22	0	85	44	51	2
9	Hawkesbury and District General Hospital	100	97	100	53	0:30	0	16	29	40	0
10	Hotel Dieu Health Sciences Hospital, St. Catharines	100	56	88	34	0:46	0	53	39	12	2
11	Humber River Regional Hospital, Toronto	100	65	100	38	0:41	0	70	46	55	31
12	Huntsville District Memorial Hospital	100	48	24	33	0:50	0	23	22	55	1
13	Huronia District Hospital, Midland	100	84	100	35	0:40	0	6	100	3	0
14	Joseph Brant Memorial Hospital, Burlington	100	43	93	33	0:47	0	69	38	27	98
15	Kirkland and District Hospital, Kirkland Lake	100	95	95	22	0:42	0	57	29	23	92
16	Leamington District Memorial Hospital	100	77	53	38	0:37	0	1	100	13	20
17	Markham Stouffville Hospital	100	74	100	44	0:34	0	61	22	43	2
18	*Niagara Health System	100	65	91	29	0:42	0	36	41	34	70
19	North York General Hospital, Toronto	100	81	100	37	0:35	0	50	26	78	96
20	Northumberland Hills Hospital, Cobourg	100	73	91	43	0:35	0	2	100	4	43
21	Perth and Smiths Falls District Hospital	100	98	98	58	0:28	0	31	59	31	13
22	Queensway-Carleton Hospital, Ottawa	100	21	100	41	0:35	0	18	26	56	61
23	Renfrew Victoria Hospital	100	96	85	28	0:38	0	12	0	12	6
24	Royal Victoria Hospital, The, Barrie	100	72	100	47	0:32	0	53	40	73	0
25	Bluewater Health/Sarnia General Hospital	100	95	100	54	0:29	0	41	10	26	54
26	Sault Ste. Marie General Hospital Inc.	100	80	100	42	0:42	0	33	35	18	100
27	Southlake Regional Health Centre, Newmarket	100	27	98	48	0:33	0	63	51	40	89
28	St. Joseph's General Hospital, Elliot Lake	100	95	76	10	1:11	0	1	100	63	75
29	St. Joseph's Health Centre, Toronto	100	33	100	24	0:45	0	45	40	30	98
30	St. Thomas-Elgin General Hospital	100	72	83	44	0:33	0	55	42	5	41
31	Temiskaming Hospital, New Liskeard	100	100	100	34	0:36	0	7	25	6	97
32	Thunder Bay Regional Health Sciences Centre	100	66	97	42	0:40	0	71	28	30	90
33	Tillsonburg District Memorial Hospital	100	8	3	27	0:44	0	35	51	2	2
34	Toronto East General Hospital	100	39	96	27	0:45	0	55	58	61	97
35	West Nipissing General Hospital, Sturgeon Falls	100	100	50	6	1:37	0	16	27	1	17
36	*William Osler Health Centre	100	52	69	12	0:50	0	75	40	20	90
37	York Central Hospital, Richmond Hill	100	52	100	15	0:49	0	75	37	29	56
	Community Hospitals Total/Average	**100**	**65**	**83**	**36**	**0:40**	**0**	**42**	**39**	**34**	**53**
Small Hospitals											
38	Campbellford Memorial Hospital	100	100	96	30	0:43	0	0		28	0
39	Carleton Place and District Memorial Hospital	100	100	100	6	0:59	0	7	50	43	43
40	Groves Memorial Community Hospital, Fergus	100	80	6	28	0:50	0	28	30	20	0
41	West Haldimand General Hospital, Hagersville	100	100	100	38	0:38	0	3	50	11	17
	Small Hospitals Total/Average	**100**	**93**	**65**	**27**	**0:46**	**0**	**10**	**34**	**25**	**12**
	Overall Total/Average	**98**	**66**	**83**	**36**	**0:40**	**4**	**42**	**41**	**36**	**55**

* indicates a multi-site corporation

Reperfusion Therapy: Refers only to patients with ST- segment Elevation MI (STEMI)

- Reperfusion Method: **Refers to patients who received Thrombolytics and/or PCI within 24 hours of arrival. Numbers may add to greater than 100 as some patients receive both thrombolytics and PCI.

- Thrombolytics door-to-needle time: Refers only to patients who received thrombolytics in ≤ 4 hours of arrival.

PCI: Percutaneous Coronary Intervention

1. Reperfusion Therapy *(continued)*

- *Primary PCI:* Primary PCI was used infrequently among the cohort, even though recent studies suggest it may offer better outcomes than thrombolytic therapy. This likely reflects the regionalization of advanced cardiac care/cardiac catheterization labs in Ontario, with relatively few hospitals having this capability.

2. Diagnostic Testing

Left ventricular function
Forty-two percent of Group B–DF AMI patients had a documented Left Ventricular (LV) function measurement. LV function is most commonly measured using echocardiography. Of those with documented LV function results, 41% had depressed LV function defined as Ejection Fraction of less than 40% or Grade II-III, III, IV or narrative description of moderate to severe ventricular dysfunction. Measurement of LV function is an important step for initiation of ACE inhibitors, a medication that is identified as a quality indicator for AMI care. The target level for documented LV function measurement is $\geq$ 75%.

Selected blood values—lipid and troponin testing
Lipid status within 24 hours of patient admission to hospital was determined in 36% of patients. This is significantly less than the target level of $\geq$ 85% and represents an area for quality improvement initiatives in Ontario. Group B–DF teaching hospitals were the most likely to perform lipid testing with an average utilization rate of 58%.

Troponin testing was performed in 55% of cases. Troponin testing, in addition to CK, has become increasingly common in Ontario, and provides a significant improvement in terms of diagnostic accuracy for AMI due to its sensitivity and specificity for myocyte necrosis. Troponin testing was most commonly used in Group B–DF teaching hospitals, where the average utilization rate was 90%.

Lower levels of echocardiography, lipid testing and troponin testing at some hospitals may reflect resource constraints.

Medication Utilization

The third set of AMI variables is presented in Table 9.

For medication utilization in AMI patients, the focus is on two key time periods:

- on arrival/admission; and,
- at discharge.

The use of medications was examined in terms of two patient groups: a) all patients and b) ideal patients. As described in Chapter 2—Methods, Table 5, *ideal patients* are those who are eligible to receive the process of care and do not have any contraindications or other reasons not to receive the process of care.

The use of ASA, ACE inhibitors, beta-blockers and statins is associated with substantial benefits in coronary heart disease patients. See Appendix E for a list of meta-analyses documenting the effectiveness of these interventions. A composite rating based on utilization of these four medications among ideal patients entitled the Secondary Prevention Rate was also derived.

Please note that data have been suppressed where the number of ideal patients was less than ten in a given hospital.

1. Medications on Arrival/Admission

Sixty-eight percent of all patients received ASA within 6 hours of hospital arrival and 27% received beta-blockers within 12 hours of admission. Among ideal patients, ASA use within 6 hours of hospital arrival rose to 74% (target ≥ 90%) and beta-blocker usage within 12 hours of admission rose to 32% (target ≥ 85%).

Eighty-seven percent of patients received ASA during their hospital stay, and this figure rose to 89% for ideal patients. Seventy-seven percent of patients received beta-blockers during their hospital stay, and this figure was unchanged for ideal patients.

These data suggest that more timely administration of ASA and beta-blockers is needed within Group B—DF hospitals.

2. Medications at Discharge

ASA was prescribed at discharge in 83% of all patients, beta-blockers in 75% of all cases, ACE inhibitors in 58% of all cases and statins were prescribed at discharge in 37% of all cases. Among ideal patients, ASA was prescribed in 86% of ideal cases, a figure approaching the recommended level of ≥ 90%. Six organizations had utilization levels of ≥ 90%.

Beta-blockers were prescribed in 78% of ideal cases. On average, the hospitals are approaching the target level of ≥ 85% but some hospitals should review their prescribing patterns. Seven organizations met or exceeded the target level of ≥ 85% utilization.

For ACE inhibitors, 71% of ideal cases (with documented left ventricular dysfunction) received a prescription, which is significantly below the target level of ≥ 85%. Six organizations met the target of ≥ 85% utilization.

Statins were prescribed at discharge in 61% of ideal cases. The target level is ≥ 70% among patients who have a documented total cholesterol level of ≥ 5.2 mmol/L or LDL cholesterol level of > 3.4 mmol/L. Eleven organizations achieved the target of ≥ 70% utilization of statins in ideal patients at discharge. It is possible that some physicians chose to give some of their patients a trial of dietary modification before initiating statin therapy, which would be a reasonable course of action in patients with moderately elevated cholesterol levels. However, for patients with high levels of cholesterol, dietary treatment is likely insufficient and should be coupled with statin therapy.

It is important to note that in order to qualify as an ideal patient for ACE inhibitor therapy, the patient needed to have an echocardiogram to determine LV function. For patients to qualify as ideal for statin therapy, they needed to receive lipid testing to determine cholesterol levels. Thus, the true number of ideal candidates is likely under estimated in the data.

Secondary Prevention Rate

The secondary prevention rate is a composite rating based on the percentage of ideal patients receiving any of the four medications indicated (ASA, beta-blockers, ACE inhibitors, statins). This indicator is 79% on average versus the target level of ≥ 85%. Although this level of utilization is encouraging, by improving appropriate utilization of these four medications to maximal levels 178–250 lives could be saved, annually, in Ontario—See Appendix E for more details. Hospitals could likely improve their secondary prevention rates by adopting standardized discharge orders/plans for their AMI patients and/or developing reminder systems.

Table 9. AMI Report Card—Group B Delayed Feedback: Medication Utilization

CCORT EFFECT Study — AMI Report Card — Group B Delayed Feedback														
		1	2	3	4	5	6	7	8	9	10	11	12	13
		Quality Indicators												
		Medication Utilization (%)												
		All Patients		Ideal Patients		All Patients				Ideal Patients				
#	Hospital	ASA within 6 hours of Arrival	Beta-blocker within 12 hours of Admission	ASA within 6 hours of Arrival	Beta-blocker within 12 hours of Admission	ASA prescribed at Discharge	Beta-blocker prescribed at Discharge	ACEI prescribed at Discharge	Statin prescribed at Discharge	ASA prescribed at Discharge	Beta-blocker prescribed at Discharge	ACEI prescribed at Discharge	Statin prescribed at Discharge	Secondary Prevention Rate (%)
	Quality Indicator Benchmark/Target			**≥ 90%**	**≥ 85%**					**≥ 90%**	**≥ 85%**	**≥ 85%**	**≥ 70%**	**≥ 85%**
Teaching Hospitals														
1	London Health Sciences Centre	84	23	88	32	93	79	64	53	94	87	68	87	88
2	*Ottawa Hospital, The	73	42	78	49	86	89	59	46	88	94	72	68	84
3	Sunnybrook & Women's College HSC, Toronto	67	29	70	38	85	82	64	40	90	80	89	71	84
4	University Health Network, Toronto	70	33	78	41	82	81	61	60	87	84	78	91	86
	Teaching Hospitals Total/Average	**75**	**33**	**79**	**41**	**87**	**83**	**62**	**49**	**90**	**87**	**75**	**76**	**86**
Community Hospitals														
5	*Chatham-Kent Health Alliance	69	15	75	23	84	76	59	49	87	82	74	69	82
6	Cornwall Community Hospital/Cornwall General	72	15	76	19	79	69	56	27	80	72	56	53	72
7	Grand River Hospital Corporation, Kitchener	83	37	90	48	89	79	53	55	94	85	78	78	87
8	Guelph General Hospital	64	39	75	46	86	91	72	41	89	89	82	66	84
9	Hawkesbury and District General Hospital	56	33	61	33	83	78	36	30	87	82	55	41	76
10	Hotel Dieu Health Sciences Hospital, St. Catharines	65	55	73	63	83	67	68	41	88	71	79	60	79
11	Humber River Regional Hospital, Toronto	58	21	64	23	82	75	51	49	82	80	62	81	78
12	Huntsville District Memorial Hospital	74	34	79	45	82	82	43	50	87	83	57	85	82
13	Huronia District Hospital, Midland	77	19	81	25	93	75	59	19	96	77	72	50	86
14	Joseph Brant Memorial Hospital, Burlington	69	13	81	18	72	67	60	46	80	69	81	79	74
15	Kirkland and District Hospital, Kirkland Lake	63	7	69	15	75	66	45	20	77	69	64	33	70
16	Leamington District Memorial Hospital	57	9	62	7	79	64	69	32	85	68	75		78
17	Markham Stouffville Hospital	64	18	71	23	80	77	38	25	81	81	62	50	76
18	*Niagara Health System	71	35	77	38	87	75	64	37	90	78	78	56	83
19	North York General Hospital, Toronto	70	26	75	42	81	75	53	50	83	78	50	67	73
20	Northumberland Hills Hospital, Cobourg	68	17	74	22	75	64	43	29	77	61	53		68
21	Perth and Smiths Falls District Hospital	64	35	72	44	84	79	52	34	87	81	69	55	82
22	Queensway-Carleton Hospital, Ottawa	64	46	70	49	83	82	43	47	84	80	67	70	79
23	Renfrew Victoria Hospital	69	19	78	22	70	57	57	20	70	70	64	25	64
24	Royal Victoria Hospital, The, Barrie	74	25	76	28	86	72	58	34	87	74	61	40	72
25	Bluewater Health/Sarnia General Hospital	79	21	81	28	85	80	58	36	87	86	69	68	82
26	Sault Ste. Marie General Hospital Inc.	69	21	83	28	85	75	61	38	89	79	68	48	79
27	Southlake Regional Health Centre, Newmarket	60	14	65	18	77	86	72	47	78	88	87	54	78
28	St. Joseph's General Hospital, Elliot Lake	71	25	78	38	88	66	38	29	92	79	44	30	80
29	St. Joseph's Health Centre, Toronto	63	14	65	20	86	62	69	45	88	65	81	81	80
30	St. Thomas-Elgin General Hospital	79	26	78	31	83	72	53	17	85	74	62		76
31	Temiskaming Hospital, New Liskeard	78	63	83	71	82	73	63	20	85	83	86		80
32	Thunder Bay Regional Health Sciences Centre	66	29	75	39	83	75	57	47	87	78	71	71	77
33	Tillsonburg District Memorial Hospital	55	12	59	12	88	75	53	15	89	74	73		82
34	Toronto East General Hospital	63	23	70	30	80	71	77	54	80	74	86	82	81
35	West Nipissing General Hospital, Sturgeon Falls	60	25	59	17	71	58	35	18	75	55	47		67
36	*William Osler Health Centre	68	21	74	26	81	75	60	28	82	78	73	36	75
37	York Central Hospital, Richmond Hill	67	25	74	29	78	76	71	40	81	73	74	91	77
	Community Hospitals Total/Average	**68**	**26**	**74**	**31**	**83**	**74**	**57**	**36**	**85**	**77**	**70**	**59**	**78**
Small Hospitals														
38	Campbellford Memorial Hospital	51	22	57	25	78	68	52	28	82	71	68	30	75
39	Carleton Place and District Memorial Hospital	53	30	61	32	74	79	50	25	79	74			74
40	Groves Memorial Community Hospital, Fergus	75	17	83	21	86	78	70	18	89	86	86		88
41	West Haldimand General Hospital, Hagersville	66	43	65	52	73	81	66	32	76	82	91		78
	Small Hospitals Total/Average	**60**	**28**	**65**	**31**	**78**	**75**	**60**	**26**	**82**	**78**	**73**	**50**	**79**
	Overall Total/Average	**68**	**27**	**74**	**32**	**83**	**75**	**58**	**37**	**86**	**78**	**71**	**61**	**79**

* indicates a multi-site corporation
ASA: aspirin
ACEI: angiotensin converting enzyme inhibitor
Data suppressed where the number of ideal patients was less than 10 in a given hospital

Hospital Care, Documented Counselling and Length of Stay (Days)

The fourth and final set of AMI variables is presented in Table 10.

1. Hospital Care

During the hospital stay, the most responsible physician overseeing the Group B–DF AMI patient was either a general practitioner/family physician (35%), a cardiologist (37%), or a general internist (20%). Another type of internist physician (e.g., respirologist, nephrologist, etc.) was responsible in 9% of cases. These data highlight the need for physicians of all specialties to be aware of current guidelines and advances in cardiac care.

2. Documented Counselling—Smoking Cessation

Smoking cessation counselling was documented as provided to 58% of Group B–DF AMI patients (who were current smokers) during their hospital stay. Increasingly recognized as an important care component for AMI patients, smoking cessation counselling should be provided to more patients during their hospital stay. During this time period patients are often highly motivated to quit smoking and receptive to counselling. It is recognized that physicians or other health care providers may have counselled patients but not documented this information within the patient charts.

3. Length of Stay (Days)

The median length of stay for Group B–DF AMI cases was six days, with modest inter-hospital variation.

AMI Related Data

For Group B–DF AMI patients in the EFFECT Study, the 30-day mortality rate was 12%; the one-year mortality rate was 21%. Related outcome data, such as in-hospital mortality rates at the hospital-specific level, are not reported for several reasons. First, the small sample size at some hospitals leads to wide statistical uncertainty around the mortality rate estimate. Second, the sample of patients abstracted at each hospital may not reflect the overall mortality rate for all AMI patients at that hospital. For example, the 30-day mortality rate for AMI at one hospital may have been 15% based on the sample of 125 charts abstracted, whereas the hospital's actual mortality rate may have been 10% for all 500 patients treated by that hospital in the same time period.

The one-year AMI re-admission rate was 11% among patients that survived the index hospitalization.

Table 10. AMI Report Card—Group B Delayed Feedback: Hospital Care, Documented Counselling and Length of Stay

CCORT EFFECT Study — AMI Report Card — Group B Delayed Feedback								
		1	2	3	4	5	6
		Most Responsible Physician (%)				Counselling	Outcomes
#	Hospital	Cardiologist	Family Practitioner/GP	Internist	Other	Smoking Cessation	Length of Stay (Days - Median)
	Quality Indicator Benchmark/Target						
Teaching Hospitals							
1	London Health Sciences Centre	84	0	10	6	42	6
2	*Ottawa Hospital, The	92	1	6	1	36	6
3	Sunnybrook & Women's College HSC, Toronto	91	0	7	3	50	6
4	University Health Network, Toronto	60	0	33	6	55	9
	Teaching Hospitals Total/Average	**85**	**0**	**11**	**3**	**42**	**6**
Community Hospitals							
5	*Chatham-Kent Health Alliance	0	76	24	0	91	6
6	Cornwall Community Hospital/Cornwall General	0	93	7	0	87	5
7	Grand River Hospital Corporation, Kitchener	90	1	2	6	94	5
8	Guelph General Hospital	60	2	30	6	57	6
9	Hawkesbury and District General Hospital	6	94	0	0	44	5
10	Hotel Dieu Health Sciences Hospital, St. Catharines	14	5	74	8	63	6
11	Humber River Regional Hospital, Toronto	65	0	14	21	43	5
12	Huntsville District Memorial Hospital	0	1	82	17	17	4
13	Huronia District Hospital, Midland	0	69	30	0	22	7
14	Joseph Brant Memorial Hospital, Burlington	27	2	49	22	64	7
15	Kirkland and District Hospital, Kirkland Lake	0	91	9	0	83	6
16	Leamington District Memorial Hospital	0	34	66	0	78	7
17	Markham Stouffville Hospital	68	3	3	26	57	6
18	*Niagara Health System	36	37	27	0	61	6
19	North York General Hospital, Toronto	64	1	15	21	52	6
20	Northumberland Hills Hospital, Cobourg	0	99	1	0	29	6
21	Perth and Smiths Falls District Hospital	0	100	0	0	85	6
22	Queensway-Carleton Hospital, Ottawa	38	0	60	1	48	5
23	Renfrew Victoria Hospital	0	100	0	0	100	5
24	Royal Victoria Hospital, The, Barrie	22	9	25	44	71	5
25	Bluewater Health/Sarnia General Hospital	0	3	97	0	85	5
26	Sault Ste. Marie General Hospital Inc.	52	20	10	17	80	5
27	Southlake Regional Health Centre, Newmarket	66	0	20	14	38	5
28	St. Joseph's General Hospital, Elliot Lake	0	100	0	0	84	5
29	St. Joseph's Health Centre, Toronto	75	0	6	18	65	7
30	St. Thomas-Elgin General Hospital	33	60	7	0	64	6
31	Temiskaming Hospital, New Liskeard	0	100	0	0	20	6
32	Thunder Bay Regional Health Sciences Centre	14	60	10	14	73	7
33	Tillsonburg District Memorial Hospital	64	35	1	0	59	5
34	Toronto East General Hospital	93	0	7	1	57	6
35	West Nipissing General Hospital, Sturgeon Falls	0	94	6	0	43	6
36	*William Osler Health Centre	68	11	18	2	37	7
37	York Central Hospital, Richmond Hill	22	0	14	64	70	7
	Community Hospitals Total/Average	**32**	**36**	**22**	**10**	**60**	**6**
Small Hospitals							
38	Campbellford Memorial Hospital	0	100	0	0	55	5
39	Carleton Place and District Memorial Hospital	0	100	0	0	40	6
40	Groves Memorial Community Hospital, Fergus	0	97	3	0	87	6
41	West Haldimand General Hospital, Hagersville	0	100	0	0	81	6
	Small Hospitals Total/Average	**0**	**99**	**1**	**0**	**66**	**6**
	Overall Total/Average	**37**	**35**	**20**	**9**	**58**	**6**

* indicates a multi-site corporation

CHF Report Card

The CHF Report Card for Group B–Delayed feedback (DF) hospitals consists of ten topics presented in the following three sections:

- Demographics, Cardiac Risk Factors and Past Medical History;
- Left Ventricular Function*, Medication Utilization,* Daily Weights* and Documented Counselling;* and,
- Hospital Care, Follow-up Care and Length of Stay.

Those identified with an asterisk* involve quality indicators.

The key findings for CHF are presented below, followed by a description of each component of the CHF Report Card and the associated data.

Key Findings—CHF Care

- **Most (71%) Group B–DF CHF patients have at least one modifiable cardiac risk factor**. Thirteen percent of Group B—DF CHF patients were current smokers, 48% were hypertensive, 18% had hyperlipidemia and 34% were diabetic.
- **Most (82%) ideal Group B–DF CHF patients are receiving ACE inhibitor medications** which serve to improve survival and reduce hospitalization rates. The target level is ≥ 85%.
- **Less than half (41%) of ideal Group B–DF CHF patients are receiving beta-blockers at hospital discharge,** which improve survival and reduce hospitalization rates.
- **Potential to save 70–156 lives** of the 14,000 new CHF patients in Ontario each year, if all ideal CHF patients received ACE inhibitors and beta-blockers at hospital discharge.
- **The 30-day mortality rate was 10% and the one-year mortality rate was 33%** for Group B–DF CHF patients in the EFFECT Study. The one-year CHF re-admission rate was 25%.

CHF Care Areas Identified for Continued Improvement

- **More Group B–DF CHF patients could benefit from beta-blocker medications**, as current utilization of 41% among ideal patients at hospital discharge is below the target of ≥ 50%.
- **Improved access to and greater utilization of echocardiography** to measure left ventricular (LV) function would improve management of patients with CHF. Study data indicate 49% of Group B–DF CHF patients had documented LV function measurement, whereas the target level is ≥ 75%.
- **More Group B–DF patients with atrial fibrillation could benefit from warfarin therapy** as current utilization among ideal patients at discharge is 52% compared to the target level of ≥ 85%.
- **Provision and documentation of counselling (on topics such as diet, medications, symptoms, daily weights) for more Group B–DF CHF patients** could lead to improved patient outcomes. The current level is 70% whereas the target level is ≥ 90%.

Group B–DF hospitals' CHF Report Card findings are described below and presented in Tables 12 to 14. **The Group B–DF CHF Report Card summary table, including all variables, is provided in Table 15 (pull-out), following Appendix G**, and is also available as a three-page document entitled Exhibit B-4 on the CCORT web site (www.ccort.ca/effect.asp).

Demographics, Cardiac Risk Factors and Past Medical History

The first set of variables presented for CHF is presented in Table 12.

1. Demographics

For the Group B–DF CHF cohort, the median age was 77 years and 49% were female.

2. Cardiac Risk Factors

Of the four modifiable cardiac risk factors, 13% of Group B–DF CHF patients were current smokers, 48% were hypertensive, 18% had hyperlipidemia and 34% were diabetic; with 71% having at least one of these risk factors.

3. Past Medical History—Cardiac and Vascular Disease

Fifty-two percent of the Group B–DF CHF patients suffer from coronary disease, (described as one or more of angina, previous PCI, or coronary artery bypass graft {CABG}), and just over one-third, or 37%, have had a previous MI. Thirty percent of the sample patients suffer from atrial fibrillation and 15% have heart valve disease involving the aortic or mitral valves. Twelve percent of these CHF patients also have some form of cancer.

Table 12. CHF Report Card—Group B Delayed Feedback: Demographics, Cardiac Risk Factors and Past Medical History

CCORT EFFECT Study — CHF Report Card — Group B Delayed Feedback																	
		1		2	3	4	5	6	7	8	9	10	11	12	13	14	15
						Patient Demographics		Cardiac Risk Factors (%)					PMH - Cardiac & Vascular Disease (%)				
#	Hospital	Study Sample (n)		Qualified (n)	Qualified (%)	Age (Median)	Female (%)	Current Smoker	Hypertension	Hyperlipidemia	Diabetes	Patients with ≥ 1 Cardiac Risk Factor	Coronary Disease	Previous MI	Atrial Fib	Valve Disease	Cancer
	Quality Indicator Benchmark/Target																
Teaching Hospitals																	
1	London Health Sciences Centre	214		181	85	76	41	15	56	27	39	77	69	50	35	17	18
2	*Ottawa Hospital, The	276		203	74	76	47	14	50	20	35	71	57	40	27	15	12
3	Sunnybrook & Women's College HSC, Toronto	128		111	87	79	59	8	44	15	29	60	58	43	32	20	12
4	University Health Network, Toronto	123		107	87	72	39	22	47	26	33	70	46	33	44	18	9
	Teaching Hospitals Total/Average	**741**		**602**	**81**	**76**	**46**	**15**	**50**	**22**	**35**	**71**	**59**	**42**	**34**	**17**	**13**
Community Hospitals																	
5	*Chatham-Kent Health Alliance	211		164	78	77	55	15	38	19	27	64	48	35	27	10	12
6	Cornwall Community Hospital/Cornwall General	135		107	79	80	47	16	47	11	31	66	50	30	31	8	13
7	Grand River Hospital Corporation, Kitchener	135		120	89	78	44	13	63	25	32	82	68	50	28	24	21
8	Guelph General Hospital	131		111	85	77	42	14	50	14	34	72	48	39	30	17	13
9	Hawkesbury and District General Hospital	105		75	71	79	63	17	45	27	41	79	60	27	29	12	9
10	Hotel Dieu Hospital, St. Catharines	130		102	78	79	46	8	55	10	30	72	59	46	27	25	16
11	Humber River Regional Hospital, Toronto	117		97	83	77	47	7	47	15	36	64	30	20	31	18	8
12	Huntsville District Memorial Hospital	94		73	78	80	48	15	42	8	29	63	45	23	40	22	10
13	Huronia District Hospital, Midland	138		106	77	77	43	19	45	7	33	72	43	35	22	11	5
14	Joseph Brant Memorial Hospital, Burlington	135		120	89	75	48	9	63	31	29	78	58	46	49	28	17
15	Kirkland and District Hospital, Kirkland Lake	98		71	72	75	49	28	35	6	31	63	32	27	13	4	8
16	Leamington District Memorial Hospital	126		88	70	77	59	6	58	31	40	77	53	34	26	7	7
17	Markham Stouffville Hospital	133		107	80	79	60	7	54	20	31	76	47	36	24	6	7
18	*Niagara Health System	589		467	79	77	49	13	49	18	33	72	53	40	28	19	12
19	North York General Hospital, Toronto	131		112	85	80	43	9	53	28	37	72	54	38	37	22	15
20	Northumberland Hills Hospital, Cobourg	135		121	90	77	48	17	45	20	35	72	52	35	28	13	6
21	Perth and Smiths Falls District Hospital	134		102	76	80	59	15	40	18	22	58	51	40	25	11	11
22	Queensway-Carleton Hospital, Ottawa	130		98	75	80	52	18	41	7	27	61	45	30	23	11	10
23	Renfrew Victoria Hospital	52		39	75	76	54	15	41	15	38	74	44	21	33	5	5
24	Royal Victoria Hospital, The, Barrie	134		107	80	79	45	16	38	13	26	63	49	43	35	10	11
25	Bluewater Health/Sarnia General Hospital	129		101	78	74	55	18	43	19	35	73	55	37	22	7	12
26	Sault Ste. Marie General Hospital Inc.	128		109	85	76	46	11	52	17	41	77	48	28	22	15	26
27	Southlake Regional Health Centre, Newmarket	128		105	82	76	44	10	33	18	47	71	51	36	25	13	9
28	St. Joseph's General Hospital, Elliot Lake	87		69	79	72	41	17	38	14	26	64	67	45	19	3	16
29	St. Joseph's Health Centre, Toronto	126		103	82	80	50	17	50	17	29	71	44	33	36	23	7
30	St. Thomas-Elgin General Hospital	133		113	85	78	47	4	50	21	41	76	52	40	35	15	14
31	Temiskaming Hospital, New Liskeard	54		40	74	74	58	13	45	15	35	68	43	28	23	3	13
32	Thunder Bay Regional Health Sciences Centre	123		108	88	78	49	10	44	13	36	69	44	29	30	15	6
33	Tillsonburg District Memorial Hospital	131		115	88	77	54	11	48	12	39	69	40	30	23	17	17
34	Toronto East General Hospital	127		97	76	78	46	18	46	19	32	66	46	33	40	26	6
35	West Nipissing General Hospital, Sturgeon Falls	53		40	75	75	30	20	63	25	53	93	68	40	15	8	10
36	*William Osler Health Centre	316		262	83	76	48	10	56	18	44	76	50	40	28	13	10
37	York Central Hospital, Richmond Hill	128		104	81	80	53	5	46	16	31	69	51	36	42	20	10
	Community Hospitals Total/Average	**4,656**		**3,753**	**81**	**77**	**49**	**13**	**48**	**17**	**34**	**71**	**50**	**36**	**29**	**15**	**12**
Small Hospitals																	
38	Campbellford Memorial Hospital	111		82	74	81	48	13	46	18	34	72	57	37	27	18	5
39	Carleton Place and District Memorial Hospital	48		36	75	78	56	22	19	8	31	58	61	33	25	6	11
40	Groves Memorial Community Hospital, Fergus	73		59	81	79	53	8	64	17	42	78	41	36	22	8	15
41	West Haldimand General Hospital, Hagersville	77		70	91	78	64	10	54	30	47	80	59	49	33	14	10
	Small Hospitals Total/Average	**309**		**247**	**80**	**80**	**55**	**13**	**49**	**20**	**39**	**74**	**54**	**39**	**27**	**13**	**10**
	Overall Total/Average	**5,706**		**4,602**	**81**	**77**	**49**	**13**	**48**	**18**	**34**	**71**	**52**	**37**	**30**	**15**	**12**

Report card based on 1999–2001 data
Hospital Groupings: Categories as per JPPC peer groups. Multi-site corporations reported at the corporate level.
* indicates multi-site corporation.
Study Sample: The number of charts reviewed as part of the chart abstraction process
Qualified: The number of charts in the study sample that met the EFFECT CHF inclusion criteria and the Framingham CHF criteria
PMH: Past Medical History MI: Myocardial Infarction

Left Ventricular Function, Medication Utilization, Daily Weights and Documented Counselling

The second set of CHF variables is summarized in Table 13.

1. Left Ventricular Function

About half (49%) of the Group B–DF CHF patients had a documented assessment of LV function during this admission or within the previous six months. This rate is low when compared to the target level of ≥ 75%. Of those patients with documented LV function, 60% had significant LV dysfunction—defined as Ejection Fraction of less than 40%, or Grade II–III, III, IV, or a narrative description of moderate to severe ventricular dysfunction. Assessment of LV function is important for diagnosis of the underlying etiology of CHF and serves as a key prognostic factor for CHF patients. For these reasons, the proportion of CHF patients who have an LV assessment should be increased. While it is recognized that access to echocardiography is a key issue with both human and capital resource implications, the lack of LV function data is an impediment to effective, evidence-based management of CHF patients.

2. Medication Utilization

The mainstay of CHF therapy is pharmacologic, and thus the focus for CHF patients is on medications prescribed at discharge. The identified medications—ACE inhibitors, beta-blockers and warfarin for patients with atrial fibrillation—were determined by the expert panel as having a highly significant impact on CHF patient outcomes.

The patient sample was assessed in terms of two groups: a) all patients and b) ideal patients. As described in Chapter 2—Methods, Table 5, ideal patients are those who are eligible to receive the process of care and do not have any contraindications to the process of care. In order to be considered ideal for some medications such as ACE inhibitors, evidence of an LV assessment was required. Please note that data have been suppressed where the number of all or ideal patients was less than ten at a given hospital, resulting in the suppression of data for many hospitals.

ACE inhibitors were prescribed at discharge in 69% of all Group B–DF CHF cases and beta-blockers were prescribed in 30% of all cases. Warfarin was prescribed for 51% of patients who suffered from atrial fibrillation.

Among ideal Group B–DF CHF patients (those patients with LV function documented in the chart and without contraindications), the level of utilization of ACE inhibitors was 82%—this is very close to the target level of ≥ 85%. Ten organizations met the target level of ≥ 85% among ideal patients.

Beta-blockers were prescribed in 41% of ideal cases versus the target level of ≥ 50%. The expert panel recognized that some patients may legitimately have beta-blockers started after discharge, as outpatients. Nevertheless, the hospital stay represents an ideal setting to initiate beta-blockers, as it provides for a controlled environment. Seven organizations met the target of ≥ 50%. Beta-blocker use, overall, was highest among teaching hospitals where the average utilization was 49%. In addition, two community hospitals exceeded the target with utilization of ≥ 65%.

Among ideal patients with atrial fibrillation, the utilization of warfarin was 52%. As the target level is ≥ 85% there is room for improvement. However, it should be noted that the sample size for this indicator is small in many hospitals, and the data should be interpreted with caution. Furthermore, physicians may have had legitimate, but undocumented, concerns about initiating this therapy in some patients.

Maximal use of ACE inhibitors and beta-blockers in CHF patients at discharge could save an estimated 70–156 patient lives annually in Ontario—see Appendix E for more details.

3. Daily Weights

Daily weights (recorded on at least one-half of the days the patient was in hospital excluding ICU days) were documented in only 14% of Group B–DF CHF patients. Clearly, performance on this indicator can be improved in order to meet the target level in ideal patients of ≥ 90%. These results are concerning, given that daily monitoring of body weight serves as an important factor in the effective management of CHF. Failure to document this information may contribute to the low level of performance on this indicator.

4. Documented Counselling

In 70% of cases, patient counselling was documented on the chart by at least one health care professional (e.g., physician, dietitian, pharmacist, nurse) on at least one of the following topics:

- Symptoms of worsening heart failure;
- Discharge medications;
- Daily weights;
- Diet (salt, fluid); and,
- Follow-up.

The target level for documented counselling is ≥ 90% in ideal patients. While four organizations met the target level, there is room for improvement at most hospitals in Group B–DF. Patient counselling is a key component of care for CHF patients. It is recognized that physicians or other health care providers may have counselled patients but not documented this information within the patient charts.

Table 13. CHF Report Card—Group B Delayed Feedback: LV Function, Medication Utilization, Daily Weights and Documented Counselling

CCORT EFFECT Study — CHF Report Card — Group B Delayed Feedback											
		1	2	3	4	5	6	7	8	9	10
		Quality Indicators									
		Left Ventricular (LV) Function (%)		Medication Utilization (%)							Documented Counselling
				All Patients			Ideal Patients				
#	Hospital	LV Function measured this admission or in previous 6 mos	Patients with Low LV Function (This adm or prev. 6 mos)	ACEI at Discharge	Beta-blocker at Discharge	Warfarin at Discharge in pts with Atrial Fib	ACEI at Discharge	Beta-blocker at Discharge	Warfarin at Discharge in pts with Atrial Fib	Daily Weights recorded > 50% of days (%)	Counselling on at least one topic (%)*
	Quality Indicator Benchmark/Target	**≥ 75%**					**≥ 85%**	**≥ 50%**	**≥ 85%**	**≥ 90%**	**≥ 90%**
Teaching Hospitals											
1	London Health Sciences Centre	85	65	70	40	61	80	46	60	45	81
2	*Ottawa Hospital, The	67	69	61	41	60	69	55	63	22	47
3	Sunnybrook & Women's College HSC, Toronto	78	60	66	34	86	88	41	85	30	62
4	University Health Network, Toronto	84	65	63	45	78	83	55	75	45	59
	Teaching Hospitals Total/Average	**78**	**64**	**65**	**40**	**68**	**80**	**49**	**67**	**34**	**62**
Community Hospitals											
5	*Chatham-Kent Health Alliance	30	51	64	28	44	90		46	10	90
6	Cornwall Community Hospital/Cornwall General	42	49	66	32	50	75	44	50	9	64
7	Grand River Hospital Corporation, Kitchener	58	65	67	34		83	36		31	89
8	Guelph General Hospital	76	67	81	40		88	50		20	48
9	Hawkesbury and District General Hospital	21	79	64	34	33			36	1	28
10	Hotel Dieu Hospital, St. Catharines	64	53	74	30		81	35		16	91
11	Humber River Regional Hospital, Toronto	66	56	73	21	30	78	35	33	0	21
12	Huntsville District Memorial Hospital	77	41	74	26	56			54	18	84
13	Huronia District Hospital, Midland	100	20	75	30					3	88
14	Joseph Brant Memorial Hospital, Burlington	57	60	72	18	67	84	14	63	8	60
15	Kirkland and District Hospital, Kirkland Lake	34	38	63	35					8	21
16	Leamington District Memorial Hospital	5	50	74	22	53			53	2	83
17	Markham Stouffville Hospital	34	59	72	31		100	50		0	78
18	*Niagara Health System	44	60	76	29	61	86	37	67	9	82
19	North York General Hospital, Toronto	81	62	59	41	61	70	65	63	1	50
20	Northumberland Hills Hospital, Cobourg	5	83	64	7	25			25	17	84
21	Perth and Smiths Falls District Hospital	30	73	69	23	56	88	9	56	12	60
22	Queensway-Carleton Hospital, Ottawa	16	30	69	34					22	51
23	Renfrew Victoria Hospital	15	50	56	36					13	63
24	Royal Victoria Hospital, The, Barrie	64	75	84	18		87	23		2	87
25	Bluewater Health/Sarnia General Hospital	40	23	55	28	17			17	5	95
26	Sault Ste. Marie General Hospital Inc.	34	36	70	37	50	64		50	17	76
27	Southlake Regional Health Centre, Newmarket	52	67	69	30	60	82	52		5	89
28	St. Joseph's General Hospital, Elliot Lake	17	75	80	15	23			23	33	76
29	St. Joseph's Health Centre, Toronto	52	57	72	32		89	40		21	51
30	St. Thomas-Elgin General Hospital	41	60	66	34	50	88	30	50	5	85
31	Temiskaming Hospital, New Liskeard	15	17	73	30					58	25
32	Thunder Bay Regional Health Sciences Centre	56	64	63	36		82	44		12	60
33	Tillsonburg District Memorial Hospital	41	66	64	25	50	76	30	50	20	81
34	Toronto East General Hospital	51	57	63	36	53	69	68	53	1	62
35	West Nipissing General Hospital, Sturgeon Falls	23	56	71	32					5	95
36	*William Osler Health Centre	69	60	70	23	47	88	39	48	7	69
37	York Central Hospital, Richmond Hill	57	66	59	27	73	78	38	75	15	83
	Community Hospitals Total/Average	**47**	**59**	**70**	**28**	**47**	**83**	**39**	**48**	**11**	**71**
Small Hospitals											
38	Campbellford Memorial Hospital	5	100	67	25	75			80	0	67
39	Carleton Place and District Memorial Hospital	11	75	66	31					22	65
40	Groves Memorial Community Hospital, Fergus	29	47	79	21					15	55
41	West Haldimand General Hospital, Hagersville	17	50	77	32					11	78
	Small Hospitals Total/Average	**15**	**57**	**73**	**27**	**71**	**77**		**76**	**10**	**67**
	Overall Total/Average	**49**	**60**	**69**	**30**	**51**	**82**	**41**	**52**	**14**	**70**

* indicates multi-site corporation
LV: Left Ventricular
ACEI: angiotensin converting enzyme inhibitor
Data suppressed where the number of all/ideal patients was less than 10 in a given hospital

Hospital Care, Follow-Up Care and Length of Stay

The third and final set of variables for CHF is presented in Table 14.

1. Hospital Care

During the hospital stay the most responsible physician (MRP) overseeing the CHF patient was most likely to be a general practitioner/family physician (46%), followed by a general internist (31%) and a cardiologist (23%). These data highlight the key role played by primary care physicians in the treatment of CHF patients.

2. Follow-up Care

Seventy percent of all Group B–DF CHF patients had follow-up care arranged with a general practitioner/family physician, whereas approximately 1 in 5 patients had follow-up care arranged with a cardiologist or a general internist. Few patients (2%) had planned follow-up care at a CHF clinic.

3. Length of Stay

The median length of stay for Group B–DF CHF patients was five days.

CHF Related Data

For Group B–DF CHF patients in the EFFECT Study, the 30-day mortality rate was 10% and the one-year mortality rate was 33%. Related outcome data, such as in-hospital mortality rates at the hospital-specific level are not reported due to the small sample of cases at some hospitals and because the mortality rate in the abstracted sample may not reflect the overall CHF mortality rate at that hospital.

The one-year CHF re-admission rate was 25% for patients surviving the index hospitalization.

Table 14. CHF Report Card—Group B Delayed Feedback: Hospital Care, Follow-Up Care and Length of Stay

CCORT EFFECT Study—CHF Report Card—Group B Delayed Feedback										
		1	2	3	4	5	6	7	8
		Most Responsible Physician (%)			Follow Up (%)				Outcomes
#	Hospital	Cardiologist	Family Practitioner/GP	Internist	Family Practitioner/GP	Cardiologist	Internist	CHF Clinic	Length of Stay (Days - Median)
	Quality Indicator Benchmark/Target								
Teaching Hospitals									
1	London Health Sciences Centre	34	2	61	82	30	25	8	6
2	*Ottawa Hospital, The	39	7	51	60	39	24	2	5
3	Sunnybrook & Women's College HSC, Toronto	39	1	59	70	34	29	2	6
4	University Health Network, Toronto	23	0	75	68	31	46	10	6
	Teaching Hospitals Total/Average	**35**	**3**	**60**	**70**	**34**	**29**	**5**	**6**
Community Hospitals									
5	*Chatham-Kent Health Alliance	0	93	7	90	8	12	0	6
6	Cornwall Community Hospital/Cornwall General	0	98	2	88	8	25	0	6
7	Grand River Hospital Corporation, Kitchener	56	21	21	69	31	12	0	4
8	Guelph General Hospital	42	20	37	40	30	12	0	6
9	Hawkesbury and District General Hospital	0	100	0	91	9	6	0	5
10	Hotel Dieu Hospital, St. Catharines	7	20	74	54	13	49	4	5
11	Humber River Regional Hospital, Toronto	51	2	47	34	37	15	1	4
12	Huntsville District Memorial Hospital	0	34	66	81	6	36	0	3
13	Huronia District Hospital, Midland	0	89	11	98	2	7	0	5
14	Joseph Brant Memorial Hospital, Burlington	37	3	60	23	8	23	0	7
15	Kirkland and District Hospital, Kirkland Lake	0	99	0	57	3	4	0	5
16	Leamington District Memorial Hospital	0	76	24	100	5	37	0	5
17	Markham Stouffville Hospital	25	8	65	47	31	11	0	5
18	*Niagara Health System	26	50	24	74	21	27	0	5
19	North York General Hospital, Toronto	46	0	54	63	30	17	1	5
20	Northumberland Hills Hospital, Cobourg	0	100	0	89	12	5	0	5
21	Perth and Smiths Falls District Hospital	0	100	0	93	5	8	0	5
22	Queensway-Carleton Hospital, Ottawa	20	6	73	43	30	32	3	6
23	Renfrew Victoria Hospital	0	100	0	95	5	5	0	5
24	Royal Victoria Hospital, The, Barrie	4	62	35	93	12	17	0	4
25	Bluewater Health/Sarnia General Hospital	0	65	34	98	3	32	0	5
26	Sault Ste. Marie General Hospital Inc.	20	50	29	75	25	19	9	4
27	Southlake Regional Health Centre, Newmarket	26	0	74	57	34	23	11	5
28	St. Joseph's General Hospital, Elliot Lake	0	100	0	79	30	0	0	5
29	St. Joseph's Health Centre, Toronto	49	0	51	55	32	38	8	6
30	St. Thomas-Elgin General Hospital	9	90	1	83	8	3	0	6
31	Temiskaming Hospital, New Liskeard	0	100	0	60	10	3	0	6
32	Thunder Bay Regional Health Sciences Centre	11	78	10	68	20	13	0	7
33	Tillsonburg District Memorial Hospital	43	57	0	64	30	9	0	4
34	Toronto East General Hospital	73	1	26	42	40	28	16	6
35	West Nipissing General Hospital, Sturgeon Falls	0	88	13	68	5	26	0	6
36	*William Osler Health Centre	61	25	14	62	43	15	0	7
37	York Central Hospital, Richmond Hill	23	13	64	69	37	27	2	7
	Community Hospitals Total/Average	**23**	**49**	**28**	**69**	**21**	**19**	**2**	**5**
Small Hospitals									
38	Campbellford Memorial Hospital	0	100	0	83	22	7	0	6
39	Carleton Place and District Memorial Hospital	0	100	0	91	6	18	0	5
40	Groves Memorial Community Hospital, Fergus	0	98	2	85	2	25	0	7
41	West Haldimand General Hospital, Hagersville	0	100	0	82	11	23	0	5
	Small Hospitals Total/Average	**0**	**100**	**0**	**84**	**11**	**18**	**0**	**5**
	Overall Total/Average	**23**	**46**	**31**	**70**	**22**	**20**	**2**	**5**

* indicates multi-site corporation

4. Quality Improvement

As indicated in these report cards, the care of AMI and CHF patients is multi-faceted. While many hospitals are performing well in some areas, almost all Group B–DF hospitals have opportunities to improve processes of care and patient outcomes. The EFFECT investigators hope these data will help participating hospitals continue to improve the quality of AMI/CHF care.

Although the focus of the EFFECT Study is in-hospital care, it is important to note that 80% of AMI patients and 71% of CHF patients in Group B–DF hospitals have at least one modifiable cardiac risk factor. This suggests that continuing attention needs to be paid to primary prevention in the community setting.

Continuous quality improvement is a stated objective of many health care organizations and a growing body of knowledge is available to guide them. Utilizing data from the EFFECT Study and other sources, the following suggestions are provided to support continuing quality and performance improvement efforts for cardiac care.

It is worth noting that other jurisdictions, including the United States, the United Kingdom, Germany, and Australia, have identified many of the same quality indicators used in this study and have major quality improvement programs underway for cardiac care.[53–56] The EFFECT investigators suggest Canadian health care providers undertake similar coordinated ongoing quality initiatives to continually improve cardiac care and patient outcomes.

Sample High-Level Work Plan to Operationalize the Data in this Study

1. Establish a lead team to review the EFFECT data and other relevant data for your organization. Charter this team to:
   - Identify the two to three key areas where you will focus your efforts.
   - Follow up with the EFFECT Study team for questions related to the EFFECT data.
   - Review your data, identify gaps between current and best practice and quantify improvement opportunities.
2. For each improvement effort:
   - Establish a multi-disciplinary performance improvement team with a physician/clinician leader.
   - Review the data and conduct a literature review if necessary, including literature regarding Change Management.
   - Review and document current processes and technology.
   - Consult with other Ontario hospitals that performed particularly well in areas of interest and are achieving identified targets.
   - Identify goals and methods for improvement e.g., create or modify standard admitting and discharge orders, pathways, guidelines, reminders, information sheets, and address access barriers such as echocardiography and troponin testing.
   - Redesign work processes and metrics, incorporating available tools and new methods such as secondary prevention or CHF clinics.
   - Train care providers—methods may include conducting continuing medical education (CME) and/or grand rounds.
   - Implement new processes.
   - Measure results and perform ongoing monitoring and maintenance to monitor data quality and to ensure tools continue to reflect best practice and are evidence-based.
   - Explore opportunities to utilize your organization's clinical information systems to support your improvement efforts.

- Participate in Phase II of the EFFECT Study, where the second round of chart review will be conducted with accompanying re-measurement of quality indicators in 2005/06, with release of results in 2006/07.

Investigate opportunities to leverage or collaborate with peer or related quality improvement efforts. Some active American organizations with relevant performance improvement models include the Institute for Healthcare Improvement (IHI) and the Joint Commission for Accreditation of Healthcare Organizations (JCAHO).

Other Resources

Additional references for improving cardiac care for consideration include:

- The Canadian Cardiovascular Society Heart Failure Guidelines (2003)[57]
- The Center for Medicare and Medicaid Services' (CMS) Cooperative Cardiovascular Project conducted in the United States and its related publications[53,58]
- The American College of Cardiology/American Heart Association Guidelines for the Management of Patients with Acute Myocardial Infarction (2000) and Congestive Heart Failure (2001) [59,60]
- The American College of Cardiology/American Heart Association Guidelines for the Management of Patients with ST-Elevation Myocardial Infarction (2004)[61]
  http://www.acc.org/clinical/guidelines/stemi/index.pdf
- The Get with the Guidelines Program,[62] a hospital-based quality improvement program for the American Heart Association and the American Stroke Association with guidelines for Coronary Artery Disease and Heart Failure. http://www.americanheart.org/presenter.jhtml?identifier=1165
- The American College of Cardiology (ACC) Guidelines Applied in Practice (GAP) initiative[63, 64] and the related tool kit available at http://www.acc.org/gap/mi/ami_downloadA.htm consisting of the following:
  - Template of AMI orders
  - Critical pathway
  - AMI pocket guide
  - Patient information form
  - Heart attack discharge form
  - Chart stickers
  - Hospital performance charts
- The Institute for Healthcare Improvement (IHI) recently launched its 100,000 Lives Campaign to make health care safer and more effective. AMI is one of six areas of focus, and a Getting Started Kit for AMI[65] has been developed entitled *Improved Care of Acute Myocardial Infarction*. The Kit includes the following components:
  - Background
  - The gap in care
  - Examples of success
  - Forming your team
  - Using the model for improvement
  - Process measures for AMI
  - Getting started
  - Sample forms

http://www.ihi.org/NR/rdonlyres/8D9C3B34-A139-4F30-8DB5-942B3A8D7FD9/0/AMIHowtoGuideFINAL.pdf

Appendix F provides additional quality improvement information and resources.

5. Interpretive Cautions

The EFFECT Study is one of the largest chart abstraction exercises ever undertaken in Canada. Considerable time, resources and cooperative effort by participating hospitals and the study team are required for data abstraction in a study of this size—85 participating hospital corporations/103 individual hospitals. The following is a list of important limitations regarding Phase I of the EFFECT Study:

Retrospective chart review—Retrospective chart review presents some challenges. For example, as the charts are reviewed some time after the fact, not all documentation may be available at the time of review (some may not be filed on the chart). In other instances, not all care may be documented within the chart. Given that the review is retrospective, there is no opportunity to inquire or clarify unclear or missing information with clinicians.

Chart format/media—The format and media of the patient chart can affect accessibility of information and ease of use. For example, the majority of patient charts abstracted consisted of traditional paper charts, which may have legibility and completeness issues. In fact, concerns regarding legibility are well documented in the literature.

Charts converted to microfilm/fiche may exclude some components, for example, nurses' notes, medication administration records, diagnostic test results or discharge summaries. In some instances, a portion of the patient charts had been converted to microfilm/fiche; in other instances, the patient charts consisted of a combination of paper-based information and electronic information residing on the hospital's information system. In instances where paper charts have been converted to scanned images stored in the information system, the accessibility of information can be dependent upon the information system's indexing capability.

Time period—The charts reviewed for the study are based on patient hospitalizations from fiscal 1999/00 and fiscal 2000/01. They represent the clinical practice of the period—essentially providing a snapshot of the clinical care at that time. As clinical practice and the evidence base continue to change over time, performance on some indicators may have improved at many Ontario hospitals.

Sample size—The sample size was determined by available case volumes, study size and available funding. Some hospitals treated lower patient volumes (e.g., less than 100 cases), and as such the sample size of those hospitals is small. Most hospitals were able to provide the full target sample of 125 cases. However, the power of the sample may not reflect the performance of that hospital among all its cases even with the larger sample size.

Content—Although this report covers many important aspects of AMI and CHF care that may improve patient outcomes, certain topics were not addressed due to time constraints, data availability and other considerations. For example, access to elective coronary revascularization, cardiac rehabilitation, implantable cardiac defibrillators, and utilization of spironolactone/digoxin, etc. It is anticipated that many of these other topics will be covered in other publications from the EFFECT investigators.

Although the EFFECT investigators have taken many steps to ensure the accuracy of the data, it is possible that residual undetected errors may remain as a number of steps are involved in processing the data for this report. Any concerns about data quality should be addressed to the CCORT research team.

6. Conclusion

The fundamental purpose of the EFFECT study is to assist in designing mechanisms to reduce the delay between the acquisition of health research and evidence and its application in the care of patients. The intent of the study is to raise awareness and provide information in a useful manner. By identifying both areas of high quality and areas for improvement, the study can serve to support continued improvement in care as we strive for clinical excellence for the citizens of Ontario.

It is hoped that participating hospitals will view the EFFECT Study as a positive and constructive tool for change and that it will assist ongoing efforts to use the data for quality improvement initiatives. Hospitals that wish to receive additional analyses or clarification of the data should contact the EFFECT research team for assistance.

The EFFECT study investigators commend all 85 Ontario hospital corporations for participating in this important study and their demonstrated commitment to public accountability and quality improvement. Organizations that receive this report, are encouraged to use it to support of continued quality improvement efforts.

The research team is grateful to the CIHR and the HSF for funding this study, and hopes to obtain ongoing funding to support and expand these types of quality improvement initiatives. Countries such as the United States, United Kingdom, and Australia have invested heavily in recent years in clinical quality improvement efforts and databases to improve cardiac care. It is vital that Canadian policymakers, funding agencies and clinicians increase their investments in this area if Canadians are to achieve the best possible health outcomes. Through ongoing, real-time, coordinated collection and provision of high quality clinical data, evidence-based practice, and thereby patient outcomes, can be optimized in Ontario and Canada.

Feedback
Your feedback regarding this report is welcomed. Please complete and return the Reader Feedback Survey provided in Appendix G or use the online version available on the CCORT web site (www.ccort.ca/effect.asp). All comments will be carefully reviewed and considered in order to improve future reports from the EFFECT study.

Next steps
EFFECT Phase II, involving a second round of chart abstraction, will begin in late 2005 and the findings will be released in 2006/07. All quality indicators will be reviewed and/or revised as needed to ensure they continue to reflect current evidence-based practice.

EFFECT Phase III—Impact assessment—involves a comparison of the hospitals' performance between Phase I and Phase II. A report documenting the findings is targetted to be released in 2006/07.

In addition to this report, the research team anticipates that the EFFECT database will prove useful for generating related reports and peer-reviewed publications on the state of cardiac care delivery in Ontario. A list of scientific publications utilizing the EFFECT data is available at http://www.ccort.ca/effect.asp.

Appendix A—References

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Appendix B—Participating Hospitals

Italics indicate hospital corporations randomized to Group B—Delayed Feedback Hospitals.

#	Hospital Name
1	Alexandra Marine & General Hospital (Goderich)
2	Arnprior District Memorial Hospital, The
3	Brantford General Hospital
4	Brockville General Hospital
5	Cambridge Memorial Hospital
6	*Campbellford Memorial Hospital*
7	*Carleton Place and District Memorial Hospital*
8	*Chatham-Kent Health Alliance:*
	Public General Hospital (Chatham); Sydenham District Hospital (Wallaceburg)
9	*Cornwall General Hospital*
	The Hospital has since amalgamated with Hotel Dieu Hospital and been named Cornwall Community Hospital
10	Credit Valley Hospital, The (Mississauga)
11	Espanola General Hospital (Espanola)
12	*Grand River Hospital Corporation (Kitchener)*
13	Grey Bruce Health Services: Meaford site; Owen Sound site
14	*Groves Memorial Hospital (Fergus)*
15	*Guelph General Hospital*
16	Haldimand War Memorial Hospital (Dunnville)
17	Halton Healthcare Services Corporation: Oakville-Trafalgar Memorial Hospital; Milton District Hospital
18	Hamilton Health Sciences Corporation:
	Hamilton General Hospital; Hamilton Henderson Hospital; McMaster Medical Centre
19	Hanover and District Hospital
20	*Hawkesbury and District General Hospital*
21	Headwaters Healthcare Centre (Orangeville)
22	Hôpital Montfort Hospital, (Ottawa)
23	Hôpital Regional de Sudbury Regional Hospital
24	Hotel Dieu Hospital (Cornwall)
	The Hospital has since amalgamated with Cornwall General Hospital and been named Cornwall Community Hospital
25	*Hotel Dieu Health Sciences Hospital (St. Catharines)*
26	*Humber River Regional Hospital (Toronto)*
27	*Huntsville District Memorial Hospital*
28	*Huronia District Hospital (Midland)*
29	*Joseph Brant Memorial Hospital (Burlington)*
30	Kingston General Hospital
31	*Kirkland and District Hospital (Kirkland Lake)*

#	**Hospital Name (Cont'd)**
32	Lakeridge Health Corporation: Lakeridge Health Oshawa; Lakeridge Health Bowmanville
33	*Leamington District Memorial Hospital*
34	Lennox and Addington County General Hospital (Napanee)
35	*London Health Sciences Centre*
36	*Markham Stouffville Hospital*
37	Mount Sinai Hospital (Toronto)
38	*Niagara Health System:*
	Douglas Memorial Hospital (Fort Erie); Greater Niagara General Hospital; Port Colborne General Hospital; St. Catharines General Hospital; Welland County General Hospital
39	Norfolk General Hospital (Simcoe)
40	North Bay General Health Centre
41	*North York General Hospital*
42	*Northumberland Hills Hospital/Northumberland Health Care Corporation (Cobourg)*
43	Orillia Soldiers' Memorial Hospital
44	*Ottawa Hospital, The—Civic Campus; General Campus;* University of Ottawa Heart Institute
45	Pembroke General Hospital
46	*Perth and Smiths Falls District Hospital*
47	Peterborough Regional Health Centre/Civic Hospital
48	*Queensway-Carleton Hospital (Ottawa)*
49	Quinte Healthcare Corporation:
	Belleville General Hospital; Prince Edward County Memorial (Picton); Trenton Memorial
50	*Renfrew Victoria Hospital*
51	Ross Memorial Hospital (Lindsay)
52	Rouge Valley Health System: Rouge Valley Centenary (Toronto); Rouge Valley Ajax and Pickering
53	*Royal Victoria Hospital, The (Barrie)*
54	*Bluewater Health/Sarnia General Hospital*
55	*Sault Area Hospitals/Sault Ste. Marie General Hospital*
56	Scarborough Hospital, The, General Division; Grace Division (Toronto)
57	South Muskoka Memorial Hospital (Bracebridge)
58	*Southlake Regional Health Centre/York County Hospital (Newmarket)*
59	*St. Joseph's General Hospital (Elliot Lake)*
60	*St. Joseph's Health Centre (Toronto)*
61	St. Joseph's Healthcare (Hamilton)
62	St. Mary's General Hospital (Kitchener)
63	St. Michael's Hospital (Toronto)
64	*St. Thomas-Elgin General Hospital*
65	Stevenson Memorial Hospital (Alliston)
66	Stratford General Hospital

#	**Hospital Name (Cont'd)**
67	Strathroy Middlesex General Hospital
68	*Sunnybrook and Women's College Health Sciences Centre (Toronto)*
69	*Temiskaming Hospital (New Liskeard)*
70	*Thunder Bay Regional Health Sciences Centre/Thunder Bay Regional Hospital*
71	*Tillsonburg District Memorial Hospital*
72	Timmins and District General Hospital
73	*Toronto East General Hospital*
74	Trillium Health Centre (Mississauga)
75	*University Health Network (Toronto)*
76	*West Haldimand General Hospital (Hagersville)*
77	West Lincoln Memorial Hospital (Grimsby)
78	*West Nipissing General Hospital (Sturgeon Falls)*
79	West Parry Sound Health Centre
80	*William Osler Health Centre: Etobicoke site, Georgetown site, Brampton site*
81	Winchester District Memorial Hospital
82	Windsor Hotel-Dieu Grace Hospital
83	Windsor Regional Hospital
84	Woodstock General Hospital
85	*York Central Hospital (Richmond Hill)*

Appendix C—Data Dictionary

The EFFECT data dictionary provides definitions for each variable and consists of two parts: Section I addresses AMI, Section II addresses CHF. Those variables that are Quality Indicators[1-2] are denoted with an asterisk *.

Data Dictionary—Section I. AMI		
Variable		**Definition**
Study Sample		
1.1	**Study sample (N)**	Number of charts reviewed as part of the chart abstraction process.
1.2	**Qualified charts (N)**	Number of patient charts reviewed, where patient met European Society of Cardiology/ American College of Cardiology (ESC/ACC) criteria for AMI, the AMI occurred before hospital arrival and the patient was not transferred from another acute care facility. Inclusion criteria: most responsible diagnosis of AMI ICD-9 code 410.
1.3	**Qualified charts (%)**	Percent of patient charts reviewed, where the patient met the ESC/ACC criteria for AMI, the AMI occurred prior to hospital arrival and the patient was not transferred from another acute care facility. Inclusion criteria: most responsible diagnosis of AMI ICD-9 code 410.
Patient Demographics		
2.1	**Age (median)**	Median age, in years, of the patients in the study cohort who satisfied the inclusion criteria.
2.2	**Female (%)**	Percent of patients in the study cohort who were female.
Cardiac Risk Factors (%)		
3.1	**Current smoker**	Percent of patients who smoked at least one cigarette per day in the month prior to admission as documented in the chart.
3.2	**Hypertension**	Percent of patients who had a documented history of hypertension.
3.3	**Hyperlipidemia**	Percent of patients who had a documented history of hyperlipidemia (e.g., total cholesterol > 5.2 mmol/L.)
3.4	**Diabetes**	Percent of patients who had a documented history of diabetes.
3.5	**Patients with ≥ 1 risk factor**	Percent of patients who had a documented history of one or more of the identified risk factors of current smoker, hypertension, hyperlipidemia, diabetes.
Past Medical History–Comorbid Conditions		
4.1	**Coronary disease**	Percent of patients who had a documented history of coronary artery disease (including angina, previous myocardial infarction, previous coronary artery bypass graft and/or percutaneous coronary intervention).
Hospital Care (%)		
5.1	**Standard admitting orders used**	Percent of patients where pre-printed standardized admission orders were utilized.

[1]Tran CTT, Lee DS, Flintoft VF, et al. CCORT/CCS quality indicators for acute myocardial infarction care. *Can J Cardiol* 2003; 19(1):38–45.
[2] Lee DS, Tran C, Flintoft V, Grant FC, Liu PP, Tu JV. CCORT/CCS quality indicators for congestive heart failure care. *Can J Cardiol* 2003; 19(4):357–364

Data Dictionary—Section I. AMI (Cont'd)		
Variable		**Definition**
Reperfusion Therapy*		
6.1	**Method–thrombolytics (%)**	Percent of STEMI patients who received reperfusion therapy in the form of thrombolysis (e.g., tPA, Streptokinase, rPA) in the emergency department or CCU/ICU within 24 hours of arrival.
6.1.1	**Thrombolytics decided by an emergency MD (%)**	Percent of STEMI patients who received thrombolytic therapy as decided by the physician on duty in the emergency department in the absence of a consult from another physician (i.e., General Internist, Cardiologist). Note: Only includes cases where thrombolysis was started ≤ 4 hours of the patient's arrival in the emergency department.
6.1.2	**Thrombolytics provided in emergency department (%)**	Percent of STEMI patients who started receiving thrombolytic therapy while still in the emergency department. Note: Only includes cases where thrombolysis was started ≤ 4 hours of the patient's arrival in the emergency department.
6.1.3	**Received thrombolytics in ≤ 30 minutes* (%)**	Percent of STEMI patients who received thrombolytic therapy in ≤ 30 minutes of hospital arrival. Note: Only includes cases where thrombolysis was started in ≤ 4 hours of the patient's arrival in the emergency department.
6.1.4	**Thrombolytics door to needle time (median, hours: minutes)**	For STEMI patients, median time in hours:minutes from arrival in emergency department (door) to when thrombolysis infusion (needle) was started. Note: only includes cases where thrombolysis was started in ≤ 4 hours of the patient's arrival in the emergency department.
6.2	**Method–percutaneous coronary intervention**	Percent of STEMI patients who received reperfusion therapy in the form of percutaneous coronary intervention (e.g., angioplasty, stent, rotoblading) within 24 hours of arrival. Note: Some patients receive both PCI and thrombolytic therapy.
Left Ventricular Function* (%)		
7.1	**Left ventricular function determined/measured**	Percent of patients who had their left ventricular ejection fraction or grade measured by ECHO, MUGA/RNA (See Appendix D—Glossary of Terms for explanation) or cardiac catheterization this admission.
7.2	**Patients with low left ventricular function**	Percent of patients with low ejection fraction, measured and documented as EF ≤ 40% or Grade II-III, III, IV or Moderate or Severe.
Lipid Measurement* (%)		
8.1	**Lipid sample obtained within 24 hours of admission**	Percent of patients who had a blood lipid test within 24 hours of admission.
Laboratory–Cardiac Measures (%)		
9.1	**Troponin done**	Percent of patients who had a Troponin I or Troponin T value measured within the first 48 hours of admission.
Medication Utilization on Arrival/Admission (All and Ideal Patients, %)*		
10.1.1	**ASA within 6 hours of arrival–all patients**	Percent of patients who received ASA within 6 hours of hospital arrival.
10.1.2	**Beta-blocker within 12 hours of admission –all patients**	Percent of patients who were admitted to hospital and received beta-blockers within the first 12 hours of admission.
10.2.1	**ASA within 6 hours of arrival–ideal patients**	Percent of patients who received ASA within 6 hours of hospital arrival, without contraindications to ASA (active bleeding on admission, history of coagulopathy, first platelet count < $100x10^9$/L drawn within 24 hours of admission, allergy to ASA, documentation of ASA administration before hospital arrival, physician documented reason for non-use of ASA {e.g., patient refusal}).

Data Dictionary—Section I. AMI (Cont'd)		
Variable		**Definition**
Medication Utilization on Arrival/Admission (All and Ideal Patients, %)* Cont'd		
10.2.2	**Beta-blocker within 12 hours of admission–Ideal patients**	Percent of patients who received beta-blockers within 12 hours of admission, without contraindications to beta-blockers (allergy or intolerance to beta-blocker, bradycardia {heart rate < 60 beats/min} on admission and not on beta-blocker, symptomatic heart failure on admission, systolic blood pressure < 100 mmHg at admission, PR interval > 0.24s on admission ECG, second or third degree heart block on admission ECG, bifascicular block on admission ECG, severe chronic obstructive pulmonary disease, asthma, taking beta-blocker pre-admission, physician documented reason for non-use of beta-blocker {e.g., patient refusal, symptomatic hypotension}).
Medication Utilization at Discharge (All and Ideal Patients, %)*		
10.3.1	**ASA prescribed at discharge–all patients**	Percent of patients alive at discharge who received prescriptions for ASA at the time of discharge or transfer.
10.3.2	**Beta-blocker prescribed at discharge–all patients**	Percent of patients alive at discharge who received prescriptions for beta-blockers at the time of discharge or transfer.
10.3.3	**ACE inhibitor prescribed at discharge–all patients**	Percent of patients alive at discharge who received prescriptions for ACE inhibitors at the time of discharge or transfer.
10.3.4	**Statin prescribed at discharge–all patients**	Percent of patients alive at discharge who received prescriptions for statins at the time of discharge or transfer.
10.4.1	**ASA prescribed at discharge–ideal patients**	Percent of patients alive at discharge who received prescriptions for ASA at the time of discharge or transfer without contraindications to ASA (evidence of active bleeding on admission or active bleeding during hospitalization; history of coagulopathy and platelet count < $100x10^9$/L, allergy to ASA, prescribed other antiplatelet agent at discharge {e.g., clopidogrel, ticlopidine} physician documented reason for nonuse of ASA {e.g., patient refusal}).
10.4.2	**Beta-blocker prescribed at discharge–ideal patients**	Percent of patients alive at discharge who received prescriptions for beta-blockers at the time of discharge or transfer without contraindications to beta-blockers (congestive heart failure and on diuretic {unless measured left ventricular ejection fraction > 50%}, systolic blood pressure < 100 mmHg at discharge, severe chronic obstructive pulmonary disorder, asthma, bradycardia {heart rate < 60 beats per min} at discharge, conduction disorder defined as: first degree atrioventricular block {PR interval > 0.24s on last ECG}; second or third degree heart block on last ECG; and bifascicular block on last ECG, allergy or intolerance to beta-blocker, physician documented reason for non-use of beta-blocker {e.g., symptomatic hypotension, patient refusal}).
10.4.3	**ACE inhibitor prescribed at discharge–ideal patients**	Percent of patients alive at discharge who received prescriptions for ACE inhibitors at the time of discharge or transfer, with past or current clinical features of heart failure, anterior infarction, ejection fraction < 40% or left ventricular grade $\geq$ III out of IV and without contraindications to ACE inhibitors (moderate or severe aortic stenosis, allergy or intolerance to ACE inhibitors, severe renal dysfunction {i.e., peak or last pre-hospital discharge serum creatinine level > 200 µmol/L}, systolic blood pressure < 100 mmHg at discharge, bilateral renal artery stenosis, hyperkalemia {i.e., peak or last pre-hospital discharge K+ > 5.5 mmol/L}, physician documented reason for non-use of ACE inhibitor at discharge {e.g. patient refusal, symptomatic hypotension}).

Data Dictionary—Section I. AMI (Cont'd)		
Variable		**Definition**
Medication Utilization at Discharge (All and Ideal Patients, %)* Cont'd		
10.4.4	**Statin prescribed at discharge–ideal patients**	Percent of patients alive at discharge who received prescriptions for statins at the time of discharge or transfer, with total serum cholesterol level on admission > 5.2 mmol/L or LDL > 3.4 mmol/L, and not already on lipid-lowering agents pre-admission, without contraindications to statins (liver disease, patients with cholestasis, patients on fibrates at risk of rhabdomyolysis, physician documented reason for non-use of statin {e.g., patient refusal}).
10.4.5	**Secondary prevention rate**	Percent of ideal patients who received $\geq$ 1 of the four identified medications: ASA, beta-blocker, ACE inhibitor, statin at discharge.
Most Responsible Physician (%)		
11.1	**Cardiologist**	Percent of patients who had a Cardiologist responsible for the majority of their care during their hospital stay.
11.2	**General practitioner/family physician**	Percent of patients who had a General Practitioner/Family Physician responsible for the majority of their care during their hospital stay.
11.3	**Internist**	Percent of patients who had a General Internist responsible for the majority of their care during their hospital stay.
11.4	**Other**	Percent of patients who had an internist who has qualified in a sub-specialty other than Cardiology (i.e., Respirology, Nephrology, Neurology etc.) responsible for the majority of their care during their hospital stay.
Documented Counselling		
12.1	**Smoking cessation (%)**	Percent of patients who received smoking cessation counselling as documented in the patient chart.
Outcomes		
13.1	**Length of stay (median, days)**	Median length of stay in hospital measured in days from date of admission to date of discharge.

Data Dictionary—Section II. CHF		
Variable		**Definition**
Study Sample		
1.1	**Study sample (N)**	Number of charts reviewed as part of the chart abstraction process.
1.2	**Qualified patients (N)**	Number of charts reviewed where the patients met the EFFECT inclusion criteria (CHF occurred before arrival, patient was not transferred from another acute care facility) and the Framingham criteria for CHF. Inclusion criteria: most responsible diagnosis of CHF ICD-9 code 428.
1.3	**Qualified patients (%)**	Percent of charts reviewed where the patients met the EFFECT inclusion criteria (CHF occurred before arrival, patient was not transferred from another acute care facility) and the Framingham criteria for CHF. Inclusion criteria: most responsible diagnosis of CHF ICD-9 code 428.
Patient Demographics		
2.1	**Age (median)**	Median age, in years, of the patients in the study cohort who satisfied the inclusion criteria.
2.2	**Female (%)**	Percent of patients in the study cohort who were female.
Cardiac Risk Factors (%)		
3.1	**Current smoker**	Percent of patients who smoked at least one cigarette per day in the month prior to admission as documented in the chart.
3.2	**Hypertension**	Percent of patients who had a documented history of hypertension.
3.3	**Hyperlipidemia**	Percent of patients who had a documented history of hyperlipidemia (e.g., total cholesterol > 5.2 mmol/L.)
3.4	**Diabetes**	Percent of patients who had a documented history of diabetes.
3.5	**Patients with $\geq$ 1 risk factor**	Percent of patients who had a documented history of one or more of the identified risk factors of current smoker, hypertension, hyperlipidemia, diabetes.
Past Medical History–Cardiac and Vascular Disease (%)		
4.1	**Coronary disease**	Percent of patients who had a documented history of coronary artery disease (including angina, previous myocardial infarction, previous coronary artery bypass graft and/or percutaneous coronary intervention).
4.2	**Previous myocardial infarction**	Percent of patients who had a documented history of a previous myocardial infarction.
4.3	**Atrial fibrillation**	Percent of patients who had a documented history of atrial fibrillation as documented on any ECG.
4.4	**Valve disease**	Percent of patients who had a documented history of valve disease involving the aortic valve and/or mitral valve.
4.5	**Cancer**	Percent of patients who had a prior or concurrent documented history of cancer.

Data Dictionary—Section II. CHF (Cont'd)		
Variable		**Definition**
Left Ventricular Function* (%)		
5.1	**Left ventricular function determined/measured**	Percent of patients who had their left ventricular ejection fraction measured by ECHO or MUGA/RNA (See Appendix D—Glossary of Terms for explanation) during this admission or within the 6 months prior to this admission as either an inpatient or an outpatient documented on this admission.
5.2	**Patients with low ventricular function**	Percent of patients who had their ejection fraction measured by ECHO and recorded as ≤ 40% or Grade III, IV or moderate or severe during this admission or within the 6 months prior to this admission.
Medication Utilization at Discharge (All and Ideal Patients, %)*		
6.1.1	**ACE inhibitors prescribed at discharge–all patients**	Percent of patients alive at discharge who received prescriptions for ACE inhibitors at the time of discharge or transfer.
6.1.2	**Beta-blockers at prescribed at discharge–all patients**	Percent of patients alive at discharge who received prescriptions for beta-blockers at the time of discharge or transfer.
6.1.3	**Warfarin prescribed at discharge in patients with atrial fibrillation–all patients**	Percent of patients alive at discharge with atrial fibrillation who received prescriptions for warfarin at the time of discharge or transfer.
6.2.1	**ACE inhibitors prescribed at discharge–ideal patients**	Percent of ideal patients alive at discharge with LV systolic dysfunction (EF < 40% or equivalent grade), who received prescriptions for ACE inhibitors at the time of discharge or transfer and without contraindications to ACE inhibitors (moderate or severe aortic stenosis, bilateral renal artery stenosis, angioedema, hives, severe rash, other allergy or intolerance to ACE inhibitor use, hyperkalemia {K+ > 5.5 mEq/L}, hypotension {SBP < 90mmHg}, renal dysfunction {creatinine > 200 ummol/L}, and physician documented reason for non-use {e.g., patient refusal}, enrolled in a clinical trial testing alternatives to ACEI).
6.2.2	**Beta- blockers prescribed at discharge–ideal patients**	Percent of ideal patients alive at discharge with LV systolic dysfunction (EF < 40% or equivalent grade), who received prescriptions for beta-blockers at the time of discharge or transfer and without contraindications to beta-blockers (conduction system disease: symptomatic bradycardia {heart rate < 60} not on beta-blocker; bifascicular block; PR interval prolongation {> 0.24s}; and 2nd or 3rd degree AV block, hypotension, asthma, severe obstructive lung disease, physician documentation of reason for non-use {e.g., patient refusal}, allergy or intolerance to beta-blocker).
6.2.3	**Warfarin prescribed at discharge in patients with atrial fibrillation–ideal patients**	Percent of ideal patients alive at discharge with atrial fibrillation during the index admission documented in chart, who received prescriptions for warfarin at time of discharge or transfer and without contraindications to warfarin (any documented bleeding episode, liver disease, uncontrolled seizure disorder, history of frequent falls, inability to cooperate, pregnancy, physician documented reason for non-use {e.g., patient refusal}, allergy or intolerance to warfarin).
Hospital Care - Daily Weights*		
7.1	**Daily weights recorded > 50% of days (%)**	Percent of patients whose daily weights were recorded by the nursing staff on more than 50% of the hospital stay days excluding days spent in the CCU/ICU.

Data Dictionary—Section II. CHF (Cont'd)		
Variable		**Definition**
Documented Counselling*		
8.1	**Documented counselling on at least one topic (%)**	Percent of patients who received counselling on at least one of the following topics: i) symptoms of worsening heart failure; ii) daily weight monitoring; iii) diuretic titration; iv) fluid restriction; v) smoking cessation; vi) diet; vii) medication; and/or viii) activity level as documented in the patient chart.
Most Responsible Physician (%)		
9.1	**Cardiologist**	Percent of patients who had a Cardiologist responsible for the majority of their care during their hospital stay.
9.2	**General practitioner/family physician**	Percent of patients who had a General Practitioner/Family Physician responsible for the majority of their care during their hospital stay.
9.3	**Internist**	Percent of patients who had a General Internist or an Internist trained in another subspecialty responsible for the majority of their care during their hospital stay.
Follow-up (%)		
10.1	**General practitioner/family physician**	Percent of patients where follow-up with a General Practitioner/Family Physician was documented.
10.2	**Cardiologist**	Percent of patients where planned follow-up with a Cardiologist was documented.
10.3	**Internist**	Percent of patients where planned follow-up with an Internist or general medical clinic was documented.
10.4	**CHF clinic**	Percent of patients where planned follow-up at a CHF outpatient clinic was documented.
Outcomes		
11.1	**Length of stay (median, days)**	Median length of stay in hospital measured in days, from date of admission to date of discharge.

Appendix D—Glossary of Terms

Acetylsalicylic Acid (ASA, aspirin)
Acetylsalicylic acid, or ASA, is used for many different reasons, including headache, fever, arthritis pain and swelling. For people with coronary artery disease, it is used to prevent heart attacks and strokes by making platelets "slippery" so they do not form clots in partially-obstructed coronary arteries.

Acute Coronary Syndromes (ACS)
A constellation of clinical symptoms compatible with acute myocardial ischemia. ACS encompasses both acute myocardial infarction and unstable angina.

Acute Myocardial Infarction (AMI)
"Heart attack"; occurs when a blood clot obstructs a coronary artery supplying blood to the heart. This obstruction, if not resolved, causes inadequate flow of oxygen- and nutrient-rich blood, and results in the death of a portion of the heart muscle.

Administrative Data
Information that is primarily collected for record keeping, financial or other health administration purposes.

Angina
Tightness, pressure or pain, usually felt in the chest due to a lack of oxygenated blood in the heart muscle, generally occurring when there is a significant but incomplete blockage of a coronary artery.

Angioplasty (or Percutaneous Transluminal Coronary Angioplasty, PTCA)
An invasive technique performed under X-ray guidance that helps to widen narrowed arteries and improve blood flow to the heart. A catheter is inserted through the blood vessels to the affected area of the identified coronary artery(s). A small balloon located at the end of the catheter is inflated/deflated several times to compress the blockage/plaque against the inner wall of the artery, thereby enlarging the inner diameter of the artery allowing improved blood flow. The balloon is then deflated and the catheter removed.

Angiotensin Converting Enzyme (ACE) Inhibitors
A class of drugs used to treat high blood pressure and congestive heart failure by interfering with the body's production of angiotensin, a chemical that adds stress to the heart by causing small arteries to constrict.

Atrial Fibrillation
An abnormal heart rhythm characterized by disorganized quivering (fibrillation) of the upper chambers of the heart (the atria) whereby they are unable to empty efficiently increasing the risk of blood clots.

Beta-blocker
A class of drugs that are used for the treatment of hypertension, heart attacks or angina. These drugs reduce stress on the heart by slowing down the heart rate, thus reducing the oxygen requirements.

Canadian Institute for Health Information (CIHI)
A federally chartered, but independent, non-profit organization that collects and processes health data from a number of sources, particularly from hospitals.

Cardiac Care Network (CCN)
Established in 1991 as a partnership among government, doctors, and hospitals that provide acute cardiac care, for planning, coordinating and monitoring the provision of cardiac care services in Ontario.

Cardiologist
A physician certified to treat problems of the cardiovascular system—the heart, arteries, and veins. Cardiology is classified as an Internal Medicine subspecialty.

Chart Abstraction
Retrieval of information from patient charts, including demographic information, risk factors, clinical process of care measurements, medication utilization, and discharge information.

Clinical Data
Data obtained from chart abstraction. Differs from administrative data in that it includes in-hospital processes of care such as thrombolytic use or time to hospital presentation, or data on important prognostic variables such as location of infarct and vital signs at presentation.

Congestive Heart Failure (CHF)
A condition where the heart pumps inefficiently due to conditions that affect the heart or lungs; may cause fluid back-up in the lungs and/or legs and shortness of breath.

Coronary Angiography
The X-ray visualization of the internal anatomy of the heart and blood vessels after a dye is injected into the coronary arteries.

Coronary Artery Bypass Graft Surgery (CABG)
Most commonly an open-heart surgical procedure that helps to improve blood flow to the heart muscle for patients with coronary artery disease or blocked arteries. A heart-to-lung bypass pump is used to re-route the blood from the heart while surgery is taking place. Grafts are taken from arteries or veins elsewhere in the body (i.e., legs) and attached above and below the blocked area of the coronary artery so that blood can be re-routed around the blockage to the heart. It is usually reserved for patients with left mainstem disease or with two or more blocked vessels and/or if angioplasty or medication are not treatment options.

Coronary Disease/Coronary Artery Disease/Cardiovascular Disease (CVD)
Any disease that affects the heart or blood vessels by restricting the flow of blood. This occurs when a build-up of cells, fat and cholesterol, often referred to as “plaque”, clogs the arteries, impeding the free flow of blood. Over time, the blood vessels can become increasingly narrowed by plaque. A plaque may rupture causing a blood clot to block the artery causing a heart attack or stroke.

Diabetes
Common, chronic condition in which the body does not produce or properly use insulin; imposes a heavy burden of morbidity and early mortality on affected patients. The cause of diabetes continues to be a mystery, although both genetics and environmental factors such as obesity and lack of exercise appear to play roles.

Echocardiography
Diagnostic ultrasound test to examine the function of the heart muscle and valves commonly used to assess the extent of damage to the heart; the 2-D echo is often accompanied by Doppler examinations which allow the clinician to measure blood flow through the heart and valves.

Ejection Fraction
The proportion, or fraction, of blood pumped out of the heart with each beat. A normal heart pumps out a little more than half the heart's volume of blood with each beat.

Enhanced Feedback for Effective Cardiac Treatment (EFFECT)
Randomized trial of cardiac report cards with the aim of determining whether collecting and publishing report cards with high quality clinical data on acute myocardial infarction and congestive heart failure quality indicators leads to greater quality of cardiac care in Ontario.

General Practitioner (Family Physician/Primary Care Physician)
Family physicians specialize in caring for the physical, mental, and emotional well-being of their patients and their families.

Health Care Report Cards
Public disclosure of performance indicators for various aspects of the health care system.

Hyperlipidemia
A general term for elevated concentrations of lipids or fat substances in the blood.

Hypertension
Elevated blood pressure; elevated systolic/diastolic readings.

Institute for Clinical Evaluative Sciences (ICES)
An independent, non-profit organization, whose objective is to conduct research that contributes to the effectiveness, quality, equity and efficiency of health care and health services in the province of Ontario.

International Classification of Diseases, 9th Revision (ICD-9)
A set of internationally accepted codes for classification of medical diagnoses, conditions and procedures; medical records staff use these codes when transcribing from physician written medical charts to the hospital database that is submitted to the Canadian Institute for Health Information (CIHI).

Internist
A certified internal medicine physician who focuses on adult medicine.

Ischemia
A decrease in the blood supply to an organ, tissue, or body part caused by constriction or obstruction of the blood vessels, that may result in damage to the tissue.

Left Ventricular (LV) Function
A measurement to assess the outflow of blood and thereby the pumping function of the left ventricle of the heart. Ventricular function is an important prognostic indicator for patients with AMI and CHF. Often used to determine the risk of various kinds of surgery, the need for medicines that can help the heart pump better, and a patient's susceptibility to other medical problems. Typically measured using echocardiography.

Length of Stay (LOS)
Number of days spent in hospital.

Lipid Testing
A blood test to measure a patient's blood lipid levels including total cholesterol, High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL) and Triglyceride levels.

Modifiable Risk Factor
A risk factor for a disease whose impact can potentially be modified or altered. For example a smoker could stop smoking and thus reduce their risk of developing smoking related illnesses such as a heart attack.

Multiple Uptake Gated Acquisition, Radionuclide Angiography (MUGA/RNA)
A nuclear medicine scan used to evaluate the wall motion of the heart and how well the heart is contracting. Calculations are made to determine how much blood is pumped out of the heart per minute (the ejection fraction or EF).

Myocyte Necrosis
Myocardial muscle cells are called cardiomyocytes. Necrosis refers to cell death. Myocyte necrosis refers to the death of muscle cells. In the context of cardiovascular disease, myoctye necrosis refers to the death of cardiac muscle cells as a result of a lack of blood flow secondary to blockage or occlusion of an artery that feeds the heart.

Percutaneous Coronary Intervention (PCI)
An important group of technologies used for the treatment of patients with cardiovascular disease. Although initially limited to balloon angioplasty and termed percutaneous transluminal coronary angioplasty (PTCA), PCI now includes other techniques capable of relieving coronary narrowing.

Primary PCI
Primary PCI is the term used when PCI is performed in patients with AMI as emergent reperfusion therapy.

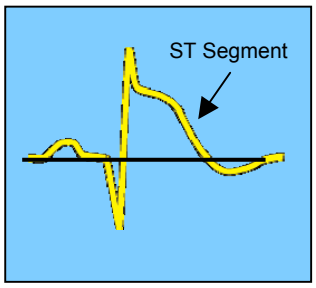
Quality Indicator
Performance measures that assess health care structure, processes and outcomes. These measures may be defined on the basis of scientific evidence or by clinical experts in the field, and are ultimately linked to improved patient outcomes.

Secondary Prevention
In the context of heart disease, secondary prevention refers to interventions or therapies such as lifestyle changes or medications aimed at slowing or reversing the progression of disease.

Standard Admitting Orders
Guidelines developed and used by physicians for use in admitting patients. These orders reduce unnecessary variability in physicians' approaches to similar disease processes and thereby improve the quality of care.

Statins
Synthetically derived cholesterol lowering agents; the principal metabolites of these drugs are specific inhibitors of 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA reductase).

ST-Segment Elevation Myocardial Infarction (STEMI)
A type of myocardial infarction or heart attack where the ST portion of the QRST waveform is elevated at least 1 mm above the baseline.



Thrombolysis
Emergency therapy given during a heart attack which involves the injection of a drug to dissolve the clot in a coronary artery and restore blood flow to the heart muscle; the sooner the therapy is administered, the better the outcome.

Troponins
Cardiac biomarkers found in both skeletal and cardiac muscle that are involved with actin and myosin in muscle contraction. Troponin T and Troponin I are relatively specific for cardiac muscle. They are released during acute myocardial ischemia and can be measured.

Warfarin
Agent used to prevent blood clots from forming or growing larger. It is often prescribed for patients with certain types of irregular heartbeat, such as atrial fibrillation and after a heart attack or heart valve replacement surgery. It works by stopping the formation of substances that cause clots. Also known as a "blood thinning" medication.

Sources:

Naylor CD, Slaughter PM, editors. Cardiovascular health and services in Ontario. An ICES atlas. 1st ed. Toronto: Institute for Clinical Evaluative Sciences; 1999.

Lee DS, Tran C, Flintoft V, Grant FC, Liu PP, Tu JV; Canadian Cardiovascular Outcomes Research Team/Canadian Cardiovascular Society Heart Failure Quality Indicator Panel. CCORT/CCS quality indicators for congestive heart failure care. *Can J Cardiol.* 2003; 19(4):357–64.

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Appendix E—Analysis of Potential Lives Saved with Maximal Use of AMI and CHF Therapies

This appendix describes the potential lives saved if:

- All ideal AMI patients received the recommended secondary prevention therapy; and
- All ideal CHF patients received identified therapies.

Analyses

Table E-1 provides an overview of the clinical evidence for the indicated medications, the number needed to treat (NNT), and the required treatment duration.

Table E-1. Meta-Analyses of Major Trials for AMI Secondary Prevention & CHF Treatment

#	Diagnosis	Medication	Meta-Analyses Reference	Number Needed to Treat (NNT)
1	**AMI**	**ASA**	Antithrombotic Trialists' Collaboration Collaborative meta-analysis of randomized trials of antiplatelet therapy for prevention of death, myocardial infarction, and stroke in high-risk patients. *BMJ* 2002; 324:71–86.	83 patients treated for a mean duration of 27 months to avoid 1 death
2		**Beta-blockers**	Freemantle JC, Young P, Mason J, Harrison J. Beta-blockade after myocardial infarction: systematic review and meta regression analysis. *BMJ* 1999; 18:1730–37.	42 patients treated for 2 years to avoid 1 death
3		**ACE inhibitors**	Flather MD, Yusuf S, Kober L, Pfeffer M, Hall A, Murray G, Torp-Pederson C, et al. Long-term ACE inhibitor therapy in patients with heart failure or left-ventricular dysfunction: a systematic overview of data from individual patients. *Lancet* 2000; 355:1575–81.	15 patients treated for 2.5 years to avoid 1 death
4		**Statin**	LaRosa JC, He J, Vupputuri S. Effect of statins on risk of coronary disease: A meta-analysis of randomized controlled trials *JAMA* 1999; 282:2340–46.	61 patients treated for mean duration of 5.4 years to avoid 1 death
1	**CHF**	**Beta-blockers**	Brophy JM, Joseph L, Rouleau JL. Beta-blockers in congestive heart failure. A Bayesian meta-analysis. *Ann Intern Med* 2001; 134:550–60	26 patients treated for 1 year to prevent 1 death
2		**ACE inhibitor**	Garg, R, Yusuf S. Overview of randomized trials of angiotensin-converting enzyme inhibitors on mortality and morbidity in patients with heart failure: collaborative group on ACE inhibitor trials. *JAMA* 1995; 273:1450–56	25 patients treated for at least 3 months to avoid 1 death

To estimate the potential effect of the maximal use of evidence-based therapies on the number of lives that could be saved in Ontario, EFFECT investigators attempted to identify high quality meta-analyses that summarize the effectiveness of each medication from major clinical trials as indicated in Table E-1. From

each reference, we determined the number needed to treat in order to prevent one death and the duration of therapy required. We then calculated the number of lives that might be saved with maximal rates (i.e., 100%) of utilization of these therapies as compared with the current utilization rate in ideal EFFECT patients. These analyses do not include thrombolytics as we were unable to identify ideal candidates for reperfusion therapy.

Using the CIHI hospital discharge abstract database (DAD) to perform the calculation, we determined the total number of new AMI and CHF patients discharged alive in 1999/00 from Ontario hospitals. We then determined the proportion of patients who would be considered ideal candidates for each medication in the EFFECT data and extrapolated that to the total population of new AMI and CHF patients in Ontario.

To calculate the number of lives saved, we multiplied the difference between the current rate and the maximal rate (100%) of medication use, by the NNT to calculate the total number of lives that may be saved with more therapy in ideal candidates. (See Tables E-2 and E-4.)

To be considered an ideal candidate for ACE inhibitors or statins, patients needed to have received LV function assessment and lipid testing respectively. In order to estimate the *maximal possible number* of ideal candidates for ACE inhibitors and statins, we assumed that each patient in Ontario received LV function assessment and/or lipid testing, and that the distribution of results were similar to that seen with those patients who actually received these tests. This provided a maximum estimate of the number of lives saved in actual and potential ideal candidates. (See Tables E-3 and E-5.)

Several caveats should be noted with this analysis. First, it assumes that the medications will have additive effects in patients, and that the NNT observed in clinical trials can be generalized to the real world. Compliance and dosing of drugs may be lower in the community setting, but this may be partially offset by higher absolute event rates (and thus lower NNTs) such that the real-world NNT is uncertain. Second, these medications may have benefit in non-ideal candidates, even though they are not included in these calculations. For example, the clinical trial evidence for these medications continues to change. More recent data suggest that ACE inhibitors may have benefits in patients with preserved LV systolic function (i.e., Heart Outcomes Prevention Evaluation—HOPE)[1] and that statins benefit patients with cholesterol levels within normal range—as defined by current guidelines (i.e., Heart Protection Study).[2] Third, this analysis assumes that ideal candidates who did not receive the therapy in hospital did not receive the therapy after discharge.

Despite these caveats, we hope these analyses will allow readers to put into perspective the overall gain that might be achieved by maximal utilization rates of evidence-based therapies in high-risk cardiac patients. They also highlight the need for the discovery of new therapies in order to achieve substantial reductions in death rates associated with these conditions.

As described in Tables E-2 and E-3 many additional lives could be saved if all ideal AMI patients received the indicated medications: ASA, beta-blockers, ACE inhibitors and statins. The estimated number of lives that could be saved ranges from 178 to 250 based on findings from the *Group A—Early Feedback Hospitals.*

[1] Yusuf S, Sleight P, Pogue K, Bosch J, Davies R, Dagenais G. Effects of angiotensin-converting-enzyme inhibitor, ramipril, on cardiovascular events in high risk-patients. The Heart Outcomes Prevention Evaluation Study Investigators. *N Eng J Med* 2000; 342(3):145–53.

[2] Collins R, Armitage J, Parish S, Sleigh P, Peto R. Heart Protection Study Collaborative Group. *Lancet* 2003 14; 361(9374):2005–16.

Table E-2. Estimated Number of Lives Saved with Maximal Utilization of AMI Secondary Prevention Medications, **1999–2000**
(Minimal estimated benefits of medical therapies on AMI death rates in Ontario)

#	Calculations			Medications				Total
				ASA	Beta-blockers	ACEI	Statins	
1	**AMI**							
1.1	Average Annual Live Discharges following AMI in Ontario	17,061						
1.2	Number Needed to Treat (NNT) to prevent 1 death			83	42	15	61	
2	**Ideal AMI Patients**							
2.1	Percent of EFFECT patients identified as Ideal*			81%	58%	25%	19%	
2.2	Estimated number of ideal patients in Ontario			13,820	9,896	4,266	3,242	
2.3	Current utilization of the medication in EFFECT study population			85%	78%	72%	61%	
2.4	Estimated number of ideal patients currently not receiving indicated therapy			2,073	2,177	1,194	1,264	
2.5	**Maximum potential lives saved if 100% of ideal patients received secondary prevention medications**			25	52	80	21	178

* To be considered an ideal patient for ACEI and statins, LV Assessment and lipid testing were required respectively

Table E-3. Estimated Number of Lives Saved with Maximal Utilization of AMI Secondary Prevention and Maximum Number of Ideal Candidates, 1999–2000
(Maximal estimated benefits of medical therapies on AMI death rates in Ontario)

#	Calculations			Medications				Total
				ASA	Beta-blockers	ACEI	Statins	
1	**AMI**							
1.1	Average Annual Live Discharges in Ontario	17,061						
1.2	Number Needed to Treat (NNT) to prevent 1 death			83	42	15	61	
2	**Ideal AMI Patients**							
2.1	*Maximum estimated percentage of EFFECT patients that could be or are ideal candidates**			81%	58%	*41%*	*39%*	
2.2	Estimated number of ideal patients in Ontario			13,820	9,896	6,995	6,654	
2.3	Current utilization of medication in EFFECT study population			85%	78%	72%	61%	
2.4	Estimated number of ideal patients currently not receiving indicated therapy			2,073	2,177	1,959	2,595	
2.5	**Maximum potential lives saved if 100% of ideal patients received secondary prevention medications**			25	52	131	43	250

* Assumes all ideal candidates for ACEI and statins received LV Assessment and lipid testing respectively

A similar approach to that used for the AMI patient analysis was used to estimate the number of lives that might be saved with optimal use of CHF therapies. As depicted in Tables E-4 and E-5 many patient lives could be saved if all ideal CHF patients received the indicated medications: beta-blockers and ACE inhibitors. The potential number of lives that could be saved ranges from 70 to 156 based on findings from the *Group A—Early Feedback Hospitals*.

Table E-4. Estimated Number of Lives Saved with Maximal Utilization of CHF Therapy, 1999–2000
(Minimal estimated benefits of medical therapies on CHF death rates in Ontario)

#	Calculations		Medications		Total
			Beta-blockers	ACEI	
1	**CHF**				
1.1	Average Annual Live Discharges in Ontario	**13,903**			
1.2	Number Needed to Treat (NNT) to prevent 1 death		**26**	**25**	
2	**Ideal CHF Patients**				
2.1	Percent of EFFECT patients that are or could be ideal*		**16%**	**17%**	
2.2	Estimated number of ideal patients in Ontario		**2,174**	**2,374**	
2.3	Current utilization of medication in EFFECT study population		**39%**	**82%**	
2.4	Estimated number of ideal patients currently not receiving indicated therapy		**1,326**	**427**	
2.5	**Potential lives saved if 100% of ideal patients received these medications**		**52**	**18**	**70**

* To be considered an ideal patient for ACEI, an LV Assessment was required

Table E-5. Estimated Number of Lives Saved with Maximal Utilization of CHF Therapy and Maximum Number of Ideal Candidates, 1999–2000
(Maximal estimated benefits of medical therapies on CHF death rates in Ontario)

#	Calculations		Medications		Total
			Beta-blockers	ACEI	
1	**CHF**				
1.1	Average Annual Live CHF Discharges in Ontario	**13,903**			
1.2	Number Needed to Treat (NNT) to prevent 1 death		**26**	**25**	
2	**Ideal CHF Patients**				
2.1	*Maximal percent of EFFECT patients that could be or are ideal candidates**		***36%***	***39%***	
2.2	Estimated number of ideal patients in Ontario		**5,005**	**5,422**	
2.3	Current utilization of medication in EFFECT study population		**39%**	**82%**	
2.4	Estimated number of ideal patients currently not receiving indicated therapy		**3,053**	**976**	
2.5	**Maximal potential lives saved if 100% of ideal patients received these medications**		**117**	**39**	**156**

* Assumes all ideal candidates for ACEI received LV Assessment

Appendix F—Quality Improvement Resources

This appendix provides additional resources on quality improvement initiatives in and outside of Canada for your reference.

1. Healthcare Commission—United Kingdom

Public reporting of performance indicators began under the Commission for Health Improvement in 2002. The Commission continued to evolve and as of April 1, 2004 was reconstituted as the Healthcare Commission whose objective is to promote improvement in the quality of healthcare in England and Wales. The Healthcare Commission is responsible for publishing the performance ratings and indicators for NHS trusts in England. The Commission's acute care performance indicators include thrombolysis treatment time and other cardiac care indicators.

http://ratings.healthcarecommission.org.uk/Indicators_2005/Trust/Indicator/indicatorDescriptionShort.asp?indicatorId=1121 (accessed April 5, 2005)

2. National Service Framework for Coronary Heart Disease—United Kingdom

The National Service Framework for Coronary Heart Disease sets out the standards and services which should be available throughout England to address heart disease. The Framework incorporates modern prevention and primary care as well as the more specialized services such as diagnosis, ambulance and emergency services, medical and surgical nursing care and specialist services including heart surgery and rehabilitation.

http://www.dh.gov.uk/assetRoot/04/05/75/20/04057520.pdf (accessed April 5, 2005)

3. Medicare Quality Improvement Community (MedQIC)—United States

The Medicare Quality Improvement Community, sponsored by the Centers for Medicare & Medicaid Services (CMS) is a national knowledge forum for healthcare and quality improvement professionals. MedQIC was established to support and promote CMS's Medicare Quality Improvement Program to assist Medicare providers "to deliver the right care to every Medicare beneficiary, every time." Initially created in 2003, MedQIC was redesigned in 2004, through a partnership with the Institute for Healthcare Improvement (IHI) to emulate IHI's structure and organization, and formally launched in 2005.

http://www.medqic.org/dcs/ContentServer?cid=1089815967044&pagename=Medqic%2FContent%2FParentShellTemplate&parentName=Topic&siteVersion=null&c=MQParents (accessed April 5, 2005)

4. Cooperative Cardiovascular Project (CCP)—United States

The Centers for Medicare & Medicaid Services' Cooperative Cardiovascular Project (CCP) is a health care quality improvement initiative started in 1992. It involves the use of evidence-based guidelines for the care of heart attack patients.

The CCP developed quality indicators based on clinical practice guidelines developed by the American College of Cardiology and the American Heart Association. As part of the CCP initiative, information on over 200,000 Medicare patients admitted to hospital for treatment of heart attack was obtained from clinical records. Patients were classified as "eligible" or "ideal" for the specific therapies described by the quality indicators. The project was expanded nationally in 1999, forming the National Acute Myocardial Infarction project to measure national performance on AMI care.

http://www.lhcr.org/PDF/AMIProjectOverview.pdf (accessed April 5, 2005)
http://www.ndhcri.org/AMI/AMI_Overview.htm (accessed April 5, 2005) (See page 5)

5. National Registry of Myocardial Infarction (NRMI)—United States

The National Registry of Myocardial Infarction (NRMI) is one of the largest observational studies of AMI. NRMI has collected data since 1990 on over two million AMI patients, and assisted over 1,600 participating hospitals assess their approach to AMI treatment and identify trends in patient outcomes. Sponsored by Genentech, NRMI is involved in evaluation of treatment procedures, monitoring resource utilization, identifying patient-selection issues, and monitoring outcomes.

http://www.nrmi.org/index.html (accessed April 5, 2005)

6. Improving Cardiovascular Outcomes in Nova Scotia (ICONS)—Canada

Improving Cardiovascular Outcomes in Nova Scotia (ICONS) was a five-year study, begun in 1997, focusing on cardiovascular disease. The premise was to determine if a disease management approach to care could improve health outcomes for citizens with cardiovascular disease. Persons with a history of heart failure, heart attack, unstable angina, atrial fibrillation, previous angioplasty or bypass surgery, known coronary artery disease, stroke or peripheral vascular diseases were eligible to participate in the study.

http://www.icons.ns.ca (accessed April 5, 2005)

7. Global Registry of Acute Coronary Events (GRACE)

GRACE is an international observational database of outcomes for patients who are hospitalized with acute coronary syndrome (ACS). GRACE includes 100 hospitals in 14 countries that will enroll a total of 10,000 patients per year. Participating physicians receive confidential quarterly reports showing their outcomes side-by-side with the aggregate outcomes of all participating hospitals. GRACE was launched at the annual meeting of the European Society of Cardiology in Barcelona on August 31, 1999.

http://www.outcomes-umassmed.org/AccessDocument.cfm?document=FoxManual_AnIntroduction.pdf (accessed April 5, 2005)

8. Berlin Myocardial Infarction Registry/Berline Herzinfarktregister (BHIR)—Germany

The Berlin Myocardial Infarction Registry/Berline Herzinfarktregister (BHIR) was founded in September 2000. It aims to support hospitals as well as other institutions within the public health sector in improving the prevention, diagnosis and treatment of heart disease, in particular, acute myocardial infarction. It also includes a focus on raising public awareness regarding the prevention of heart disease. BHIR is a joint effort of Berlin Hospitals, the Berlin Chamber of Physicians and the Department of Public Health at the Technical University of Berlin.

The second phase of operation began October 1, 2003, and runs until September 30, 2005. Since 2001, BHIR has been financially supported by the Boehr Pharma KG.

http://www.herzinfarktregister.de (accessed April 5, 2005)

9. Brisbane Cardiac Consortium—Australia

The Brisbane Cardiac Consortium is a collaborative group of hospital and primary care clinicians from Royal Brisbane, Princess Alexandra and Queen Elizabeth II Hospitals, and Brisbane North and Southside Central Divisions of General Practice. The group's aim is to improve the quality of care for people who have been hospitalized with angina, heart attack or heart failure. Approximately 1,600 patients with angina, or who have suffered a heart attack and 1,000 patients with congestive heart failure were involved in the program between October 2000, and August 2002.

The project was sponsored by the Royal Australasian College of Physicians and Queensland Health with funding of one million dollars provided by the Commonwealth Department of Health and Aged Care. The Brisbane Cardiac Consortium is part of the national Clinical Support Systems Program (CSSP).
http://www.health.qld.gov.au/bcc/clinical_indicators.asp (accessed April 5, 2005)

10. Joint Commission on Accreditation of Healthcare Organizations (JCAHO)—United States

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) evaluates and accredits over 16,000 health care organizations and programs in the United States. JCAHO has developed standards and evaluated the compliance of health care organizations against these benchmarks since the 1950s.

In 1997, JCAHO introduced the ORYX initiative to integrate outcomes and other performance measurement data into its hospital accreditation process. Since July 2002, many acute care hospitals have been required to collect data on one or two of four Core Measures Sets (AMI, Heart Failure, Community-acquired Pneumonia, or Pregnancy and Related Conditions). Core Measures are specific ORYX indicators chosen for a given core therapeutic area. A group of core measures bundled together forms a core measure set. Core measures relate to a disease or process of care. For example, the AMI core measure set is composed of nine core measures and the Heart Failure core measures set consists of four core measures. Many of the EFFECT quality indicators are similar to the JCAHO core measures.

http://www.jcaho.org/pms/core+measures/ami-overview.htm (accessed April 5, 2005)

http://www.jcaho.org/pms/core+measures/hf_overview.htm (accessed April 5, 2005)

11. Institute for Healthcare Improvement—United States

A not-for-profit entity, the Institute for Healthcare Improvement (IHI) works to improve health by advancing the quality and value of health care. Based in Boston, IHI was founded in 1991. It provides a range of tools and resources for health care organizations interested in performance improvement.

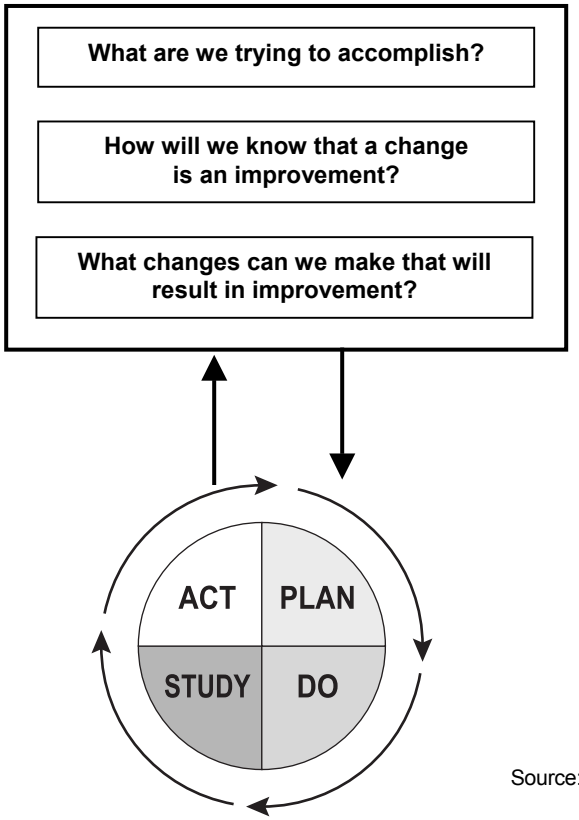
The IHI has recently launched its 100,000 Lives Campaign to make health care safer and more effective. AMI is one of six areas of focus and IHI has developed a document for AMI entitled *Getting Started Kit for AMI: Improved Care of Acute Myocardial Infarction,* which is available at:

http://www.ihi.org/NR/rdonlyres/8D9C3B34-A139-4F30-8DB5-942B3A8D7FD9/0/AMIHowtoGuideFINAL.pdf, (accessed April 5, 2005)

A performance improvement methodology referred to by the IHI is “PDSA,” short for “Plan, Do, Study, Act.” This methodology described by the IHI as “The PDSA Cycle,” is shorthand for testing a change: planning it, trying it out, observing the results, and acting on what is learned. Introduced by improvement gurus W. Edwards Deming and William Shewart, and later enhanced by Langley, Nolan, Nolan, Norman and Provost in their book, *The Improvement Guide*, it is a well-established scientific method for achieving change. (See Figure F-1.)

Source: http://www.ihi.org/IHI/Topics/ESRD/VascularAccess/HowToImprove/ESRDTestingChanges.htm (accessed April 5, 2005)

Figure F-1. Plan—Do—Study—Act Cycle



Source: *The Improvement Guide,* by Langley, Nolan, Nolan, Norman and Provost; Jossey Bass, 1996.

Additional information regarding IHI is available at:
http://www.ihi.org/ihi (accessed April 5, 2005)

Appendix G—Reader Feedback Survey

We welcome your feedback on this report and your comments and suggestions on ways to improve subsequent reports. All feedback will be kept confidential. Please complete this survey and send it and your comments by mail or fax to:

Linda Donovan c/o EFFECT Study
Institute for Clinical Evaluative Sciences (ICES)
G1 06, 2075 Bayview Avenue, Toronto, Ontario M4N 3M5
Fax: 416 480-6048

Please check (☑) the appropriate box.

1. Please indicate if you are associated with:
   - ☐ An Early Feedback hospital (Group A) of the EFFECT Study
   - ☐ A Delayed Feedback (DF) hospital (Group B) of the EFFECT Study
   - ☐ Neither

2. How did you obtain your copy of the report?
   - ☐ It was mailed to me
   - ☐ From a colleague
   - ☐ From the web site
   - ☐ I requested a copy
   - ☐ Other: please specify:_____

3. To what extent have you read through the report?
   - ☐ I read through the entire document
   - ☐ I read specific chapters
   - ☐ I read specific chapters and browsed through the entire document
   - ☐ I browsed through the entire document

4. Please indicate how you rate each section of the report in terms of its usefulness:

Section	Rating			
Executive Summary	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read
Introduction	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read
Methods	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read
Findings—Group B–DF	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read
Quality Improvement	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read
Interpretive Cautions	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read
Conclusion	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read
Appendices	❍ Very Useful	❍ Somewhat useful	❍ Not Useful	❍ Not read

5. How would you rate the following aspects for the report?

Item	Rating			
Clarity/readability	❍ Excellent	❍ Good	❍ Fair	❍ Poor
Organization/format	❍ Excellent	❍ Good	❍ Fair	❍ Poor
Use of tables and figures	❍ Excellent	❍ Good	❍ Fair	❍ Poor
Quality of analysis	❍ Excellent	❍ Good	❍ Fair	❍ Poor
Level of detail presented	❍ Excellent	❍ Good	❍ Fair	❍ Poor
Other:_____	❍ Excellent	❍ Good	❍ Fair	❍ Poor

A key objective of the EFFECT study and the report is to assist in designing mechanisms to support quality improvement efforts for cardiac care.

6. In your opinion, how useful was this document in supporting your organization's efforts in cardiac care?

 Very useful Useful Somewhat useful Not useful Not applicable

7. In your opinion, how useful were the data provided in this document?

 Very useful Useful Somewhat useful Not useful Not applicable

8. How do you plan to use the information presented in this report?

_____
_____
_____
_____

9. How would you improve this report?

_____
_____
_____
_____

10. What are your suggestions for improving future reports?

_____
_____
_____
_____

11. What is your main position/role?

 Health care provider—please specify type: _____
 Health services manager or administrator
 Other hospital staff—please specify type: _____
 Researcher
 Policy analyst
 Elected official
 Student
 Other: _____

12. Would you be interested in being notified about future studies/reports published by the CCORT investigators? You may terminate this notification service at any time.

 Yes, my email address is _____
 No

Thank you for taking the time to provide us with your feedback.

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