| REPORT DOCUMENTATION PAGE | | | | | Form Approved OMB No. 0704-0188 |
|---|---|---|---|---|---|



| 1. REPORT DATE *(DD-MM-YYYY)* | 2. REPORT TYPE | 3. DATES COVERED *(From - To)* |
|---|---|---|
| 04-06-2007 | FINAL REPORT | JULY 2006-JULY 2007 |

**4. TITLE AND SUBTITLE**
Implementation of Get with the Guideline Acute Myocardial Infarction Program at Johns Hopkins Hospital and its Effect on Core Measures

**5a. CONTRACT NUMBER**

**5b. GRANT NUMBER**

**5c. PROGRAM ELEMENT NUMBER**

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**5d. PROJECT NUMBER**

**5e. TASK NUMBER**

**5f. WORK UNIT NUMBER**

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**
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**8. PERFORMING ORGANIZATION REPORT NUMBER**

**9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)**
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**10. SPONSOR/MONITOR'S ACRONYM(S)**

**11. SPONSOR/MONITOR'S REPORT NUMBER(S)**
34-07

**12. DISTRIBUTION/AVAILABILITY STATEMENT**
Distribution A -- Approved for public release; distribution in unlimited

**13. SUPPLEMENTARY NOTES**

**14. ABSTRACT**
John Hopkins Hospital implemented the Get with the Guidelines (GWTG) evidence-based program for use with patients who have Acute Myocardial Infarction (AMI), a component of Congenital Heart Disease (CHD). CHD is the single leading cause of death for persons in the United States. The GWTG program is a web-based tool developed by the American Heart Association (AHA) that allows for data entry and benchmarking of AHA guidelines. The stated goal of the evidence-based program is to save patient lives and can be reached through the identification of delays in treatment and failure to provide secondary prevention therapies. A reduction in door-to-balloon time and compliance with arrival and discharge medication protocol is important because research shows that these save patient lives. Through the use of the GWTG program and other process improvements, Johns Hopkins Hospital is on its way to becoming a national benchmark hospital for core measure arrival and discharge medications, and has a plan in place to reduce the door-to-balloon time to meet established AHA guidelines.

**15. SUBJECT TERMS**
core measures, door-to-balloon time, Get with the Guidelines, AHA, AMI, medication

| 16. SECURITY CLASSIFICATION OF: a. REPORT | b. ABSTRACT | c. THIS PAGE | 17. LIMITATION OF ABSTRACT | 18. NUMBER OF PAGES | 19a. NAME OF RESPONSIBLE PERSON |
|---|---|---|---|---|---|
| u | u | u | u | 37 | Education Technician |
| | | | | | 19b. TELEPHONE NUMBER *(Include area code)* (210) 221-6443 |

**Standard Form 298** (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

Army-Baylor Graduate Program in Health and Business Administration

Graduate Management Project:
Implementation of Get with the Guidelines Acute Myocardial Infarction Program at Johns Hopkins Hospital and its Effect on Core Measures

Presented to LtC Glenn Yap



In partial fulfillment of the requirements for
HCA 5661 – Administrative Residency

By
Capt Jason Richter

Ft Sam Houston, TX

25 May 2007

# Table of Contents

# Executive Summary

Johns Hopkins Hospital implemented the Get with the Guidelines (GWTG) evidence-based program for use with patients who have Acute Myocardial Infarction (AMI), a component of Congenital Heart Disease (CHD). CHD is the single leading cause of death for persons in the United States. The GWTG program is a web-based tool developed by the American Heart Association (AHA) that allows for data entry and benchmarking of AHA guidelines. The stated goal of the evidence-based program is to save patient lives and can be reached through the identification of delays in treatment and failure to provide secondary prevention therapies. Prior to program implementation Johns Hopkins had been unable to meet its goal of a national benchmark facility on door-to-balloon time and some core measure discharge medications for its AMI patients. A reduction in door-to-balloon time and compliance with arrival and discharge medication protocol is important because research shows that these save patient lives. Through the use of the GWTG program and other process improvements, Johns Hopkins Hospital is on its way to becoming a national benchmark hospital for core measure arrival and discharge medications, and has a plan in place to reduce the door-to-balloon time to meet established AHA guidelines.

# Introduction

## Research Question

This study analyzes whether implementation of the American Heart Association's (AHA) Get With the Guidelines (GWTG) program reduces the time from admission to treatment for patients with Acute Myocardial Infarction (AMI). Additionally, the study identifies if there is increased compliance of preventative medicine guidelines through use of GWTG. Core measure medications include beta blockers and aspirin at arrival, smoking cessation, and the following discharge medications: beta blockers, aspirin, angiotension converting enzyme (ACE) inhibitors, angiotension receptor blocker (ARB), and lipid lowering medications. The study population consists of patients admitted to Johns Hopkins Hospital with AMI for the three years prior to implementation of the GWTG program on February 26, 2007 and the six weeks following it.

## Hypotheses

The null hypothesis is that GWTG has no impact on an AMI patient's time to treatment and does not affect compliance with preventative medicine guidelines. The alternate hypothesis is that GWTG has an impact on an AMI patient's time to treatment and affects compliance with preventative medicine guidelines.

## Purpose

The purpose of the case study is to determine whether the GWTG tool helps reduce the time to thrombolytic agent and angioplasty, also called percutaneous coronary intervention (PCI), on patients with AMI, as well as increase physician compliance to secondary prevention guidelines for patients with the diagnosis. GWTG is an evidence-based performance improvement tool designed to address issues of hospital non-compliance with accepted guidelines for AMI. It offers a tool to collect data that is both critical to provide feedback to enable improvements in AMI treatment and secondary prevention. As a mandate toward reimbursement, both the state and Center for Medicare and Medicaid Services (CMS) and the state of Maryland require disclosure of quality indicators and measures. The belief of Johns Hopkins senior leadership is that these indicators will be made public in the near future.

Prior to implementation of the GWTG program, there was no real-time tracking system to check the times from admission to thrombolytic agent and PCI. Reviews of medical records indicated that there was a failure to meet established time to treatment AHA guidelines (see Appendix C for guidelines). Additionally, the secondary prevention medications data collection is done retrospectively by the Johns Hopkins Quality Improvement Division and offers no comparison benchmark data for similar hospitals. A retrospective review had been performed up to two months after discharge.

## Intended Audience

The intended audience for this report is internally and externally based. The internal audience includes those involved directly or indirectly with the treatment of patients with AMI and/or those who help in development of the GWTG program at Johns Hopkins Hospital. The Cardiology and Emergency departments, Critical Care Unit, Cardiac Catheterization Lab (Cath Lab), the Center for Innovations at Johns Hopkins, executive leadership, and the patient all fit the criteria to be an intended audience member.

The external audience can include other hospitals, insurance groups, the AHA, and patients. If GWTG improves Johns Hopkins' compliance rates of preventative therapies and reduces subsequent AMI diagnoses for patients, it should be marketed toward patients and insurance groups. Patients want the best care; if data suggests that Johns Hopkins has the best compliance rates on preventative therapies that should be communicated to the patient. This is particularly true if the hospital exceeds benchmarks. Insurance groups would be pleased to see cost savings through a reduction in expensive procedures for AMI patients. The AHA has an interest in knowing that the program it sponsors is a success toward improving hospital compliance with its guidelines. Other hospitals can use studies such as this one to show a method that works to improve compliance with established guidelines.

## Background

Coronary Heart Disease (CHD) is the single largest killer of Americans. Within that category, myocardial infarction acts as the leading cause of death in the United States as well as in most industrialized nations (Bajzer, 2002). As an underlying or contributing cause of death, CHD claimed the lives of 653,000 people in 2003. AMI was responsible for 221,000 of those (American Heart Association, 2006). The survival rate for patients hospitalized with AMI is at a historical high, approximately 90-95%. This improved mortality rate is a result of enhancements in emergency response and treatment strategies. The incidence of AMI is estimated at 565,000 new attacks and 300,000 recurrent attacks annually. Hospital discharges of AMI patients numbered 946,000 in 2003.

AMI is defined as death or necrosis of myocardial cells. It occurs when myocardial ischemia exceeds a critical threshold and overwhelms myocardial cellular repair mechanisms that are designed to maintain normal operating function and hemostasis (Bajzer, 2002). Patients who suspect they are having an AMI usually arrive at the emergency department. Tests that can confirm an AMI are electrocardiogram, blood test, and echocardiography. Decisions regarding medical and interventional treatments are based on specific findings. Patients are classified into one of the following categories based on the presence or absence of ST segment elevation on the presenting electrocardiogram: ST elevation myocardial infarction, non-ST elevation myocardial infarction.

Besides the obvious health and lifestyle risks to the population, heart disease has a significant cost to the public. The direct and indirect cost of coronary heart disease is expected to reach $142.5 billion in 2006. In 2001, $11.6 billion was paid to Medicare beneficiaries for the disease; AMI registered a payment of $11,201 per discharge. An estimate by Butler et al (2002) predicts that if all survivors of first AMI were treated with beta blockers for 20 years, it would result in a savings of $18 million and add 447,000 years to their lives.

According to a case control study of 52 countries, nine primary risk factors account for more than 90% of the risk of an initial AMI (AHA, 2006). Approximately 90% of AMI patients have prior exposure to at least one of the major risk factors. Risk factors include: hyperlipidemia, diabetes, hypertension, abdominal obesity, smoking, lack of physical activity, low daily fruit and vegetable consumption, alcohol over consumption, and psychosocial index. With the exception of diabetes and psychosocial index all major risk factors can be improved through secondary prevention therapies and treatment.

The primary goal of therapy upon onset of AMI is the rapid restoration of normal coronary blood flow. The primary obstacles to this restoration include the patient's failure to recognize AMI symptoms and a delay in medical attention. Mortality increases for every 30 minutes that elapse before a patient with ST-segment elevation is recognized and treated. The median door-to-drug time for thrombolytic therapy has been reduced in recent years from 61.8 minutes to 37.8 minutes in 2003. However, this still exceeds the 30 minute goal set in 1991 by the National Registry of Myocardial Infarction. An additional guideline is that the time from hospital arrival to PCI should be 90 minutes or less. The data tracking mechanism in GWTG provides visibility of the elapsed time at each critical stage in the process, and thereby highlights any significant delays in the treatment.

Aside from the risk of death from the initial onset of AMI, victims of the diagnosis are much more likely than the rest of the population to experience additional heart attacks, strokes, and death in the near future. Within 6 years of an AMI, 18% of men and 35% of women will have another heart attack, 8% of men and 11% of women will have a stroke, and 7% of men and 6% of women will die (AHA, 2006). Patients that survive the acute stage of a heart attack have a chance of debilitating illness and death that is 1.5-15 times higher than that of the general population.

Because of the increased risk of future complications and death, patients and their hospital staff should ensure that the patient receives all secondary prevention therapies, as dictated by guidelines set forth by the American College of Cardiology (ACC) and the

AHA (see Appendix C for guidelines). The AHA goal is to reduce coronary heart disease by 25% by focusing on the acute event and prevention. GWTG places a heavy emphasis on prevention, where AHA estimates there will be 8-16% of the risk reduction for heart disease. Because of a low adherence rate to AHA guidelines for secondary prevention of cardiovascular diseases, this risk reduction is a realistic goal. Although improvements have been made, the sad reality is that many care delivery teams fail to adhere to the guidelines. Of the 1800 hospitals now using GWTG, covering 75% of all AMI patients in the United States, compliance on risk factors prior to use of GWTG was as follows: aspirin 78%, ACE I inhibitors 59%, beta blockers 50%, smoking cessation advice 42% (Smaha, 2004). The compliance rates with AHA's guidelines are troubling considering the risk reduction for an AMI recurrence through use of secondary treatments. The use of beta blockers, aspirin, and lipid-lowering medications has resulted in notable risk reductions in cardiovascular death and nonfatal reinfarcation (McCormick et al, 1999). In a study of 1710 patients, beta blockers exhibited a 22% and 27% risk reduction, respectively, while aspirin was 13% and 31%, and lipid-lowering drugs were at 14% and 25%. A positive of the GWTG program is that it has led to significant increases in compliance with many preventative guidelines. For example, smoking cessation advice more than doubled within one year.

Get With the Guidelines is an American Heart Association hospital evidence-based patient management program. GWTG has programs for coronary artery disease (CAD), stroke, and heart failure. The CAD module was the first GWTG program and will be the one used in this study. It started as a pilot in New England in 2000 and was introduced nationally in 2001. The goal of the program is that patients receive appropriate medications and risk modification counseling as inpatients and at discharge. The program focuses on this compliance of MI guidelines through data collection, monitoring, and benchmarking practices.

The GWTG program uses a web-based online Patient Management Tool (PMT) that provides an interactive assessment and reporting system that assists in implementation of the GWTG program and the tracking of AMI patient data. The PMT has the capability to provide access to benchmarking reports, check the most current guidelines, transmit data to the Joint Commission on Accreditation of Healthcare Organizations (JCAHO), and fax letters to referring physicians. The benchmarking reports are critical because of reporting requirements for regulatory agencies and for the ability to compare one facility against the best. Because GWTG and the PMT are electronic, benchmarking, decision support, and the dissemination of guidelines are much easier than if a paper format was used.

The interactive nature of the GWTG program makes it easy to use, and its existence as an evidence-based program gives it increased credibility among medical staff. On the AHA website, the GWTG program has a variety of tools to use for ease of program implementation. Examples include: planning guides and templates, poster art, a description of capabilities and tutorial for the PMT, and a listing of the AHA guidelines.

A strong body of evidence suggests that in-hospital initiation of medical therapies during an acute coronary event is critical to success toward getting patients to accept the treatment (LaBresh, Gliklich, Liljestrand, Peto, & Ellrodt, 2003). Because outpatient initiation may be less consistent, failure to initiate medical therapy in the hospital is one of the causes of a large treatment gap. For example, in the Butler et al (2002) study, only

7-10% of patients without a discharge prescription for beta blockers were using the drugs during the first 30 days after an AMI. This contrasts with the 80% of patients who were found to use beta blockers when given a prescription as an inpatient. Initiation of medical therapy in patients at time of discharge has show improved adherence to drug therapy, and has improved short and long-term outcomes. A tool that provides reminders and guideline prompts during the patient care encounter can affect real-time guideline adherence for each patient by the patient care team. Development of a data collection sheet (see Appendix D) that is driven by the AHA GWTG's criteria, and completed while the patient is at the hospital, is in line with this approach. This is in contrast to traditional quality improvement in which ad hoc reports are used to make changes for future patients, while patients initially impacted do not receive any benefit.

Increasing compliance rates of AHA secondary prevention guidelines for AMI is not simply a number. Most importantly, it significantly reduces the patient's chance for a deadly recurrence of AMI. Statistics related to a first AMI show that 36% of patients will die either before or during the hospital admission (Butler et al, 2002). After discharge, cardiovascular mortality was approximately 10% in the first year and 5% in each year thereafter (Law, Watt, & Wald, 2002). For a subsequent AMI, the chance that a person will die prior to discharge jumps significantly to 53%. After discharge, cardiovascular mortality for the second AMI was 20% in the first year and 10% in each year thereafter. These numbers indicate that a person who has a second AMI diagnosis is at a significantly higher risk of death than a patient who has an AMI for the first time. It is unusual for physicians to seek out patients who have had AMI years before to advise them of their ongoing increased risk and to evaluate and reinstate preventative treatment, despite the effectiveness of this screening and the preventative treatments.

Systematically identifying patients who have previously had an AMI should be a priority for the hospital. The high and prolonged mortality rate risk makes it critical that effective preventative treatments are maintained indefinitely for all patients who have suffered an AMI, with particular emphasis on those patients who have suffered multiple AMIs.

Despite the abundance of literature that shows the success of using preventative therapies in patients who have suffered an AMI, not all patients should receive every therapy. Evidence-based clinical guidelines support use of the therapies in all patients except those who have contraindications to a specific treatment. Beta blocker use is contraindicated in patients with heart block, bradycardia, congestive heart failure, reactive airways disease, diabetes mellitus, and depression (McCormick et al, 1999). Aspirin may be contraindicated in patients with bleeding disorders, peptic ulcer disease, thrombocytopenia, and aspirin allergy. The number of patients who have contraindications to aspirin and beta blockers are few. In the study of 1,712 Massachusetts patients, the number of contraindications was 18% for beta-blockers and 4% to aspirin.

Besides medications, the door-to-balloon time has been shown to be a significant measure of mortality in patients with AMI. Door-to-balloon is defined as the time that elapses from when a patient arrives at the emergency department to the time when a catheter guidewire crosses the culprit lesion in the cath lab. According to a study done by Welsh (2003), 30-day mortality rates for patients who had an acute MI is 6.4 percent if the door-to-balloon time is greater than 90 minutes (see Figure 1), but is 4 percent if it is between 76 and the AHA goal of 90 minutes. There is a 62 percent increased mortality rate if the door-to-balloon time is greater than 120 minutes. Johns Hopkins Hospital was not meeting this goal for all patients prior to implementation of the GWTG program.

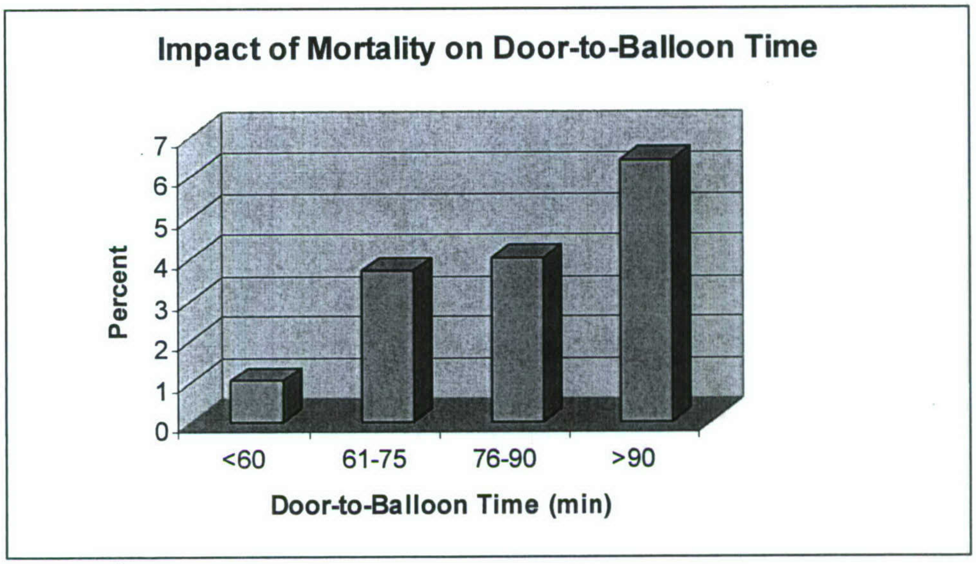


*Figure 1*. Impact on Mortality of Door-to-Balloon Time. Source: from Prehospital Management of Acute ST-Elevation Myocardial Infarction: A Time for Reappraisal in North America, 2003, *American Heart Journal, 145*, p. 4

One way to improve door-to-balloon time is to have the emergency department activate the cath lab while the patient is still en route to the hospital. A study of 365 hospitals found that step alone reduced door-to-balloon time by an average of 15 minutes (Bradley et al, 2006). This same study found that 14 minutes are saved if the emergency department makes a single call to a central page operator, who then pages the interventional cardiologist and catheterization laboratory staff.

## Theoretical Framework

There are multiple reasons why GWTG was expected to accomplish the desired outcomes of the study. One reason is that use of the tool was very successful in the

GWTG's New England pilot study and in a 24 hospital collaborative in Massachussets (LaBresh, Ellrodt, Gliklich, Liljestrand, & Peto, 2004). The second reason is GWTG is a tool that prompts the user to ask specific questions as to whether secondary prevention interventions have taken place. By requiring an answer to a question and allowing the tracking of that answer, GWTG puts the pressure on the healthcare provider to increase adherence to secondary prevention guidelines. The tool specifically shows who is not adhering to the AHA guidelines and allows for focused training for these personnel to improve compliance. If the program is run concurrently with the patient visit, GWTG offers the opportunity to fix what would have otherwise been a failure to prescribe a secondary prevention therapy.

Johns Hopkins devoted the resources of physicians, nurses, case managers, and administrators to a working group that examined acute MI and the implementation of GWTG to improve treatment associated with it. The working group used GWTG as a tool to monitor the progress of its initiatives to improve medication compliance and reduce the door-to-balloon time for patients with AMI.

Although GWTG offers tools for improving core measure medications associated with AMI, it does not offer much to directly improve the other critical aspect of AMI treatment, door-to-balloon time. While the PMT tool in GWTG has the ability to enter data and track the total door-to-balloon time, it does not directly reduce time in the process. However, the identification of Johns Hopkins' failure to meet the AHA goal of 90 minutes, led to the working group's mission to reduce the door-to-balloon time to meet the AHA standard. Based on successes at Johns Hopkins' affiliate hospital Bayview and the Bradley study in the New England Journal of Medicine, this group mapped out the process (see Appendix E and F) and determined that initiation of a bridge team would significantly reduce the door-to-balloon time. On April 6, 2007, Johns Hopkins Hospital began using a bridge team to reduce door-to-balloon times during off-peak hours. Off-peak hours are considered 6:00 p.m. to 7:00 a.m. Monday through Friday, and all 24 hours on weekends and holidays. The bridge team's role is to transport and prepare the patient until the on-call heart attack team arrives. The bridge team is the CCU resident and the patient transport team. The patient transport team consists of a paramedic and registered nurse. Because there was downtime associated with the old process, the new process that eliminates that downtime was expected to lead to reductions of up to 55 minutes of door-to-balloon time.

### Ethical Considerations

Data that is entered into GWTG is stored and maintained in a specialized and secure facility. The program complies with federal privacy and security standards. All data is de-identified and all site information is confidential. Additionally, patients are tracked in the GWTG database through use of a Johns Hopkins Hospital identification number, rather than patient name. Use of this identifier is required to meet the Health Insurance Portability and Accountability Act (HIPAA) requirements.

## Data Collection & Design

The GWTG CAD web-based program was used as the tool for Johns Hopkins health professionals to input data after implementation of GWTG. More specifically, Outcome, Inc., an information services company that specializes in web-based data management, partnered with the AHA to provide an infrastructure for the PMT that is used for data entry. The PMT is designed for ease of use; it is primarily a point and click interface that uses data definitions consistent with CMS indicators and JCAHO core measures.

The most significant component in making GWTG a useful program for both the hospital and its patients is communication. Simply because a program exists and has been shown to be successful does not guarantee that it will be used appropriately. For example, despite numerous studies that showed that beta-blockers reduced the risk for a subsequent AMI, research illustrates that it took 3-5 additional years before utilization of these preventative therapies increased (Butler, 2002). Likewise, GWTG has been shown in the New England pilot study and anecdotal evidence from hospitals using the system to be very successful in improving compliance of preventative therapy guidelines. These hospitals were successful because they had medical (in most cases a physician) champion who supported the program and was able to convince other medical staff of its merits. Johns Hopkins utilized a physician champion to encourage staff to buy into the process changes. Meetings with the working group that comprised key physician, nurse, and administrative staff were conducted bi-weekly for 3 months, in order to improve compliance with core measure medications and the door-to-balloon time. The physician champion was critical to garnering the support of other physicians, the personnel who are responsible for completion of the GWTG form. Staff training and awareness of the program was considered extremely important. Each physician and nurse in the Cath Lab, Critical Care Unit, ED, and Cardiac Surgery were notified via email of the new policy. All those critical areas were represented in the bi-weekly meetings to increase understanding of the new process and to garner their support as unit champions.

Data can be entered either retrospectively or concurrently into the PMT. Entry takes roughly 90 seconds per patient (Smaha, 2004). The concurrent approach is the most desirable because GWTG offers interactive capabilities to check patient data against coded algorithms derived from the guidelines to alert the care provider to patients who have not received applicable treatments (LaBresh et al, 2003). The check guidelines feature lists a patient's risks, identified by the medical history, demographics, and other patient data entered, along with a recommendation for any intervention missed. If the physician or nurse enters the data while the patient is still under their care, the potential missed intervention can be instituted without further delay. The retrospective entry into PMT can be done one of two ways: through a chart review or physician completion of a paper version of the PMT and then the enlistment of someone else to do the computer online entry. In both retrospective cases, there is a missed opportunity for immediate secondary prevention. However, because data was ultimately entered in the PMT the missed therapy can be discovered and the patient given proper attention. This approach involves a slightly greater workload because of the need to contact the patient. Hospitals that currently use the tool differ significantly in how data is entered. Depending on the hospital, unit nurses, medical house staff, case managers, cardiac rehabilitation nurses, and nurse practitioners perform data entry.

Data entry into the web-based PMT is conducted using a single page outline format. There are three distinct points of entry: admission, in-hospital care and discharge. The admission includes time tracking, demographics, medical history, diagnosis, and medications at admission. Points of emphasis for core measures include aspirin and beta blocker administration on arrival. In-hospital care covers procedures performed and the times they were completed. The discharge information includes time, status, medications, and risk interventions that were performed on the patient.

The PMT serves as a database for all AMI patients. The database can be queried to analyze a variety of measures (see Appendix B). In addition to the tracking benefit, many of the fields in the PMT are reporting requirements for the Joint Commission, Maryland, and CMS. Thus, the opportunity is there not only to save patient lives but to meet guidelines from a variety of agencies, and meet reimbursement criteria; some reimbursement methodologies for cardiology services require minimum criteria in order to be able to collect from the company or agency.

Baseline data is a key element of the tool and was collected by the quality improvement (QI) team at Johns Hopkins. The data was collected retrospectively through chart reviews. The QI office at Johns Hopkins is the group that historically has gathered and assessed efforts to meet preventative therapy targets associated with AMI. All previous efforts to track compliance with AHA guidelines have been performed by QI through the retrospective chart reviews. The downside of a retrospective review is it does not allow for the opportunity to administer missing medications or change documentation because the review is performed in a post-hoc manner.

The data collection design implemented at Johns Hopkins is a blend between prospective and retrospective. A paper form (see Appendix D) is included in the chart of each patient who is diagnosed with AMI. Forms are located at all points of entry, to include the ED, Cath Lab, Critical Care Unit, and Cardiac Surgery. The form is completed by a physician and is designed to ensure that appropriate arrival and discharge medications are prescribed and that documentation is provided when they are not prescribed. All patients with AMI are monitored by Cath Lab case managers. The case managers collect the forms from the patient chart and ensure the completeness of the form. If a form is not completed in its entirety, the case manager is instructed to either obtain the information from the electronic medical record or discuss with and obtain the missing data from the physician who completed the form. After collection of the form by the case managers, the paper form is given to an administrative employee who enters the data into the GWTG PMT.

Implementation of the GWTG web-based tool and paper form used to document patient medication information began on February 26, 2007. At that point, staff had instructions to complete the data collection form on each patient admission with an AMI diagnosis. During the 11 week period of data collection, 27 paper forms were completed and entered into the database. Some forms were incomplete with missing data fields. Those forms that were missing information were completed by a cath lab case manager or were taken to the physician for completion.

Besides completeness of data fields on the form, there is concern that a form is completed on each patient who has an AMI diagnosis. Because there are various points of entry for each patient and manual processes for completion of the GWTG form and entry into the PMT, it is important to have a check to identify if a form is completed for each patient. There is a report that the Admissions Department can run to identify all patients who have an AMI diagnosis. A match of that report against the GWTG forms that are monitored by the case managers ensures that a paper GWTG data collection form is completed, tracked, and placed in the medical record of each patient. If there is a disparity between the GWTG data sheets collected and the admissions report then investigation into reasons for the disparities is conducted by the case managers.

# Data Analysis

## Analytical Strategy

The plan is to use the reporting function in GWTG on a monthly basis to compare performance since GWTG implementation with that of the baseline data, AHA and ACC guidelines, as well as with benchmark reports that GWTG offers. Core measure medications and door-to-balloon time statistics are shown to senior leadership at various meetings. Benchmarking in the GWTG tool can be performed using individual physicians, institutions, health systems, and national data. The PMT generates online, on-demand reports of quality measures that incorporate the following components (see Appendix B for a detailed list of measures): administrative, patient demographics, cardiac diagnosis, cardiac procedures, patient history, clinical and laboratory findings, medications at discharge, lifestyle modification.

Improvement in compliance with preventative therapy guidelines is important because of the risk of an AMI recurrence. Patients nearly double the risk of death through a second AMI. As previously mentioned in the McCormack study (1999), medications at discharge and lifestyle modification factors are controllable by the health care team and patient, and significantly reduce the risk of cardiovascular death.

## Analytical Techniques

Comparative analysis was used to look at adherence to guidelines on a physician and institution level. Because of the ability to see reports down to the individual physician level, it is much easier to target physicians who may need additional training or mentorship to meet the guidelines of secondary prevention. Institutional analysis can compare Johns Hopkins with similar hospitals and all hospitals to gauge its standing in the United States toward improving secondary prevention. Additionally, the baseline data is important to examine the effect of the GWTG program on Johns Hopkins.

An analysis of variance (ANOVA) was conducted to look at the relationship among the groups of data (Henkel, 1976). ANOVA is a comparison of two or more population or treatment means. In this case, the means refer to the six core measure data elements that are expressed in Table 1. The comparison groups used for the six elements were the pre-GWTG group of 2006 and the post-GWTG group of 2/26/07 thru 5/24/07. A large ratio of the mean squares, or the F-statistic, would imply that the amount of variation explained by implementation of the GWTG is large in comparison with the residual error. The goal of using ANOVA was to assess the statistical impact of GWTG protocol on core measure outcomes.

A time-series analysis was performed to look at the time from admission to PCI. It is important that Johns Hopkins remains compliant with AHA and ACC guidelines in order to most effectively treat patients. As indicated in the Butler study, this is important because mortality increases for every 30 minutes that elapse before a patient with ST-segment elevation is recognized and treated.

Data can be analyzed with a variety of charts and graphs, importation to a spreadsheet-based tool, and statistical analysis. The tool has the ability to perform analysis and data manipulation by downloading the data into a spreadsheet. Line and bar graphs can be used to compare performance. Data can be displayed with 95% confidence intervals.

To check for completeness of data, medical records of all patients admitted with AMI can be queried monthly and compared to the GWTG database to identify any patients who were not entered in GWTG. Johns Hopkins has the ability to run reports that show all patients who were billed with an acute MI diagnosis. Completeness is important to the analysis as it adds validity to the data.

The GWTG program has the ability to highlight areas of failed performance to display problematic areas where resources can be positioned for improvement efforts. Analysis can include process mapping and process improvement directives to improve compliance with AHA guidelines.

# Results/Conclusions

There was improvement when comparing outcomes on compliance with core measure medications pre-GWTG and post-GWTG. This improvement is similar to what other hospitals that have implemented GWTG have observed. Results are displayed in the table below:

Table 1: *Core Measure Medications, Percent Given to Patients 2004-2007*

| | Pre-GWTG | | | Post-GWTG | Other GWTG Hospital |
|---|---|---|---|---|---|
| Medication | 2004 | 2005 | 2006 | 02/26/07-05/24/07 | Avg |
| Aspirin on Arrival | 92% | 94% | 98% | 100% | 98% |
| Beta Blocker on Arrival | 94% | 94% | 94% | 100% | 98% |
| Aspirin on Discharge | 99% | 97% | 100% | 100% | 98% |
| ACE/ARB on Discharge | 93% | 81% | 81% | 100% | 91% |
| Smoking Cessation Advice | 92% | 94% | 93% | 100% | 96% |
| Beta Blocker on Discharge | 99% | 99% | 99% | 100% | 97% |

The results are striking, in that there is 100% compliance on all core measure medications post-GWTG. There was no prior year when there was 100% compliance in *one* medication, let alone each of them. Additionally, Johns Hopkins compliance with core measure medications exceeds the average of the 668 hospitals that use the GWTG PMT. A caveat to the post-GWTG numbers is that the sample size was very small. Based on the extensive effort to implement the new procedures there was a limited amount of time for data collection. Therefore, the sample size was 27, compared with 378 for aspirin on discharge in 2005.

A statistical test, single-factor analysis of variance (ANOVA), was conducted to look at relationships between groups. The groups analyzed were the before GWTG year group of 2006, and the post-GWTG group of February through May, 2007. All six medication measures from Table 1 were included in each time group. The ANOVA showed a between groups p value of .403 and an F value of 4.067. The p value > .05 indicates that there is no statistical significance between the time groups. Better outcomes in 2007 for the six medication measures may be due to chance.

Despite the small sample size and the possibility that better outcomes may be due to chance, there is little denying that there has been increased compliance after the implementation of GWTG and the associated paper form. The mean percentage in Table 1 indicates the impact of the GWTG program on medication compliance. Part of the increase may be attributed to improved documentation now that the physicians must declare whether a medication is prescribed and give a reason if it is not. It is possible that in the past, physicians properly prescribed medications but did not properly document in the medical record. Additionally, the pre-GWTG numbers are based on a retrospective review of medical records for all patients who had a billing diagnosis of AMI. The post-GWTG numbers are based on a pool of patients defined by the Admission Department report as having had an AMI. There is the possibility that patients who were diagnosed with AMI after being admitted for another diagnosis may be missing from the GWTG database.

Aside from improvements based on past performance, the period under study shows that Johns Hopkins has been equal to or better than all other hospitals that use GWTG in meeting core measure medications. For the medications under study, Johns Hopkins placed in the 100 percentile for the six weeks post-GWTG implementation.

The conclusion is that the GWTG program acts as a reminder tool for physicians to prescribe medications that relate to an acute MI or give reasons for not prescribing them.

The prompts in the web-based tool, or in Johns Hopkins case, a paper form, call attention to specific medications and require that physicians answer to why a medication is not prescribed. Additionally, GWTG fosters improved documentation of contraindications for why a medication was not prescribed. The review of core measures, in the guise of a paper GWTG form, takes place in a more prospective versus retrospective manner; mistakes or omissions can be remedied while the patient is still at the hospital and physician behaviors can be corrected in a timely manner.

Aside from medications, the door-to-balloon time for a patient is expected to be reduced due to the onset of the bridge team. The belief is that the bridge team will reduce the door-to-balloon time by approximately 55 minutes. This should be accomplished through an elimination of the dead time that occurred when the patient previously remained in the ED and waited for the on-call heart attack team to arrive. Instead of waiting in the ED, the patient is transported from the ED to the Cath Lab and prepped for surgery. While results are not available yet, the expected reduction in door-to-balloon time will make Johns Hopkins a benchmark hospital and put it in the top 10 percent nationally for this critical measure. Although GWTG doesn't provide tools to directly improve this measure, it provides the ability to monitor and benchmark performance.

The GWTG program is proven; it has had success at improving core measure medication compliance at a number of different hospitals. It offers the ability to track and compare performance against other hospitals. The system is simplistic enough to be a sustainable program.

# Recommendations

The recommendation is that hospitals use the GWTG program a similar program. The GWTG program works well because it is backed by the AHA, has monthly software updates, offers the ability to run reports, and provides a model to improve documentation and compliance with established guidelines. To improve door-to-balloon time, hospitals should establish a plan of action outside of the realm of GWTG, but can use GWTG to monitor the performance of that plan.

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# Appendices

## Appendix A - Definition of Terms

ACC – American College of Cardiology

AHA – American Heart Association

AMI - Acute Myocardial Infarction. Essentially a heart attack. Myocardial infarction focuses on the heart muscle (the myocardium) and the changes that occur in it due to sudden (acute) deprivation of circulating blood. The main change is death (necrosis) of myocardial tissue. The interruption of blood is usually caused by arteriosclerosis with narrowing of the coronary arteries, the culminating event being a thrombosis (clot). The word "infarction" comes from the Latin "infarcire" meaning "to plug up or cram." It refers to the clogging of the artery.

CAD – Coronary Artery Disease. Refers to the atherosclerosis that causes hardening and narrowing of the coronary arteries. Diseases caused by the reduced blood supply to the heart muscle from coronary atherosclerosis are called coronary heart diseases.

CHD – Congenital Heart Disease. A malformation of the heart or the large blood vessels near the heart. Includes heart attacks, sudden unexpected death, chest pain, abnormal heart rhythms, and heart failure due to weakening of the heart muscle. More Americans die from this than any other accident or disease.

CMS – Center for Medicare and Medicaid Services

GWTG – Get With the Guidelines. It is a hospital-based quality improvement program designed to close the treatment gap in cardiovascular disease. The program provides physicians and healthcare providers with materials, information, and tools based on AHA/ACC secondary prevention guidelines on cardiovascular disease.

PCI - Percutaneous Coronary Intervention. It is another name for angioplasty, or the surgical repair of a blood vessel, either by inserting a balloon-tipped catheter to unblock it, or by reconstructing or replacing part of the vessel.

PMT – Patient Management Tool. It is an online, interactive assessment and reporting system that helps track a hospital's performance with the Get With the Guidelines program. It provides patient-specific guideline information and enables each institution to track its adherence to the guidelines individually and against national benchmarks.

QI – Quality and Innovations Department at Johns Hopkins

# Appendix B – GWTG Data Elements

## GWTG—CAD

### CAD Data Points

- Arrival Date/Time
- Discharge Date/Time
- Transfer Status
- Payment Source
- Demographics (DOB, and Race)
- Relevant Medical History
- Smoking within the last 12 months
- Cardiac Diagnosis
- Procedures during this hospital visit
- Initial ECG
- Atrial Fib
- Thrombolytic Therapy Date/Time
- Primary PCI Date/Time
- Vital Signs (height, weight, BMI)
- Lipids
- Ejection Fraction
- LVF Assessment
- Documented LVSD
- Discharge Status
- Medications at Arrival (ACE, ASA, ARB, BB)
- Medications at Discharge (ACE, ASA, ARB, BB)
- Contraindications to Medications at Arrival
- Contraindications to Medications at Discharge
- Lipid-Lowering Medications
- Antiplatelet/Anticoagulant
- Other Meds at Discharge
- Risk Interventions

*CAD Measures*

- Percent of patients discharged on ACE inhibitors
- Percent of patients discharged on ACE inhibitors or ARBs
- Percent of AMI patients discharged on ACE inhibitors
- Percent of patients discharged on Aspirin
- Percent of patients discharged on Beta Blockers
- Percent of Current Smokers who receive Smoking Cessation Advice
- Percent of Patients who receive Statins or Lipid-Lowering Drugs
- Percent of patients with a last recorded systolic pressure <140 mmHg & diastolic pressure <90 mmHg blood pressure
- Percent of patients with a recorded LDL
- Percent of patients with LDL>100 who receive statins or lipid-lowering drugs
- Percent of patients that receive rehab or physical activity recommendations
- Percent of patients with documented LVSD discharged on ACE inhibitors
- AMI and Angina Patients without aspirin contraindications who received aspirin within 24 hours before or after hospital arrival
- AMI and Angina Patients without beta blocker contraindications who received aspirin within 24 hours before or after hospital arrival
- Mean time from arrival to administration of thrombolytic agent in patients with ST segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to hospital arrival time
- Number of patients (with ST segment elevation or left bundle branch block on the ECG performed closest to hospital arrival time) whose time from arrival to thrombolytic therapy is < 30 minutes
- Mean time from arrival to percutaneous coronary intervention (PCI) in patients with ST segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to hospital arrival time
- Number of patients (with ST segment elevation or left bundle branch block (LBBB) on the electrocardiogram (ECG) performed closest to hospital arrival time) whose time from arrival to percutaneous coronary intervention (PCI) is less than 90 minutes
- Percent of HF patients whose charts document receipt of instruction regarding activity level
- Percent of HF patients whose charts document receipt of instruction regarding diet
- Percent of HF patients whose charts document receipt of instructions regarding medications
- Percent of HF patients whose charts document receipt of instructions regarding follow-up
- Percent of HF patients whose charts document receipt of instructions regarding weight management
- Percent of HF patients whose charts document receipt of instructions regarding symptoms worsening
- The % of patients with AMI non-STEMI or percutaneous coronary intervention with Stent who are discharged on clopidogrel
- Percent of overweight patients that receive weight management and physical activity recommendations
- Percent of patients discharged on ACE inhibitors or ARBs
- Percent of AMI patients discharged on ACE inhibitors or
- ARBs
- Percent of patients with documented LVSD discharged on ACE inhibitors or ARBs

*JCAHO Measures:*

- Aspirin at Arrival
- Aspiring prescribed at discharge
- ACEI for LVSD
- Adult Smoking cessation advice/counseling
- Beta blocker prescribed at discharge
- Beta blocker at arrival
- Time to thrombolysis
- Thrombolytic agent received within 30 minutes of hospital arrival
- Time to PCI
- PCI received within 120 minutes of hospital arrival
- Inpatient Mortality

# Appendix C – AHA Guidelines for Secondary Prevention

## Aspirin at Arrival:

| | |
|---|---|
| **Period of assessment** | Within 24 hours before or after hospital arrival. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

The use of aspirin has been shown to reduce mortality with AMI.

**Corresponding Guideline(s)**

ACC/AHA STEMI Guidelines (6)

*Class I*

Aspirin should be chewed by patients who have not taken aspirin before presentation with STEMI. The initial dose should be 162 mg (Level of Evidence: A) to 325 mg (Level of Evidence: C). Although some trials have used enteric-coated aspirin for initial dosing, more rapid buccal absorption occurs with non–enteric-coated aspirin formulations.

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*

Antiplatelet therapy should be initiated promptly. Aspirin should be administered as soon as possible after presentation and continued indefinitely (Level of Evidence: A).

## Aspirin at Discharge:

| | |
|---|---|
| **Period of assessment** | Hospital discharge. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

The use of aspirin has been shown to reduce recurrent MI and death in patients surviving an initial MI.

**Corresponding Guideline(s)**

ACC/AHA STEMI Guidelines (6)

*Class I*

A daily dose of aspirin (initial dose of 162 to 325 mg orally; maintenance dose of 75 to 162 mg) should be given indefinitely after STEMI to all patients without a true aspirin allergy (Level of Evidence: A).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*

Antiplatelet therapy should be initiated promptly. Aspirin should be administered as soon as possible after presentation and continued indefinitely (Level of Evidence: A).

## Beta Blocker at Arrival:

| | |
|---|---|
| **Period of assessment** | Within 24 hours after hospital arrival. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

To reduce ventricular arrhythmias, recurrent ischemia, reinfarction, and if given early enough, infarct size and short-term mortality.

**Corresponding Guideline(s)**

ACC/AHA STEMI Guidelines (6)

*Class I*

Oral beta-blocker therapy should be administered promptly to those patients without a contraindication, irrespective of concomitant fibrinolytic therapy or performance of primary PCI (Level of Evidence: A).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*

A beta-blocker, with the first dose administered intravenously if there is ongoing chest pain, followed by oral administration, in the absence of contraindications (Level of Evidence: B).

## Beta Blocker at Discharge:

| | |
|---|---|
| **Period of assessment** | Hospital discharge. |
| **Source of data** | Administrative data and medical records. |

**Rationale**

Reduction in recurring events and long-term mortality.

**Corresponding Guideline(s)**

ACC/AHA STEMI Guidelines (6)

*Class I*

All patients after STEMI except those at low risk (normal or near-normal ventricular function, successful reperfusion, absence of significant ventricular arrhythmias) and those with contraindications should receive beta-blocker therapy. Treatment should begin within a few days of the event, if not initiated acutely, and continue indefinitely (Level of Evidence: A).

*Class IIa*

It is reasonable to prescribe beta-blockers to low-risk patients after STEMI who have no contraindications to that class of medications (Level of Evidence: A).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*

Beta-blockers in the absence of contraindications (Level of Evidence: A).

## LDL (Cholesterol) Assessment:

| | |
|---|---|
| **Period of assessment** | Inpatient admission. |
| **Source of data** | Administrative data and medical records. |

**Rationale**

Measurement of lipid levels in patients with STEMI and NSTEMI is essential to gauging the need for lipid-lowering therapy and/or dietary modification and assessing the risk of subsequent coronary events.

**Corresponding Guideline(s)**

AHA/ACC Guidelines for Preventing Heart Attack and Death in Patients With Atherosclerotic Cardiovascular Disease: 2001 Update (8)
Assess fasting lipid profile in all patients, and within 24 hours of hospitalization for those with an acute event.

ACC/AHA STEMI Guidelines (6)

*Class I*

A lipid profile should be performed, or obtained from recent or past records, for all STEMI patients, preferably after they have fasted and within 24 hours of symptom onset (Level of Evidence: C).

## Lipid-Lowering Therapy at Discharge:

| | |
|---|---|
| **Period of assessment** | Hospital discharge. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

Multiple clinical trials have shown the benefit of lipid-lowering therapy for patients who have had an acute coronary event. Initiation of lipid-lowering therapy at discharge is preferred to enhance patient compliance with medication therapy.

**Corresponding Guideline(s)**

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*

Lipid-lowering agents and diet in post-acute coronary syndrome patients, including post-revascularization patients, with LDL-c greater than 130 mg/dl (Level of Evidence: A).

Lipid-lowering agents if LDL-c level after diet is greater than 100 mg/dl (Level of Evidence: B).

ACC/AHA STEMI Guidelines (6)

*Class I*

The target LDL-c level after STEMI should be substantially less than 100 mg/dl. Patients with LDL-c 100 mg/dl or above should be prescribed drug therapy on discharge, with preference given to statins (Level of Evidence: A).

## ACEI or ARB at Discharge:

| | |
|---|---|
| **Period of assessment** | Hospital discharge. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

ACEIs have been shown to reduce mortality rates for patients with AMI (or who recently had an MI) and have LVSD (9–13). Benefit has been greatest for those with anterior MI and those with greater LV dysfunction (LVEF <0.40). Benefit also has been shown in diabetic patients with LV dysfunction (14). Current guidelines (5,6) recommend (Class I designation) in-hospital initiation (within 24 hours) and outpatient continuation indefinitely.

The use of ARBs post-STEMI has not been as thoroughly explored as ACEIs in STEMI patients. The OPTIMAAL trial found no significant differences between losartan (target dose 50 mg once daily) and captopril (target dose 50 mg three times daily) in all-cause mortality (15); there was a trend toward better outcome with captopril. The VALIANT trial compared the effects of captopril (target dose 50 mg three times daily), valsartan (target dose 160 mg twice daily), and the combination (captopril target dose 50 mg three times daily; valsartan target dose 80 mg twice daily) on mortality in post-MI patients with LV dysfunction (16). During a median follow-up of 24.7 months, death occurred in 19.9% of the valsartan group, 19.5% of the captopril group, and 19.3% of the combined group. Accordingly, guidelines suggest that valsartan monotherapy (target dose 160 mg twice daily) should be administered to STEMI patients who are intolerant of ACEIs and have evidence of LV dysfunction. However, guidelines also state that valsartan monotherapy can be a useful alternative to ACEIs—the decision in individual patients may be influenced by physician and patient preference, cost, and anticipated side-effect profile (6).

**Corresponding Guideline(s)**

ACC/AHA STEMI Guidelines (6)

*Class I*

An ACEI should be administered orally within the first 24 hours of STEMI to patients with an anterior MI, pulmonary congestion, or LVEF less than 0.40, in the absence of hypotension (systolic blood pressure less than 100 mm Hg or less than 30 mm Hg below baseline) or known contraindications to that class of medications (Level of Evidence: A).

An ARB should be administered to STEMI patients who are intolerant of ACEIs and who have either clinical or radiological signs of heart failure or LVEF less than 0.40. Valsartan and candesartan have established efficacy for this recommendation (Level of Evidence: C).

An ACEI should be administered orally during convalescence from STEMI in patients who tolerate this class of medication, and it should be continued over the long term (Level of Evidence: A).

An ARB should be administered to STEMI patients who are intolerant of ACEIs and have either clinical or radiological signs of heart failure or LVEF less than 0.40. Valsartan and candesartan have demonstrated efficacy for this recommendation (Level of Evidence: B).

*Class IIa*

In STEMI patients who tolerate ACEIs, an ARB can be useful as an alternative to ACEIs provided there are either clinical or radiological signs of heart failure or LVEF is less than 0.40. Valsartan and candesartan have established efficacy for this recommendation (Level of Evidence: B).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*

Long-Term Medical Therapy

ACEIs for patients with CHF, LV dysfunction (LVEF less than 0.40), hypertension, or diabetes (Level of Evidence: A).

## Smoking Cessation Counseling:

| | |
|---|---|
| **Period of assessment** | Hospital discharge. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

In patients who have undergone an acute coronary event, smoking cessation is essential to their recovery, long-term health, and the prevention of subsequent reinfarction. All STEMI and NSTEMI patients with a history of smoking should be advised to quit and offered smoking cessation resources including nicotine replacement therapy, pharmacological therapy (i.e., bupropion), and referral to behavioral counseling or support group.

**Corresponding Guideline(s)**

ACC/AHA STEMI Guidelines (6)

*Class I*

Patient counseling to maximize adherence to evidence-based post-STEMI treatments (e.g., compliance with taking medication, exercise prescription, and smoking cessation) should begin during the early phase of hospitalization, occur intensively at discharge, and continue at follow-up visits with providers and through cardiac rehabilitation programs and community support groups, as appropriate (Level of Evidence: C).

Patients recovering from STEMI who have a history of cigarette smoking should be strongly encouraged to stop smoking and to avoid secondhand smoke. Counseling should be provided to the patient and family, along with pharmacological therapy (including nicotine replacement and bupropion) and formal smoking cessation programs as appropriate (Level of Evidence: B).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*

Specific instructions should be given on the following: smoking cessation and achievement or maintenance of optimal weight, daily exercise, and diet (Level of Evidence: B).

Consider the referral of patients who are smokers to a smoking cessation program or clinic and/or an outpatient cardiac rehabilitation program (Level of Evidence: A).

## Time to Fibrinolytic (Thrombolytic) Therapy:

| | |
|---|---|
| **Period of assessment** | Within 6 hours after hospital arrival. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

There are a multitude of experimental and clinical studies that demonstrate that amount of myocardial salvage is directly related to time of fibrinolytic therapy administration. The earlier the treatment, the more myocardium is salvaged (i.e., "time is muscle"). Total time to fibrinolytic drug administration is dependent on a multitude of processes that begins on patient's arrival to the emergency department. The National Heart Attack Alert Program has chosen to focus on four D's of the overall process: Door, Data, Decision, and Delivery. The three easiest data points to measure on retrospective chart review are Door (arrival time), Data (ECG time), and Delivery (time of drug administration). Decision time can only be determined if the physician documents in the medical records the actual time that he/she gave the order for fibrinolytic drug administration. Data time only truly reflects actual data time if physician immediately reviews ECG results ("data not seen is data not done").

**Corresponding Guideline(s)**

**Door-to-Data (ECG) Time**
ACC/AHA STEMI Guidelines (6)

*Class I*
A 12-lead ECG should be performed and shown to an experienced emergency physician within 10 min of emergency department arrival for all patients with chest discomfort (or anginal equivalent) or other symptoms suggestive of STEMI (Level of Evidence: C).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*
A 12-lead ECG should be obtained immediately (within 10 min) in patients with ongoing chest discomfort and as rapidly as possible in patients who have a history of chest discomfort consistent with acute coronary syndrome but whose discomfort has resolved by the time of evaluation (Level of Evidence: C).

**Data-to-Decision Time**
No ACC/AHA Guideline Recommendations

**Decision-to-Delivery Time**
No ACC/AHA Guideline Recommendations

**Door-to-Delivery (fibrinolytic drug administration) Time**
ACC/AHA STEMI Guidelines (6)

*Class I*
The delay from patient contact with the health care system (arrival at the emergency department or contact with paramedics) to initiation of fibrinolytic therapy should be less than 30 min. Alternatively, if PCI is chosen, the delay from patient contact with the health care system (typically, arrival at the emergency department or contact with paramedics) to balloon inflation should be less than 90 min (Level of Evidence: B).
ACC/AHA Indications for Fibrinolytic Therapy–ST-Segment Elevation Cohort

ACC/AHA STEMI Guidelines (6)

*Class I*
All STEMI patients should undergo rapid evaluation for reperfusion therapy and have a reperfusion strategy implemented promptly after contact with the medical system (Level of Evidence: A).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*
Patients with definite acute coronary syndrome and ST-segment elevation should be evaluated for immediate reperfusion therapy (Level of Evidence: A).
ACC/AHA Indications for Fibrinolytic Therapy–LBBB Cohort

ACC/AHA STEMI Guidelines (6)

*Class I*
In the absence of contraindications, fibrinolytic therapy should be administered to STEMI patients with symptom onset within the prior 12 hours and new or presumably new LBBB (Level of Evidence: A).

## Time to PCI:

| | |
|---|---|
| **Period of assessment** | Within 24 hours after hospital arrival. |
| **Sources of data** | Administrative data and medical records. |

**Rationale**

The role of primary angioplasty in STEMI patients presenting to the emergency department with contraindications to fibrinolytic therapy is clear. Likewise, it is well-established that emergency PCI is more effective than fibrinolytic therapy in centers in which PCI can be performed by experienced personnel in a timely fashion. What is debatable is the utility of primary angioplasty in the typical community hospital. Since fibrinolytic therapy can be administered in most centers within 30 to 60 min of arrival, and since fibrinolytic therapy usually opens the occluded artery within 60 to 90 min, this equates to reperfused artery in 90 to 150 min after emergency department arrival in patients with STEMI treated with fibrinolytic therapy. Since "time is muscle," there obviously has to be a time from arrival until balloon insufflation in which the benefits of PCI are lost due to excess myocardial death that would have been spared had fibrinolytic therapy been administered. Thus, it is imperative to continually strive to improve door-to-balloon times such that the benefits of PCI are not lost from the excess cell death due to delays in opening occluded vessel.

**Corresponding Guideline(s)**

**Door-to-Data (ECG) Time**
ACC/AHA STEMI Guidelines (6)

*Class I*
A 12-lead ECG should be performed and shown to an experienced emergency physician within 10 min of emergency department arrival for all patients with chest discomfort (or anginal equivalent) or other symptoms suggestive of STEMI (Level of Evidence: C).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*
A 12-lead ECG should be obtained immediately (within 10 min) in patients with ongoing chest discomfort and as rapidly as possible in patients who have a history of chest discomfort consistent with acute coronary syndrome but whose discomfort has resolved by the time of evaluation (Level of Evidence: C).

**Data-to-Decision Time**
No ACC/AHA Guideline Recommendations

**Decision-to-Delivery Time**
No ACC/AHA Guideline Recommendations

**Door-to-Delivery Time (primary PCI)**
ACC/AHA STEMI Guidelines (6)

*Class I*

The delay from patient contact with the health care system (arrival at the emergency department or contact with paramedics) to initiation of fibrinolytic therapy should be less than 30 min. Alternatively, if PCI is chosen, the delay from patient contact with the health care system (typically, arrival at the emergency department or contact with paramedics) to balloon inflation should be less than 90 min (Level of Evidence: B).

ACC/AHA Indications for Primary PCI
ACC/AHA STEMI Guidelines (6)

*Class I*
All STEMI patients should undergo rapid evaluation for reperfusion therapy and have a reperfusion strategy implemented promptly after contact with the medical system (Level of Evidence: A).
The delay from patient contact with the health care system (arrival at the emergency department or contact with paramedics) to initiation of fibrinolytic therapy should be less than 30 min. Alternatively, if PCI is chosen, the delay from patient contact with the health care system (typically, arrival at the emergency department or contact with paramedics) to balloon inflation should be less than 90 min (Level of Evidence: B).

ACC/AHA UA/NSTEMI Guidelines (5)

*Class I*
Patients with definite acute coronary syndrome and ST-segment elevation should be evaluated for immediate reperfusion therapy (Level of Evidence: A).

LBBB Cohort
ACC/AHA STEMI Guidelines (6)

*Class I*
If immediately available, primary PCI should be performed in patients with STEMI (including true posterior MI) or MI with new or presumably new LBBB who can undergo PCI of the infarct artery within 12 hours of symptom onset, if performed in a timely fashion (balloon inflation within 90 min of presentation) by persons skilled in the procedure (individuals who perform more than 75 PCI procedures per year). The procedure should be supported by experienced personnel in an appropriate laboratory environment (performs more than 200 PCI procedures per year, of which at least 36 are primary PCI for STEMI, and has cardiac surgery capability) (Level of Evidence: A).

# Appendix D – Data Collection Sheet

**Patient History #:** ____________________ **Patient Name:** ____________________ **Date of Birth:** ___________

**Arrival Date/Time:** ________________________ **Discharge Date/Time:** ______________________

**Cardiac Diagnosis:** ☐ AMI – STEMI ☐ AMI – non-STEMI
**Left Ventricular Systolic Dysfunction (LVSD)?** ☐ Yes ☐ No
**Ejection Fraction (EF) =** ______%
**Low Density Lipoprotein (LDL) =** ______mg/dl

**Aspirin (ASA) given within 24 hours of arrival?** ☐ Yes ☐ No
If No, then check the appropriate box below:
☐ Warfarin/Coumadin as pre-arrival medication ☐ ASA allergy
☐ Active bleeding on arrival or within 24 hrs after arrival ☐ Other - must be documented in medical record

**Beta blocker (BB) given within 24 hours of hospital arrival?** ☐ Yes ☐ No
If No, then check the appropriate box below:
☐ BB allergy ☐ Bradycardia HR < 60 bpm on arrival or within 24 hrs after arrival while not on a BB
☐ Heart failure on arrival or 24 hrs after arrival
☐ 2nd or 3rd degree HB on EKG on arrival or within 24 hrs after arrival and does not have a pacemaker
☐ Shock on arrival or within 24 hrs after arrival ☐ Other - must be documented in medical record

**Discharge Status:** ☐ Discharge home ☐ Discharge/Trans to another hospital ☐ Other:________________

**ASA prescribed at discharge?** ☐ Yes ☐ No
If No, then check the appropriate box below:
☐ ASA allergy ☐ Bleeding on admission ☐ Bleeding during hospitalization ☐ On NSAID*
☐ Warfarin/Coumadin prescribed at discharge ☐ Anemia* ☐ Acute upper GI disorder*
☐ History of peptic ulcer disease* ☐ Renal insufficiency* ☐ Other - must be documented in medical record

**Angiotension Converting Enzyme Inhibitor (ACE-I) prescribed at discharge?** ☐ Yes ☐ No
If No, then check the appropriate box below:
☐ ACE-I allergy ☐ Patient is discharged on hydralazine/nitrate therapy* ☐ Hypotension*
☐ Moderate or severe aortic stenosis ☐ Worsening renal function* ☐ Hyperkalemia*
☐ Bilateral renal artery stenosis* ☐ Pregnancy*
☐ Other - must be documented in medical record

**Angiotension Receptor Blocker (ARB) prescribed at discharge?** ☐ Yes ☐ No
If No, then check the appropriate box below:
☐ ARB allergy ☐ Patient is discharged on hydralazine/nitrate therapy* ☐ Hypotension*
☐ Moderate or severe aortic stenosis ☐ Worsening renal function* ☐ Hyperkalemia*
☐ Bilateral renal artery stenosis* ☐ Pregnancy*
☐ Other - must be documented in medical record

**Beta-blocker prescribed at discharge?** ☐ Yes ☐ No
If No, then check the appropriate box below:
☐ BB allergy ☐ Bradycardia (HR < 60 bpm on day of discharge or day prior to dc while not on a BB)
☐ 2nd or 3rd degree heart block on EKG on arrival or during hospital stay & does not have a pacemaker
☐ Asthma/severe reactive airway disease* ☐ Symptomatic hypotension*
☐ Other - must be documented in medical record

**Lipid lowering agent prescribed at discharge?** ☐ Yes ☐ No
If No, then check the appropriate box below:
☐ Allergy to lipid lowering agents ☐ Has not tolerated lipid lowering agents in the past
☐ History of or current liver disease ☐ Substantial alcohol consumption
☐ Renal insufficiency/failure ☐ Other - must be documented in medical record

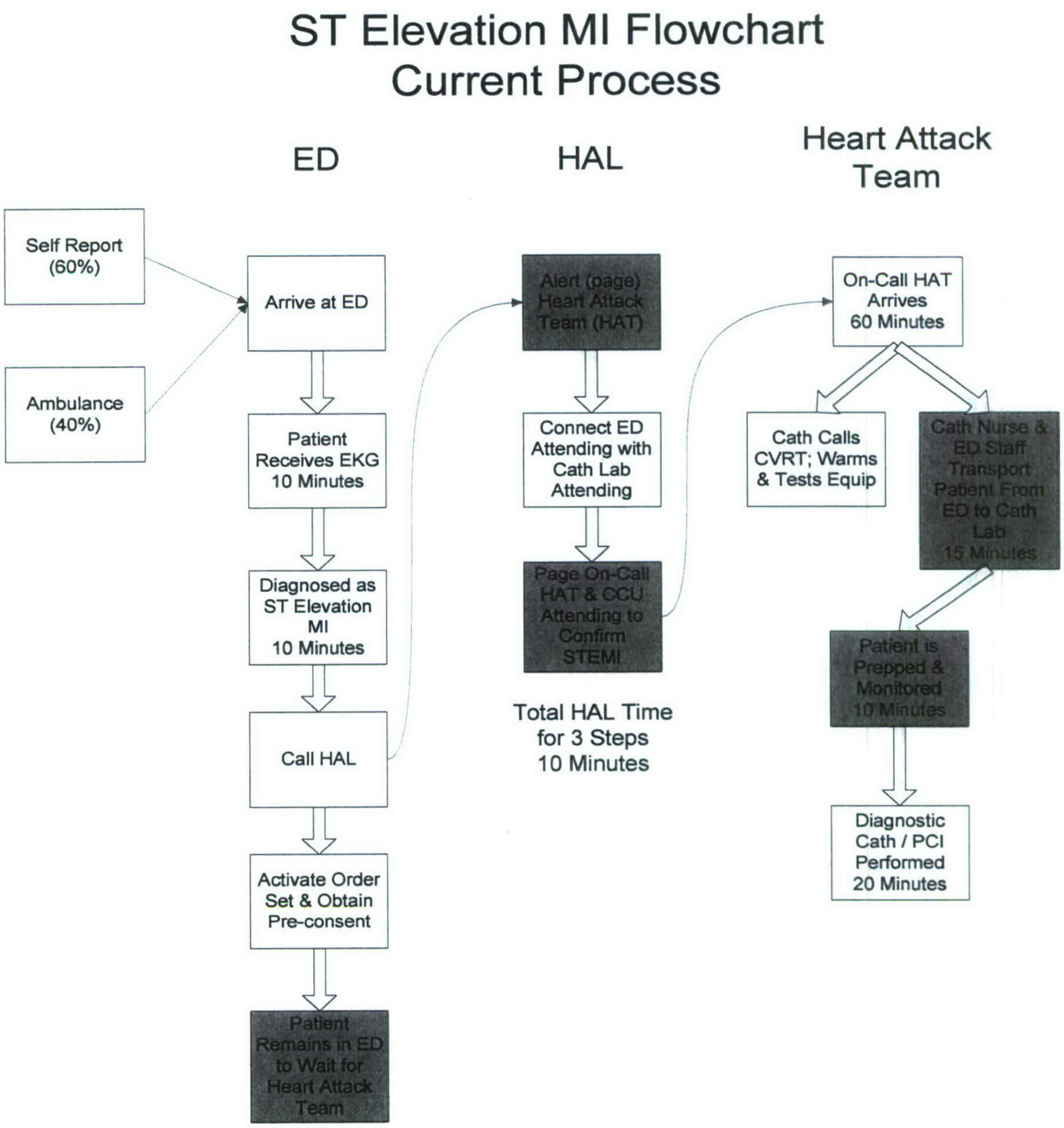
**History of Cigarette Smoking (in past 12 months)?** ☐ Yes ☐ No
**Smoking Cessation Counseling Given (if smoked in past 12 months):** ☐ Yes ☐ No

* = items need documentation in the medical record that links to the reason why a medication is not prescribed

Form Completed by (signature/title/ID#): ________________________________ Date: ___________

Form Completed by (signature/title/ID#): ________________________________ Date: ___________

## Appendix E – JHH STEMI Process Prior to Bridge Team

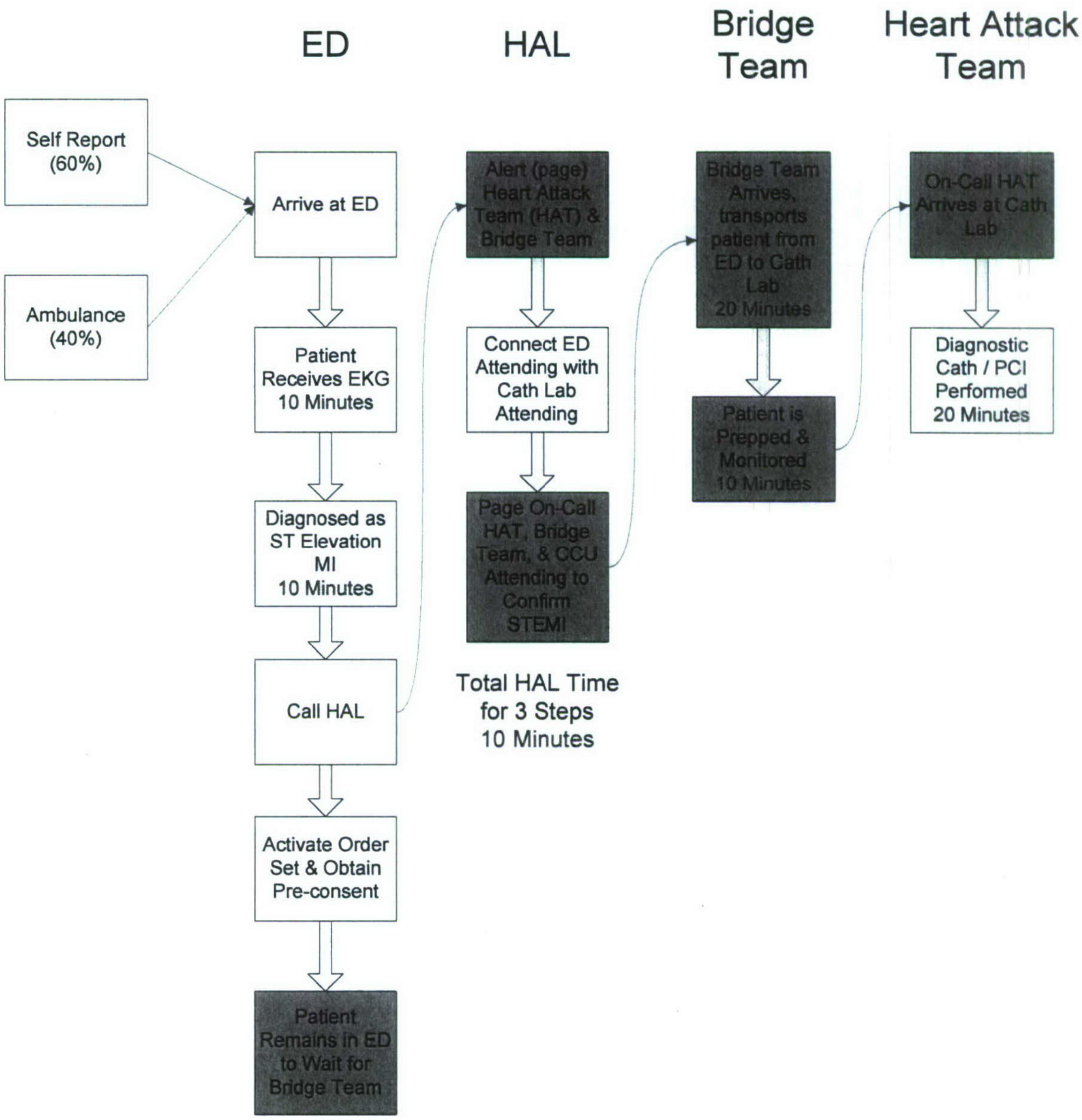



Total Door-to-Balloon Time = 135 Minutes

Note: Green indicates that the process will change under the proposed bridge team

## Appendix F – JHH STEMI Process After Use of Bridge Team

# ST Elevation MI Flowchart
# Process Utilizing Bridge Team




## Total Door-to-Balloon Time = 80 Minutes

Note: Green indicates process modification from existing process
It will still take 60 minutes for HAT to arrive. However, all prep work will be completed prior to its arrival and patient will be ready for PCI