Improving Quality of Care for Acute Myocardial Infarction
The Guidelines Applied in Practice (GAP) Initiative

Rajendra H. Mehta, MD, MS
Cecelia K. Montoye, MSN
Meg Gallogly, BA
Patricia Baker, MS
Angela Blount, MPH
Jessica Faul, MPH
Canopy Roychoudhury, PhD
Steven Borzak, MD
Susan Fox, MSN
Mary Franklin, CNS
Marge Freundl, MSN
Eva Kline-Rogers, MSN
Thomas LaLonde, MD
Michele Orza, ScD
Robert Parrish, MM
Martha Satwicz, MSN
Mary Jo Smith, MSN, MPH
Paul Sobotka, MD
Stuart Winston, DO
Arthur A. Riba, MD
Kim A. Eagle, MD
for the GAP Steering Committee of the American College of Cardiology

**Context** Quality of care of patients with acute myocardial infarction (AMI) has received intense attention. However, it is unknown if a structured initiative for improving care of patients with AMI can be effectively implemented at a wide variety of hospitals.

**Objective** To measure the effects of a quality improvement project on adherence to evidence-based therapies for patients with AMI.

**Design and Setting** The Guidelines Applied in Practice (GAP) quality improvement project, which consisted of baseline measurement, implementation of improvement strategies, and remeasurement, in 10 acute-care hospitals in southeast Michigan.

**Patients** A random sample of Medicare and non-Medicare patients at baseline (July 1998–June 1999; n=735) and following intervention (September 1–December 15, 2000; n=914) admitted at the 10 study centers for treatment of confirmed AMI. A random sample of Medicare patients at baseline (January–December 1998; n=513) and at remeasurement (March–August 2001; n=388) admitted to 11 hospitals that volunteered, but were not selected, served as a control group.

**Intervention** The GAP project consisted of a kickoff presentation; creation of customized, guideline-oriented tools designed to facilitate adherence to key quality indicators; identification and assignment of local physician and nurse opinion leaders; grand rounds site visits; and premeasurement and postmeasurement of quality indicators.

**Main Outcome Measures** Differences in adherence to quality indicators (use of aspirin, β-blockers, and angiotensin-converting enzyme [ACE] inhibitors at discharge; time to reperfusion; smoking cessation and diet counseling; and cholesterol assessment and treatment) in ideal patients, compared between baseline and postintervention samples and among Medicare patients in GAP hospitals and the control group.

**Results** Increases in adherence to key treatments were seen in the administration of aspirin (81% vs 87%; \(P=0.02\)) and β-blockers (65% vs 74%; \(P=0.04\)) on admission and use of aspirin (84% vs 92%; \(P=0.002\)) and smoking cessation counseling (53% vs 65%; \(P=0.02\)) at discharge. For most of the other indicators, nonsignificant but favorable trends toward improvement in adherence to treatment goals were observed. Compared with the control group, Medicare patients in GAP hospitals showed a significant increase in the use of aspirin at discharge (5% vs 10%; \(P<0.001\)). Use of aspirin on admission, ACE inhibitors at discharge, and documentation of smoking cessation also showed a trend for greater improvement among GAP hospitals compared with control hospitals, although none of these were statistically significant. Evidence of tool use noted during chart review was associated with a very high level of adherence to most quality indicators.

**Conclusions** Implementation of guideline-based tools for AMI may facilitate quality improvement among a variety of institutions, patients, and caregivers. This initial project provides a foundation for future initiatives aimed at quality improvement.

JAMA. 2002;287:1269-1276
www.jama.com

©2002 American Medical Association. All rights reserved.
ported that quality of care for Medicare beneficiaries with AMI was far from optimal.2 Many subsequent studies have shown similar disappointing adherence to the therapies recommended in published guidelines.3-6 Furthermore, quality of care of patients with AMI varies with age, sex, race, geographic location, physician specialty, and hospital teaching status.7,3,7-16 This variation in care is likely linked to outcomes.11,13,17 Although recent analyses of care patterns over time have suggested steady improvement in the use of key therapies in patients with AMI,18,19 there remain important opportunities to improve adherence to evidence-based therapies.3,5-20

In this report, we describe the initial impact of the Guidelines Applied in Practice (GAP) initiative of the American College of Cardiology (ACC) in southeast Michigan. Conceptually, the program sought to incorporate national guidelines into care processes, focused on both caregivers (physicians and nurses) and patients, in part by creating tools and systems that reinforce adherence to key evidence-based therapies.

METHODS

The GAP Project

The ACC developed the project’s purpose, timeline, clinical topic, site partner, interventions, and project design. The Southeast Michigan Heart Consortium was selected for the pilot GAP project on the basis of its commitment to quality improvement and excellence in practice. The consortium consists of 31 hospitals with a diverse patient population from which a representative sample of hospitals could be selected.

The Interventions, Tool Kit, and Project Implementation

The GAP Project was a multifaceted intervention that consisted of a project kickoff presentation, creation and implementation of a customized tool kit based on ACC/AHA (American Heart Association) national guidelines, identification and assignment of local physician and nurse opinion leaders, “grand rounds” site visits, and premeasurement and postmeasurement of quality indicators. The indicators used to assess quality are shown in Table 2. The project was characterized by an extremely rapid timeline, and the entire project was implemented in a single calendar year (Figure 1). The data were analyzed in January and February 2001, and the results presented in March.

The GAP tool kit (created based on national guidelines) consisted of 7 critical components: (1) AMI standard order, (2) clinical pathway, (3) pocket guide/pocket card, (4) patient information form, (5) patient discharge form, (6) chart stickers, and (7) hospital performance charts. Versions of

<table>
<thead>
<tr>
<th>Table 1. Hospital Characteristics in the GAP Project*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital Characteristics</strong></td>
</tr>
<tr>
<td>Teaching hospital</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Volume‡</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Facility for cardiac catheterization and CABG surgery</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Predominantly osteopathic</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Hospitals with &gt;10% minority patients with AMI discharged per year</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

*GAP indicates Guidelines Applied in Practice; CABG, coronary artery bypass graft; and AMI, acute myocardial infarction. †The 1 other hospital that volunteered for the GAP project but was not part of the Southeast Michigan Hospital Profiling Project (SEMHPP) was a nonteaching, small-volume hospital with no cardiac catheterization facility. ‡Large volume indicates hospitals with more than 400 Medicare patients with AMI discharged per year; moderate volume, between 250 and 400 such patients; and small volume, fewer than 250 such patients.
these tools had already been used successfully at several southeast Michigan hospitals21,22 (the GAP tool kits are available at: http://www.acc.org). Each GAP hospital was assigned one physician and one nurse leader from outside the hospital system from the Southeast Michigan Quality Forum to serve as opinion leaders. They assisted in the development of quality improvement plans, tool kit customization, and project implementation. The project was initiated at each hospital with a grand rounds that introduced the project protocol, and presented the hospital's baseline quality indicator performance as compared with the state average and the aggregate of other GAP hospitals. Mechanisms for disseminating the tools, evaluating processes of care, and data collection and analysis were also discussed.

**Study Sample**

The baseline sample was identified using claims with the International Classification of Diseases, Ninth Revision, Clinical Modification principal discharge diagnosis code for AMI between July 1, 1998, and June 30, 1999. Data were abstracted from 2 groups: cases with Medicare as their primary insurance (Medicare group) and patients not having Medicare as their primary insurance (non-Medicare group). The sample size was calculated following the determination of a target level of improvement by the project’s physician leaders for each quality indicator (Table 2). Medicare baseline cases were identified from filed CMS beneficiary claims data while non-Medicare baseline patients were found from individual hospital discharge databases. A 21% random sample and a 40-case minimum of baseline Medicare cases were selected from each hospital. The non-Medicare sample consisted of an 11.5% random sample and a minimum of 25 cases per hospital. Of 2588 Medicare and 1872 non-Medicare cases, 537 and 254 cases were abstracted, respectively. Patients without a confirmed AMI and those with codes that designated a subsequent episode of care were excluded from the study sample, leaving 735 patients to constitute the baseline sample. Additional indicator-specific inclusion and exclusion criteria were applied so that only “ideal” patients (ie, those without any absolute or relative contraindication for that specific indicator) remained in the denominators.2,19

Cases discharged between September 1 and December 15, 2000, with the same inclusion and exclusion criteria were eligible for remeasurement. Cases for both Medicare and non-Medicare groups were identified from individual hospitals. All Medicare cases discharged from the hospital with a valid beneficiary claim during the remeasurement period were sampled. For non-Medicare cases, a 57.5% sample was selected with 25 minimum cases per hospital. For remeasurement, 771 Medicare and 313 non-Medicare charts were abstracted, and after exclusions as noted above 914 patients remained in the postintervention sample. As in the baseline, additional inclusion and exclusion criteria were applied at the indicator level.2,19

**Control Group**

Thirty of the 31 hospitals in southeast Michigan were originally participants in the Southeast Michigan Profiling Project (SEMHPP), a cooperative quality improvement initiative with the MPRO. This included 10 hospitals selected for GAP and 11 of 12 hospitals that volunteered for GAP but were not selected (non-GAP hospitals). The impetus for the SEMHPP was hospitals’ need for performance data to be used for public profiling by the Southeast Michigan Employer and Purchaser Consortium. After receiving baseline reports (1/1/98–12/31/98), hospitals were asked to submit improvement plans including details of indicators to be addressed and planned actions to change processes of care. Hospitals were encouraged to implement or up-

---

**Table 2. Quality Indicators for AMI and Their Targeted Improvement Levels**

<table>
<thead>
<tr>
<th>Quality Indicator</th>
<th>Targeted Improvement Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early indicators</td>
<td></td>
</tr>
<tr>
<td>Aspirin within 24 h, %</td>
<td>95</td>
</tr>
<tr>
<td>β-Blocker within 24 h, %</td>
<td>78</td>
</tr>
<tr>
<td>Time to thrombolysis, median, min</td>
<td>30</td>
</tr>
<tr>
<td>Time to PTCA, median, min</td>
<td>60-120</td>
</tr>
<tr>
<td>LDL cholesterol measurement within 24 h</td>
<td>NA†</td>
</tr>
<tr>
<td>Late indicators</td>
<td></td>
</tr>
<tr>
<td>Aspirin at discharge, %</td>
<td>95</td>
</tr>
<tr>
<td>β-Blocker at discharge, %</td>
<td>87</td>
</tr>
<tr>
<td>ACE inhibitor at discharge, %</td>
<td>78</td>
</tr>
<tr>
<td>Smoking cessation counseling, %</td>
<td>75</td>
</tr>
<tr>
<td>Cholesterol-lowering therapy at discharge</td>
<td>NA†</td>
</tr>
<tr>
<td>Dietary counseling</td>
<td>NA†</td>
</tr>
</tbody>
</table>

*Only “ideal” patients were considered for each of the measures. AMI indicates acute myocardial infarction; early indicators, those instituted with 24 hours of admission; PTCA, percutaneous transluminal coronary angioplasty; ACE, angiotensin-converting enzyme; LDL, low-density lipoprotein; and late indicators, those instituted at discharge or after.
†Indicator under development and review in the Center for Medicare and Medicaid Services’ Sixth Scope of Work.

**Figure 1. The Guidelines Applied in Practice (GAP) Timeline**

[Diagram of the GAP Timeline with milestones such as Project Kickoff, Individual Kickoff, Project Implementation, Data Analysis, Hospital Remeasurement, and Presentation.]
date standing orders, care pathways, and discharge forms to include all components of AMI care with the intent of improving quality of care for patients with AMI. The hospitals responded variably by implementing improvement strategies to improve 1 or more indicators using different hospital-specific strategies.

Remeasurement data for the SEMHPP was collected from these hospitals between March 1 and August 31, 2001. These baseline (n = 513) and remeasurement (n = 388) SEMHPP data of Medicare patients from the 11 hospitals (Table 1) were used to provide control data.

Data Collection
Medical records for each sampled hospitalization were forwarded to a clinical data abstraction center. Data were systematically collected for each hospitalization, including patient medical history, symptoms on arrival, electrocardiographic examination, in-hospital treatment and events, and discharge treatment and disposition. The data abstraction tools used for the GAP and the SEMHPP (control group) projects were the same except for modifications made to abstract information about tool use for GAP hospitals. For quality assurance purposes, data were reabstracted for a random sample of both baseline and remeasurement records (4%) by the clinical data abstraction center. There was an overall reliability of 93.2% (original abstracted data vs reabstracted data) and an accuracy rate of 96.5% (both original abstracted data and reabstracted data compared with criterion standard data) for the 289 variables in the abstraction module. Quality of care was assessed by measuring the use of key indicators in “ideal” patients as reported in previous studies (Table 2). Four other test indicators, i.e., indicators that are under development and review, were also evaluated (Table 2).

Statistical Analysis
Data analyses were performed using the same algorithm as the one used for CMS's current national AMI quality indicators. Abstracted data were analyzed to confirm the presence of an AMI based on elevated cardiac biomarker(s) and/or electrocardiographic analyses, and/or presence of chest pain within 48 hours of arrival as reported by earlier studies. Sample comparisons were made using a 2-tailed binomial test for proportions, a \( \chi^2 \) test for categorical variables, and a paired \( t \) test or Wilcoxon rank sum test for continuous variables. Each quality indicator baseline rate was compared to the remeasurement rate for “ideal” cases at the aggregate and individual hospital level. The baseline and remeasurement data for Medicare patients from GAP were compared with data from Medicare patients with AMI in the control group collected as a part of SEMHPP. Additional analyses were performed to examine the effect of the intervention in Medicare and non-Medicare patients, and in different age, sex, and racial groups among the GAP hospitals. Tool-specific analyses were also conducted. The effect of tool use, based on the tool's presence or reference in the chart, was correlated between adherence to the early indicators and the AMI standard orders, and between quality indicators at discharge and the AMI patient discharge forms. All \( P \) values were 2-tailed with an \( \alpha \) of .05. SAS version 6.12 (SAS Institute Inc, Cary, NC) was used for all statistical analyses.

RESULTS
Demographics, Past Medical History, and Clinical Presentations
Overall, 1649 patients were studied, including 735 from the baseline period (pre-GAP interventions) and 914 from the post-GAP period. Most demographics and clinical characteristics of the 2 patient populations were similar (Table 3). Also, most of the demographics and clinical characteristics of the baseline and remeasurement for the Medicare patients in the SEMHPP (control group) were similar (Table 3).

Change in Performance: Impact of GAP
Overall Change in Quality of Care. Significant increases in overall adherence to key treatments were observed in the administration of aspirin and \( \beta \)-blockers at admission and in the administration of aspirin and smoking cessation counseling at discharge (Figure 2A and C). For virtually all other quality indicators, nonsignificant but favorable trends toward improvement in adherence to quality indicators were observed (Figure 2A, B, and C). No substantive effect on time to reperfusion in ST-segment-elevation AMI was observed. However, a small sample size precluded meaningful analyses and interpretation of the change in this indicator.

As compared to the SEMHPP (control) patients, the Medicare GAP cohort showed a significant improvement in the use of aspirin at discharge (5% vs 10%, \( P < .001 \)). The improvement in the administration of early aspirin, \( \beta \)-blocker at discharge, and documentation of smoking cessation counseling tended to be higher (albeit nonsignificantly) in the GAP Medicare cohort vs the control group (Table 4).

Change in Quality of Care Among Different Insurance Types, Age Groups, Sex, and Race. Although both Medicare and non-Medicare patients demonstrated favorable effects of GAP interventions, improvement in various performance measures were more apparent in the Medicare population compared with the non-Medicare population but no statistically significant interaction was found. As a result of the interventions, the baseline gap in the performance measures between the non-Medicare and Medicare population was narrowed in the remeasurement phase. Similarly, the impact of the intervention tended to be more pronounced in very elderly patients (75 years or older) as opposed to a younger cohort (younger than 75 years). The benefit of improvement in overall adherence to performance measures was more apparent in women. Furthermore, the intervention was effective in equalizing the adherence to most quality indicators in white and nonwhite patients. However, because of lack of power for subgroup analysis, the trends of improvement in
these different subgroups did not reach statistical significance.

**Tool Use**

Evidence of tool use was identified on chart review in approximately one quarter of abstracted charts in terms of use of AMI-specific standard admission orders (26.0%), clinical pathways (27.2%), and AMI-specific discharge forms (23.7%). Evidence of the remaining GAP tools (patient information forms, chart stickers) in the charts was identified less frequently than for the 3 tools listed above.

When there was evidence that AMI standard orders were used, a significant improvement in adherence to performance measures was seen in the early administration of aspirin and in the early measurement of low-density lipoprotein cholesterol, and there was a nonsignificant trend for improvement in the early use of β-blockers (FIGURE 3A, Table 4). Similarly, evidence that

---

**Table 3.** Demographics: Medicare (GAP and SEMHPP) and Non-Medicare (GAP) Patients*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>GAP Non-Medicare (n = 220)</th>
<th>GAP Medicare (n = 515)</th>
<th>SEMHPP Medicare (n = 513)</th>
<th>GAP Non-Medicare (n = 251)</th>
<th>GAP Medicare (n = 663)</th>
<th>SEMHPP Medicare (n = 388)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>61 (27.7)</td>
<td>265 (51.5)</td>
<td>272 (53.0)</td>
<td>78 (31.1)</td>
<td>331 (49.9)</td>
<td>210 (54.1)</td>
</tr>
<tr>
<td>Nonwhite</td>
<td>36 (16.4)</td>
<td>112 (21.7)</td>
<td>83 (16.2)</td>
<td>37 (14.7)</td>
<td>158 (23.8)</td>
<td>71 (18.3)</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td>55.3 (11.6)</td>
<td>76.2 (9.0)</td>
<td>77.5 (10.1)</td>
<td>56 (11.2)</td>
<td>75.6 (10.0)</td>
<td>77 (10.2)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>122 (55.5)</td>
<td>368 (71.5)</td>
<td>359 (70.0)</td>
<td>155 (61.8)</td>
<td>517 (78.0)</td>
<td>322 (82.9)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>58 (26.4)</td>
<td>177 (34.4)</td>
<td>181 (35.3)</td>
<td>67 (26.7)</td>
<td>238 (35.9)</td>
<td>143 (36.9)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>113 (51.4)</td>
<td>95 (18.5)</td>
<td>73 (14.2)</td>
<td>123 (49.0)</td>
<td>137 (20.7)</td>
<td>73 (18.8)</td>
</tr>
<tr>
<td>Prior AMI</td>
<td>65 (29.6)</td>
<td>221 (42.9)</td>
<td>189 (36.8)</td>
<td>73 (29.1)</td>
<td>315 (47.5)</td>
<td>201 (51.8)</td>
</tr>
<tr>
<td>Prior CHF</td>
<td>29 (13.2)</td>
<td>171 (33.2)</td>
<td>158 (30.8)</td>
<td>24 (9.6)</td>
<td>222 (33.5)</td>
<td>169 (43.6)</td>
</tr>
<tr>
<td>Prior CABG</td>
<td>29 (13.2)</td>
<td>97 (18.8)</td>
<td>77 (15.0)</td>
<td>25 (10.0)</td>
<td>131 (19.8)</td>
<td>69 (17.8)</td>
</tr>
<tr>
<td>Prior PTCA</td>
<td>39 (17.7)</td>
<td>81 (15.7)</td>
<td>53 (10.3)</td>
<td>43 (17.1)</td>
<td>127 (19.2)</td>
<td>58 (14.9)</td>
</tr>
<tr>
<td>Prior stroke</td>
<td>17 (7.7)</td>
<td>97 (18.8)</td>
<td>104 (20.3)</td>
<td>15 (6.0)</td>
<td>126 (19.0)</td>
<td>99 (25.5)</td>
</tr>
<tr>
<td>SBP &gt;160 mm Hg or DBP &gt;100 mm Hg</td>
<td>122 (55.5)</td>
<td>368 (71.5)</td>
<td>359 (70.0)</td>
<td>155 (61.8)</td>
<td>517 (78.0)</td>
<td>322 (82.9)</td>
</tr>
<tr>
<td>Heart rate &gt;100/min</td>
<td>36 (16.4)</td>
<td>152 (29.5)</td>
<td>157 (30.6)</td>
<td>46 (18.3)</td>
<td>170 (25.6)</td>
<td>121 (31.2)</td>
</tr>
</tbody>
</table>

*GAP indicates Guidelines Applied in Practice; SEMHPP, Southeast Michigan Hospital Profiling Project; AMI, acute myocardial infarction; CHF, congestive heart failure; CABG, coronary artery bypass graft; PTCA, percutaneous transluminal coronary angioplasty; SBP, systolic blood pressure; and DBP, diastolic blood pressure.

---

**Figure 2.** Overall Effects of the Guidelines in Applied Practice (GAP) Intervention on Early (A, B) and Late (C) Quality Indicators

- **A** Early Indicators (Aggregate)
- **B** Late Indicators (Aggregate)

**Legend:**
- Preintervention
- Postintervention

LDL indicates low-density lipoprotein cholesterol measured in hospital; Thrombolysis, time to thrombolytic administration in minutes; PTCA, time to primary percutaneous transluminal coronary angioplasty in minutes; ACE, angiotensin-converting enzyme inhibitor given at discharge; and Smoking, smoking cessation advice documented in chart. Error bars indicate 95% confidence intervals.

©2002 American Medical Association. All rights reserved. (Reprinted) JAMA, March 13, 2002—Vol 287, No. 10
the AMI standard discharge form was used was associated with significant improvements in the use of aspirin and/or β-blockers at discharge, and with smoking cessation counseling, dietary counseling, and cholesterol-lowering therapy at discharge (Figure 3B, Table 4).

**COMMENT**

This initial report of the GAP initiative of the ACC illustrates opportunities available to improve care for AMI and provides a framework for similar initiatives targeting other diagnoses. Either trends toward higher adherence to quality indicators or significant improvements were observed for a majority of those measured. In particular, groups identified by prior studies to be more prone to receive suboptimal care, eg, elderly persons and women, tended to be more likely to benefit regarding both the early and late indicators. Perhaps even more interesting was the higher level of adherence observed at remeasurement for early quality indicators when AMI standardized orders were evident in the medical record. Similarly, improved adherence to late indicators was observed when the AMI-specific discharge tool was in the chart. These percentages, in the 80s and 90s, (Figure 3A and B), represent the kinds of levels that we can hope for if we are successful in creating effective standardized delivery systems that involve physicians, nurses, and patients in the quality paradigm and begin at or before admission and continue until discharge.

Although there was no designed control group in the GAP project, data for Medicare patients from 11 volunteer hospitals collected as part of the SEMHPP initiative served as a control group. When the improvement in various quality indicators between baseline and remeasurement for GAP Medicare patients was compared with the improvement for these indicators in the control hospitals, a significant improvement was observed in the use of aspirin at discharge, with nonsignificant trends for greater improvement in GAP hospitals for other quality indicators such as early aspirin use, use of ACE inhibitor at discharge, and documentation of smoking cessation counseling. At the time that GAP was implemented, in addition to the growing...

### Table 4. Quality Indicators for Medicare Patients in GAP vs SEMHPP Hospitals*

<table>
<thead>
<tr>
<th>Quality Indicators</th>
<th>SEMHPP (Control) Hospitals (n = 11)</th>
<th>GAP Participating Hospitals (n = 10)</th>
<th>P Value (for Follow-up Rates, Controls vs GAP Hospitals)</th>
<th>Follow-up Rates When GAP Tools Used, %</th>
<th>P Value (for Follow-up Rates, Controls vs Hospitals Using GAP Tools)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early aspirin</td>
<td>85.2 81.7</td>
<td>76.5 87.1</td>
<td>.12 92.6</td>
<td>.005</td>
<td></td>
</tr>
<tr>
<td>Early β-blockers</td>
<td>59.5 76.1</td>
<td>62.5 73.3</td>
<td>.64 77.1</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>Discharge aspirin</td>
<td>74.6 78.6</td>
<td>82.0 91.7</td>
<td>&lt;.001 98.4</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>Discharge β-blockers</td>
<td>70.3 86.4</td>
<td>87.3 92.9</td>
<td>.27 100.0</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>Discharge ACE inhibitors</td>
<td>77.5 75.4</td>
<td>80.0 84.7</td>
<td>.14 89.5</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>36.1 42.6</td>
<td>27.7 50.4</td>
<td>.31 85.5</td>
<td>&lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

*GAP indicates Guidelines Applied in Practice; SEMHPP, Southeast Michigan Hospital Profiling Project; and ACE, angiotensin-converting enzyme.

**Figure 3. Adherence to Early Quality Indicators in Patients With and Without Evidence of Use of Standardized Admission Orders and Adherence to Late Indicators in Patients With and Without Evidence of Use of Discharge Form**

See Figure 2 legend for expansions of terms. P values are for comparisons between preintervention (baseline) quality adherence levels and postintervention quality adherence levels in medical records with evidence of tool use. Error bars indicate 95% confidence intervals.
successful in improving adherence to per-
caregivers and patients, may be suc-
improvement tools and involving both 
specifically targeting use of quality 
generated increased awareness of qual-
ity of care for AMI patients among the 
nonparticipating volunteer hospitals 
that served as a control group. The fact 
that there was only a modest improve-
ment in the quality-of-care indicators 
that were targeting quality improvement in AMI 
care among all hospitals in the region, 
with a second reason being only vari-
able tool use during the project.

The initial GAP experience builds on 
the results of prior quality improve-
ment projects. These projects have sug-
gested that a systematic approach, par-
ticularly targeting use of quality 
 improvement tools and involving both 
caregivers and patients, may be suc-
cessful in improving adherence to per-
formance measures. Yet, unlike prior 
single-institution experiences or 
regional initiatives that targeted 1 or 2 
key indicators of care for patients with 
AMI, GAP, when implemented appro-
priately through the use of tools, 
appeared to be successful in improv-
ing the overall care among diverse institu-
tions in which physicians with dif-
ferent subspecialty training treat a wide 
variety of patient populations. The tools 
were meant not only to provide physi-
cians and nurses with an evidence-
based outline to appropriately manage 
their patients, but also to reinforce these 
key quality goals by serving as remind-
ers during the care process. These tools 
were also meant to provide patients with 
education and empowerment and to 
help them better understand their dis-
ease and the long-term goals of its treat-
ment, including lifestyle strategies.

We believe the GAP pilot initiative 
may provide the foundation for future 
initiatives, and that it is unique in sev-
eral ways. First, the national guidelines 
for management of AMI were used as 
the basis for tools that, when used, re-
minded physicians, nurses, and pa-
tients of the key goals of therapy dur-
ing the care process itself. Second, both 
internal and external opinion leaders 
worked with the hospitals and their staffs 
into the project and assist in 
identifying barriers to successful imple-
mentation, a strategy previously shown 
to be effective in influencing physician 
behavior. Third, great flexibility was 
allowed as hospitals customized the tools 
that served as a control group. The fact 
that these ongoing efforts that were 
was a project sponsored by 
BlueCross BlueShield that targeted area 
hospitals to improve the use of β-block-
ers and aspirin at discharge for all pa-
tients with AMI who participated in 
their health maintenance organiza-
tion. Thus, all volunteer hospitals were 
involved in quality improvement ef-
forts on their own. Furthermore, GAP 
generated increased awareness of qual-
ity of care for AMI patients among the 
nonparticipating hospital that served 
as a control group. The fact 
that there was only a modest improve-
ment in the quality-of-care indicators 
that were targeting quality improvement in AMI 
care among all hospitals in the region, 
with a second reason being only vari-
able tool use during the project.

The initial GAP experience builds on 
the results of prior quality improve-
ment projects. These projects have sug-
gested that a systematic approach, par-
ticularly targeting use of quality 
 improvement tools and involving both 
caregivers and patients, may be suc-
cessful in improving adherence to per-
formance measures. Yet, unlike prior 
single-institution experiences or 
regional initiatives that targeted 1 or 2 
key indicators of care for patients with 
AMI, GAP, when implemented appro-
priately through the use of tools, 
appeared to be successful in improv-
ing the overall care among diverse institu-
tions in which physicians with dif-
ferent subspecialty training treat a wide 
variety of patient populations. The tools 
were meant not only to provide physi-
cians and nurses with an evidence-
based outline to appropriately manage 
their patients, but also to reinforce these 
key quality goals by serving as remind-
ers during the care process. These tools 
were also meant to provide patients with 
education and empowerment and to 
help them better understand their dis-
ease and the long-term goals of its treat-
ment, including lifestyle strategies.

We believe the GAP pilot initiative 
may provide the foundation for future 
initiatives, and that it is unique in sev-
eral ways. First, the national guidelines 
for management of AMI were used as 
the basis for tools that, when used, re-
minded physicians, nurses, and pa-
tients of the key goals of therapy dur-
ing the care process itself. Second, both 
internal and external opinion leaders 
worked with the hospitals and their staffs 
to implement the project and assist in 
identifying barriers to successful imple-
mentation, a strategy previously shown 
to be effective in influencing physician 
behavior. Third, great flexibility was 
allowed as hospitals customized the tools 
to suit their own experience and style, 
allowing them greater “local owners-
ship” and more active involvement in en-
suring a favorable adoption of the tools 
at each hospital. Fourth, the project 
took advantage of prior quality improve-
ment initiatives and dialogue involving 
MPRO, the state contractor for CMS’s 
 improvement initiative, and all of the 
hospitals. The trust and relationships, 
which had been successfully fueled by 
a series of initiatives in the 1990s, al-
lowed the initial measurement to be 
made and were vital to the quick action 
of the improvement plan.

This study has important limita-
tions. The initial measurement oc-
curred more than a year before the qual-
ity improvement intervention. Thus, it is 
likely that some of the observed im-
provement represented a natural drift to-
ward higher adherence. However, the 
modest improvement seen in the quality-
of-care indicators among GAP Medi-
care patients, compared with controls 
who volunteered for the project but who 
were not selected and where other qual-
ity improvement initiatives were al-
ready ongoing, suggests that the GAP 
initiative did have at least a modest im-
 pact on the quality of care. Although the 
hospitals agreed to use admission and/or 
discharge tools, these tools were iden-
tified during chart review in only a mi-
nority of patients. It is possible that the 
aggressive timeline of the GAP initia-
tive may not have provided caregivers 
with an adequate opportunity to be-
come familiar with and to adopt the 
tools. A longer implementation period, 
insistence on tool use, continuous moni-
toring, and attempts to identify and over-
come barriers for tool use may result in 
greater use of the tools and conse-
quently better adherence in future ini-
tiatives. Evidence of tool use was asso-
ciated with the greatest impact on the 
change in performance measures. This 
finding argues for a strategy where in-
titutions and caregivers adopt stan-
dard tools and processes to optimize 
quality of care for patients with AMI. Be-
cause of the multifaceted intervention 
approach implemented in GAP, it was 
not possible to gauge the efficacy of in-
dividual components in improving the 
 adherence of the quality indicators. Fi-
nally, the cost implications of this qual-
ity improvement initiative were not 
evaluated, and future studies need to ad-
dress the cost-effectiveness of such pro-
grams in communities at large.

In summary, we have shown that the 
creation and implementation of guide-
line-based tools surrounding care of 
AMI may facilitate quality improve-
ment among a wide variety of institu-
tions, patients, and caregivers. This ini-
tial GAP project provides a foundation for future initiatives aimed at quality improvement.

Author Affiliations: Division of Cardiology, Depart-
ment of Internal Medicine, University of Michigan, Ann 
Arbor (Drs Mehta and Eagle, and Ms Kline-Rogers); Ameri-
can College of Cardiology, Bethesda, Md (Ms 
Montoye and Gallogly, and Dr Orza); Michigan Peer 
Review Organization, Plymouth (Ms Baker, Blount, 
and Faul, Dr Roychoudhury, and Ms Satwicz); Divi-
sion of Cardiology, Department of Internal Medi-
cine, Henry Ford Health System, Detroit, Mich (Dr Bor-
zak, Ms Fox); Division of Cardiology, Department of 
Internal Medicine, St John Hospital and Medical Cen-
ter, Detroit, Mich (Dr LaLonde); Disease Manage-
ment, St John Health System, Warren, Mich (Ms Fre-
und); Greater Detroit Area Health Council, Detroit, 
Mich (Mr Parrish); Division of Cardiology, Depart-
ment of Internal Medicine, St Joseph Mercy Health 
System, Ann Arbor, Mich (Ms Smith, Dr Winston); De-
partment of Internal Medicine, Division of Cardi-
ology, Detroit Medical Center, Detroit, Mich (Dr Sa-
botka); and Department of Internal Medicine, Division 
of Cardiology, Dearborn, Mich (Ms Franklin, Dr Riba).

Author Contributions: Study concept and design: 
Mehta, Montoye, Gallogly, Baker, Blount, Borzak, 
Franklin, Freundl, Kline-Rogers, LaLonde, Orza, 
Parrish, Satwicz, Smith, Sobotka, Winston, Riba, Eagle.

Acquisition of data: Fox, Orza.

©2002 American Medical Association. All rights reserved.
QUALITY OF CARE IN AMI: THE GAP INITIATIVE

Analysis and interpretation of data: Mehta, Montoya, Blount, Fau1, Roychoudhury, Orza. Drafting of the manuscript: Mehta, Montoya, Gallogy, Baker, Blount, Borzak, Franklin, Freund, Lalonde, Parrish, Satzvich, Smith, Sobotka, Winston, Eagle. Critical revision of the manuscript for important intellectual content: Mehta, Fau1, Roychoudhury, Fox, Kline-Rogers, Orza, Riba, Eagle. Statistical expertise: Blount, Fau1, Roychoudhury. Obtained funding: Orza, Parrish. Administrative, technical, and material support: Mehta, Montoya, Gallogy, Baker, Blount, Borzak, Franklin, Freund, Kline-Rogers, Lalonde, Orza, Parrish, Satzvich, Smith, Sobotka, Winston, Riba. Study supervision: Mehta, Montoya, Blount, Orza, Riba, Eagle.

REFERENCES


