ED overcrowding is a nationally recognized problem negatively impacting patient care and safety. At 1 academic medical center, there was neither a method to measure ED overcrowding nor any hospital-wide response to appropriately allocate resources to address the needs of the staff and patients. The Condition Yellow Project was undertaken to develop processes that would address ED overcrowding.

Background

SAFE AND TIMELY CARE
Patients seeking emergency care in the United States are faced with overcrowding conditions that impair the ability to receive safe and timely care.1 Overcrowding creates prolonged wait times for patients to be seen and may increase the risk of adverse outcomes, according to a study from the University of California, Davis.2

NEW YORK STATE DEPARTMENT OF HEALTH
In December 2000 a “Dear Hospital Administrator” letter was issued by the New York State Department of Health.3 The intent of the letter was to reaffirm for hospitals their obligations to address ED overcrowding and ambulance diversion. Several obligations including not housing admitted patients in the emergency department and only requesting ambulance diversion when the acceptance of another patient might endanger the life of that patient or others in the department were discussed. Other responsibilities identified in the letter included the fact that ED overcrowding is a hospital-wide problem and not a problem of the department alone.

JOINT COMMISSION
In 2002, round tables were held by the Joint Commission to attempt to address the impact that ED overcrowding has on patient safety and what systemic causes contribute to the overcrowded conditions. This roundtable discussion led to a national symposium in 2003 seeking solutions to this public health crisis.4

PATIENT DEATH
ED overcrowding is associated with increased patient mortality rates. A study that included 3 tertiary metropolitan hospitals showed a linear relationship between a tool that measured overcrowding hazard risk and ED overcrowding.5

HEALTH CARE ACCESSIBILITY
Over the last 20 years, decreased accessibility to health care has evolved with the closing of key health care facilities, changes in reimbursement from third-party payers, and increasing lack of health insurance coverage. ED overcrowding results in patients leaving without being seen6 and an increase in hours of ambulance diversion.7

DIRECTOR SURVEY
Approximately 91% of ED medical directors surveyed during 1992 and 2004 indicated that ED overcrowding is a problem in their emergency departments.8 Overall, ED visits had increased nationwide by 22% during that period of time.9

BOARDING
Boarding of admitted patients in the emergency department for extended periods of time because of a lack of acute inpatient beds only makes the overcrowded conditions worse.10 ED overcrowding creates a “dysfunctional environment” that can lead to increased lengths of stay for those admitted patients being held in the emergency department rather than being transferred to inpatient beds.11 This increased length of stay on the inpatient side results in reduced bed availability for those admitted patients waiting in the emergency department.
RECENT STUDY
In one 450-bed nonprofit teaching hospital in Pennsylvania, results of a study showed that although 25% of the patients seen in that emergency department were brought in by ambulance, 52% of those patients brought in by ambulance were admitted. After calculation of projected charges, mean rates of ambulance arrivals, and projected number of patients if not on ambulance diversion, the study projected a $3,150,079 loss in net patient revenue to other health care facilities in the service area.12

Overcrowding Tools
ED overcrowding measurement has been limited at best. Several studies were conducted to determine the validity and reliability of tools that were developed to measure ED overcrowding. One study compared the National Emergency Department Overcrowding Scale (NEDOCS) and the Emergency Department Work Index.13 Both were found to correlate well and showed good discrimination in predicting ED overcrowding. Another study compared academic institutions and the use of the NEDOCS tool to determine validity in quantifying ED overcrowding,14 and this study led to our consideration of using the NEDOCS tool for this project.

ED overcrowding was recognized as a significant problem by our organization. The Condition Yellow Project was undertaken to develop processes that would address ED overcrowding.

Project Objectives
The objectives identified by the project team were as follows:

1. Development of strategies to address overcrowding and throughput
2. Evaluation of current strategies piloted
3. Identification of stakeholders to obtain input related to strategies and provide education related to the need for change
4. Identification of a valid and reliable tool to measure ED overcrowding
5. Development of a hospital-wide response plan based on measured ED overcrowding conditions
6. Identification of communication methodology
7. Identification of data needs for evaluation
8. Evaluation of current ED care-delivery model for ability to handle increased volume
9. Evaluation of effectiveness of planned response and strategies
10. Initiation of dialogue with executive council members related to uniform approach to city-wide diversion

Community Needs Assessment
EMERGENCY DEPARTMENT
Currently, our emergency department sees over 55,000 visits a year. It is a level 1 trauma center in the Central New York region, and serves 17 counties. The hospital was experiencing some financial issues related to volumes. In 2007 ED overcrowding resulted in a decrease in inpatient admissions by 3.8%, a decrease in ED visits by 3.4%, an increase in the number of patients leaving before being seen, and an increase in diversion hours of close to 15%. A low patient satisfaction score of 73.1% was related to excessive waiting times in the emergency department. Because the hospital is a state-run facility, a higher population of uninsured patients came to the emergency department for their primary health care needs, which contributed to the overcrowded conditions.

PROVIDER OF SERVICE
The type of provider that offered the services of patient care, throughput, and reduction of ED overcrowding was the organization as a whole. The organization as a whole has committed to improving patient flow by identifying it as one of the strategic goals. Direct and indirect caregivers, ancillary department staff, and medical staff have all been involved in the response plan to provide the services of patient care and reduction of ED overcrowding.

DEMANDER OF SERVICE
The demanders of service are categorized into 3 groups:

- Patients and families
- Hospital employees hospital wide
- Board and administrative leaders

The community was in dire need of improved accessibility to health care with a safe and efficient manner of delivery. The patients and families were one category of demanders from a care-delivery perspective. The hospital employees were demanders from the perspective of appropriate allocation of resources to support the care-delivery needs of those patients and families that they served. The board and administrative leaders were demanders from an organizational-performance perspective. As the only level 1 trauma center in the region, this organization had the opportunity to become the benchmarked facility of care.

Leadership Challenges
The organization has had numerous leadership changes. Over the last 4 years, all of the senior leadership, including the president of the university and the hospital chief executive officer, has been replaced. The nursing management
structure has also undergone change and is just being finalized. Although the hospital has attempted to address the ED overcrowding issues, there has not been a focus on problem solving from a hospital-wide perspective.

A throughput committee was developed in an attempt to begin to evaluate the issue of ED overcrowding. This committee developed 40 various initiatives to address throughput with no significant changes in the percent of diversion hours over the last 2 years (Figure), because there was no planned approach to coordinate these various initiatives in response to resource management.

Outputs
The outputs of the implementation of the project were follows:

1. Selection of a reliable and valid tool to measure ED overcrowding
2. Development of a hospital-wide response plan based on the measurement of ED overcrowding
3. Evaluation of the effectiveness of the response plan
4. Evaluation of the effectiveness of the current staffing model within the emergency department to support patient volume increases through the reduction of ambulance diversions and patients who leave without being seen

A timeline was developed to provide a structured approach to meeting the project objectives over a 2-year period. The timeline was organized into 4 phases to provide flexibility if unforeseen delays in implementation occurred.

Change Theory/Methodology: Appreciative Inquiry
Through recognition of effective processes and systems, identification of benchmark performers and the reduplication of those efforts were the impetus of change through a positive framework of problem solving. This approach emphasized strengths rather than weaknesses.\textsuperscript{15} It led to an overall engagement of staff hospital wide.

Organizational Readiness Assessment
To determine organizational readiness for change, a SWOT analysis, as described in Table 1, was conducted to determine those strengths, weaknesses, opportunities, and threats associated with the implementation of this project. Barriers to the project were also identified.

Market Failure
Market failure is described by Finkler et al\textsuperscript{16} as a condition whereby the market does not function fully and freely. As a result, the supply and demand are unbalanced unless there is an intervention to correct them. In the example of ED overcrowding, the demand for patient care exceeded the capability to meet those demands. There are 3 categories of factors related to market failure: lack of full information, monopoly of power, and externalities.\textsuperscript{16}

Barriers
In looking from the market-failure perspective, we noted 2 potential barriers to the success of the project. The first

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**TABLE 1**  
**SWOT analysis**

<table>
<thead>
<tr>
<th>Internal forces</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong organizational leadership commitment</td>
<td>Potential for poor patient outcomes if not developed well</td>
</tr>
<tr>
<td></td>
<td>Staff see throughput as a problem and are frustrated with patient flow</td>
<td>History of failure in sustaining change</td>
</tr>
<tr>
<td></td>
<td>Nursing management team understands financial impact</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External forces</th>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lack of trust in follow-through</td>
<td>Consumers can go to other organizations</td>
</tr>
<tr>
<td></td>
<td>Patient satisfaction very low</td>
<td>Current staffing plan may not support planned program</td>
</tr>
<tr>
<td></td>
<td>State reimbursement below expected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surrounding hospital ED visits increasing</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE**
Diversion hours.
was related to the lack of full information. Employees not working in the emergency department have a lack of understanding of throughput and how the work that they do in their patient care areas impacts the patient throughput in the emergency department. Not providing adequate information related to how all activities are linked and how the response plan ensures a consistent response based on a valid and reliable measurement tool will lead to the failure of the project. This barrier was addressed by disseminating information through various communication venues.

The second identified barrier is externalities. Care is provided regardless of the ability to pay for that care. The organization is currently facing significant budget cuts. Not having the financial resources to support the project will be a barrier to its success. The budget developed showed a positive return on investment to support the project needs.

**Quality Measurement**

**SIX AIMS**
The Institute of Medicine released a report in 1999 related to the crisis of patient safety in the United States. In a second report, in 2001, there were 6 improvement aims identified: safe, effective, patient centered, timely, efficient, and equitable. In reviewing the 6 aims for the US health care system identified by the Institute of Medicine, we found that all of them are incorporated in our project.

**SCORING TOOL**
The project scoring tool chosen is NEDOCS, which specifically measures the state of overcrowding based on the number of patients being cared for in the department, the time from triage to a treatment room, the time from treatment to an admitted bed, the number of patients receiving ventilation in the department, and the number of available inpatient beds in the hospital.

**Evaluation Methodology: Pretest–Post-test Method**

To evaluate the effectiveness of the response plan, a pretest–post-test (before-after) comparison was conducted. This design was selected because the data measurement that would be available before the response plan was identified and implemented and the measurement conducted after implementation could be used to estimate the effect on patient throughput and ED overcrowding. The evaluation and monitoring of the data were completed by the Deputy Director of Nursing and reported through the organization’s quality committee structure. The data to be compared included the following:

1. Diversion hours per month for last 2 years
2. Patient satisfaction scores for last 2 years
3. Total yearly ED visits
4. Total inpatient admissions for 2 prior years
5. Rate of patients leaving without being seen
6. Length of stay of ED admissions

**Outcomes**

Outcome measures were identified that supported the incorporation of the 6 aims. Those outcome measures were as follows:

1. Diversion hours would be reduced by 50% over the first year.
2. Patient satisfaction related to waiting times in the emergency department would be improved to the 90th percentile in the Patient Satisfaction Survey within the first year.
3. ED visits would increase by 600 visits (8%) in the first year.
4. Inpatient admissions would increase by 10% within the first year.
5. The rate of patients leaving before being seen would be decreased by 50 per month within 1 year.
6. The average length of stay for ED patients would be reduced by 1 hour.

**Financial Plan**

This project was part of the operational budget of the hospital. All associated costs were funded through operations. Cost benefits of the project were evaluated based on net

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**TABLE 2**

<table>
<thead>
<tr>
<th>Detailed budget for Condition Yellow Project: 2008-2009 Fiscal Year</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel expenses (salary and benefits)</td>
<td></td>
</tr>
<tr>
<td>Nursing</td>
<td>$438,592.40</td>
</tr>
<tr>
<td>Nursing benefits</td>
<td>$119,197.32</td>
</tr>
<tr>
<td>Total personnel expenses</td>
<td>$557,789.72</td>
</tr>
<tr>
<td>Operating expenses</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>$5,000.00</td>
</tr>
<tr>
<td>Total operating expenses</td>
<td>$562,789.72</td>
</tr>
<tr>
<td>Total projected revenue and income</td>
<td>$4,996,701.48</td>
</tr>
<tr>
<td>Net profit</td>
<td>$4,433,911.76</td>
</tr>
</tbody>
</table>
revenue contributions to overall operations. The return on investment was high, with a ratio for total expenses to total revenue of 0.21.

Revenue was projected based on the number of ambulances per hour that the emergency department received when not on diversion and resulted in an admission, the percentage of patients admitted who walked into the department, the total increase in patients treated and released, and the decrease in those patients who registered but left without being seen.

Expenses were based on the cost of a bed flow coordinator, increasing registered nurses by 2 full time equivalents during high-volume times, and the addition of 6 full time equivalents for licensed practical nurses to practice as partners with the registered nurse staff in the department to support the projected volume increases. A summary is shown in Table 2.

### Outcome Results

The overall performance exceeded expectations (Table 3). In July 2008 the hospital implemented the response plan based on NEDOCS, organizing 49 throughput initiatives into a coordinated response. Decreased diversion hours, decreased numbers of patients leaving without being seen, a record number of ED visits, and a revenue increase by 27.7% ($5.1 million) were found. Project sustainability was evident by the organizational support and cultural transformation. In our organization, ED overcrowding is now a hospital-wide issue, not an emergency department–only issue.

### Future Growth Strategies

One of the future growth strategies will be to increase services and support based on the performance outcomes of the program. The volumes experienced exceeded projected goals, which resulted in a higher-than-planned inpatient census. This resulted, in the early part of the summer, in further overcrowding and an increase in diversion hours.

By mid September 2008, the hospital had successfully opened an additional 50 inpatient beds with the completion of an expansion project. As volumes increase, a strategic plan will need to be developed to address expansion not only of the emergency department but also of all ancillary services and inpatient areas. Continued growth of the organization will mean financial stabilization, increased need for recruitment of staff, and perhaps a vision of a unified collaborative

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**TABLE 3**

<table>
<thead>
<tr>
<th>Project goal</th>
<th>Project result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in diversion hours by 50% in the first year (from 3,776 to 1,888)</td>
<td>Diversion hours decreased to 1,750.</td>
</tr>
<tr>
<td>Increase in ED visits by 600 in first year (to 40,722)</td>
<td>ED visits increased by 3,303, to 44,025.</td>
</tr>
<tr>
<td></td>
<td>The improved staffing model implemented in December 2008 provided the human resources needed for the anticipated volume increases.</td>
</tr>
<tr>
<td>Increase in admissions by 10% in first year (to 6,467 patients)</td>
<td>Admissions increased 11% (715 patients).</td>
</tr>
<tr>
<td>Decrease in LWBS patients by 50 patients per month (total of 2,316 per year)</td>
<td>The number of LWBS patients was 2,072.</td>
</tr>
<tr>
<td>Reduction in mean length of stay for ED patients by 1 hour</td>
<td>The mean time decreased by 1.6 hours. The data collection methodology was changed by the organization, and the comparison was unable to be continued.</td>
</tr>
<tr>
<td>Improvement in Press Ganey scores to 90th percentile related to waiting times in emergency department</td>
<td>The patient satisfaction scores related to waiting times in the emergency department were not captured. An organizational change was made to nonstandardized questions in the Press Ganey survey. As a result, the data were no longer collected.</td>
</tr>
</tbody>
</table>

LWBS, leaving without being seen.
approach to meeting the health care needs of the communities served through the merging of other health care facility services with ours.

REFERENCES