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***“By analyzing administrative data, local provider surveys, and enhanced chart reviews, the Mortality Review Committee obtained a more complete understanding of opportunities to reduce the mortality index and improve patient care.”***

***—The Mortality Review Committee:  
A Novel and Scalable Approach to  
Reducing Inpatient Mortality (p. 393)***

## Reducing Preventable Inpatient Mortality

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## Methods, Tools, and Strategies

# The Mortality Review Committee: A Novel and Scalable Approach to Reducing Inpatient Mortality

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The Institute of Medicine's report *To Err Is Human* estimated that between 44,000 and 98,000 inpatient deaths a year in the United States were due to potentially preventable medical error.<sup>1</sup> Despite improvements in patient safety during the past decade, inpatient mortality remains an issue.<sup>2</sup> As one incentive for hospitals to focus on the goal of reducing mortality, publicly available data comparing hospital quality use mortality as an essential component of their ranking algorithms.<sup>3</sup> In addition, the US Agency for Healthcare Research and Quality encourages the use of mortality measures in its quality metrics,<sup>4</sup> and 44 states participate in the Healthcare Cost and Utilization Project's State Inpatient Databases,<sup>5</sup> which collect longitudinal data on a variety of cost and quality measures including mortality. As public reporting of outcomes, including mortality, becomes increasingly common for specialties<sup>6</sup> and hospitals,<sup>7</sup> the focus on reducing inpatient mortality will continue to grow.

Although hospitals have been charged to reduce inpatient mortality, there is a scarcity of literature on effective methods to achieve this aim. Inpatient mortality has been reviewed within the context of departmental morbidity and mortality meetings since the early 1900s,<sup>8</sup> but to our knowledge there is little written about hospitalwide mortality review committees. Some organizations have anecdotally found the creation of a mortality review committee to be helpful in improving patient safety and quality of care.<sup>9-11</sup> Mortality review committees have been tasked with chart reviews, rapid response team debriefings, collection of provider feedback, and the creation of weekly, standing root cause analysis meetings. However, none of the reported review committees or interventions have been associated with a measureable improvement in mortality.

In this article, we describe the development of a mortality review committee charged with reducing preventable mortality at an academic medical center, and, through the use of concrete examples, we demonstrate the measureable improvement in mortality associated with the improvement initiatives implemented by this committee.

## Article-at-a-Glance

**Background:** Despite the importance of reducing inpatient mortality, little has been reported about establishing a hospitalwide, systematic process to review and address inpatient deaths. In 2006 the University of Pennsylvania Health System's Mortality Review Committee was established and charged with reducing inpatient mortality as measured by the mortality index—observed/expected mortality.

**Methods:** Between 2006 and 2012, through interdisciplinary meetings and analysis of administrative data and chart reviews, the Mortality Review Committee identified a number of opportunities for improvement in the quality of patient care. Several programmatic interventions, such as those aimed at improving sepsis and delirium recognition and management, were initiated through the committee.

**Results:** During the committee's first six years of activity, the University HealthSystem Consortium (UHC) mortality index decreased from 1.08 to 0.53, with observed mortality decreasing from 2.45% to 1.62%. Interventions aimed at improving sepsis management implemented between 2007 and 2008 were associated with increases in severe sepsis survival from 40% to 56% and septic shock survival from 42% to 54%. The mortality index for sepsis decreased from 2.45 to 0.88. Efforts aimed at improving delirium management implemented between 2008 and 2009 were associated with an increase in the proportion of patients receiving a "timely" intervention from 18% to 57% and with a twofold increase in the percentage of patients discharged to home.

**Discussion:** The establishment of a mortality review committee was associated with a significant reduction in the mortality index. Keys to success include interdisciplinary membership, partnerships with local providers, and a multipronged approach to identifying important clinical opportunities and to implementing effective interventions.

## Methods

### SETTING

The University of Pennsylvania Health System (Philadelphia) is a large (772-bed) urban teaching hospital staffed by more than 1,950 registered nurses and 1,600 physicians and house staff. There are approximately 37,000 admissions annually. Most clinical services sponsor graduate medical education programs. The chief medical officer [P.J.B.], an active infectious disease specialist, reports directly to the chief executive officer and thus has access to hospital resources to support his efforts.

### TARGETING REDUCTION IN THE MORTALITY INDEX

In 2006, in response to increased transparency of publicly available outcomes data and a reported mortality index—the ratio of observed to expected mortality—greater than those of our peer institutions, the chief medical officer targeted a reduction in this key quality metric.

At our institution, the mortality index was calculated using data from the University HealthSystem Consortium (UHC), a cooperative of 119 nonprofit academic medical centers that promotes collaboration on improving clinical and operation performance through transparent sharing of data.<sup>12</sup> UHC maintains a clinical database that includes information on observed and expected mortality and is based on encounter discharge data from 215 hospitals that are either members or member affiliates. Logistic regression modeling based on database variables, such as demographic, diagnostic, and procedural information, is used to generate estimates of expected mortality.<sup>13</sup>

The chief medical officer identified leaders from the two largest departments—surgery and medicine—and charged them with assembling a team to both examine data on mortality and make programmatic recommendations on methods to reduce mortality. The Mortality Review Committee was formed with multidisciplinary membership representing important strategic areas of the hospital, including nursing, physicians, data analysts, and key corporate suite administrators, such as the vice president of quality and safety [P.G.S.].

### THE MORTALITY REVIEW COMMITTEE'S THREE-PRONGED APPROACH

In 2006 the Mortality Review Committee began implementing a three-pronged approach to better understand mortality, which entailed a detailed analysis of administrative claims records, use of the 360 Degree (360°) online survey to elicit providers' opinions of the preventability of each inpatient death, and implementation of an enhanced chart review process. Following the identification of a quality improvement (QI) oppor-

tunity, the committee performed a causal analysis of the clinical practices to identify the strategy for performance improvement. The QI initiatives involved the design of new work flows, development of clinical decision support tools, and provider education campaigns. We highlight two QI initiatives created through this process—one aimed at improving the management of sepsis and the other aimed at improving the management of delirium in the inpatient hospital units.

*The Use of Administrative Data.* Administrative data are readily available and are both easy and inexpensive to obtain. The data can be used to define trends and target areas for deeper investigation. Analysis of three years of hospital discharge data revealed a disparity between the hospital's mortality index and that of other top-performing health care institutions. However, the association between these findings and the overall quality of care at our hospital was not clear. Administrative data can be limited in its completeness, timeliness, and utility for assessing care processes.<sup>14-16</sup> In addition, administrative data are poorly suited to identifying errors of omission or commission.<sup>15</sup> Given these limitations, providers may attribute lower-than-expected performance in the mortality index to a presumed higher patient acuity that was not sufficiently reflected in the clinical documentation, decreasing the utility of these data in practice.

The primary determinant of the expected component of the mortality index is derived from administrative data collected from the medical record following hospital discharge. The accuracy and completeness of the physician documentation determines the accuracy of the calculated expected mortality and affects the measure of hospital performance determined by the mortality index. Chart abstracters who assign International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes based on provider documentation are not permitted to interpret results to determine disease severity. Thus, incomplete documentation by providers can adversely affect the mortality index.<sup>17,18</sup> To address this issue, in early 2006 the medical records department at the hospital developed and implemented a clinician query process. For each inpatient death with a severity of illness or risk of mortality score less than 4, as calculated using UHC methodology,<sup>13</sup> the responsible provider was notified to address with an addendum any additional diagnoses or procedures that were not captured to accurately represent the patient's clinical state and care provided. Simultaneously, a template for provider notes (Appendix 1, available in online article) was developed to help standardize the documentation process to optimize the clarity of provider assessments, and diagnostic and treatment plans.<sup>19,20</sup>

*360° Online Survey to Reveal Provider Perspectives.* In 2009

Local Provider Survey Questions

1. Was the primary reason for admission for hospice or palliative care?  
 Yes  No  Don't Know  
**\*\*\*If Yes, stop. The form is complete. No other information is needed.\*\*\***
2. What do you think was the primary diagnosis that drove the need for this patient's admission to the hospital? \_\_\_\_\_  Don't know  N/A  
admission to the ICU? \_\_\_\_\_  Don't know  N/A
3. Was mortality expected on admission?  
 Yes  No  Don't Know  
If so, explain \_\_\_\_\_
4. Do you think patient's death was preventable?  
 Yes  No  Don't Know  
If so, explain \_\_\_\_\_
5. Please list any important problems or issues with the patient's care/level of service that you feel should be addressed systematically?  
\_\_\_\_\_  
\_\_\_\_\_
6. Based on your current recollection, did any of the following events occur and possibly contribute to the patient's death? (Please check)  

<input type="checkbox"/> Fall	<input type="checkbox"/> Infection
<input type="checkbox"/> Aspiration	<input type="checkbox"/> PE
<input type="checkbox"/> Delirium	<input type="checkbox"/> Procedure complication
<input type="checkbox"/> Bleeding (post op/procedure)	<input type="checkbox"/> Drug Effect
<input type="checkbox"/> Other _____	

  
If so, explain \_\_\_\_\_  
\_\_\_\_\_

Figure 1. Questions from the 360° online survey are distributed at the time of death to all primary caregivers of the deceased patient, including house staff, faculty, and allied providers (nursing staff and respiratory therapists). N/A, not applicable; PE, pulmonary embolism.

a 360° online survey was implemented (Figure 1, above). All providers responsible for the care of a patient who died during an inpatient hospitalization were asked to complete the survey. The survey prompted clinicians to identify whether palliative care was provided and to share any insights into the patient's condition that might have resulted in the patient's death.

Using this technique, providers reported information that did not make it to the medical record regarding the deceased patient's clinical course. In addition, the survey provided an opportunity for all respondents to provide an opinion on the primary cause of death. Survey responses, which are reviewed by the Mortality Review Committee and may be used in peer review, are kept privileged and confidential. Responses indicating potential litigation or poor patient satisfaction are shared with risk management and patient-guest relations, with provider de-identification.

The 360° survey data proved helpful in identifying actionable items for QI. Gupta et al. reported that in a retrospective analysis of data from the The 360° survey data proved helpful in identifying actionable items for QI. Gupta et al. reported that in

a retrospective analysis of data from the 3,095 360° surveys that the providers completed for 1,683 (67.8%) of the 2,483 patients who died at the hospital between February 2009 and March 2012, 1.40% (42 patients /3,095 surveys) of the deaths were recorded as preventable, with sepsis/infection (25.0%) a condition commonly associated with preventability.<sup>21</sup> In addition, 26.2% of patients whose death was considered preventable experienced "early death," defined as death within 48 hours of admission.<sup>21</sup>

Although the responses did not always identify causes for preventable deaths, QI opportunities were often revealed. Consider a representative provider response regarding the subjective description of a preventable death that the Mortality Review Committee did not deem preventable: "I believe this patient was not transferred safely from the emergency room to the medical intensive care unit, and had the patient been adequately resuscitated prior to transfer, it is possible that death would have been avoided."<sup>21(p. e4)</sup> In this case, issues raised regarding transfer behavior and timeliness of care resulted in refinement of our transfer policy. The data also proved helpful for addressing

**Table 1. Mortality Review Committee Recommendations Regarding Opportunities for Improvement in Mortality Using a Hybrid Approach: Administrative Data and Chart Review and the Expected Target Effect on Observed/Expected Mortality Rate**

Data Source and Opportunity	Increase in Expected Mortality	Decrease in Observed Mortality
<b>Administrative Discharge Data</b>		
Documentation and Coding*	X	X
Falls, Aspiration and Delirium†		X
Hospice Services		X
Sepsis†	X	X
<b>Chart Review</b>		
Falls, Aspiration and Delirium†		X
Sepsis†		X
Supervision of house staff and allied providers		X
Early recognition of deterioration		X
Improvement in communication between clinicians and nonlaboratory diagnostic services (radiology, cardiology, etc.)		X

\* Health system efforts to improve deficiencies in documentation and coding can improve quality, as active clinical issues may not be documented because they are not recognized by the treating team.

† These initiatives were identified with administrative data and confirmed as clinical opportunities using chart review.

mortality due to sepsis (see right) and earlier recognition of clinical deterioration (Table 1, above).

### USING MANUAL CHART REVIEW TO UNDERSTAND INDIVIDUAL DEATHS

A chart review process for those patients who died in the hospital was developed to uncover issues in care processes and to record information systematically in a database to enable subsequent analyses for associations and trends. As the process matured, a chart abstraction tool resembling the UHC tool developed during its Improving Survival Initiative<sup>22</sup> was created to standardize this process. The charts were reviewed by a registered nurse and discussed with one of two physician leaders of the Mortality Review Committee. Charts were “closed” after recording opportunities for improvement in clinical decision making, timeliness of care, supervision, and level of care.

When clinical issues were identified by the Mortality Review Committee members, further chart review was directed to the local providers and physicians within the organization with an expertise in the clinical area under investigation. For example, for a postoperative patient who died of sepsis, the chart would be

sent to the surgical team and the infectious disease director for review to determine if optimal patient care was delivered. Final impressions were documented in the central mortality database.

### SPECIFIC INITIATIVES CHAMPIONED BY THE MORTALITY REVIEW COMMITTEE

#### *Implementation of Specific Quality Improvement Initiatives for Sepsis (2007–2008)*

**Use of Administrative Data.** In 2007 approximately 38% (324/863) of all deaths had an associated diagnosis of sepsis. Examination of administrative data revealed that although mortality decreased significantly for septic patients admitted through the emergency department (ED), the mortality for septic patients on the hospital floors had failed to improve. Further investigation revealed that the ED implemented an early goal-directed therapy program for septic patients in January 2005 that realized a significant reduction in sepsis-related mortality for patients admitted through the ED.<sup>23</sup> To determine whether these data were explained by differences in acuity of the floor patients compared to ED patients or whether there were differences in the care processes, detailed chart reviews were performed to compare care processes between the two locations.

**Validation of Discharge Data by Focused Chart Review.** A time line was constructed for both populations to compare the speed with which the expected interventions for sepsis were instituted. This analysis revealed that there were dramatic delays in recognition and treatment of the floor patients with septic shock compared to patients in the ED, explaining at least in part the differences in mortality between the two sites. In addition, a systematic review of medical records, data collection from rapid response team encounters, and an internal review of incident reports suggested that there were significant opportunities to improve sepsis care for hospitalized patients.

**Development, Implementation, and Evaluation of the Sepsis Management Program.** The goal of the initiative was to improve early detection of sepsis and to institute timely and appropriate antibiotic therapy. A number of interventions were developed to address these aims. Informal literature reviews and benchmarking with UHC data were used to help guide intervention design. In addition, the Penn Medicine Center for Evidence-Based Practice performed a number of formal evidence reviews to inform Mortality Review Committee efforts, including reviews on best practices for delirium management, sepsis management, and prevention of aspiration pneumonia.<sup>24</sup> In January 2007, an antibiotic algorithm was created to aid in the administration of empiric antibiotics for all patients with septic shock, and a pharmacist was added to the rapid response team

to facilitate the ordering and administration of the medications. In addition, the medical ICU (MICU) critical care pharmacists implemented a rapid antibiotic protocol for the assessment and treatment of severely septic patients, monitoring the prescribing speed, the choice of medications, and the de-escalation or switching of antibiotics when cultures were available. These interventions were followed by a multidisciplinary education campaign in 2008. Posters and pocket cards (Appendix 2, available in online article) tailored to the types of providers who received them were disseminated to assist bedside providers with the recognition and management of septic patients. A website was created to display all the educational materials and tools in a single location. Finally, two all-day nursing staff symposiums, nightly lectures and in-services for the off-shift nursing staff, education sessions for the medicine and surgery house staff, and an online education program were organized to facilitate the dissemination of these resources. Ultimately, this work was translated into a computerized clinical decision support intervention as well (Appendix 3, available in online article).

To measure the effectiveness of the interventions, we tracked time to administration of STAT antibiotics, survival from severe sepsis and septic shock for patients in the MICU, and hospital-wide sepsis mortality.

#### *Implementation of Specific Quality Improvement Initiatives for Delirium (2008–2009)*

**Use of Administrative Data.** In the examination of administrative data, a statistically significant association between the presence of delirium and death was identified. In 2008 approximately 23% (206/883) of all deaths had an associated diagnosis of delirium, aspiration, or accidental fall. Because the association was not proof of causality, the committee performed a detailed analysis of medical records to assess whether delirium was an important contributor to mortality.

**Validation of Discharge Data by Focused Chart Review.** All deaths with a code suggestive of delirium were reviewed by an experienced nurse. If issues relating to quality were identified, a confirmatory review was conducted by a physician. Data abstracted from charts were merged with administrative data and collected in a database. Data were handled by a quality department representative assigned to the project as a part of her Six Sigma training.<sup>22</sup>

The reviews identified several aspects of delirium management believed to be opportunities for improvement in care process and thus overall mortality, including the absence of any formal delirium screening process, inconsistencies in assessment methods, and deficiencies in implementing appropriate non-

pharmacologic and pharmacologic treatments for delirium. In addition, although delirium was not a direct cause of death in many cases, not infrequently delirium was the presenting sign of another underlying critical illness, such as sepsis, for which recognition and treatment was delayed. Finally, the analysis also revealed an association between delirium and two other important complications—*aspiration and falls*.

**Development, Implementation, and Evaluation of the Delirium Management Program.** The goal of the initiative was to improve the timeliness of the detection of deterioration in mental status as well as the timeliness and completeness of the clinical evaluation. Informal literature reviews, formal literature reviews performed by the Center for Evidence-based Practice, and benchmarking with UHC data were all used to help guide intervention design. A subcommittee for Falls, Aspiration and Delirium (FAD) was created to develop tools and educational resources to improve delirium management with the hope of reducing the incidence of delirium-related death throughout the hospital, which were implemented between November 2008 and April 2009. Given its higher sensitivity and its simplicity, a “change in mental status” was identified as an appropriate trigger for delirium screening. The Richmond Agitation-Sedation Scale<sup>25</sup> was added to the nursing flow sheets used to track vital signs (every 15 minutes to 8 hours, depending on the care setting) to help nurses screen for and document mental status changes, with subsequent screening for delirium as appropriate. A diagnostic algorithm was developed to evaluate patients systematically for the underlying cause. Finally, both nonpharmacologic and pharmacologic evidence-based treatment strategies were formalized. In addition, between November 2008 and March 2009, a multidisciplinary education campaign was launched, including laminated pocket cards as bedside prompts for advanced practice nurses, house staff, and faculty regarding the correct screening, evaluation, and management of delirium, as well as a guide to the nonpharmacologic interventions for change in mental status and delirium (Appendix 4, available in online article). Posters were distributed to all inpatient units to raise awareness among all allied health care providers and prompt the appropriate screening, evaluation, and management of delirium (Appendix 5, available in online article). The FAD subcommittee developed and organized two staff symposiums and in-services for all house staff, nursing personnel, and key attending staff regarding the importance of a change in mental status, clinical implications, and appropriate interventions. Ultimately, this work was also translated into a computerized clinical decision support intervention (Appendix 6, available in online article).

To measure the effectiveness of these interventions, we

tracked inpatient mortality and several process measures, including the time from delirium onset (or any change in mental status) to an appropriate clinical intervention and the proportion of patients with delirium who were discharged to home.

**Results**

**MORTALITY INDEX AND OBSERVED MORTALITY RATE**

In 2009 the Center for Evidence-based Practice at Penn Medicine was asked to examine the impact of the Mortality Review Committee on the mortality index. Given that the committee was established in 2006, the center examined the time period from 2006 to 2009. During this period, numerous quality interventions occurred simultaneously (Table 1; and Table 2, right). Thus, it was not possible to identify direct causal relationships between any one intervention and improvements in mortality; however, it was clear that the mortality index, as assessed by UHC data, steadily decreased during the period of study (Figure 2, page 393)—by approximately 0.09 per year, from 1.08 in 2006 to 0.53 in 2012 (*t*-test; *p* < .01). In addition, the observed mortality rate decreased from to 2.45% to 1.62% during the same period (*t*-test; *p* < .01). Beyond clinical improvement initiatives, substantive improvements in the documentation process resulted in the expected mortality rate increasing from 2.27% in 2006 to 3.04% in 2012 (*t*-test; *p* < .01).

**SEPSIS**

Following the QI initiatives for sepsis, time to administration of STAT antibiotics for rapid response team cases<sup>26</sup> was reduced from two and a half hours to less than one hour (*t*-test; *p* < .01) and from three hours to less than one and a half hours for cases in the MICU. In addition, survival from severe sepsis increased from 40% to 56%, and survival from septic shock improved from 42% to 54% hospitalwide.

Moreover, following the implementation of QI initiatives for sepsis, the mortality index for patients with a diagnosis of sepsis steadily declined from 2.75 to 1.01 in the MICU and from 2.45 to 0.88 for the hospital as a whole.

**DELIRIUM**

Following the QI initiatives for delirium, delirium cases were identified more frequently and at an earlier time. Before the QI initiatives, the average time to intervention for delirium was eight hours. Following the campaign, this response time decreased to an average of one hour. In addition, the rate of “timely” intervention for delirium within two hours increased from 18% to 57% (*t*-test; *p* < .01). Although there was no change in the mortality index for patients with a discharge diag-

<b>Role of the MRC</b>	<b>Intervention</b>
Development	Mortality Review Process 360° Survey Medical Records Query Process Falls, Aspiration and Delirium (FAD) Education Campaign Sepsis Campaign Revision of Supervision Policy for Faculty, House Staff, and Allied Providers
Supportive	Rapid Response Team Hospice Program

nosis of delirium during the study interval, there was a twofold increase in the likelihood that a patient would be discharged independently to home for those who received an intervention for delirium within two hours compared to those who did not (*t*-test; *p* < .05).

**Discussion**

We have described the use of a multidisciplinary mortality review committee to address inpatient mortality at a large, urban academic hospital. The diversity of the committee membership encouraged a multipronged approach to QI initiatives. Highlighting two initiatives developed and implemented by the committee to address sepsis and delirium, we demonstrate the enormous success that can be achieved through a systematic approach to mortality reduction. With 37,000 admissions annually, the reduction in mortality—as measured by the UHC observed mortality data—from 2006 to 2012, translated into approximately 300 fewer deaths in 2012 than in 2006 (37,000 × 0.83% absolute reduction in observed mortality). This study builds on previous work that has suggested that the formation of a mortality review committee can help health care organizations improve their inpatient mortality<sup>9,10</sup> and provides additional evidence to suggest that such a committee can be associated with a measurable improvement in observed to expected mortality.

**KEYS TO SUCCESS**

Through interdisciplinary meetings, partnerships with local providers, and a multipronged approach to data collection (including analysis of administrative data and manual chart reviews), the Mortality Review Committee identified and addressed a number of opportunities for QI (Tables 1 and 2). By conducting interdisciplinary meetings, the committee prevented “finger-pointing” and promoted a collaborative problem-

Trends in the Mortality Index, Observed Mortality, and Expected Mortality Following the Development of the Mortality Review Committee, Fiscal Year (FY) 2006–FY 2012

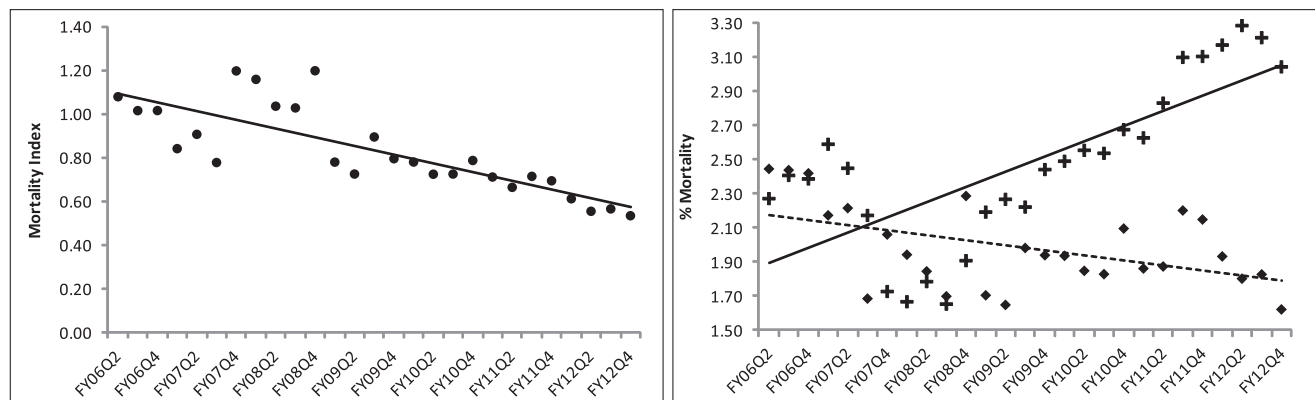


Figure 2. Data from the University HealthSystem Consortium (UHC) observed-to-expected mortality ratio, 2006–2012, are shown as Mortality Index with trend line (left), and observed and expected mortality (right). Diamonds (with dotted trend line) and crosses (with solid trend line) represent the observed and expected mortality, respectively. Of note, in the fourth quarter (Q4) of FY 2007, UHC recalibrated its mortality index algorithm, which was associated with a discontinuity in the data.

solving culture, which in turn reduced provider resistance, facilitating successful and well received improvement initiatives.

Partnering with local providers promoted the collection of unique perspectives and the successful development and implementation of improvement initiatives. Through the use of the local provider surveys that were collected immediately following a death, the Mortality Review Committee was able to gain a unique perspective on factors that may have contributed to inpatient mortality. Partnering with local providers was also important for the development and implementation of improvement initiatives. Being on the front lines of patient care, local providers often have the best sense of how to improve hospital processes and are in an excellent position to develop innovative solutions to problems identified by the Mortality Review Committee. Furthermore, involving local providers in the development of these initiatives increased provider buy-in. We found that providers were much more likely to accept an initiative that was developed by their colleagues than one that was seemingly forced upon them by the administration.

Developing a multipronged, systematic approach to data collection was crucial to success. By analyzing administrative data, local provider surveys, and enhanced chart reviews, the Mortality Review Committee obtained a more complete understanding of opportunities to reduce the mortality index and improve patient care. For example, when looking at Patient Safety Indicator data, we found that they were often inaccurate when compared with the review of the medical record. This problem has subsequently been substantiated in the literature.<sup>27</sup> In addition,

administrative data alone are often too superficial to inform the development of solutions to the problems they may identify. Finally, creating a systematic chart abstraction process and a centralized database to synthesize data facilitated the trending of data over time, which allowed the Mortality Review Committee to assess the impact of improvement initiatives.

There is no substitute for the alignment of organizational priorities, incentives, and leadership. The organization established mortality reduction as a priority. Executive leadership and all departmental chairs were challenged to achieve reductions in mortality. The pressure from the health system leadership to reduce the mortality index paved the way for the success of the Mortality Review Committee. With buy-in coming from the top as well as from local providers, the organization was open to the committee's proposals.

One limitation of these data presented in this article is the use of the mortality index as a quality measure. Although the mortality index is a helpful metric to correct for patient severity of illness, it is possible for improvements in the mortality index to be driven by increasing expected mortality (such as by improved coding) rather than by improving observed mortality. However, our data show that although increases in expected mortality do explain a component of the improvements in the mortality index, there was also a trend toward decreases in observed mortality during this time period. Furthermore, it is often challenging to demonstrate large improvements in observed mortality because of the low incidence of patient mortality at baseline. Another limitation is that the mortality index provides



Table 3. Improvement Initiatives Under Development

- Implementation of House Staff Quality Committee
- House Staff Representation at Leadership Meetings
- Integration of Evidence-Based Medicine Through Information Technology
- Implementation of Patient Surveillance System/Early Warning System

a static metric, while mortality reduction is a continuous and fluctuating process. As a result, our estimate of approximately 300 fewer deaths in 2012 compared with 2006 might be smaller if it were possible to examine on a more granular level.

Our data demonstrate a marked improvement in our mortality index over time. As with other QI initiatives (such as the National Surgical Quality Improvement Program at the Department of Veterans Affairs,<sup>28</sup> where a dramatic improvement in postoperative morbidity and mortality was demonstrated), it is plausible that our findings reflect the Hawthorne effect. This is in part intentional. By examining mortality closely and raising provider awareness of efforts to reduce inpatient mortality, we hope to have directly influenced observed and expected mortality. Similarly, we hope that the specific interventions informed by the Mortality Review Committee were important in effecting the improvements in mortality witnessed in our hospital. Regardless of the explanation for our results, the Mortality Review Committee will continue to work to reduce inpatient mortality (Table 3, above).

### CONTINUOUS QUALITY IMPROVEMENT

Going forward, the Mortality Review Committee will need to continue to look for efficient ways to identify improvement opportunities, design interventions, and measure their impact. The current chart review process requires 0.5 full-time equivalents (FTEs) of time from a highly qualified nurse reviewer and approximately 0.2 FTEs of physician time. Access to data analysis support is also important. The full committee meets for one and a half hours every other month. Many health care organizations may not have adequate resources to pursue such an approach and even if they do, there is still an opportunity cost to devoting so much time and effort to chart reviews. Improved methods for identifying charts for review, similar to the Institute for Healthcare Improvement Trigger Tools,<sup>29</sup> will need to be developed to increase the efficiency of this process. In addition, participation in the 360° provider reviews needs to be increased. Creating a stronger culture of continuous quality improvement may help increase participation, and organizations with strong

cultures of QI may be better suited to adopting such a tool. In addition, improvements in the design of the 360° form may result in increased participation.

The goal of reducing inpatient mortality is a continuous journey. The hospital has set a goal of zero preventable deaths by 2014. Thus far, the Mortality Review Committee has implemented numerous initiatives to lower the mortality index. On the basis of the literature and the committee's experiences, the initiatives have been targeted to impact specific processes related to either the observed or expected components of the mortality index. Given the number of initiatives and overlapping implementation timetables, it was not possible to determine which initiatives had the greatest impact on the mortality index. We conclude that the synergistic effects of all the initiatives implemented during the process of continuous quality improvement have propelled us toward reaching our mortality index goals. ■

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Appendix 1. Template for Provider Documentation

**DEPARTMENT OF MEDICINE  
INITIAL HOSPITAL VISIT/INPATIENT CONSULT**

Date: \_\_\_\_\_ Time: \_\_\_\_\_  Initial Visit  Consult – Requesting Physician: \_\_\_\_\_  
(Requires all 3 components: History, Exam, and Medical Decision Making)

**(1) HISTORY:**

Chief Complaint/HPI: 1. (Consult: Level 3-5 = ≥4 elements; Level 1-2 = ≤3)  
2. (Admit: 4 elements required)

(location/quality/duration/timing/severity/context/modifying factors/associated signs/symptoms)

unable to obtain (indicate reason)

**MEDICATION/ALLERGIES: SEE MEDICATION RECONCILIATION FORM**

ROS: 1. (Consult: Level 4-5 = 10; Level 3 = 2-9; Level 2 = 1; Level 1 = 0)  Remainder Negative  unable to obtain (indicate reason)  
2. (Admit: Level 2-3 = ≥10; Level 1 = 2-9)

	NI	Comments (positive or pertinent negs)		NI	Comments
Constitutional			Integumentary		
Eyes			Musculoskeletal		
Ears/Nose/Mouth/Throat			Neurological		
Respiratory			Psychiatric		
Cardiovascular			Endocrinologic		
Gastrointestinal			Hematologic		
Genitourinary			Immunologic		

(Address ALL Histories; the term "non-contributory" is acceptable, when appropriate)

PMH:  unable to obtain (indicate reason)  
 non-contributory

**Present on Admission**  
 Pressure ulcers  
Location:  
Stage:  
 Catheter associated UTI  
 Catheter related blood stream infection

FH:  Non obtainable  NC

SH:  Non obtainable  NC  
 ETOH  
 Tobacco  
 IVDA  
 Occupation  
 Living Situation

**DO NOT USE UNAPPROVED ABBREVIATIONS**

Page 1 of 3

12022010

The template for provider documentation was used on the inpatient medicine service to help standardize the documentation process to optimize the clarity of provider assessments as well as diagnostic and treatment plans.

(continued on page AP2)

Appendix 1. Template for Provider Documentation (continued)

Date \_\_\_\_\_

**MULTI-SYSTEM EXAMINATION:** (*Consult: Level 4-5 = 2 boxes in 9 systems; Level 3 = any 12; Level 2 = any 6; Level 1 = any 5*)  
*Elaborate abnormal findings (Admit: Level 2-3 = 2 boxes in 9 systems; Level 1 = any 12)*

Constitutional: T: \_\_\_\_\_ P: \_\_\_\_\_  reg BP: \_\_\_\_\_  sit RR: \_\_\_\_\_ WT: \_\_\_\_\_ HT: \_\_\_\_\_  See Flow Sheet  
 irreg  supine

Appearance:

Eyes:  no scleral icterus  PERRLA  nl fundus exam

E/N/M/T:  nl hearing  nl external canals/tympanic membrane  
 nl teeth, lips, gums  clear oropharynx

Neck:  nl appearance and movements; nl JVP  
 trachea midline  
 no thyroid enlargement, masses

Respiratory:  symmetrical chest expansion and respiratory effort  
 clear to auscultation and palpation  
 nl percussion

Breast:  nl breast symmetry  no masses/tenderness of breast or axillae

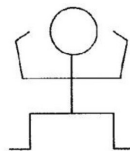
Cardiovascular:  nl sounds; no murmurs, gallops or rubs  no JVP  
 no carotid bruits  nl PMI; no thrill  
 nl pulses (*indicate*)  femoral  pedal  other:

Abdominal:  no tenderness; nl sounds  no hernias present  
 no hepatosplenomegaly  nl digital rectal exam  
 neg hemoccult test



Lymphatic:  no adenopathy  cervical  supraclavicular  axillary  inguinal

Musculoskeletal:  nl gait  no clubbing, cyanosis  
 nl symmetry, ROM, strength and tone



Skin:  no rashes or ulcers  no nodules

Neuro:  nl cranial nerves  nl reflexes  nl sensation

Psych:  alert, oriented to person, place, time  
 intact memory  nl affect, judgment, insight

Genitourinary: MALE:  nl scrotum; no tenderness or masses  nl penis  
 nl digital rectal exam or prostate  
 FEMALE: (pelvic exam with or without specimen collection for smear and cultures)  
 nl external genitalia and vagina  no urethral tenderness  
 nl bladder; no masses or tenderness  
 nl cervix; no lesions or discharges  nl uterus  
 nl adnexa/parametria

**DO NOT USE UNAPPROVED ABBREVIATIONS**

Page 2 of 3

(continued on page AP3)

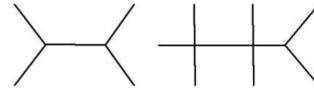
Appendix 1. Template for Provider Documentation (continued)

Date \_\_\_\_\_

**(3) MEDICAL DECISION MAKING:**

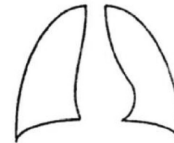
**Assessment and Plan:** *(Possible Dx / Treatment Options / Additional Testing / Therapeutic Intervention)*

**Data Review:**



**EKG**

**CXR**     **NAD**



See Attending Supplement

Resident / Fellow Signature / Print: \_\_\_\_\_ MS R1 R2 R3 Fellow

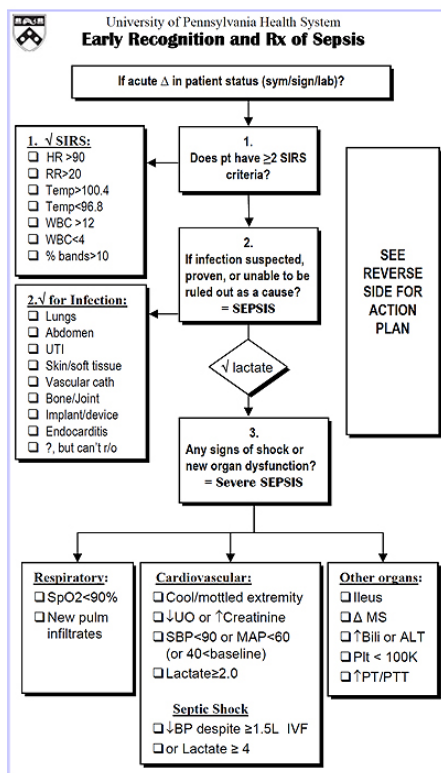
Date: \_\_\_\_\_ Time: \_\_\_\_\_ Pager: \_\_\_\_\_

**DO NOT USE UNAPPROVED ABBREVIATIONS**

Page 3 of 3

Appendix 2. Pocket Card Developed for Sepsis Diagnosis and Management

2a. Front of card



2b. Back of card

University of Pennsylvania Health System  
**Early Recognition and Rx of Sepsis - Continued**

Confirm Diagnosis:

- ≥2 SIRS?  N  Y
- Infection suspected or can't r/o as a cause for the acute Δ?  N  Y  
\*If Y to both → SEPSIS (always √Lactate → ABG syringe in CC/lab)
- Shock or other organ dysfunction?  N  Y # Y → Severe SEPSIS  
\*If Lactate ≥4, or SBP <90 despite 1.5L IVF → Septic SHOCK

Immediate Action Plan:

- Consider RRT consult
- √ Lactate (via ABG syringe to CC lab), CBC/diff, P7, LFTs, +/-ABG
- √ ScvO2 if CVC/PICC
- Blood cultures: → @ \_\_\_\_\_
- Ensure IV access (18g/TLC)
- If exam/data c/w shock, give IVF boluses 500 ml q15 x 3-4 to resolve
- Monitor VS q15 min
  - Cardiac monitor
  - P.Ox (NC → SpO2 >92%)

If Septic Shock: (Lactate ≥4 and/or SBP <90 (MAP <60) despite ≥1.5L IVF):

- Call RRT for:
  - Help with IV access: @ \_\_\_\_\_
  - STAT ABx (w/1 hr): @ \_\_\_\_\_
  - ICU transfer: @ \_\_\_\_\_
- EGDT:
  - If MAP <65 despite IVF start NE
  - If ScvO2 < 70% (CVP 8-12 → Hgb ≥10 → Dobutamine)

Document Other Events & Data:

Event	Value	Time
Lactate	_____	_____
ICU transfer	_____	_____

EGDT Data:

1 <sup>st</sup> CVP	_____
CVP @ goal 8-12	_____
1 <sup>st</sup> ScvO2	_____
ScvO2 @ goal ≥70%	_____

**Nursing Responsibilities**  
(following identification of sepsis)

1. Notify MD, Charge Nurse of findings. Call RRT if further assistance needed.
2. Place on cardiac monitor, pulse oximeter, supplemental O2 (NC to maintain SaO2 > 92%).
3. Obtain VS (BP, HR, RR) q15 min (temp q 1 hr)
4. If MAP < 65 (or < baseline) or shock is present, give 500 ml 0.9% NaCl or Lactated Ringers over 15 minutes using pressure bag. Repeat x 2 (total 1.5 L) to obtain MAP ≥ 65.
5. Coordinate w / MD need for labs / cultures
6. Give antibiotics within 1 hour of hypotension or shock.
7. Insert Foley catheter if hypotensive, getting IV fluids.

**Within 2 hours of recognition, Nursing and MD will:**

- Evaluate clinical condition, laboratory values and vital signs.
- If lactate ≥ 4 mmol/L, or MAP < 65 after 1.5 L IV fluids: Transfer to ICU for EGDT (begin EGDT using RRT if transfer delay).
  - If other parameters are deteriorating, consider ICU transfer.
- If lactate < 4 mmol/L, and MAP > 65 after IV fluids, continue with VS Q 15 min X 4, Q30 min X 4, Q1 hour X 4, then routine.



Appendix 2a (front). Laminated pocket card prompt to guide screening for sepsis; Appendix 2b (back). Laminated pocket card prompt to guide evaluation and management of sepsis for physicians (left) and nurses (right). Selected abbreviations: CC, critical care; EGDT, early goal-directed therapy; MAP, mean arterial pressure; MS, mental status; NC, nasal cannula; R/O: rule out; SIRS, systemic inflammatory response syndrome; UO, urine output; UTI, urinary tract infection.

Appendix 3. Screenshot of Clinical Decision Support Intervention for Sepsis Management

Order	Frequency	Instructions
<input checked="" type="checkbox"/> <b>Vital Signs</b>	Every 15 Minutes	Until MAP greater than 65 mmHg for one hour and then every one hour...
<input checked="" type="checkbox"/> <b>Monitor SAO2.</b>	Continuous 24 hours	Resuscitation Goal: Pulse Oximetry greater than 92 % Saturation
<input type="checkbox"/> Oxygen Therapy		
<input type="checkbox"/> Monitor CVP		Resuscitation Goals: CVP 8 -12 mmHg
<input type="checkbox"/> Central Venous O2 Sat		Resuscitation Goals: CV O2 Sat greater than 70 % or mixed venous greater than 65 %
<input checked="" type="checkbox"/> <b>I&amp;O (Strict)</b>		
<input type="checkbox"/> Indwelling Urinary Catheter (IUC)		Record urine output every 8 hours or per unit protocol...
<input type="checkbox"/> Insert --		Two 18-gauge peripheral IVs
<input type="checkbox"/> Telemetry Order set HUP		
<input type="checkbox"/> NPO Standard order HUP		
<input checked="" type="checkbox"/> <b>Severe Sepsis/Septic Shock</b>		

Antibiotic therapy should be directed at the likely source, but if source is unknown empiric BS coverage should be given.  
 REMINDER: Order initial dose STAT.

Suspected Source of Sepsis	ABX Orders Given Last 24 hours
<ul style="list-style-type: none"> <li><input type="checkbox"/> Abdominal, Pelvis</li> <li><input type="checkbox"/> Central Line</li> <li><input type="checkbox"/> Meningitis</li> <li><input type="checkbox"/> Pneumonia - Community Acquired</li> <li><input type="checkbox"/> Pneumonia - Hospital Acquired</li> <li><input type="checkbox"/> Skin and Soft Tissue</li> <li><input type="checkbox"/> Urosepsis</li> <li><input type="checkbox"/> Unknown Source</li> </ul>	ceFAZolin IVPB - 1Gram(s) intraVENEUS piggyback Every 8 Hours at 08-Nov-2011 17:13:00

The clinical decision support tool provides prompts to help the clinician assess the clinical situation, begin early goal-directed therapy, and administer appropriate antibiotics in a timely fashion. This tool automatically populates recent relevant laboratory data to aid the clinician in evaluation.

Appendix 4. Pocket Card Developed to Guide Screening, Evaluation, and Management of Delirium, as Well as the Nonpharmacologic Interventions for Change in Mental Status and Delirium

4a. Front of card

### Screening, Evaluation & Mgmt of Change in Mental Status (MS)/Delirium

Delirium, or any change in MS, is a medical emergency & should be evaluated urgently to avoid adverse outcomes

#### Screening

Document baseline MS (on admission\*);  
Assess for changes continuously; Document changes prn & assessment q shift  
*(Assess from family if admission MS is a change from home baseline; and include family observations in routine assessments)*

**Normal (or at Baseline)**

- Attentive, able to focus
- Thinking clearly
- Alert and calm

**Abnormal (or any change vs. baseline):**

- Inattentive/distracted at times
- Confused at times
- Agitated/anxious or drowsy/sedated (includes Delirium)

Assess q shift

- Assess airway, breath, circulation
- Follow for expected improvement and resolution within 4-6 hrs, as known precipitant clears


\*Call MD/Charge RN\*

Is there a known self-limited cause? (e.g. post-sedation/anesthetic)

YES

NO

**Assessments**  
see reverse side



### Screening, Evaluation & Mgmt of Change in Mental Status (MS)/Delirium – CONTINUED

#### ASSESSMENTS

**Initial Assessment:**

- ✓ Airway, Breathing, Circulation, O<sub>2</sub> Sat
  - *Emphasis:* Can pt protect airway; is cough adequate?
- ✓ Vital signs (compare to baseline)/ ✓ SIRS /consider sepsis
- ✓ Glucose (& review recent labs)
- Consider **shock** – ✓ urine output, are limbs cool and pulses weak
- Consider **CNS event** – is pt following commands? does stimulation elicit focal deficits?, ✓ pupils, other cranial nerves

**Secondary Assessment:**

- **History:** Review recent meds (especially anticholinergics, opioids, benzodiazepines), procedures, events (e.g. falls), R/O pain
- Consider withdrawal, e.g. alcohol, benzodiazepines, opioids, home meds not resumed
- Assess restraints including devices lines & tubes
- Is this a complication of a procedure or treatment (either new or recent escalation of treatment)
- Consider malnutrition, dehydration, constipation; ✓ urine/stool output
- ✓ with family – how does this relate to baseline MS?
- Consider sleep deprivation, sensory deficit, hear/visual impairment
- **Phys Exam:** complete plus skin, wounds, lines/tubes
- **Routine Tests:** P7, Lactate, Ca/P, LFT, CBC, UA, EKG, CXR
- **Selected Tests:**
  - BCx
  - Card Enzymes
  - ABG (or VBG)
  - Drug levels
  - CT head (LP)
  - NH3
  - Utox
  - EEG
  - TFT's

(continued on page AP7)

Appendix 4a (front). Laminated pocket card prompt to guide screening, evaluation, and management of change in mental status/delirium, distributed during the Falls, Aspiration and Delirium (FAD) campaign. Appendix 4b (back). Laminated pocket card prompt to guide pharmacologic and nonpharmacologic management of change in mental status/delirium, distributed during the FAD campaign. R/O, rule out; RRT, rapid response team; SOB, shortness of breath.



Appendix 4. Pocket Card Developed to Guide Screening, Evaluation, and Management of Delirium, as Well as the Nonpharmacologic Interventions for Change in Mental Status and Delirium (continued)

4b. Back of card

### Delirium Non-Pharm Interventions

**Acute Agitated Delirium**

- Patient at risk to harm self or others or interfere with medical care or patient shows significant distress.
- R/O SOB and pain as a cause
- R/O contraindication to Haloperidol
  - Monitor EKG, K+ and Mg+ daily

- **Hypo-Active or Calm Delirium**

**Non-Pharm Management**  
(Details in RN policy & Delirium Web-site):

- Consider RRT or ICU transfer
- Consider ↑ monitoring: Pulse ox, telemetry (if AHA indication), & follow up on vital signs & labs
- **Avoid (or remove) physical restraints or limiting movement (as this will increase agitation)**
- Use redirection, mits, sitters, observation bed, frequent family visits or prolonged family stay (24/7)
- Stop non-essential meds (benzodiazepines/other sedatives/anticholinergics) except if benzo has been given chronically (>5days)
- Remove non-essential equipment e.g. lines/tubes, or camouflage if needed
- Assess and manage pain
- Initiate **aspiration, safety, and fall** precautions and place call bell in patient's reach; speech therapy consultation
- Enable communication (glasses, hearing aids, dentures, interpreters; paper/pencil, communication boards, Passy Muir Valves for tracheostomies)
- Reorient patient and educate family about delirium
- Minimize noise, consider relaxation therapies, music, massage
- Normalize sleep-wake cycle
- Maintain mobility and self-care ability
- Consider psych consult if interventions fail to resolve change in MS/delirium in 48 hrs

Mild

Moderate

Severe

Penn Medicine

### Delirium Pharm Interventions - CONTINUED

Mild	Moderate	Severe
<p>(RASS 1-2; anxious but not aggressive, non-purposeful movements)</p> <ul style="list-style-type: none"> <li>• Non-pharmacologic interventions</li> <li>• <b>If refractory symptoms/signs &gt; 24 hours, consider Haloperidol-</b></li> </ul> <p>&lt;65 y.o. → 0.5- 1 mg po, IV, or IM</p> <p>&gt;65 or frail → 0.5 mg po, IV, or IM</p>	<p>(RASS 3; pulls or removes catheters, EKG leads, tubes; aggressive)</p> <p>Haloperidol dosing:</p> <p>&lt;65 y.o. → 2-4 mg po, IV, or IM</p> <p>&gt;65 or frail → 1-2 mg po, IV, or IM</p>	<p>(RASS 4; combative, violent, danger to staff)</p> <p>Haloperidol dosing:</p> <p>&lt;65 y.o. → 4-10 mg IV/IM</p> <p>&gt;65 or frail → 2 mg IV/IM maximum</p>



**Does agitation persist 20-30 min after IV/IM Haloperidol?**

**YES**

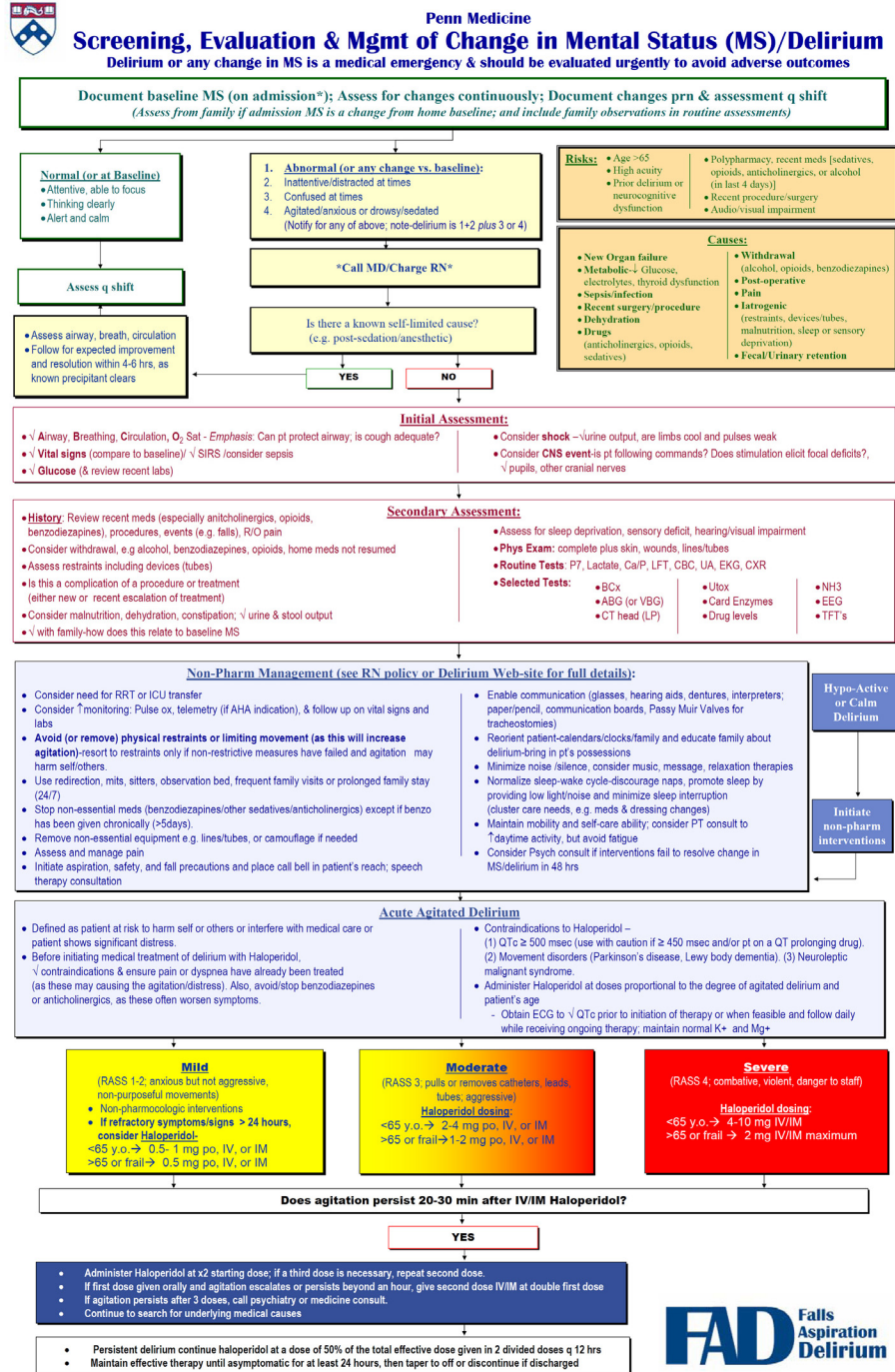
- Administer Haloperidol at x2 starting dose; if a third dose is necessary, repeat second dose.
- If first dose given orally and agitation escalates or persists beyond an hour, give second dose IV/IM at double first dose
- If agitation persists after 3 doses, call psychiatry or medicine consult.
- Continue to search for underlying medical causes

- If delirium persists, continue haloperidol at a dose of 50% of the total effective dose given in 2 divided doses q 12 hrs
- Maintain effective therapy until asymptomatic for at least 24 hours, then taper to off or discontinue if discharged

**Continued on reverse side**

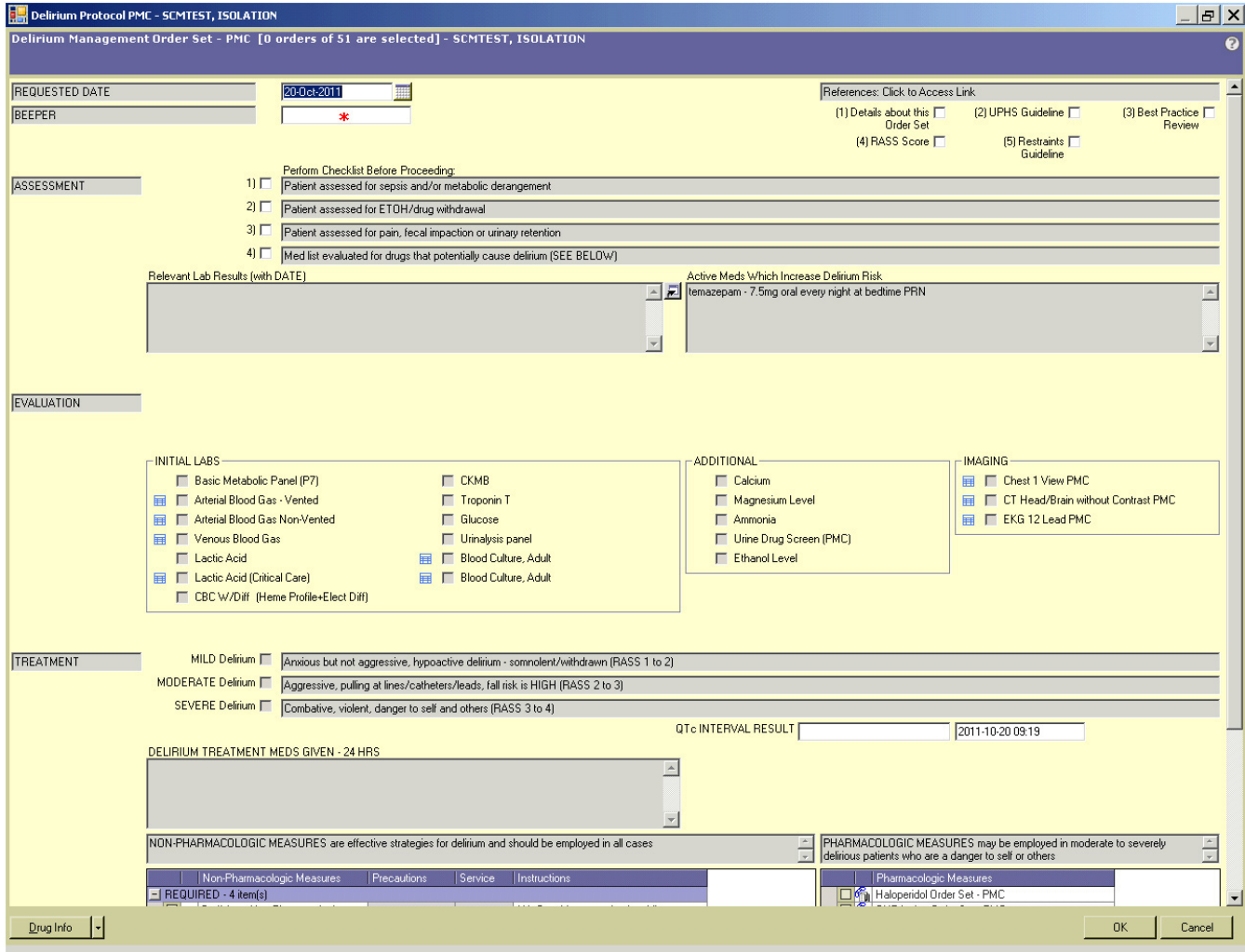



Appendix 5. Sample Poster Developed by the Falls, Aspiration and Delirium Subcommittee



This poster was created for inpatient units to raise awareness and guide screening, evaluation, and management of change in mental status/delirium, distributed during the Falls, Aspiration and Delirium (FAD) campaign.

Appendix 6. Screenshot of Clinical Decision Support Intervention for Delirium Management



**Delirium Protocol PMC - SCMTEST, ISOLATION**  
 Delirium Management Order Set - PMC [0 orders of 51 are selected] - SCMTEST, ISOLATION

REQUESTED DATE: 20-Oct-2011  
 BEEPER: \*

References: Click to Access Link  
 (1) Details about this Order Set  (2) UPHS Guideline  (3) Best Practice Review   
 (4) RASS Score  (5) Restraints Guideline

**ASSESSMENT**  
 Perform Checklist Before Proceeding:  
 1)  Patient assessed for sepsis and/or metabolic derangement  
 2)  Patient assessed for ETOH/drug withdrawal  
 3)  Patient assessed for pain, fecal impaction or urinary retention  
 4)  Med list evaluated for drugs that potentially cause delirium (SEE BELOW)

Relevant Lab Results (with DATE):  
 Active Meds Which Increase Delirium Risk:  
 temazepam - 7.5mg oral every night at bedtime PRN

**EVALUATION**

**INITIAL LABS**  
 Basic Metabolic Panel (P7)  
 Arterial Blood Gas - Ventd  
 Arterial Blood Gas Non-Ventd  
 Venous Blood Gas  
 Lactic Acid  
 Lactic Acid (Critical Care)  
 CBC w/Diff (Heme Profile+Elect Diff)  
 CKMB  
 Troponin T  
 Glucose  
 Urinalysis panel  
 Blood Culture, Adult  
 Blood Culture, Adult

**ADDITIONAL**  
 Calcium  
 Magnesium Level  
 Ammonia  
 Urine Drug Screen (PMC)  
 Ethanol Level

**IMAGING**  
 Chest 1 View PMC  
 CT Head/Brain without Contrast PMC  
 EKG 12 Lead PMC

**TREATMENT**  
 MILD Delirium  Anxious but not aggressive, hypoactive delirium - somnolent/withdrawn (RASS 1 to 2)  
 MODERATE Delirium  Aggressive, pulling at lines/catheters/leads, fall risk is HIGH (RASS 2 to 3)  
 SEVERE Delirium  Combative, violent, danger to self and others (RASS 3 to 4)

QTc INTERVAL RESULT: 2011-10-20 09:19

DELIRIUM TREATMENT MEDS GIVEN - 24 HRS

NON-PHARMACOLOGIC MEASURES are effective strategies for delirium and should be employed in all cases  
 PHARMACOLOGIC MEASURES may be employed in moderate to severely delirious patients who are a danger to self or others

Drug Info: REQUIRED - 4 item(s) | Haloperidol Order Set - PMC

OK Cancel

*This tool provides prompts to help the clinician assess the clinical situation, order appropriate laboratory and imaging studies, and choose an effective treatment strategy. This tool automatically populates recent relevant laboratory data from the past seven days and active medications that are known to increase the risk of delirium to aid the clinician in evaluation.*