

Use of a Geriatric Quality Initiative to Educate Internal Medicine Residents about Delirium and Its Risk Factors

DANIELE ÖLVECKZY, MD, MA
MELISSA L. P. MATTISON, MD
KENNETH J. MUKAMAL, MD, MPH

Abstract

Background Delirium is a common and debilitating complication of inpatient care for many older adults, yet internal medicine residents often do not recognize delirium or its risk factors. Integrating geriatric education (eg, delirium recognition) with inpatient quality improvement (QI) is not well tested.

Methods We developed an educational pilot program within an ongoing hospital-wide geriatric QI initiative (Global Risk Assessment and Careplan for the Elderly-Acute Care [GRACE-AC]). GRACE-AC modifies the inpatient computerized provider order entry system to meet the needs of vulnerable older adults and uses a bedside care checklist to identify patients with possible delirium and promote delirium prevention by checking on the need for “tethers” (intravenous fluids, Foley catheters, and telemetry). Residents were assessed before and after each inpatient rotation by using anonymous electronic surveys.

Results A total of 167 eligible residents (91%) completed prerotation surveys, and 102 (56%) residents completed postrotation surveys. All but the first rotating resident group received a standardized 2-minute educational in-service orientation. In a comparison of postrotation responses before and after implementation of the in-service, the proportion of residents who reported improvement in their ability to recall which patients had tethers increased from 17% to 52% for intravenous fluids ($P = .004$), 28% to 75% for Foley catheters ($P < .001$), and 21% to 50% for telemetry ($P = .02$). Comparing pre- and postrotation surveys, the proportion of correct responses to questions on haloperidol dosing and the characteristics of delirium increased from 26% to 76% and 31% to 63%, respectively (both $P < .001$).

Conclusions Our pilot program demonstrated that inpatient geriatric QI initiatives can be successfully merged with a brief educational curriculum.

Editor’s Note: The online version of this article contains the Global Risk Assessment and Careplan for the Elderly-Acute Care (GRACE-AC) bedside checklist; the Phase I, II, and III pre- and postrotation surveys; a transcript of the in-service;

and a screenshot of the antipsychotic decision support used in this study.

All authors are at Division of General Medicine and Primary Care, Beth Israel Deaconess Medical Center. **Daniele Ölveczky, MD, MA**, is Instructor of Medicine, Harvard Medical School; **Melissa L. P. Mattison, MD**, is Assistant Professor of Medicine, Harvard Medical School, and Associate Chief, Section of Hospital Medicine; and **Kenneth J. Mukamal, MD, MPH**, is Associate Professor of Medicine, Harvard Medical School.

Funding: The authors report no external funding source for this study.

Presented orally at the Society of General Internal Medicine Regional Meeting, March 4, 2011, Boston, MA.

The authors are grateful to the Global Risk Assessment and Careplan for the Elderly-Acute Care Working Group, including Angela Botts Catic, MD, Julie Moran, DO, and Christine Kristeller, RN; to Grace Huang, MD, and Julie Irish, PhD, Shapiro Institute for Education and Research, for their assistance with survey instrument design; and to Anna Johansson, PhD, for help with human subjects’ protection.

Corresponding author: Daniele Ölveczky, MD, MA, Department of Medicine, Beth Israel Deaconess Medical Center, 330 Brookline Avenue, Span 2, Boston, MA 02215, dolveczk@bidmc.harvard.edu

Received July 8, 2012; revision received November 30, 2012; accepted January 25, 2013.

DOI: <http://dx.doi.org/10.4300/JGME-D-12-00190.1>

Introduction

Delirium is a common and debilitating condition in hospitalized elders.¹ It affects 11% to 42% of elderly medical inpatients² and is associated with increased mortality.³ As the proportion of older hospitalized patients increases, effective methods to improve the care of elders systematically and efficiently are needed.⁴ Coincident with growth in the culture of patient safety, hospitals have commonly adopted principles of quality improvement (QI) from other fields, incorporating plan-do-study-act (PDSA) feedback loops to make continuous improvement based on the results of preceding cycles.

A challenging aspect of QI is the ability to integrate it into the mission of academic medical centers. The modern academic medical center’s mandate is multifaceted and complicated. It is expected to provide high-quality patient care, to educate residents, and decrease hospital costs while adhering to ever more stringent resident duty hours. Given this situation, novel and time-effective methods of resident

education must be developed and integrated into other hospital functions. To our knowledge, few studies have demonstrated successful integration of inpatient quality initiatives with resident education on delirium to maximize their academic value.

We describe an educational effort to improve residents' recognition and treatment of delirious patients that is integrated into a concurrent QI initiative designed for the unique needs of hospitalized elders. We hypothesized that combining QI and education in a brief, targeted intervention during internal medicine ward rotations would result in improved knowledge and awareness of delirium.

Methods

Clinical and Training Services of the Medical Center

Beth Israel Deaconess Medical Center (BIDMC) is a 631-bed tertiary care medical center in Boston, MA, and a major teaching affiliate of Harvard Medical School, with approximately 40 000 admissions annually. The institution trains 160 internal medicine residents. Throughout 3 years of core internal medicine training, residents spend approximately 12 months rotating through the general medical service,⁵ and at any given time, approximately 30 residents rotate through the general medicine service. All orders are entered electronically through a computerized provider order entry (CPOE) system, which was developed internally and has been used successfully for other QI initiatives.⁶

Geriatric Quality Improvement and Integrated Educational Initiative

Development of the Geriatric Quality Improvement Initiative The Global Risk Assessment and Careplan for Elders-Acute Care (GRACE-AC) is an ongoing quality initiative developed and established at BIDMC in 2009 to optimize and standardize care for

What was known

Integrating geriatric education for residents with inpatient quality improvement (QI) is not well tested.

What is new

An educational pilot program within an ongoing hospital-wide geriatric quality improvement initiative used an existing computer system and a bedside care checklist to identify patients with possible delirium and promote delirium prevention.

Limitations

Single-site study limits generalizability, and study design did not assess patient outcomes.

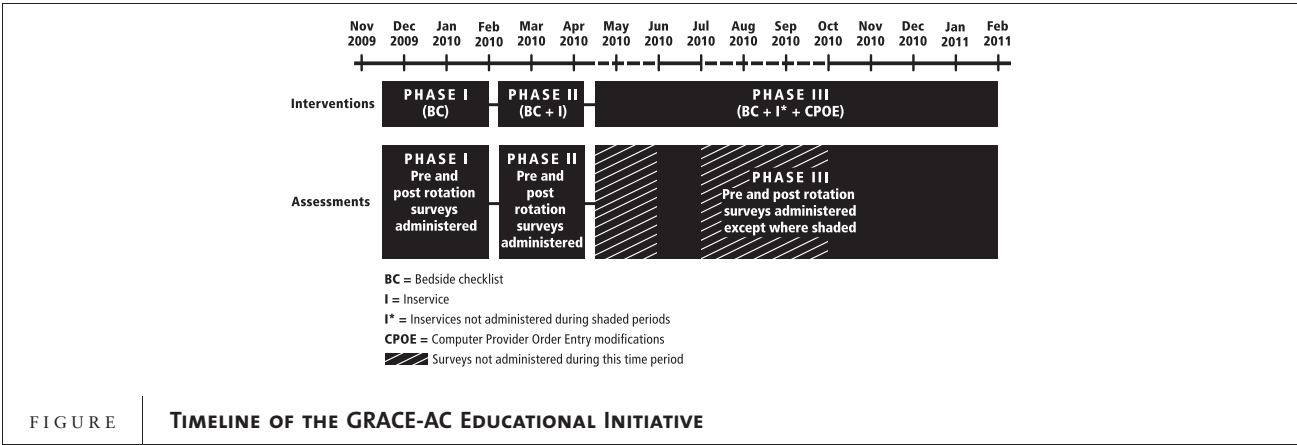
Bottom line

Inpatient geriatric QI initiatives can be successfully merged with a brief educational curriculum.

hospitalized elders.⁷ A group of geriatric medicine and hospital medicine specialists, psychiatrists, nurses, computer support staff, and pharmacists designed the initiative. A subset of this group, the GRACE-AC working group, consisting of 2 geriatrics hospitalists, 2 geriatricians, and 1 geriatrics nurse specialist, met regularly to plan and monitor its implementation. GRACE-AC and its pilot educational initiative consisted of several complementary features implemented serially in 3 phases (FIGURE).

Phase I: GRACE-AC Bedside Care Checklist The GRACE-AC bedside checklist (BC) was piloted on 3 medical wards in November 2009 and implemented hospital-wide in late April 2010. The bedside checklist consists of a single sheet of paper stored at the bedside. It is divided into delirium screening and delirium prevention (provided as online supplemental material).

To screen for delirium, the checklist incorporates key features of the Confusion Assessment Method (CAM), a widely used instrument with validity evidence in the



hospital setting with nurse assessors, to determine the presence of delirium.⁸ To ascertain delirium, the CAM requires (1) acute onset of symptoms, (2) symptoms that fluctuate with time, and (3) inattention along with an altered level of consciousness or disorganized thinking. Thus, nurses test attention daily by asking patients to state the months of the year, days of the week, or numbers from 10 to 1 in reverse order. To evaluate consciousness, nurses use the Richmond Agitation and Sedation Scale (RASS), which has high interrater reliability when used by nurses at the bedside.⁹ A RASS score is calculated twice daily to detect fluctuations in a patient's mental status.

If a patient is unable to perform the daily test of attention or scores from <-1 to $>+1$ on the RASS and either of these findings is new, nurses activate the institution's rapid response team (RRT; consisting of the primary intern, resident, and attending physician). The physician team examines the patient for inciting causes of delirium, adjusts or prescribes medication if appropriate, and considers geriatric or psychiatric consultation. In the first 17 months of the GRACE-AC program, the RRT was called 16 times per 1000 discharges for this reason.

For prevention, the second part of the checklist reminds care team members to assess the ongoing need for tethers (Foley catheters, intravenous fluid, and telemetry); document the fact that the patient has ambulated or has been moved from bed to chair, if not able to ambulate, at least twice daily; and to avoid unnecessary disruptions to the patient's sleep. These interventions appear to minimize delirium among hospitalized elders.¹⁰

Survey Instruments and Administration

Brief pre- and postrotation electronic surveys were created de novo to assess residents' knowledge and awareness of delirium. In Phases I and II only, the frequency of communication with members of the patient's care team was also assessed (see surveys provided as online supplemental material). Existing survey instruments, such as the University of Michigan Geriatric Clinical Knowledge Assessment¹¹ and UCLA Geriatrics Knowledge Test,¹² lack key questions about components of GRACE-AC and recommended internal medicine and family medicine resident competencies.¹³ The new surveys were designed with educational staff at the BIDMC Shapiro Center for Education.¹⁴ As with other elements of this QI effort, we modified surveys based on feedback from residents, the GRACE-AC working group, and Shapiro Center staff; analysis of responses from previous cycles; and the components of GRACE-AC available for use.

In all 3 phases of the educational intervention, residents were contacted by e-mail 1 week before starting their rotation. The invitation e-mail included a link to the

prerotation survey and stated that participation was voluntary, confidential, and would not affect their residency evaluation. Residents who completed both pre- and postrotation surveys were entered into a lottery to win one of five \$30 gift cards from local coffee chains. Residents were asked to complete postrotation questionnaires within 2 weeks after their rotations; thus, questionnaires were completed approximately 4 to 6 weeks after the in-service. The study and electronic survey instruments were approved by the BIDMC Committee on Clinical Investigations.

Survey questions were grouped into 3 domains: frequency of communication in Phases I and II, perception in all 3 phases, and knowledge in Phase III. In the perception domain, present in all 3 phases, respondents reported whether they thought the GRACE-AC checklist had improved their awareness of delirium in their patients and their ability to recall which patients had tethers. These questions did not permit us to determine if residents were aware of the checklist or of delirium itself.

Phase II: Addition of an Educational In-Service (BC + In-Service [Phase II]) Based on feedback from residents who participated in Phase I, we added a scripted, 2-minute, small group educational in-service to residents during the first week of their medicine rotations during Phase II, starting in February 2010 (see transcript provided as online supplemental material). The content incorporated specific recommended geriatric competencies (numbers 5 and 17–20) relevant to the care of the hospitalized older patient.¹³ The in-service was delivered after residents completed prerotation surveys and was conducted directly on hospital wards to reduce disruption in clinical activity.

Phase III: CPOE Modifications (BC + I + CPOE) On April 26, 2010, the BIDMC CPOE system was modified to recommend several geriatric-specific orders. These included changing the default activity order from “ad lib” to “get patient out of bed twice daily.” An existing customized drug warning system for the medical center's CPOE application, in place since 2004,⁶ was broadened to include all commonly used antipsychotic drugs. A decision support screen to provide guidance to ordering providers about the drugs' proper indications and doses was also added (see screen shot of decision support provided as online supplemental material). The 2-minute in-services were continued during this phase.

After the CPOE modifications regarding antipsychotic medications went into effect, we added questions in the knowledge domain. Residents were surveyed about the appropriate use of antipsychotics, using haloperidol as a specific example, and the cardinal features of delirium. To accommodate this the frequency of communication domain was omitted to focus on resident education. In addition, in postrotation questionnaires in Phase III only, residents

compared their ability to diagnose delirium before and after the rotation. Due to staffing limitations, surveys and in-services were only administered in one cycle during the first 6 months of Phase III.

Statistical Analysis

For the perception domain, we tested a linear trend in binary response across the 3 cycles with an extended Mantel-Haenszel χ^2 test for linear trend with 1 degree of freedom. Contingency tables with standard χ^2 tests were used to compare the proportion of correct responses in the knowledge domains pre- versus postrotation as well as improvement in self-reported ability to diagnose delirium. We performed these analyses using an open-source epidemiologic calculator (Open Epi, Atlanta, GA; <http://openepi.com>).¹⁵ Because not all individuals completed pre- and postrotation questionnaires, we also tested for the proportions of correct responses restricted to the subset of residents who completed both surveys by using McNemar's test in GraphPad (San Diego, CA) software.¹⁶

Results

We contacted approximately 180 internal medicine residents performing their ward rotations from November 2009 to February 2011. Most residents who responded were interns (TABLE 1), because interns comprise the bulk of the residents on these rotations. Greater than 90% completed prerotation surveys, and 56% of the residents contacted completed postrotation surveys.

TABLE 2 shows results from the perception domain. Few respondents initially reported that the GRACE-AC checklist improved their awareness of delirium or identification of patients with tethers. With the administration of the 2-minute talks (in-services) during phases II and III, residents were significantly more likely to report an improvement in both. As expected, the proportion of residents who reported they were somewhat confident to unsure about their ability to diagnose delirium in prerotation surveys did not change across all 3 phases ($P = .73$).

In Phase III only postrotation survey respondents were asked to compare their ability to diagnose delirium before and after rotating on the medicine service. Among these 46 residents, 22% reported that their ability to diagnose delirium had been good or excellent before the rotation, compared with 71% ($P < .001$) afterward.

TABLE 3 lists results of the knowledge domain. Postrotation knowledge domain scores increased significantly compared to prerotation scores. We also compared responses before and after among the subset of 40 individuals who answered both pre- and postrotation surveys. For haloperidol dosing, the proportion of correct

responses improved from 20% to 72% ($P < .001$). For features of delirium, the proportion of correct responses improved from 27% to 63% ($P = .04$).

Discussion

We found that a single, brief, targeted teaching intervention lasting 2 minutes, when complemented by ongoing exposure to a geriatrics quality initiative, was associated with a marked increase in residents' awareness of delirium and ability to recall patients with tethers (a risk factor for delirium). This occurred even prior to the institution of changes to the CPOE system and, thus, may be of interest to other centers where CPOE systems are not available. Moreover, the combined interventions were associated with increases in resident knowledge in important geriatric domains, including dosing of antipsychotic medication and the characteristics of delirium.

We applied a key principle of quality improvement, the sequential PDSA cycle, during the course of the educational intervention. This principle inevitably has both positive and negative aspects. Its flexibility and emphasis on repeated revision of the intervention enabled us to make changes in real time that incorporated the feedback and observations of GRACE-AC working group members and the Shapiro Center for Education. This increased flexibility contributed substantially to our ability to provide an educational curriculum that was of appropriate scope and intensity. In addition, the multifaceted nature of the initiative, incorporating a brief educational "moment" reinforced by structural changes to clinical care at the nursing level and decision support built into clinical computing systems, is likely to have led to greater improvement than either component alone would have. On the other hand, classic clinical trials rely upon static interventions that are applied to a full cohort of participants, an approach that conflicts with the dynamic nature of QI. This led to an unfortunately complex study design with multiple phases and limited power to test those features that were modified in latter stages of GRACE-AC. For example, self-reported ability to diagnose delirium was added as a question only in Phase III. This is likely to remain a point of tension for rigorous study of QI initiatives for the foreseeable future.

Limitations

Our study had several limitations. One important limitation is its restriction to a single institution, potentially limiting its generalizability. The response rate to postrotation surveys was approximately 60%, not dissimilar to many other surveys of practicing clinicians.¹⁷ This does not necessarily influence our results from the perception domain (TABLE 2), as these compared responses using only postrotation survey data, so any selection bias would be

TABLE 1 STUDY POPULATION

Phase	No. of Postrotation Residents (n = 184)	No. of Prerotation Residents (n = 181)
No. of responses received from contacted residents (%)	167 (91)	108 (60)
Phase I	39	32
Phase II	50	30
Phase III	78	46
No. of surveys received by year of training		
PGY-1	111	80
PGY-2	31	13
PGY-3	25	15
No. of responses received surveys completed (%)	167 (100)	102 (94)
Phase I	39	29
Phase II	50	29
Phase III	78	44

Abbreviation: PGY, postgraduate year.

expected to be similar across phases. However, it is possible that this led us to overestimate the benefit of the intervention in the knowledge domain (TABLE 3), as the subset of individuals who responded to the final survey might have been the most motivated and eager to learn.

Another limitation is that our study was not designed to determine whether the improvement in resident knowledge and awareness of delirium that we observed led to improved patient outcomes. In addition, we focused on residents' self-reported ability to diagnose delirium and not their actual ability, as we did not validate respondents' reported abilities with formal geriatric assessments.

However, improvements in self-reported ability did correlate with improvements in knowledge domain scores.

Although residents' knowledge of the characteristics of delirium improved from 31% to 63%, a reassuring finding, it leaves substantial room for further improvement. Our study also tested only short-term improvements in knowledge, and the degree to which the gains in knowledge will be sustained over time remains to be tested. An interesting area to explore in future studies is the issue of residents' clinical exposure to patients with delirium and how this may impact residents' responses to the survey instruments. In the GRACE-AC quality initiative, the hospital's RRT is

TABLE 2 PROPORTION OF RESPONDENTS WHO RESPONDED AFFIRMATIVELY TO QUESTIONS IN THE PERCEPTION DOMAIN ACCORDING TO PHASE OF THE GRACE-AC PROGRAM^a

Phase	I (n = 29), No. (%)	II (n = 29), No. (%)	III (n = 44), No. (%)	P (trend) ^b
Do you think that the GRACE-AC bedside checklist increased your awareness of the presence of delirium in your elderly inpatients?	9 (31%)	23 (79%)	28 (64%)	.04
Did the GRACE-AC checklist help remind you which patient had:				
Telemetry	6 (21%)	15 (52%)	22 (50%)	.02
Intravenous fluids	5 (17%)	11 (38%)	23 (52%)	.004
A Foley catheter	8 (28%)	17 (58%)	33 (75%)	< .001

Abbreviation: GRACE-AC, Global Risk Assessment and Careplan for the Elderly-Acute Care.

^aTotal = 102.

^bP value from Mantel-Haenszel χ^2 test of the trend across categories.

TABLE 3 PROPORTION OF RESPONDENTS WHO CORRECTLY ANSWERED QUESTIONS IN THE KNOWLEDGE DOMAIN PRE- AND POSTROTATION DURING PHASE III OF THE GRACE-AC INITIATIVE			
Question	Knowledge Domain Scores (% correct)		
	Prerotation (n = 79)	Postrotation (n = 46) ^a	P
Haloperidol dosing: What is the MAXIMUM DAILY dose of haloperidol recommended for delirious elderly patients who acutely pose a danger to themselves or others? (multiple choice)	26	76	< .001
Features of delirium: What are the 2 hallmark features of delirium? (multiple choice)	31	63	< .001

Abbreviation: GRACE-AC, Global Risk Assessment and Careplan for the Elderly-Acute Care.
^a In Phase III, two additional residents answered these questions, although they did not complete the entire survey (see TABLE 1).

activated when a patient is observed to suffer from new onset delirium. We unfortunately are unable to track which residents had patients for whom the RRT was activated and thus cannot at this time compare the residents’ exposure to patients with delirium.

Conclusion

Our pilot program demonstrates that inpatient delirium QI initiatives can be successfully merged with educational programs. Improvements in resident knowledge and perception occurred with a simple, brief intervention that did not involve prolonged periods of time spent away from clinical care or other teaching activities. Further research is needed to validate the survey instruments used, particularly because these surveys were designed to be complementary to a local program (GRACE-AC) and to incorporate recommended geriatric competencies. In the future, it will also be useful to disaggregate the larger GRACE-AC initiative into smaller components to determine exactly which aspects are most effective at addressing the clinical and educational domains, as a more streamlined and parsimonious intervention may be easiest to scale to the broadest possible audience.

References

1 Inouye SK. Delirium in older persons. *N Engl J Med*. 2006;354:1157.
2 Siddiqi N, House AO, Holmes JD. Occurrence and outcome of delirium in medical in-patients: a systematic literature review. *Age Ageing*. 2006;35:350–364.
3 Leslie DL, Zhang Y, Holford TR, Bogardus ST, Leo-Summers LS, Inouye SK. Premature death associated with delirium at 1-year follow-up. *Arch Intern Med*. 2005;165:1657–1662.

4 Institute of Medicine. Retooling for an aging America: building the health care workforce. <http://www.iom.edu/Reports/2008/Retooling-for-an-Aging-America-Building-the-Health-Care-Workforce.aspx>. Accessed April 1, 2013.
5 Tess AV, Yang JJ, Smith CC, Fawcett CM, Bates CK, Reynolds EE. Combining clinical microsystems and an experiential quality improvement curriculum to improve residency education in internal medicine. *Acad Med*. 2009;84:326.
6 Mattison MLP, Afonso KA, Ngo LH, Mukamal KJ. Preventing potentially inappropriate medication use in hospitalized older patients with a computerized provider order entry warning system. *Arch Intern Med*. 2010;170:1331–1336.
7 Botts A, Moran J, Kristeller C, Olveczky D, Mattison M. The global risk assessment and careplan for elders (GRACE): an innovation to standardize and improve care of hospitalized elders. *Gerontologist*. 2011;51(suppl 2):483.
8 Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegel AP, Horwitz RI. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med*. 1990;113:941–948.
9 Ely EW, Truman B, Shintani A, Thomason JWW, Wheeler AP, Gordon S, et al. Monitoring sedation status over time in ICU patients: reliability and validity of the Richmond Agitation-Sedation Scale (RASS). *JAMA*. 2003;289:2983–2991.
10 Inouye SK, Bogardus ST, Charpentier PA, Leo-Summers L, Acampora D, Holford TR, et al. A multicomponent intervention to prevent delirium in hospitalized older patients. *N Engl J Med*. 1999;340:669.
11 Williams BC, Fitzgerald JT. Brief instrument to assess geriatrics knowledge of surgical and medical subspecialty house officers. *J Gen Intern Med*. 2006;21:490–493.
12 Reuben DB, Lee M, Davis JW Jr, Eslami MS, Osterweil DG, Melchiorre S, et al. Development and validation of a geriatrics attitudes scale for primary care residents. *J Am Geriatr Soc*. 1998;46:1425–1430.
13 Williams BC. Medicine in the 21st century: recommended essential geriatrics competencies for internal medicine and family medicine residents. *J Grad Med Educ*. 2010;2:373–383.
14 Huang GC, Newman LR, Tess AV, Schwartzstein RM. Teaching patient safety: conference proceedings and consensus statements of the millennium conference 2009. *Teach Learn Med*. 2011;23:172–178.
15 OpenEpi. Epidemiologic calculators. <http://www.openepi.com/OE2.3/Menu/OpenEpiMenu.htm>. Accessed November 28, 2012.
16 McNemar test calculator. <http://graphpad.com/quickcalcs/McNemar.cfm>. Accessed November 27, 2012.
17 Asch DA, Jedrziewski MK, Christakis NA. Response rates to mail surveys published in medical journals. *J Clin Epidemiol*. 1997;50:1129–1136.