Structured handoff checklists improve clinical measures in patients discharged from the neurointensive care unit

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Summary

While up to 80% of medical errors may result from poor communication at clinical transitions of care, there has been relatively little study of the effect of standardized communication tools on clinical quality measures. We prospectively examined the effect of a standardized handoff checklist on clinical outcomes for patients dismissed from the neurointensive care unit. We found that the checklist resulted in significant reductions in patients transferred with inaccurate medication reconciliation and unnecessary urinary catheters. Participating physicians were surveyed and generally viewed the handoff checklist favorably. Standardized communication tools such as checklists may play a useful role in reducing medical errors related to communication between patient care teams.

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Improving transfers of care between clinical providers is an increasing priority of patients, policymakers, and regulatory agencies,¹ yet much of the systematic study of clinical handoffs has emphasized communication at the same level of care, such as during shift changes.^{2,3} Comparatively few studies have examined handoffs between the intensive care unit (ICU) and hospital floor services,⁴ and most studies have relied on practitioner interviews or surveys rather than on clinical measures or outcomes.^{5,6}

Up to 80% of medical errors involve ineffective communication at clinical transfers of care^{7,8} and standardizing handoffs can reduce potential errors.^{3,9} The purpose of our study was to measure the effect of a standardized transfer documentation checklist on clinical measures and on provider satisfaction. We hypothesized that incorporating a standardized checklist into existing transfer documentation would increase the rate of inaccurate medication reconciliation by transferring physicians and would reduce unnecessary urinary catheter use, ICU readmission, length of stay, and adverse events. We postulated that the standardized documentation would be valued by transferring and accepting physicians alike.

METHODS

Creation of the transfer checklist

A team of neurology physicians, including 4 authors (E.A.C., N.M.K., R.R.F., S.A.M.), created a transfer checklist to address issues considered important at transfer and to supplement the transfer note and verbal physician-to-physician report in use at our academic medical institution. A revised version containing the elements pertinent to this study is included in figure 1 and the original version used during the study is provided as figure e-1 at Neurology.org/cp. The checklist prompted transferring resident physicians to explain their affirmative responses to yes/no questions in text boxes that appeared for select questions. All resident physicians transferring patients from the neurosciences ICU during the study period were instructed on its use and its insertion into the existing electronic medical record transfer note.

Data collection

We prospectively studied all consecutive patient transfers at Saint Marys Hospital, Rochester, Minnesota, from the neurosciences ICU to hospital floor services that occurred between October 1, 2011, and April 28, 2012. The transfer checklist was implemented on January 28, 2012, and used for the last 3 months of the study period, until April 28, 2012. Information from the electronic medical record and the ordering system was recorded, including patient birth date, age at admission, sex, diagnosis, palliative/comfort care status (defined as comfort as the primary goal), admission and discharge dates, and time of transfer order from the neurosciences ICU. Diagnoses were categorized according to cause (vascular, seizure, neoplastic, neuromuscular, or other) and were not exclusive.

Data associated with transfer-related issues were collected, including urinary catheter use, including time of order for urinary catheter insertion and removal. When urinary catheters were placed prior to ICU admission, the time was recorded as 00:00 on the admission date. When there was no electronic order for discontinuation of the urinary catheter, the time used for removal was the final hour charted of indwelling catheter use on the intake and outtake nursing record. Patients were considered to have had the urinary catheter removed prior to transfer if the discontinue catheter order was placed by an ICU physician within 90 minutes from the time of the transfer order (in all cases, this reflected the time the patient was still in the ICU, as based on ICU vital signs charting). Medication reconciliation of IV antihypertensives and vasopressors was considered to have not been performed if patients had active orders for either IV antihypertensives or vasopressors at transfer. Neither IV antihypertensives nor vasopressors can be administered on non-ICU neurology hospital floors, which is why this was used as a marker for completion of medication reconciliation. Neurosciences ICU readmission rates, rapid response team alerts, and catheter-associated urinary tract infections (CAUTI) were recorded as adverse events.

Supplemental Data

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Figure 1 Intensive care unit transfer documentation checklist

ICU TRANSFER CHECKLIST

MEDICATION RECONCILIATION

Have IV blood pressure medications been given in the last 24 hours? Yes/No

Have all IV cardiac medications and sedatives been either discontinued or converted to oral form? Yes/No

Was antiplatelet therapy or anticoagulation (other than DVT prophylaxis) started during ICU admission? Yes/No

Have any home medications been stopped or held temporarily? Yes/No

If yes, state medication and indication

Have additional medications been added during ICU admission? Yes/No

If yes, state medication and indication

Were antimicrobials started during ICU admission? Yes/No

If yes, state which medication, indication, and planned duration

Should opioids be avoided in this patient? Yes/No

URINARY CATHETER

Does the patient have a urinary catheter? Yes/No

If yes, state indication:

PROPHYLAXIS

Current DVT prophylaxis:

Options: SCDs/TEDS, Heparin SC, Heparin IV, Warfarin

VITALS/CARES

Does the patient have recommended blood pressure parameters? Yes/No

If yes, state BP parameters

CONSULTS

Are any consult services involved, including Speech Pathology and PM&R? Yes/No

If yes, state which services are involved

FOLLOW-UP

Does the patient have outstanding test results, cultures, or consulting service recommendations? Yes/No

If yes, state outstanding results/recommendations

Does the patient have decision making power? Yes/No

If no, who is the designated medical decision maker?

What is the patient's code status?

Options: Full Code, DNR/DNI, other

The transfer checklist is divided into 6 categories with Yes/No response options or a text box for answers, as applicable. Certain responses prompt a follow-up question or allow a written response. DNI = do not intubate; DNR = do not resuscitate; DVT = deep vein thrombosis; ICU = intensive care unit; SC = subcutaneous; SCDs = sequential compression devices; TEDs = thromboembolic-deterrent stockings.

Compliance with checklist use was recorded using the electronic medical record. All resident physicians accepting care of patients from the neurosciences ICU during the study period were anonymously queried via an electronic survey during the last week of each month from October 1, 2011, to April 28, 2012. After checklist initiation, transferring physicians were surveyed at the end of each month from February to April 28, 2012. Overall satisfaction was assessed on a 5-point Likert scale ([1] completely unsatisfied; [2] somewhat unsatisfied; [3] neutral; [4] somewhat satisfied; [5] completely satisfied). The checklist used during the study period was

Table 1 Characteristics of ICU patients before and after implementation of a standardized ICU transfer documentation checklist^a

Variable	Preimplementation (n = 130)	Postimplementation (n = 131)	p Value ^b
Age, y, mean (range)	65 (24–77)	63 (23–84)	0.18
Women	55 (42)	70 (53)	0.09
Diagnosis			
Vascular	89 (68)	98 (75) ^b	0.56
Seizure	25 (19)	9 (7) ^c	0.002
Neoplastic	5 (4)	5 (4) ^c	0.99
Neuromuscular	5 (4)	5 (4) ^c	0.99
Other	6 (5)	14 (11) ^c	0.11
Palliative care patients	9 (7)	17 (13)	0.14
Patients with catheter	87 (67)	84 (64)	0.70
Patients with catheter on palliative care	6/87 (7)	14/84 (17)	0.10
Abbreviation: ICU = intensive care unit.			
^a Values are number (%) unless indicated otherwise.			
^b Data were analyzed with the χ^2 test and the Student <i>t</i> test.			
^c Percentages total >100% due to rounding.			

revised on the basis of survey responses and results of our review of the electronic medical record.

Statistical analysis

Statistical analyses were performed using JMP software (version 9.0.1; SAS Institute, Cary, NC). Data were visually inspected for normality. Categorical data were analyzed with the χ^2 or Fisher exact test (2-sided), and continuous variables were analyzed with the Student *t* test. Group differences were considered significant at $p < 0.05$.

Standard protocol approvals, registrations, and patient consents

This study was approved by the Mayo Clinic Institutional Review Board.

RESULTS

There were 130 and 131 patient transfers from the neurosciences ICU during the preimplementation and postimplementation phases, respectively. The checklist compliance rate was 93% (122/131). Transition to palliative care and transfer to a non-neurologic hospital service were the most common factors in noncompliance. The survey results and the electronic medical record results led us to revise the checklist to keep only those features identified as helpful by transferring and accepting physicians. The revised checklist (figure 1) has been added as a permanent section of the established transfer document.

Demographic information for the preimplementation and postimplementation groups is summarized in table 1. No significant difference existed between groups in average age, sex, or number of patients transitioned to palliative care. Diagnoses were similar, except that more patients in the preimplementation group were admitted with seizure ($p = 0.002$). There was no difference in the length of inpatient stay after dismissal from the ICU in either group (table 2).

The number of patients with a urinary catheter prior to transfer was similar between the groups. After checklist implementation, the mean duration of urinary catheter use per patient decreased by 26 hours (from 120 hours to 94 hours) ($p = 0.03$). After transfer checklist

Table 2 Outcomes of ICU patients before and after implementation of a standardized ICU transfer documentation checklist

Variable	Preimplementation (n = 130)	Postimplementation (n = 131)	p Value ^a
LOS, days			
Mean ICU LOS	3.7	3.3	0.38
Mean LOS on hospital floor after transfer	5	5	0.31
Mean LOS on hospital floor after transfer (excluding palliative care patients)	5.0	4.5	0.21
Urinary catheter use			
Duration of urinary catheter, h, mean (range)	120 (0-597)	94 (0-516)	0.03
Patients with catheter not removed at transfer, n/total (%)	62/87 (71)	47/84 (56)	0.05
Nonpalliative patients with catheter not removed at transfer, n/total (%)	56/81 (69)	33/70 (47)	0.001
Nonpalliative patients with catheter not removed at transfer when checklist was used postimplementation, n/total (%) ^b	56/81 (69)	28/65 (43)	0.003
Medication reconciliation			
Patient transfers with active IV antihypertensives or vasopressors, n/total (%)	47/130 (36)	13/131 (10)	<0.001
Patient transfers with active IV antihypertensives or vasopressors when checklist was used postimplementation, n/total (%) ^b	47/130 (36)	11/122 (9)	<0.001
Adverse events			
ICU readmissions, n (%)	4 (3)	5 (4)	0.74
Rapid response team calls, n (%)	2 (2)	4 (3)	0.69

Abbreviations: ICU = intensive care unit; LOS = length of stay.
^aData were analyzed with the χ^2 test and the Student t test.
^bAnalysis of postimplementation transfers when the checklist was used.

implementation, fewer patients were transferred with a urinary catheter in place (71% [62/87] compared with 56% [47/84]) ($p = 0.07$). This difference was significant when palliative care patients were excluded from the analysis (urinary catheter use is a comfort measure in some palliative care patients) ($p = 0.001$). Implementation of the checklist increased the number of patients transferred with reconciled IV antihypertensives and vasopressors as indicated by the decrease in transferred patients on such medications from 36% (47/130) to 10% (13/131) ($p < 0.001$). There were no CAUTIs during the study period, and there were no changes in the rates of ICU readmissions or rapid response team calls.

Of accepting physicians, 38% (19/50) returned surveys preimplementation and 63% (19/30) returned surveys postimplementation, whereas 67% (8/12) of transferring physicians returned surveys (table 3). Initiation of the checklist did not change the overall satisfaction of accepting physicians with the transfer process, from 3.89 preimplementation to 3.68 postimplementation ($p = 0.34$). Accepting physicians reported a decrease in the number of patients transferred to them with a urinary catheter from 1.74 to 0.79 ($p = 0.04$), but not in the number of times that they themselves thought that medication reconciliation had not been completed, from 1.84 to 1.26 ($p = 0.20$). Most (74% [14/19]) accepting physicians indicated that the checklist facilitated documentation; 95% (18/19) indicated that it saved time for them in the transfer process. One-half (4/8 [50%]) of the transferring physicians reported that the checklist took 2–5 minutes to complete, whereas one-fourth each (25% [2/8]) reported that the checklist required less than 2 minutes or 5–10 minutes. Most transferring physicians (88% [7/8]) reported that the checklist reminded them to address

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an issue prior to patient transfer, yet just over half (62% [5/8]) indicated that the checklist should continue to be used. The most useful aspects of the checklist reported by both the transferring and the accepting physicians were medication reconciliation (38% [3/8] and 68% [13/19]), urinary catheter use (25% [2/8] and 16% [3/19]), and deep vein thrombosis prophylaxis (12% [1/8] and 11% [2/19]). The category of pain/agitation on the checklist was considered most useful by 5% (1/19) of the accepting physicians. Just over one-third (38% [3/8]) of the transferring physicians indicated that the checklist had no useful components.

DISCUSSION

These findings demonstrate that standardized transfer documentation can improve transition of care by increasing rates of IV medication reconciliation and by decreasing unnecessary urinary catheter use. Accurate medication reconciliation at the time of ICU transfer is critical to avoid medication-related medical errors.^{10,11} Other authors have described nurse-led cross-checks of transfer reports from the ICU made by physicians, thereby reducing the rate of transition-related errors.⁴ In contrast, our protocol integrated the checklist into existing workflows and thus improved reconciliation of IV antihypertensives and vasopressors without increasing demands on other health care workers. However, we did not include medication reconciliation for all medication classes because the most common medication reconciliation issues identified in this clinical setting in our hospital were related to IV antihypertensives and vasopressors.

Table 3 Survey results from transferring and accepting physicians

Most useful aspect of template	Accepting physicians (n = 19)	Transferring physicians (n = 8)	p Value ^a
Medication reconciliation, %	68	38	
Urinary catheter use, %	16	25	
DVT prophylaxis, %	11	13	
Pain/agitation, %	5	0	
Code status, %	0	0	
Diet, %	0	0	
None	0	38	
Helpfulness of template (1 = not at all; 3 = neutral; 5 = extremely helpful), average	3.42	3.25	1.0
Template should continue, %	84	63	0.26

Abbreviation: DVT = deep venous thrombosis.
^aData were analyzed with Fisher exact test.

The standardization of physician handoff is complementary to the nursing transfer handoff, which utilizes a standardized checklist during verbal nurse-to-nurse report.

In addition to medication reconciliation, urinary catheterization status was considered important by both the transferring and the accepting physicians. This is in contrast to prior studies that have reported that many physicians are often unaware of unnecessary urinary catheterization.¹² This change may be a reflection of increased attention to the use of urinary catheters and CAUTIs. The Centers for Medicare and Medicaid Services has targeted CAUTI as a quality measure, with implications for patient care and financial reimbursement.¹³ The critical care setting is of particular importance with its high frequency and duration of urinary catheter use, both of which predispose patients to CAUTI.^{14,15} A standardized transfer checklist is a simple, inexpensive approach that could decrease the risk of CAUTI.

Given the increased workload involved in performing quality improvement projects such as this one, it is important to consider provider satisfaction and its possible effect on long-term compliance and overall project success. Providers in our study had a generally favorable response to the checklist intervention, and most indicated that its use should continue. One critique of the checklist was that it was too lengthy to complete, which prompted a revision that incorporated only those areas considered useful by physicians and those areas that objectively improved patient care. This version of the checklist has been incorporated into our existing transfer documentation, used in conjunction with verbal physician report. The standardization of physician handoff is complementary to the nursing transfer handoff, which utilizes a standardized checklist during verbal nurse-to-nurse report.

This study has a number of limitations. A low overall adverse event rate precluded the detection of differences in adverse events between the preimplementation and postimplementation groups. Use of the transfer checklist was high but did not reach 100%. This may have been due to the comprehensive nature of the checklist, which was lengthy and required additional effort on the part of transferring physicians. The provider satisfaction survey response rate was low, possibly limiting the validity of our observations concerning physician satisfaction.

Despite the limitations, these findings demonstrate how a standardized handoff instrument can improve performance on clinical measures and be favorably received by users. Further study of standardized handoffs in other clinical transition settings is warranted.

REFERENCES

1. The Joint Commission. Transitions of care: the need for a more effective approach to continuing patient care [Internet]. Oakbrook Terrace, IL: The Joint Commission; 2013. Available at: http://www.jointcommission.org/assets/1/18/Hot_Topics_Transitions_of_Care.pdf. Accessed August 2, 2013.
2. Wayne JD, Tyagi R, Reinhardt G, et al. Simple standardized patient handoff system that increases accuracy and completeness. *J Surg Educ* 2008;65:476–485.
3. Moseley BD, Smith JH, Diaz-Medina GE, et al. Standardized sign-out improves completeness and perceived accuracy of inpatient neurology handoffs. *Neurology* 2012;79:1060–1064.
4. Perren A, Conte P, De Bitonti N, Limoni C, Merlani P. From the ICU to the ward: cross-checking of the physician's transfer report by intensive care nurses. *Intensive Care Med* 2008;34:2054–2061.
5. Lin F, Chaboyer W, Wallis M. A literature review of organisational, individual and teamwork factors contributing to the ICU discharge process. *Aust Crit Care* 2009;22:29–43.
6. Motamedi SM, Posadas-Calleja J, Straus S, et al. The efficacy of computer-enabled discharge communication interventions: a systematic review. *BMJ Qual Saf* 2011;20:403–415.
7. Solet DJ, Norvell JM, Rutan GH, Frankel RM. Lost in translation: challenges and opportunities in physician-to-physician communication during patient handoffs. *Acad Med* 2005;80:1094–1099.

8. Sutcliffe KM. Defining and classifying medical error: lessons for learning. *Qual Saf Health Care* 2004;13:8–9.
9. Arora V, Johnson J. A model for building a standardized hand-off protocol. *Jt Comm J Qual Patient Saf* 2006;32:646–655.
10. Rothschild JM, Landrigan CP, Cronin JW, et al. The Critical Care Safety Study: the incidence and nature of adverse events and serious medical errors in intensive care. *Crit Care Med* 2005;33:1694–1700.
11. Kopp BJ, Erstad BL, Allen ME, Theodorou AA, Priestley G. Medication errors and adverse drug events in an intensive care unit: direct observation approach for detection. *Crit Care Med* 2006;34:415–425.
12. Saint S, Wiese J, Amory JK, et al. Are physicians aware of which of their patients have indwelling urinary catheters? *Am J Med* 2000;109:476–480.
13. Wald HL, Kramer AM. Nonpayment for harms resulting from medical care: catheter-associated urinary tract infections. *JAMA* 2007;298:2782–2784.
14. Gray M. Reducing catheter-associated urinary tract infection in the critical care unit. *AACN Adv Crit Care* 2010;21:247–257.
15. Huang WC, Wann SR, Lin SL, et al. Catheter-associated urinary tract infections in intensive care units can be reduced by prompting physicians to remove unnecessary catheters. *Infect Control Hosp Epidemiol* 2004;25:974–978.

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