



Using the Rothman Index and Length of Stay as a Trigger for Palliative Care in the Medical Intensive Care Unit and Step-Down Units

Rebecca Gagne Henderson, MSN, APRN, ACHPN ○ Barbara McCloskey, DNSc, RN ○
Ellen Walter, BSN, RN ○ Joan Rimar, DNSc, RN ○ Mei Bai, PhD, RN ○
Ernest D. Moritz, MD

Despite the increased number of palliative care teams in the United States, access to palliative care in the hospital continues to be inadequate. The availability of a simple method to identify appropriate patients for palliative care may increase access. A pilot study was conducted using an observational prospective approach to analyze the effects of palliative interventions for those with a Rothman Index score of less than 40 and a length of stay of greater than 5 days for patients in the medical intensive care and step-down units in an urban teaching hospital, which provides tertiary palliative care. The Rothman Index is a validated formula providing a real-time measure of patient condition based on existing data in the electronic medical record. Patients receiving the palliative intervention had a decrease in the mean length of stay from 26.3 days for all other groups to 13.9 days. The odds ratio of a 30-day readmission for those patients without a palliative visit was 4.4. Costs were lowered by 54% for the palliative intervention group. The Rothman/length of stay trigger for palliative care intervention may have the potential to bend the cost curve for the health care system.

Palliative care improves patient outcomes, increases patient and family satisfaction, provides cost savings, and extends survival time for some patients.¹⁻⁴ Despite these desirable results, patients have difficulty accessing palliative care in a timely, effective, patient-centered, and equitable manner.^{5,6} Barriers include differing philosophies and culture among clinicians, lack of continuity of clinicians, and a deficit of knowledge and awareness of the benefits of palliative care by patients, families, and clinicians.^{3,6,7} The challenge to palliative experts is to develop a strategy that promotes and simplifies the identification of patients with palliative needs and the integration of palliative interventions into the care of those who may benefit.

Although there are many screening tools available that identify patients with palliative needs, they are cumbersome, require review of the medical record, and are completed manually.⁸⁻¹³ The traditional triggers to identify a palliative patient include a coexisting number of patient characteristics such as stage of illness, symptom burden, comorbidities, functional status, number of hospitalizations, and others, making identification difficult.

KEY WORDS

30-day readmission, palliative, Rothman Index, trigger

Rebecca Gagne Henderson, MSN, APRN, ACHPN, is palliative program manager, Yale New Haven Hospital, CT.

Barbara McCloskey, DNSc, RN, is financial clinical coordinator, ITS Analytics, Yale New Haven Hospital, CT.

Ellen Walter, BSN, RN, is care manager, Yale New Haven Hospital, CT.

Joan Rimar, DNSc, RN, is clinical management consultant, ITS Analytics, Yale New Haven Hospital, CT.

Mei Bai, PhD, RN, is post-doctoral fellow, Yale School of Medicine, CT.

Ernest D. Moritz, MD, is medical director, Palliative Care, Yale New Haven Hospital, CT.

Address correspondence to Rebecca Gagne Henderson, MSN, APRN, ACHPN, Yale New Haven Hospital, 1450 Chapel St, New Haven, CT 06515 (Rebecca.gagnehenderson@ynhh.org).

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Rothman Index as a Trigger

The Rothman Index (RI) is a validated, disease-agnostic, continuous measure of patient condition that is calculated using vital signs, laboratory, and the binomial quantification of nursing assessment data.^{14,15} The RI software (PeraTrend) uses existing data from the electronic medical record and calculates the patients' RI scores, which are displayed in graphical form, available in real time without any additional work for clinicians. The RI is available at the hospital and is used as an early warning system for the detection of patient deterioration.¹⁶ As of this time, there is no evidence in the literature of the use of the RI to identify palliative care patients.

Knowing that the identification of patients who would benefit from a palliative care consult can be difficult, we hypothesized that the readily available RI score may aid in that task.

The score of RI of 40 or less was determined as the score indicating that a patient is at a high risk of deteriorating in the



hospital.¹⁴ The criterion of length of stay (LOS) of 5 days or greater was chosen to (1) avoid resistance of a palliative clinician approaching an attending physician before having had the opportunity to make the patient well, (2) allow for testing to confirm palliative findings and prognosis, and (3) place palliative care in a position of asking for a consultation upon the conclusion of the mean Diagnosis-Related Group (DRG) weighted stay.

A preliminary review was conducted of 112 charts of patients with an RI of 40 or less and an LOS of 5 days or greater (RI/LOS) who were in the hospital during the month of February 2014. A palliative care screening tool was applied to the charts (Figure 1). The screening tool was modified from the Central Baptist screening tool from the Center to Advance Palliative Care's Web site,¹¹ which identifies patients who meet hospice criteria. After applying the modified

YNHH Screening Tool for Inpatient Consultation

Criteria – Please consider the following criteria when determining palliative care eligibility	
1. <u>Basic Disease Process</u> a) Cancer (metastatic/recurrent) b) Advanced COPD c) Stroke (with decreased function by at least 50%) d) ESRD e) Advanced Cardiac disease-CHF, severe CAD, CM (LVEF<30%) f) End Stage Dementia g) Other life-limiting illness	Yes No
2. <u>Concomitant Disease Processes:</u> a) Liver disease b) Dementia c) Renal disease d) COPD e) CHF f) Other conditions complicating care	Yes No
3. <u>Functional Status of Patient:</u> PPSv2 score of 50% or <	Yes No
4. <u>Other Criteria to Consider in Screening</u> <ul style="list-style-type: none"> • Patient has unacceptable level of pain or other symptom distress >24 hours. • Patient has frequent visits to emergency department (>1x month for same diagnosis). • Patient has more than one hospital admission for the same diagnosis in the last 6 months • Patient has been hospitalized within the previous 30 days • Patient was in the ICU setting during last hospitalization without returning to independence or baseline. Determined by Rothman Index. • Patient was admitted from an ECF or at home with hired aide. • Patient is not a candidate for curative therapy or refuses aggressive treatment. • Patient was discharged from last hospitalization with Rothman Index score 60 or > at last discharge. • Patient has PEG in place/dysphagia/aspiration episodes. • Patient experienced cardiac arrest/PEA this hospitalization. • Documented poor prognosis. • Documentation of Frailty/Failure to Thrive • Weight loss/loss of appetite 	2 or more of other criteria: Yes No
If answer is yes to 3 or more sections please consider palliative care consultation.	

FIGURE 1. YNHH screening tool for inpatient consultation. Adapted and modified from the Central Baptist Screening Tool.



TABLE 1 RI \leq 40 and LOS \geq 5d in the Year 2014

Patient Population	Discharge Period	Total N	Mean RI	Mean LOS	In-hospital Mortality Rate	30-d Readmission Rate
All YNH/SRC patients	2014	21 219	76.49	4.8	1.3%	15.1%
YNH/SRC patients with RI \leq 40 LOS \geq 5 d	2014	570	29.21	14.7	23.0%	23.5

Abbreviations: LOS, length of stay; RI, Rothman Index; SRC, Saint Raphael's Campus; YNH, Yale New Haven Hospital.

screening tool to the specified charts, it was found that 96% of the patients identified by the RI/LOS criteria also met criteria for hospice eligibility. Those who did not meet the screening tool criteria were those with ethanol withdrawal, multiple sclerosis exacerbation, Guillain-Barré syndrome, and other acute illness of a nonprogressive nature without complicating comorbidities. It was decided that the RI/LOS criteria were valuable and worth being tested.

We then requested a report containing data to describe the difference in the mean LOS, in-hospital mortality rate, and 30-day readmission rate for all patients admitted to the intensive care unit (ICU) in 2014 and the same data of those meeting the RI of 40 or less and the LOS of 5 days or greater (RI/LOS) for patients admitted to the ICU in 2014 (Table 1).

The report showed that 21 219 patients were admitted to the ICU in 2014. Of that population, there were 507 patients who met the RI/LOS criteria. The outcomes for those meeting the criteria were 23.5% readmission rate, 23% in-hospital mortality, and only 17.8% referral rate to hospice. These numbers were concerning because these patients represent high-cost-high-need seriously ill patients and require the appropriate level of care during their hospitalization¹⁷ (Table 1).

PILOT PROGRAM AND METHODOLOGY

On the basis of these data, it was decided that the next step would be to assess the RI/LOS criteria as a trigger for palliative care consultation. A pilot study was conducted to determine whether there were differences in outcomes for those who met the criteria and were seen by palliative care. Palliative consultation included a full consultation by an advanced certified hospice and palliative nurse (ACHPN) practitioner to include the history of illness, prognostica-

tion, symptom management, emotional support, and goal of care (GOC) discussions. Because these patients were frequently on artificial life support, unresponsive, or too ill to discuss their condition, most of these interventions occurred with family and were focused on GOC discussions. Data were only collected related to the decision making as a result of GOC discussions including the ACHPN.

Patients in the medical ICUs and step-down units were placed into intervention and control groups. The Microsoft Excel randomization function was used to place the patients in groups on a daily basis. Patients were entered into the program two at a time. Whichever patient had the highest number was placed into the intervention group. Those with the lowest number were put into the control group. Should only 1 patient meet the criteria on a given day, they were entered into the program along with a mock participant and were placed in the intervention group if they had the highest number or the control group if they had the lower number. One family refused consultation and was excluded from the pilot study.

Only patients attended by a specific group of hospitalists were included in the intervention or control groups. Patients who were in the intervention group but whose hospitalist attending physician did not agree to the consultation were placed in a third group labeled “declined.” Patients of private and specialist attending physicians were allocated to a fourth group (private/spec) and did not receive intervention. After screening and allocation occurred, the ACHPN would approach the attending physician, inform him/her that the patient met the criteria for the pilot study, and offer a palliative care plan. Although the purpose of the pilot study was to determine the effectiveness of palliative care for these patients, another unexpected pattern appeared in the sampling. After 3 months, a total of 96 patients met the criteria. Of

TABLE 2 Population/Disposition

Groups	Intervention	Declined	Control	Private/Specialist	All Groups
Population	n = 14	n = 21	n = 32	n = 29	n = 96
Mean age, y	76.2	73.2	71.6	66.6	71.7
Female, %	57	44	52	48	49
White, %	64	78	69	57	69



those, 32 patients were allocated to the control group. Only 14 of the 35 interventional patients were allowed to be seen or considered palliative recommendations (Table 2). When the physician denied consultation or the physician disregarded recommendations made by palliative care, the patient was allocated into a group labeled the “declined group.”

If, upon the day of eligibility, the patient's condition improved to the point that the RI score returned from 40 to 60 or higher, the patient was excluded from the pilot study. The number of patients who were excluded because of a score returning to 60 or higher was not tracked. Patients in the control group who were later referred for palliative consultation after the date of eligibility were seen by palliative care and then were excluded from the analysis. This resulted in 2 patients being excluded.

DATA COLLECTION AND ANALYSIS

Upon completion of each palliative consultation, data were entered into our clinical database application. After the completion of data collection, a descriptive analysis and a financial analysis were conducted.

In addition, a χ^2 test was applied to determine statistical significance for outcomes regarding disposition to hospice, “do not resuscitate” (DNR) status, number of deaths, and number of patients who died with a DNR in place and/or hospice.

MEASUREMENTS/OUTCOMES

Data points that were included in the descriptive analysis included disposition location upon discharge, 30-day readmission, deaths during the course of the pilot study and 6 months beyond, in-hospital mortality rates, code status, direct costs, and LOS. These measurements will be applied to all groups within the sample (N = 96).

RESULTS

The sample included a total of 96 patients who met the RI/LOS criteria. Whereas 35 patients were in the intervention group, only 14 patients had the palliative interven-

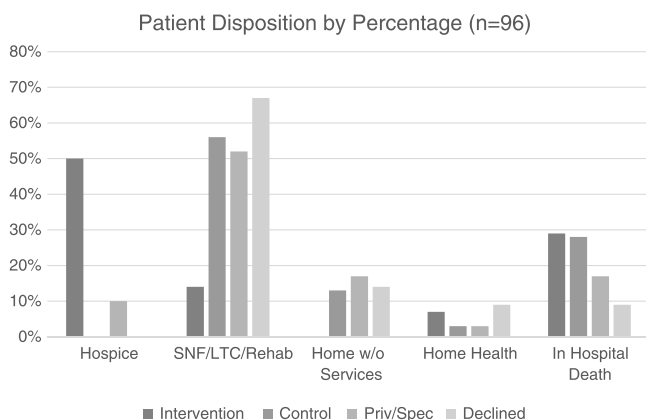


FIGURE 2. Discharge location of patients by sample group.

Unique Readmissions

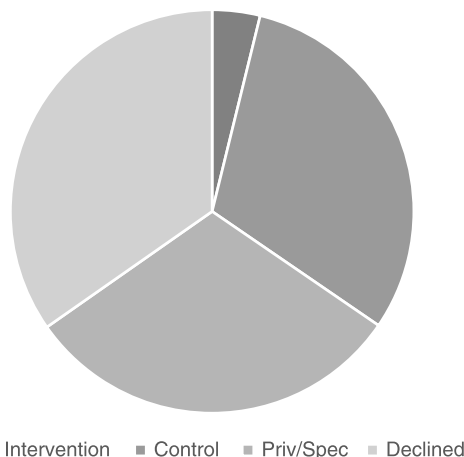


FIGURE 3. 30-day readmissions by sample group.

tion (Table 2) because 60% of the hospitalist attending physicians' refusal to allow the intervention. Reasons for declining the intervention were not investigated.

The mean age of the sample was 71.7 years; 49% were women, and 69% were white (Table 2). The intervention group was found to have greater hospice use than the control group, refusal group, and private/specialist group. Of the intervention patients, 50% were enrolled into a hospice program after a GOC meeting. There were no hospice referrals for the declined and control groups. Three of the private/specialty group (10%) went to hospice (Figure 2).

In the sample, there were a total of 25 readmissions within 30 days of discharge for the nonpalliative sample. There was a 4.4 odds ratio (24.9%) of having a 30-day readmission in the group who were not exposed to palliative care. The intervention group had a readmission rate of 3.8% compared with a 34.6% readmission rate of the declined group (Figure 3).

Of the 96 patients, 43 remained alive as of June 2016. Of those patients who died, the number of days lived to the date of death for all intervention patients was 278 days.

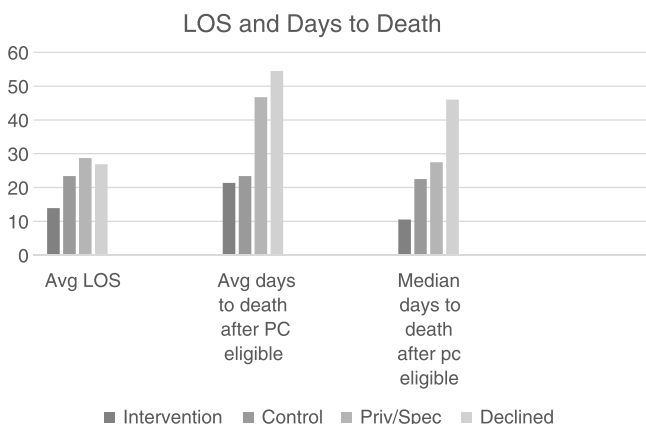


FIGURE 4. Number of days lived from eligibility for a palliative consultation to death by sample group.

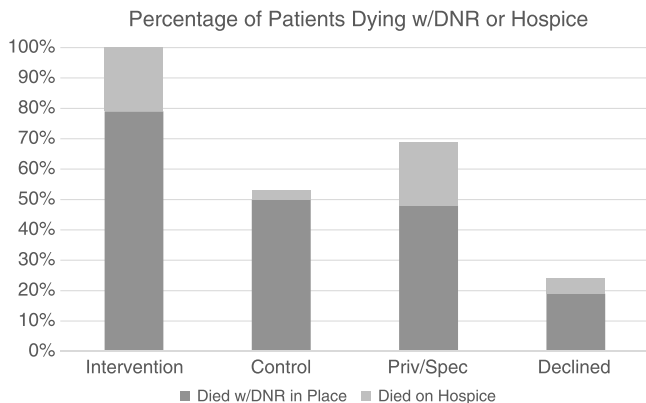


FIGURE 5. Percentage of patient with a DNR in place or on hospice at time of death by sample group.

The total number of days to death for the control group was 444 days. The declined group had a total of 436 days before dying. The private and specialist doctor's patients lived collectively for 607 days (Figure 4). The mean number of days for those who died in the intervention group was 21.4 days compared with a mean of 41.5 days for those without a palliative consultation (Figure 4).

We explored the number of patients who died on hospice or died with a DNR. Those who were exposed to palliative care 100% died on hospice or as a DNR (*P* .42). In comparison, the patients with a hospitalist or private/specialist physician died with a DNR or on hospice 25% of the time (Figure 5, Table 3).

Direct costs of hospital care for those patients seen by palliative care were markedly lower (Figure 6). The mean direct cost for patients with a palliative consultation was \$26 117, whereas the mean direct cost for the other groups was \$47 997. The group with the highest direct costs was the private physicians and specialists at \$50 916, for whom consultation was not provided (Figure 7).

DISCUSSION

The results of this pilot study demonstrated the potential usefulness of the RI/LOS as a trigger for palliative consul-

TABLE 3 Statistical Significance Between the Intervention and Control Groups			
	Intervention	Control	<i>P</i>
Deaths	13	19	.0354
"Do not resuscitate" (DNR) patients	79%	50%	.1056
Hospice referrals	57%	3%	<.0001
Died as DNR or hospice	100%	59%	.0042

Please note that the P value was based on the χ^2 analysis on the intervention and control groups only.

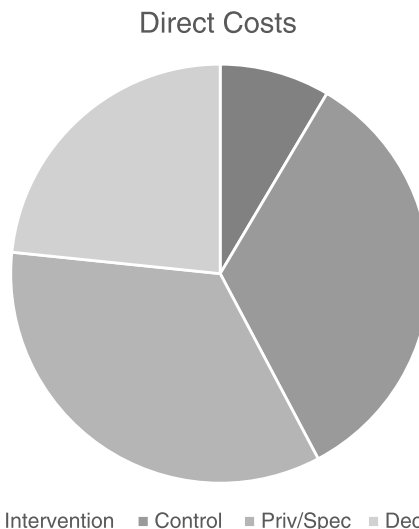


FIGURE 6. Illustrates proportion of direct cost for patients by sample group.

tations. The pilot study showed benefit to the hospital and patients in terms of the prevention of 30-day readmissions, LOS, and lowering costs.

The RI/LOS trigger identified patients with unmet palliative needs in the hospital. Although the palliative movement continues to promote moving palliative care "upstream," this pilot illustrates the continued unmet need of dying patients in the hospital.

Strengths/Weaknesses/Limitations

To determine whether the RI/LOS is of use in other settings, further investigation with a larger sample would be required. If this pilot study could be replicated in other hospitals using the RI/LOS criteria, there may be a considerable "bend in the cost curve" across systems. In 2014, we identified 507 patients who met the criteria at 1 hospital's MICU. If each one of these had an encounter with palliative care, the cost savings and reduction in patient and family suffering might be considerable.

It is also important to determine the quality of life for those who lived after the pilot study beyond June 2016. It

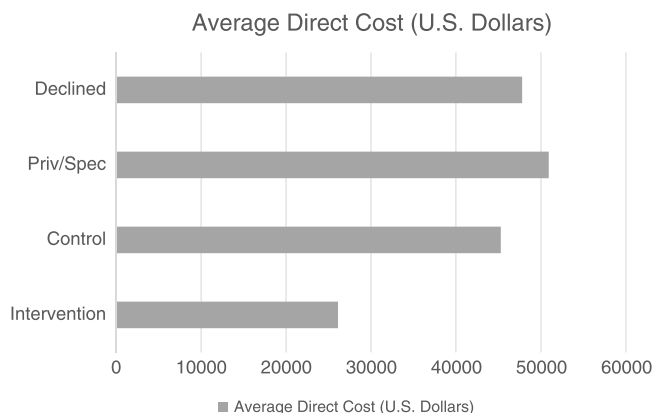


FIGURE 7. Average direct costs in American dollars by sample group.



is suspected that many of these patients remain frail and sick with low functional status. A recent study showed that many of those living completely dependent describe this as “worse than death.”¹⁸ We cannot account for the potential suffering and poor quality of life for those left living. Further investigation is necessary to determine the ramifications of living when very debilitated.

Potential Hawthorne Effect

Because all patients were only seen by 1 ACHPN and had the knowledge of being involved in the pilot study, there may have been an effect upon the performance and behavior of this individual. To determine the validity of these findings, further research would be necessary of outcomes when the clinician is unaware of data collection and there are a number of different clinicians.

Bias for Refusal Group

One of the weaknesses of this pilot study was the bias introduced when allowing the hospitalist to forego a consultation. Once a consultation was refused, we are uncertain of how this influenced the future actions of the team caring for the patient. There may have been heightened efforts to make the patient well or greater efforts to have GOC discussion without palliative care. A qualitative study is essential to ascertain the motivations of this group.

Financial Analysis

This pilot study did not consider the cost savings compared with revenue generated by these patient encounters. This pilot study has not revealed whether the criteria of RI/LOS decreases revenue for the hospital. However, the LOS for the 16 most common DRGs in the ICU averages to be 4.4 days. It seems that the 5-day LOS may be the appropriate time for the trigger. The expansion of this pilot study will measure the outcomes of revenue.

Lack of Patient Centeredness

This pilot study measured palliative care outcomes of interest to the organization; however, it may be important to have increased knowledge of more patient-centered outcomes. Palliative care continues to struggle to make a case for return on investment and expansion of programs. This pilot study could be used to make such a case.

Future Endeavors

We plan to expand this pilot study as a clinical redesign and to include general medical patients. During the clinical redesign, we will examine DRGs, LOS, direct costs, and actual savings to the Yale New Haven Health System

and consider ramifications of expanding the design throughout the health system.

References

1. White KR, Stover KG, Cassel JB, Smith TJ. Nonclinical outcomes of hospital-based palliative care. *J Healthc Manag.* 2006;51(4):260-273.
2. Morrison RS, Penrod JD, Cassel JB, et al. Cost savings associated with US hospital palliative care consultation programs. *Arch Intern Med.* 2008;168(16):1783-1790.
3. Bharadwaj P, Helfen KM, Deleon LJ, et al. Making the case for palliative care at the system level: outcomes data. *J Palliat Med.* 2016;19(3):255-258.
4. Temel JS, Greer JA, Muzikansky A, et al. Early palliative care for patients with metastatic non-small-cell lung cancer. *N Engl J Med.* 2010;363(8):733-742.
5. Meier DE. Measuring quality of care for the sickest patients. *Harvard Business Review.* September 18, 2015.
6. Roczen ML. Palliative care and intensive care units: a systematic review. *J Hosp Palliat Nurs.* 2016;18(3):201-211.
7. You JJ, Downar J, Fowler RA, et al. Barriers to goals of care discussions with seriously ill hospitalized patients and their families: a multicenter survey of clinicians. *JAMA Intern Med.* 2015;175(4):549-556.
8. Begum AA. Using a screening tool to improve timely referral of patients from acute oncology-haematology to palliative care services. *BMJ Qual Improv Rep.* 2013;2(1).
9. Bowman J, George N, Barrett N, Anderson K, Dove-Maguire K, Baird J. Acceptability and reliability of a novel palliative care screening tool among emergency department providers. *Acad Emerg Med.* 2016;23(6):694-702.
10. Richards CT, Gisondi MA, Chang CH, et al. Palliative care symptom assessment for patients with cancer in the emergency department: validation of the screen for palliative and end-of-life care needs in the emergency department instrument. *J Palliat Med.* 2011;14(6):757-764.
11. Center to Advance Palliative Care. *Central Baptist Hospital Palliative Care Screening Tool.* 2016. <https://www.capc.org/search/?q=central+baptist+screening+tool>. Accessed March 3, 2017.
12. Trout A, Kirsh KL, Peppin JF. Development and implementation of a palliative care consultation tool. *Palliat Support Care.* 2012;10(3):171-175.
13. Wharton T, Manu E, Vitale CA. Enhancing provider knowledge and patient screening for palliative care needs in chronic multimorbid patients receiving home-based primary care. *Am J Hosp Palliat Care.* 2015;32(1):78-83.
14. Rothman MJ, Rothman SI, Beals JIV. Development and validation of a continuous measure of patient condition using the electronic medical record. *J Biomed Inform.* 2013;46(5):837-848.
15. Yakusheva O, Lindrooth R, Weiss M. Nurse value-added and patient outcomes in acute care. *Health Serv Res.* 2014;49(6):1767-1786.
16. Sankey CB, McAvay G, Siner JM, Barsky CL, Chaudhry SI. “Deterioration to door time”: an exploratory analysis of delays in escalation of care for hospitalized patients. *J Gen Intern Med.* 2016;31(8):895-900.
17. Banoff KM, Milner K, Rimar J, Greer AE, Canavan M. Assessment of novel tool for identifying hospitalized patients with heart failure at risk for 30-day readmission, high cost, and longer length of stay. *Nurs Econ.* 2016;34(4):172-181.
18. Rubin EB, Buehler AE, Halpern SD. States worse than death among hospitalized patients with serious illnesses. *JAMA Intern Med.* 2016;176(10):1557-1559.