Cost-Benefit Analysis of a Support Program for Nursing Staff

Dane Moran, MPH,† Albert W. Wu, MD,*† Cheryl Connors, MS,‡ Meera R. Chappidi, MPH,*† Sushama K. Sreedhara, MBBS,† Jessica H. Selter, MD,* and William V. Padula, PhD†*

Objectives: A peer-support program called Resilience In Stressful Events (RISE) was designed to help hospital staff cope with stressful patient-related events. The aim of this study was to evaluate the impact of the RISE program by conducting an economic evaluation of its cost benefit.

Methods: A Markov model with a 1-year time horizon was developed to compare the cost benefit with and without the RISE program from a provider (hospital) perspective. Nursing staff who used the RISE program between 2015 and 2016 at a 1000-bed, private hospital in the United States were included in the analysis. The cost of running the RISE program, nurse turnover, and nurse time off were modeled. Data on costs were obtained from literature review and hospital data. Probabilities of quitting or taking time off with or without the RISE program were estimated using survey data. Net monetary benefit (NMB) and budget impact of having the RISE program were computed to determine cost benefit to the hospital.

Results: Expected model results of the RISE program found a net monetary benefit savings of US $22,576.05 per nurse who initiated a RISE call. These savings were determined to be 99.9% consistent on the basis of a probabilistic sensitivity analysis. The budget impact analysis revealed that a hospital could save US $1.81 million each year because of the RISE program.

Conclusions: The RISE program resulted in substantial cost savings to the hospital. Hospitals should be encouraged by these findings to implement institution-wide support programs for medical staff, based on a high demand for this type of service and the potential for cost savings.

Key Words: cost benefit analysis, medical error, second victim, health personnel, nurses, adverse event

(*J Patient Saf* 2017;00: 00–00)

Virtually all practicing healthcare providers experience highly stressful events during their careers. However, the provider's emotional response, coping mechanisms, and state of well-being after an event can vary greatly among individuals.[1] Some are seriously traumatized and become "second victims" of the same incidents that harm patients.[2] In the recovery process from such incidents, providers may follow one of the three potential paths of "dropping out, surviving, or thriving."[3] The first two of these paths refer to decreased work productivity, taking time off from work or even quitting the job. Not only are these outcomes detrimental to the provider, but also they are associated with monetary losses for the employing institution with a previous estimate of nurse turnover costing US $300,000 for every 1% increase in turnover.[4]

Most healthcare providers have reported not receiving institutional support to assist with distress that occurs after an adverse event.[3,5] At Johns Hopkins Medicine, the Resilience In Stressful Events (RISE) program provides support healthcare workers after they experience a stressful event.[6] This program aims to provide multidisciplinary, peer-to-peer support in a nonjudgmental environment to provide timely support, help healthcare providers to employ healthy coping strategies, and to promote overall well-being. By helping providers cope more effectively after important stressful events, such as an unexpected patient death or a medical error, the program has the potential to decrease provider turnover and productivity losses associated with adverse events.

A key element of the RISE program is peer support provided by colleagues who work in the clinical environment, understand the stressors that are present, and have a great deal of compassion for their peers. These individuals volunteer to serve as RISE responders and are trained using a specific curriculum to provide support primarily psychological first aid, rather than mental health care or human resource counseling. The peers are generally not known to the callers who use the service; if they are personally acquainted, the peer responder can defer the call to another responder. The goal is to provide timely support, which is offered 24 hours per day and 7 days per week. The peer responder is expected to contact the caller within a maximum of 30 minutes of receiving a page. Timely support is usually provided in person but may also be provide by phone, if desired by the caller.

Regardless of their primary clinical role at Johns Hopkins Hospital, peer responders are expected to respond strictly as a trained RISE responders. They do not ask interrogative questions related to the event. The support provided is focused on the caller's feeling rather than the details of the event. All interactions and information are confidential. The only exception is any indication imminent of harm to self or others. The RISE program is housed under the Patient Safety Committee and does not report to supervisors, human resources, or risk management.

The RISE responders are trained to show up in a timely manner, engage fully with the caller, listen actively, empathize, and help them identify coping strategies that will allow them to recover, as well as to be resilient and thrive in their role as a caregiver.

Although RISE and similar programs have anecdotally been successful in averting provider turnover and productivity losses, there have been no formal evaluations of the economics of provider support programs. Therefore, our aim was to evaluate the cost benefit of the RISE program from the hospital's perspective. We hypothesized that the RISE program results in a cost savings in the short term.

METHODS

Design

We developed a Markov model to conduct a cost-benefit analysis comparing the costs to a hospital with and without the RISE program. The analysis was conducted for a 1000-bed private hospital in the United States and was conducted from a provider perspective. The cost-benefit analysis was designed to summarize all costs invested in the RISE program infrastructure as well as monetize benefits using the friction cost method.[7] This method was unique for the case being studied because it considers losses in labor productivity until a suitable replacement could be found.

From the *Johns Hopkins University School of Medicine; †Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health; and ‡Johns Hopkins Hospital, Baltimore, Maryland.

Correspondence: Albert W. Wu, MD, 624 N Broadway, Hampton House, 653 Baltimore, MD 21205 (e-mail: awu@jhu.edu).

The authors disclose no conflict of interest.

Supplemental digital contents are available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.journalpatientsafety.com).

Model parameters were obtained from hospital and survey data. Costs were reported in 2015 US dollars. The time horizon was 1 year; thus, costs were not discounted. Costs of the RISE program were compared with the economic savings from fewer days taken off and reduced rates of quitting to determine whether RISE results in overall cost savings to the hospital. Our analysis focused solely on nursing staff time off and quit rates because of data availability considerations. However, the RISE program is accessible to all hospital staff who may have the same incidents.

Model

The Markov model (Fig. 1) was built using TreeAge (TreeAge Software, Inc, Williamstown, Mass; 2009). Upon experiencing a stressful event, nurses transitioned between the following three states: unaffected, time off, and quit. The cycle length was 1 day and there were 365 cycles. The model had four nodes with different transition probabilities for the three possible states, dependent on whether the RISE program was in place and whether the nurse

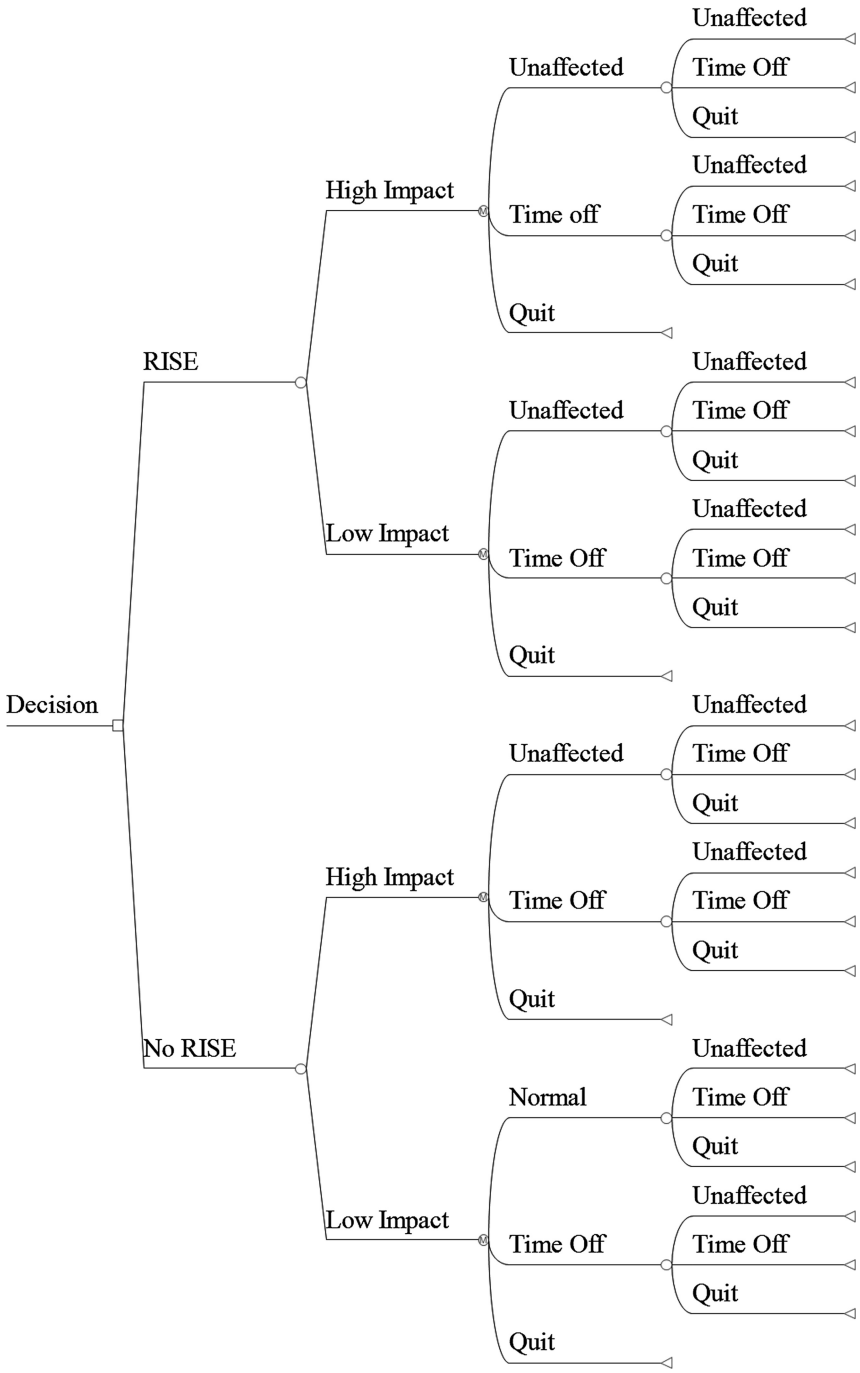

FIGURE 1. A simplified Markov diagram comparing costs with the hospital with and without the RISE program.

TABLE 1. Probabilities

State	Base Case	Range for Sensitivity Analyses	Data Source
Probabilities			
High-impact event	0.80	0.6–1.0	Survey data
No RISE			
Quit (high impact)	0.0122	0.00914–0.01523	Survey data
Quit (low impact)	0.0003	0.00021–0.00034	Survey data
Day off (high impact)	0.0136	0.01020–0.01699	Survey data
Day off (low impact)	0.0003	0.00023–0.00038	Survey data
RISE			
Quit (high impact)	0.0034	0.00253–0.00422	Survey data
Quit (low impact)	0.0001	0.00009–0.00015	Survey data
Day off (high impact)	0.0097	0.00729–0.01215	Survey data
Day off (low impact)	0.0020	0.00148–0.00247	Survey data

*Data obtained from the RISE program.

experienced a high-impact event (e.g., a patient death) or a low-impact event (e.g., a close call). If nurses did quit, they ceased to cycle through the model.

Assumptions

The model contained several assumptions. First, the probabilities of quitting and taking a day off were obtained from survey data that presented hypothetical scenarios to nurses and, thus, may not have been an exact representation of reality. Second, the probabilities of quitting and taking days off were modeled to be the same each day throughout the year, whereas in reality, they would likely be more dynamic, such as decrease further out after the event. Third, potential financial losses in productivity for providers who did not take time off after an incident were not examined in the model.

Data Collection

A survey was conducted to estimate the transition probabilities for the model, which was approved as exempt nonhuman subject research by Johns Hopkins Institutional Review Board (IRB00006942). The survey was completed by a convenience sample of 36 nurses working at Johns Hopkins Hospital in either an intensive care (78%), surgical/medical (17%), or pediatric unit (4%) who were familiar with the RISE program. The questions focused on identifying the probability of quitting and taking a day off after a stressful event with and without the RISE program (see Appendix, http://links.lww.com/JPS/A81 for survey instrument). Missing data were removed from the analysis in calculating the final transition probabilities of the model (Table 1). Costs of the RISE program were enumerated from RISE financial data. Cost of taking a day off was obtained from Johns Hopkins Hospital human resources data. The cost of quitting to the hospital was obtained through a literature review (Table 2).

The biggest cost for the RISE program is time. The strategy used to budget for time was obtaining buy-in from high- and mid-level leadership to support their staff in serving peer responders on the RISE team, if applicable, and using the RISE team when needed. Leaders were the main target audience during implementation and have been the primary referral source for employees, primarily in allowing time for employees to be responders and get support. Leaders might allow for indirect/nonclinical time for participation as a responder and coordinate the schedule so that adequate coverage is available for employees who need support. There was one key leader of the program who dedicated 0.3 to 0.5 full time employment equivalents to lead the program. This was not initially budgeted for, but as the program became more established, the RISE team leader became an official patient safety specialist position at Johns Hopkins Hospital. Additional funding was obtained from a grant by the Josie King Foundation to help train peer responders. The team ultimately developed a tailored curriculum that is now used to help caregivers become peer responders.

Cost Benefit

We calculated the average cost to the hospital for each nurse who used RISE by dividing the RISE program annual cost by the number of nurses seen by RISE in 2015, which was 80 nurses. The cost of one day off was obtained by calculating the average daily wage of a nurse at Johns Hopkins Hospital, using data from human resources. The cost of quitting that was used in our model was based on values reported in the literature and expert opinion.[8–10]

Results of the cost-benefit analysis were interpreted as a net monetary benefit (NMB) by subtracting the RISE program costs from monetized benefits seen as a reduction in loss of labor and workforce productivity. The Markov model was used to calculate the NMB of the RISE program per nurse that is seen by the program. This value was used to calculate the annual benefit for a hospital of investing in a peer-support program by taking into account the number of nurses who participate in the RISE program.

Budget impact was also calculated from the differences in model cost with and without RISE and examined from the perspective of a hospital wishing to institute a peer-support program similar to RISE.

Sensitivity Analysis

Univariate and multivariate sensitivity analyses were used to test model uncertainty. These sensitivity analyses were performed by varying all base case estimates by reported distributions (e.g., confidence intervals, standard deviations) or by varying estimates ±25% of the mean when distributions were not reported.

A Bayesian multivariate probabilistic sensitivity analysis applied distributions for each variable to characterize uncertainty on all parameters simultaneously using 50,000 Monte Carlo simulations. Beta and Dirichlet distributions were used for probabilities

TABLE 2. Costs

State	Cost Type	Base case costs, US $	Range for Sensitivity Analyses	Data Source
Program costs per nurse seen	Fixed	656.25	492.19–820.31	JH data
Time off	Daily	211.55	158.66–264.44	JH data
Quit	Fixed	100,000	50,000–150,000	Hayes et al,[8] Jones,[9] O'Brien-Pallas[10]

TABLE 3. Expected Results of the Base Case Cost-Benefit Analysis

Strategy	Cost (US $ 2015)	NMB
No RISE	81,196.45	
RISE	58,620.40	22,576.05

(i.e., values of 0.0–1.0), and γ distributions were used for costs (i.e., positive values).

RESULTS

Expected Costs and Benefits

The RISE program resulted in a positive NMB after 1 year of US $22,576.05 (Table 3). Compared with the cost of the RISE program per nurse that was seen (US $656.25), the NMB obtained from the RISE program through survey respondent's estimated decreasing in turnover and days off work was estimated to be much greater ($23,232.30) (Fig. 2). The expected annual budget impact for a hospital by implementing a program such as RISE was found to be a savings of US $1.81 million by extrapolating the individual-level cost saving to all users of the program.

Sensitivity and Threshold Analysis

Our results were robust to variations in input parameters. Univariate sensitivity analysis revealed that the model was most sensitive to (1) cost of the RISE program and (2) cost of turnover (i.e., quitting). A two-way sensitivity analysis of varying the probabilities of quitting after a low- or a high-impact event showed variability in the positive NMB of RISE when both probabilities were simultaneously greater than expected.

The probabilistic sensitivity analysis showed that the RISE program resulted in a positive NMB compared with not having a RISE program in 49,987 of the 50,000 (>99%) Monte Carlo simulations at a mean NMB of US $23,360 (95% confidence interval, US −$3006 to US $161,278).

The thresholds at which cost of RISE did not result in a positive NMB were at US $23,232 for the cost of the RISE program per nurse and US $3587 for the replacement cost to the hospital of having a nurse quit.

DISCUSSION

The hospital is a hazardous environment not only for patients but also for medical providers who are at a high risk of emotional distress and burnout because the stresses that they face in their work.[11] This is especially true after a medical error, which may lead to the provider becoming a second victim of the medical error.[2] Given that adverse events are not uncommon in the hospital setting, it is important that health care organizations provide support to their workers after such stressful events.[12] Patient injuries and other stressful events can lead to burnout and high turnover rates, which can negatively impact patient care further. Peer-support programs have been helpful in supporting medical providers after medical errors, yet the financial benefit of these programs have not been well known before this study.[13–15]

The results of this study suggest that having a peer-support program for medical providers may provide hospitals with a substantial return on investment and, thus, constitute good value for the hospital. We estimate that the existence of a peer-support program in our hospital enables it to save at least US $1.8 million each year. This is largely driven by lowering nursing turnover. We have developed a conceptual model that illustrates how value might be added to a hospital by implementing a peer-support program for medical providers (Fig. 2).

It has been previously shown that hospitals with poor nurse retention spend US $3.6 million more than those with high

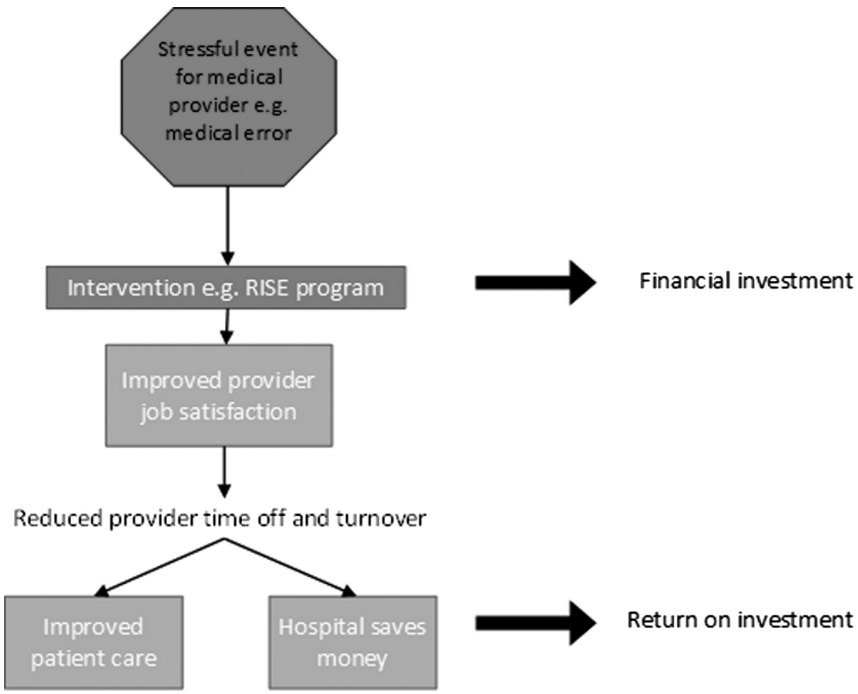

FIGURE 2. Illustration to demonstrate the expected benefits of the rise program.

retention,[16] which suggests that our results are not implausible. However, the largest source of variability in our study was the turnover cost of a nurse.[8–10,17] Further research to get a more precise estimate of nursing turnover would help provide a more accurate cost benefit of having a peer-support program.

Our study was limited by several factors. First, the probabilities of quitting and taking a day off with or without the RISE program were estimated using survey data. Although these data were obtained from the nurses who work in the hospital and who were familiar with how the RISE program works, it is possible that they could have overestimated or underestimated the benefits of the RISE program. Sampling bias was also potentially a limitation of the survey, in that the nurses sampled do not reflect the average nurse. Moreover, our results are subject to confounding because nurses who are more likely to use the RISE program might be less likely to quit or take a day off even without the RISE program.

Second, we only considered nurses in our analysis, despite the RISE program being available to all medical providers. If we had included other medical providers such as physicians, greater savings might be expected because the replacement costs for physicians tends to be greater than that for nurses.[18] Thus, this analysis likely represents a low-end estimate of the value of the RISE program. Third, the time off that nurses took after a stressful event was, in some cases, already budgeted for by the hospital because it was counted toward their paid time off.

Our findings add to the body of evidence supporting the adoption of institutional peer-support programs for medical providers into hospitals by demonstrating that there may be financial benefits to hospitals by doing so. Furthermore, in this era of global budgeting, hospitals might be able to advocate for a budget increase if they adopt a program such as RISE.[19] Peer-support programs might also enable hospitals to obtain higher-level rewards for becoming a center of excellence by decreasing turnover and improving quality of care. For example, with a peer-support program, providers might be more likely to come to work with optimal state of well-being and contribute to a positive work environment and provide high-quality, safe care. They may also be more engaged and more likely to commit to the organization.

In addition, the American Nurses Credentialing Center Magnet Recognition Program requires that Magnet facilities illustrate exemplary professional practice in the realm of "clinical nurses' participation in nursing retention activities and the impact on turnover rates."[20] Given the RISE program's direct implication on nursing turnover and time off, as illustrated in this model, it could potentially be seen as an exemplar of excellence in nursing practice.

CONCLUSIONS

We found that a peer-support program to support medical providers through stressful events may provide substantial value to hospitals, in addition, to the benefits to providers and patients. Hospitals should consider adopting a peer-support program for medical providers for both ethical and financial reasons.

ACKNOWLEDGMENTS

The authors thank the Josie King Foundation and Maryland Patient Safety Center for helping support this research.

REFERENCES

1. Wu AW, Folkman S, McPhee SJ, et al. How house officers cope with their mistakes. *West J Med*. 1993;159:565–569.
2. Wu AW. Medical error: the second victim. *West J Med*. 2000;172:358–359.
3. Scott SD, Hirschinger LE, Cox KR, et al. The natural history of recovery for the healthcare provider "second victim" after adverse patient events. *Qual Saf Health Care*. 2009;18:325–330.
4. Nursing Executive Committee. Reversing the Flight of Talent: Nursing Retention in an Era of Gathering Shortage. Washington, DC: The Advisory Board Company; 2000.
5. Edrees HH, Paine LA, Feroli ER, et al. Health care workers as second victims of medical errors. *Pol Arch Med Wewn*. 2011;121:101–108.
6. Edrees H, Connors C, Paine L, et al. Implementing the RISE second victim support programme at the Johns Hopkins Hospital: a case study. *BMJ Open*. 2016;6:e011708.
7. Gold M, Siegel J, Russell L, et al. *Cost-effectiveness in Health and Medicine: Report of the Panel on Cost-effectiveness in Health and Medicine*. New York: Oxford University Press; 1996.
8. Hayes LJ, O'Brien-Pallas L, Duffield C, et al. Nurse turnover: a literature review—an update. *Int J Nurs Stud*. 2012;49:887–905.
9. Jones CB. Revisiting nurse turnover costs: adjusting for inflation. *J Nurs Adm*. 2008;38:11–18.
10. O'Brien-Pallas L, Griffin P, Shamian J, et al. The impact of nurse turnover on patient, nurse, and system outcomes: a pilot study and focus for a multicenter international study. *Policy Polit Nurs Pract*. 2006;7:169–179.
11. Shanafelt TD, Mungo M, Schmitgen J, et al. Longitudinal study evaluating the association between physician burnout and changes in professional work effort. *Mayo Clin Proc*. 2016;91:422–431.
12. Classen DC, Resar R, Griffin F, et al. 'Global trigger tool' shows that adverse events in hospitals may be ten times greater than previously measured. *Health Aff (Millwood)*. 2011;30:581–589.
13. Scott SD, Hirschinger LE, Cox KR, et al. Caring for our own: deploying a systemwide second victim rapid response team. *Jt Comm J Qual Patient Saf*. 2010;36:233–240.
14. Barnes J, VanPelt R. *Helping healthcare workers heal after critical events*. Baltimore: Continuing the Journey: Destination—Superior Performance University HealthSystem Consortium Conference;October 13; 2006.
15. van Pelt F. Peer support: healthcare professionals supporting each other after adverse medical events. *Qual Saf Health Care*. 2008;17:249–252.
16. Coopers PW. What works: healing the healthcare staffing shortage. *PriceWaterhouseCoopers, LLP*. 2007. Available at: http://www.wiche.edu/info/agendaBook/nov07/presentations/Carparelli.pdf. 2007. Accessed February 24, 2017.
17. Pittman P, Herrera C, Bass E, et al. Residency programs for new nurse graduates: how widespread are they and what are the primary obstacles to further adoption? *J Nurs Adm*. 2013;43:597–602.
18. Schloss EP, Flanagan DM, Culler CL, et al. Some hidden costs of faculty turnover in clinical departments in one academic medical center. *Acad Med*. 2009;84:32–36.
19. Sharfstein JM, Kinzer D, Colmers JM. An update on Maryland's all-payer approach to reforming the delivery of health care. *JAMA Intern Med*. 2015;175:1083–1084.
20. Clark ML. The Magnet Recognition Program and evidence-based practice. *J Perianesth Nurs*. 2006;21:186–189.