Evaluating the Costs of Nurse Burnout-Attributed Turnover: A Markov Modeling Approach

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Objective: Burnout is a public health crisis that impacts 1 in 3 registered nurses in the United States and the safe provision of patient care. This study sought to understand the cost of nurse burnout-attributed turnover using hypothetical hospital scenarios.

Methods: A cost-consequence analysis with a Markov model structure was used to assess nurse burnout-attributed turnover costs under the following scenarios: (1) a hospital with "status quo" nurse burnout prevalence and (2) a hospital with a "burnout reduction program" and decreased nurse burnout prevalence. The model evaluated turnover costs from a hospital payer perspective and modeled a cohort of nurses who were new to a hospital. The outcome measures were defined as years in burnout among the nurse cohort and years retained/employed in the hospital. Data inputs derived from the health services literature base.

Results: The expected model results demonstrated that at status quo, a hospital spends an expected $16,736 per nurse per year employed on nurse burnout-attributed turnover costs. In a hospital with a burnout reduction program, such costs were $11,592 per nurse per year employed. Nurses spent more time in burnout under the status quo scenario compared with the burnout reduction scenario (1.5 versus 1.1 y of employment) as well as less time employed at the hospital (2.9 versus 3.5 y of employment).

Conclusions: Given that status quo costs of burnout are higher than those in a hospital that invests in a nurse burnout reduction program, hospitals should strongly consider proactively supporting programs that reduce nurse burnout prevalence and associated costs.

Key Words: nurse, burnout, turnover, workforce, Markov, decision analysis

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As the largest healthcare professional group in the United States, registered nurses (RNs) ensure patient quality and safety across all healthcare settings given their role in patient assessment, intervention delivery, monitoring, and overall clinical decision making.[1,2] A plethora of health services research to date demonstrates that an adequate supply of RNs (i.e., safe nurse-to-patient staffing ratios) in health care settings is needed to optimize patient outcomes.[3–7] Hospitals that remain understaffed and those that have high RN burnout rates are associated with poor patient satisfaction,[8,9] increased patient adverse events (i.e., medical errors, missed nursing care),[10,11] and poor quality indicators[3,12] that impact hospital safety ratings.[4]

Registered nurse burnout, defined as emotional exhaustion, depersonalization, and a decreased sense of personal accomplishment,[13–15] is an occupational syndrome[16] that not only significantly impacts patient quality outcomes but also is also associated with poor hospital work environments and high RN turnover rates.[1] Before the COVID-19 pandemic, the national RN turnover rate was 17%[17,18] across the United States; current RN turnover rates are projected to increase well beyond this rate.[19,20] Given the ongoing COVID-19 pandemic, it is expected that both RN burnout and turnover will continue to increase as demonstrated by an increase in critical staffing needs across numerous hospital settings and units. Registered nurses who experience burnout are twice as likely to leave their bedside nursing job in comparison with RNs who are not experiencing burnout.[4] This is problematic because RN turnover is costly to hospitals.[21,22] Such rising burnout and turnover rates signal an increased risk of compromised patient quality and safety across U.S. hospitals.

Registered nurse turnover is costly to hospitals that spend time and financial resources onboarding and training new RNs and investing in contract RNs (i.e., travel RNs) to fill staffing vacancies. Contract RNs are typically more expensive for hospitals to hire.[18,21,23,24] The average cost of RN turnover per RN ranges from approximately $40,000 to $100,000.[18,25] Although the cost of RN turnover has been established, there remains a gap in health services research identifying the cost of RN burnout-attributed turnover. This specific distinction is important to establish so that hospitals may understand the need to invest in systems-level interventions that reduce RN burnout.[1] In addition, there are no studies to date that have conceptualized RN burnout costs, despite recent studies published on physician burnout costs in the United States.[26] This study aims to fill this gap by preliminarily studying RN burnout-attributed turnover costs for hospitals. Thus, the purpose of this study was to develop a cost model that assessed the cost of RN burnout-attributed turnover for a hypothetical health care organization. This study is important to support health care work environments for RNs and ultimately improve patient quality and safety outcomes.[27]

METHOD

This cost-consequence analysis used a Markov structure to evaluate the incremental cost of RN burnout-attributed turnover at status quo compared with a hospital with a burnout reduction program. The analysis represents a hypothetical hospital in the United States and was conducted from the hospital perspective as payer. Our analysis focused solely on turnover costs among RNs new to the hospital (i.e., newly hired experienced RN or a newly graduated RN) but could be extended to model other clinical years of experience, professions, and relevant costs. This study consists of a head-to-head analysis comparing the status quo of RN burnout (termed here "status quo arm") in a hospital to a hospital with an RN burnout reduction program (termed here "burnout reduction arm").

Status Quo Arm

The status quo arm consisted of a series of states reflecting the hypothetical progression of an RN in states of "burnout" or "no burnout" in a hospital over a time horizon up to 10 years (Fig. 1) using a Markov model structure. Model parameters and costs were extracted from an extensive health services literature search specific

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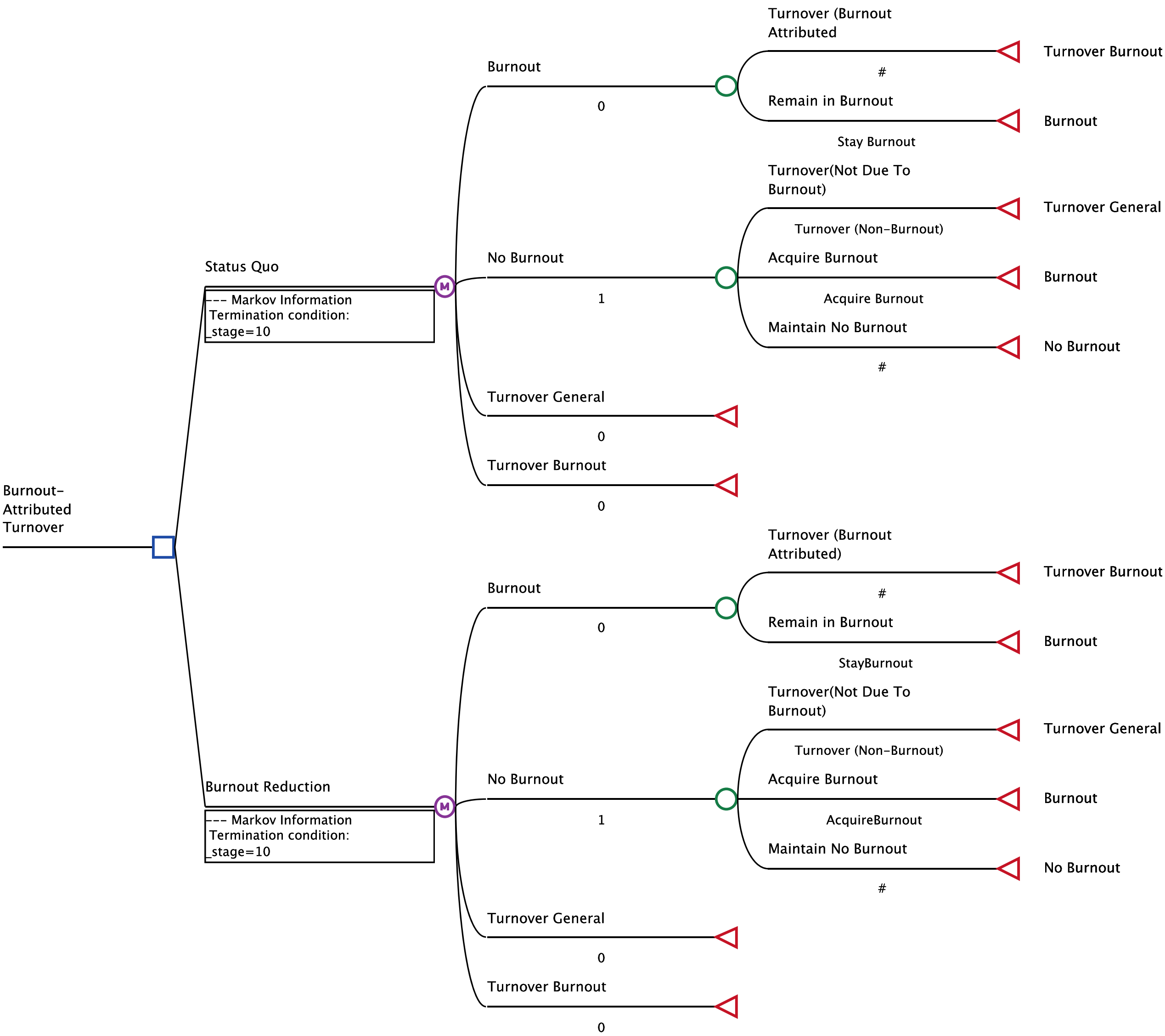

FIGURE 1. Cost-consequence model: RN burnout-attributed turnover. The head-to-head model features Markov models in each arm (i.e., status quo and burnout reduction) to compare hospital costs associated with burnout-attributed turnover.

to RN burnout and turnover outcomes in hospitals (Table 1). Costs were adjusted to 2018 dollar U.S. values and discounted at 3% in alignment with recommendations from the Panel on Cost Effectiveness in Medicine.[29] Outcome measures in the model were burnout costs per RN incurred by the hospital and cost per year that an RN is employed in the hospital, given that RNs spend different amounts of time in the hospitals under each arm. By tracking years in burnout and total years at the hospital as outcome measures, the model is able to estimate the total expected years in burnout and the total expected years at the hospital. The percentage of time spent in burnout within the model was calculated by dividing years in burnout by years employed in the hospital.

Burnout Reduction Arm

The burnout reduction arm maintained the same model structure as the status quo arm but was modified to have a hypothetical reduction in RN burnout attributed to a yearly salary bonus. The burnout reduction arm reflected a reduction in burnout (approximate 50% burnout reduction from status quo) based on Brooks Carthon and colleagues'[8] study on RN burnout rates across hospital work environments and associated patient satisfaction ratings. The burnout reduction program in this model was considered an improvement in the quality of the hospital work environment, as measured by the Practice Environment Scale of the Nursing Work Index and used in Brooks Carthon and colleagues'[8] evaluation of RN burnout across hospitals. The differences in RN burnout between the status quo and burnout reduction arms are attributed to improvements in the quality of the hospital work environment wherein RNs rate managerial leadership, strong relationships with interprofessional colleagues, active patient quality and safety programs, and leadership opportunities in the health care organizations.[8] The policy intervention in this study is a hypothetical salary bonus, which is used to represent a financial intervention to improve job satisfaction.[27,30,31] Combined with the attributes of an improved hospital work environment, this hypothetical salary bonus reflects studies in the health services literature describing strategies to improve RN recruitment and retention.[26,29]

TABLE 1. Model Inputs and Sources

Model Input	Base Estimate	Sensitivity Analysis Range	Source
Probabilities			
Nonburnout-attributed turnover	0.17	0.11–0.28	1,5,17
Acquiring burnout over time			1,7,8,11
1–5 y (status quo)	0.35	0.33–0.36	
6–10 y (status quo)	0.49	0.41–0.49	
1–5 y (burnout Reduction)	0.16	0.11–0.21	
6–10 y (burnout reduction)	0.26	0.24–0.28	
Burnout-attributed turnover	0.43	0.20–0.52	1,7
Healthcare costs			
Turnover per RN, $ (status quo)	74,676	36,853–102,634	18,21–24
Turnover per RN, $ (burnout intervention)	44,806	36,853–102,634	18,21–24
Salary bonus, $	5627 (8% increase)	5–10% (4,220–7, 034)	23,28

Model inputs used for the status quo and burnout reduction arms. Inputs derived from nursing/health services literature.

In the current study, the prevalence of RN burnout is less in the RN burnout intervention arm compared with the status quo arm, as represented by Brooks Carthon and colleagues' study[8] evaluating hospitals with RN burnout rates divided into quartiles. Thus, the RN burnout reduction program burnout rates were gleaned from the lowest 2 quartiles, whereas the status quo burnout rates were the highest 2 quartiles.

Model Design

The cost-consequence analysis (Fig. 1) was developed using TreeAge Pro (2019, Version 20.2.1; TreeAge Software, Inc, Williamstown, Mass).[32] The RN cohort modeled in this study was considered bedside RNs from a general, nonintensive care unit–based hospital setting who were new to a hospital (i.e., newly hired or newly graduate RN). In both arms, the hypothetical model progressed the RN cohort through a series of 3 primary "states": burnout, no burnout, and turnover (either non-burnout or burnout attributed). The hypothetical RN cohort started in the state of "no burnout" (i.e., 100% of the cohort began in the "no burnout" state) and across model cycles made the following transitions: "acquire burnout," "maintain no burnout," "remain in burnout," or "turnover" (non-burnout or burnout attributed; Fig. 1).

When modeling years in burnout, an outcome value of 1 was incurred during each cycle when the cohort was in the "burnout" state; however, no other states incurred the outcome value. This value was used to denote that an RN was in the "state" of burnout and was used to calculate the percentage of time an RN spent in burnout while employed at the organization. When modeling total years in the organization, an outcome value of 1 was incurred during each cycle when the cohort entered the "burnout" and "no burnout" states. The model structure and states were the same for both the status quo and burnout reduction arms.

Model Inputs

Data for the model were collected from a systematic review of observational studies, randomized controlled trials, and case studies on RN burnout and turnover in hospitals. The model inputs (Table 1) in this study were RN burnout and turnover rates, gleaned from literature evaluating RN staffing ratios, work environment ratings, RN burnout, and RN turnover rates. Of note, the probability of acquiring burnout increased over the 10 years as reflected in Table 1, to signify an RN's increased risk for burnout as years of experience increased in the work setting.[8] For example, the probability of acquiring burnout in the status quo arm increased for RNs over the 10 years from 35.3% (years 1–5 in hospital) to 49% (years 5–10).[8]

The probability of acquiring burnout in the burnout reduction arm was derived from Brooks Carthon and colleagues'[8] study evaluating RN burnout rates across various hospitals in the United States. The probability of acquiring burnout in this arm was reduced by approximately 50% in this model. Thus, compared with the status quo arm where burnout probability was 35.3% (years 1–5) and 49% (years 5–10), the burnout reduction arm probabilities were 16% (years 1–5) and 26.6% (years 5–10).

Turnover costs are the primary costs considered in this study because (1) it represents a metric of RN supply/demand instability, (2) it is costly, amounting to 0.75 to twice an RN's salary,[21] and (3) it represents a loss of human capital (i.e., RN expertise)[21] that, if invested in, could result in returns (i.e., improved patient outcomes, reduced patient readmissions)[33] for a hospital. Costs considered in both model arms were turnover costs informed by the Robert Wood Johnson Foundation Wisdom in Nursing study[34] and by Jones'[21] RN turnover methodology. Turnover costs (Table 1) accounted for RN vacancies, hiring, orientation/training, reduced new RN productivity, decreased RN productivity in preturnover phase, and RN termination.[21] Turnover costs in the status quo arm were higher to account for higher RN vacancies compared with the burnout reduction arm. The burnout reduction arm included an additional cost (a policy intervention, see "burnout reduction arm") for all cohort members in the "burnout" and "no burnout" states. This cost was a salary bonus that was 8% of an RN's annual wage and reflected a type of RN retention policy incentive that would be associated with reducing RN burnout.[30,35]

Sensitivity Analyses

Univariate and multivariate sensitivity analyses were performed to test model uncertainty.[36,37] Sensitivity analyses were conducted in the model with the outcome measure representing total years in the hospital. Sensitivity analyses were performed by varying base case estimates by reported distributions (i.e., confidence intervals, standard deviations) or by varying the estimates by ±15% of the mean when distributions were not reported in the literature. Probabilistic sensitivity analysis (PSA) was performed using 10,000 Monte Carlo simulations to compare the status quoto the burnout reduction arm. β distributions were applied to probabilities to the burnout reduction arm. β distributions were

TABLE 2. Expected Results of the Base Case Model

Strategy	Total Cost* (U.S. $ 2018)	Cost (U.S. $ 2018) per RN†	Years in Organization (Effectiveness)	Years in Burnout
Status quo	49,373	16,736	2.95	1.54
Burnout reduction program	40,689	11,592	3.51	1.10

Increased RN burnout in the status quo resulted in increased RN years in burnout and reduced years retained in the hospital. Alternatively, RNs in a burnout reduction scenario experienced fewer years in burnout and more years in the hospital with reduced hospital costs.

*In model simulated up to 10 years.

†Cost per RN per year employed in organization.

applied to probabilities (i.e., parameters between 0 and 1) and γ distributions were applied for costs.

RESULTS

The model results (Table 2) demonstrated that a hospital with a burnout reduction program is less costly and retains RNs longer in the hospital (i.e., has lower RN turnover) and RNs spend less time in burnout compared with a status quo hospital that does not address RN burnout. In modeling the cost of RN burnout-attributed turnover over a period up to 10 years, the burnout reduction program cost $40,689 per RN versus $49, 373 in the status quo. The cost of RN burnout-attributed turnover per year of RN employment was lower in the RN burnout reduction program compared with the status quo ($11,592 versus $16,736 per year). On average, RNs spent more time employed in the hospital with an RN burnout reduction program compared with the status quo (3.51 versus 2.95 y). In addition, RNs spent less time in burnout compared with the status quo hospital (1.1 versus 1.5 y). Thus, RNs employed in the hospital with a burnout reduction program spent 30% of years employed in burnout, whereas those in the status quo hospital spent 51% of their years employed in burnout. Approximately 67% of the nursing cohort experienced burnout-attributed turnover over 10 years in the status quo; 47% of the nursing cohort experienced burnout attributed turnover over 10 years in the burnout reduction scenario. Therefore, the burnout reduction arm produced cost-savings compared with the status quo by retaining RNs longer in the organization and reducing RN burnout ($11,592 versus $16,736 per year). Although the hospital with a burnout reduction program included an annual cost of $5627 (salary bonus) compared with the status quo, approximately $5144 was saved by reducing RN turnover from reduced RN burnout prevalence each year.

Sensitivity Analyses

Model results were robust to variations in the input parameters. Univariate sensitivity analyses (Fig. 2) demonstrated that the model was most sensitive to (1) the costs of turnover in both the status quo and burnout reduction program and (2) the probability of nonburnout-attributed turnover. Multivariate sensitivity analyses demonstrated that up until a probability of 20% of acquiring burnout and an RN turnover cost of $70,000 the status quo is preferred in terms of cost (i.e., cost less). Specifically, both variables were changed in one arm (i.e., status quo) while the other arm (i.e., burnout reduction arm) was held constant (and vice versa). In altering status quo variables, the status quo cost less than the turnover reduction hospital until a turnover cost of $69,000 and nonburnout-attributed turnover probability of 28%. However, RNs still remained in the hospital longer in the burnout reduction program. In varying the burnout reduction arm, turnover costs less than $90,000 regardless of nonburnout-attributed turnover probabilities favored the hospital with a burnout reduction program in

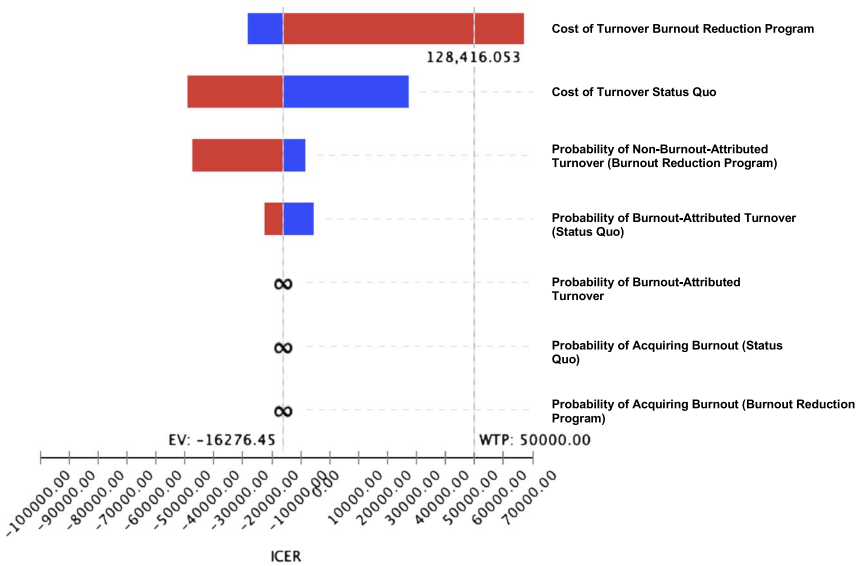

FIGURE 2. Tornado diagram: univariate sensitivity analysis. ICER, incremental cost effectiveness ratio; WTP, willingness-to-pay. Tornado diagram indicating variations in input parameters and sensitivity specifically to RN turnover costs and probability of nonburnout-attributed turnover in the burnout reduction program. Note: red bars indicate a parameter that increased in value from the base case; blue bars indicate a decrease in the base case values. A decreasing, negative ICER identifies low costs and increased years retained in the hospital as outcome measures.

terms of cost and years retained in the hospital. We also varied the costs of RN turnover and the cost of the RN burnout intervention (i.e., salary bonus cost) in the RN burnout intervention arm. The burnout reduction program hospital was preferred (i.e., cost less and retained more RNs) if the cost of RN turnover was less than $60,000, regardless of salary bonus cost. Finally, we varied the probability of acquiring burnout and cost of RN turnover in the status quo arm and found that up until a probability of 20% of acquiring burnout and an RN turnover cost of $70,000, the status quo is preferred in terms of cost (i.e., cost less). At higher burnout probabilities (i.e., 30% and higher) and RN turnover costs in the status quo greater than $70,000, the burnout reduction is preferred in terms of cost and years retained in the hospital (Fig. 2).

The PSA (Fig. 3) demonstrated that the hospital with a burnout reduction program was a lower cost scenario (i.e., cost less than approximately $50,000) with more years retained in the organization compared with the status quo (i.e., from 2 to 5 y RN retention in the organization over 10 y). The status quo remained a higher cost option (i.e., within $30,000–$150,000) with between 2 and 3.5 years retained in the organization over 10 years. Overall, the status quo remained the scenario where RNs spent the least amount of time in the hospital in comparison with the burnout reduction scenario, which proved to cost more.

DISCUSSION

This study is one of the first to establish evidence around RN burnout costs using Markov modeling approaches. The model results demonstrated that a status quo hospital will spend approximately $16,000 on RN burnout-attributed turnover costs per RN, per year employed. Alternatively, a hospital that is able to reduce RN burnout by 50% can experience cost savings of approximately $5000 per RN per year employed in the organization. The cost savings in the RN burnout reduction hospital relate to reductions in RN burnout and associated turnover. Specifically, RNs in the status quo hospital spent less time employed in the organization compared with a hospital with reduced RN burnout levels (3.51 versus 2.95 y). Registered nurses spent approximately 50% of their years employed in the status quo hospital in a state of burnout compared with 30% of employed years in the burnout reduction hospital. Overall, reducing RN burnout demonstrated cost savings in the RN burnout reduction hospital because more people were retained in the hospital, despite costs added annually because of an RN salary bonus. Considering that RNs are the largest healthcare professional group in the United States, identified cost savings are projected to be significant and should be considered as RN burnout and turnover rates rise because of the COVID-19 pandemic.[33,38]

Results from the sensitivity analyses in this study have important implications for policy translation to clinical practice. Our results demonstrate that when the RN burnout prevalence is greater than 20% and RN turnover costs are greater than $70,000, the burnout reduction program costs less, retains RNs longer in the hospital, and has fewer RNs experiencing burnout. Before COVID-19, RN burnout rates were on average 34% across the United States and have since increased to approximately 50% during COVID-19.[39–41] Thus, our results signify a critical need for hospital investment in RN burnout interventions given that RN burnout prevalence is well greater than 30% at this time.

Our results also support the need for hospitals to regularly assess RN burnout prevalence to optimally finance RN staffing. Contract RNs (i.e., travel RNs) cost more for hospitals to hire than permanent RN salaries.[18,21,23] Given that contract RNs are often hired to fill staffing vacancies, it is imperative that hospitals assess RN burnout regularly to avoid high RN turnover and the inefficient hiring of travel RNs.[18,21,23] Our model supports the need for hospitals to regularly assess RN burnout as a means to project financial costs of RN turnover and other costs associated with burnout, such as poor patient outcomes. Using the data from this model, hospital policies can be created mandating RN-targeted interventions once RN burnout rises greater than 20% to 25%. Such interventions could include financial incentives (i.e., salary bonus) or increased vacation time when RNs pick up more shifts over a pay period. Failing to intervene on RN burnout represents a financial loss to a hospital from a direct cost perspective, and an indirect cost perspective as can be modeled in future studies.

The PSA was robust in demonstrating that the burnout reduction program was overall less costly than the status quo scenario and represented more years in the organization for RNs ranging from 2 to 5 years. These findings support published research to date with evidence indicating that new RNs spend less than 5 years in a bedside job before leaving for a new job position but also uniquely identifies differences in RN retention years based on

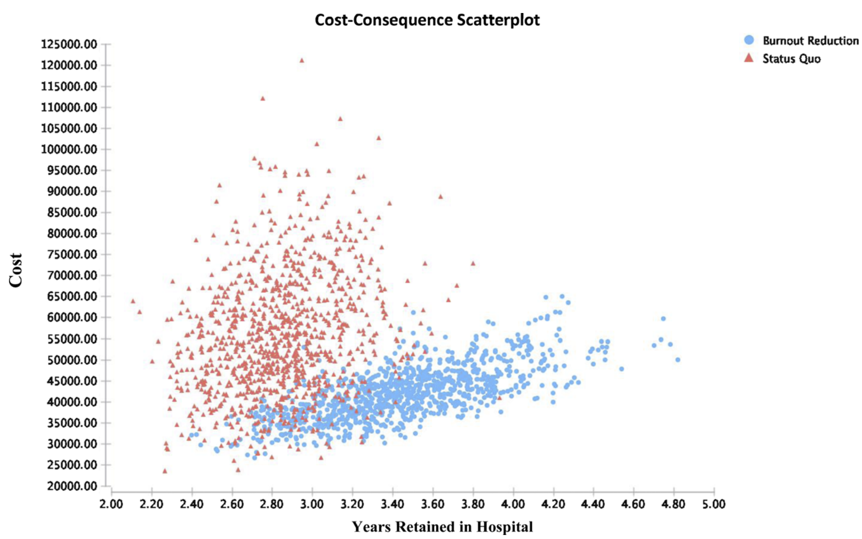

FIGURE 3. Probabilistic sensitivity analysis scatterplot. Probabilistic sensitivity analysis results demonstrated the outcome measure (i.e., RN years retained in the organization) variation in the burnout reduction program compared with the status quo. Note: Red triangle indicates the status quo; blue circle indicates burnout reduction program.

hospital scenario.[42] These findings demonstrate the need for hospitals to target policies and interventions specifically within the first 3 to 5 years of an RN's practice, regardless of the hospital climate (i.e., status quo or with a burnout reduction program). Policies and interventions include offering financial incentives for RNs as they become preceptors for newer RNs (e.g., salary bonus, vacation time), instituting mandated staffing ratios, and allocating/distributing RN workload equitably across clinician groups.[27,30,31] In addition, as RNs gain more years of experience on the unit, they can be offered increased educational opportunities (e.g., time off to attend conferences) and/or tuition reimbursement. Such offerings may aid in RNs feeling supported and valued on the unit, which is often a driver of RN burnout and turnover.[1,24] The implementation of such interventions can also, by addressing RN burnout, have an improved impact on patient quality outcomes and potentially further cost savings.[1]

This study has limitations that are critical to address. First, the cost model was limited to RN turnover costs and a salary bonus associated with the RN burnout reduction program. Thus, it was assumed that the RN burnout costs are related predominately to turnover. This limitation fails to account for relevant RN burnout costs beyond turnover that are important to nursing, the patient, and the hospital, such as RN absenteeism, reduced RN productivity (i.e., RN presenteeism), patient adverse events, and other important factors.[43–45] If these dimensions were added, however, RN burnout-attributed turnover costs within the status quo would be even higher, thus making a stronger case for reducing burnout in hospitals. Second, the data informing this study derived from published literature and not primary data collection. As a result, data sources may not be generalizable to specific hospital settings. Third, the model assumes that RNs entering the model are new to the hospital or nursing overall. Although not all RNs are new to a hospital, this cohort characteristic is beneficial in present day given how travel nursing (i.e., contract nursing services) are consulted frequently to account for RN shortages particularly in the COVID-19 pandemic.[28] Thus, hospitals experiencing a high number of new RNs (i.e., due to new graduate or travel nursing hiring) can benefit from this data. In addition, the model does not "replace" RNs after a portion of the cohort is lost because of RN turnover. Thus, the results from this study cannot be generalized to all nursing experiences related to burnout and turnover.

Despite the limitations presented from this study, the model and associated findings are a critical first step necessary to develop programs of research evaluating RN burnout costs in health care organizations. The National Academies of Science, Medicine, Engineering, and Medicine state that identifying the economic costs of clinician burnout is a critical first step to understand the true burden of burnout in health care organizations.[1] This study sets the stage for future national research agendas assessing RN burnout costs across the United States, stratified by health care setting (e.g., emergency department, general medicine, surgical, etc.). By developing a basic structure using Markov modeling to identify RN cohort costs, this study successfully identifies that modeling RN burnout costs is valuable for health care organizations and can demonstrate financial decision-making strategies. As RNs and other clinicians in the United States continue to be impacted by COVID-19 from a well-being perspective,[38,46,47] developing robust decision analytic/economic models assessing RN burnout costs is critical.

CONCLUSIONS

The costs of RN burnout-attributed turnover in this study were based on data from published literature on RN burnout and turnover and are considered to have some uncertainty. Despite this uncertainty, the cost models suggest that RN burnout reduction can reduce RN turnover and associated costs. Hospital investments in reducing RN burnout may lead to financial cost savings and increased RN retention in hospitals, which can indirectly positively impact patient quality and safety outcomes downstream.

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