Factors Associated With Provider Burnout in the NICU

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BACKGROUND: NICUs vary greatly in patient acuity and volume and represent a wide array of organizational structures, but the effect of these differences on NICU providers is unknown. This study sought to test the relation between provider burnout prevalence and organizational factors in California NICUs.

METHODS: Provider perceptions of burnout were obtained from 1934 nurse practitioners, physicians, registered nurses, and respiratory therapists in 41 California NICUs via a validated 4-item questionnaire based on the Maslach Burnout Inventory. The relations between burnout and organizational factors of each NICU were evaluated via t-test comparison of quartiles, univariable regression, and multivariable regression.

RESULTS: Overall burnout prevalence was 26.7% ± 9.8%. Highest burnout prevalence was found among NICUs with higher average daily admissions (32.1% ± 6.4% vs 17.2% ± 6.7%, P < .001), higher average occupancy (28.1% ± 8.1% vs 19.9% ± 8.4%, P = .02), and those with electronic health records (28% ± 11% vs 18% ± 7%, P = .03). In sensitivity analysis, nursing burnout was more sensitive to organizational differences than physician burnout in multivariable modeling, significantly associated with average daily admissions, late transfer proportion, nursing hours per patient day, and mortality per 1000 infants. Burnout prevalence showed no association with proportion of high-risk patients, teaching hospital distinction, or in-house attending presence.

CONCLUSIONS: Burnout is most prevalent in NICUs with high patient volume and electronic health records and may affect nurses disproportionately. Interventions to reduce burnout prevalence may be of greater importance in NICUs with ≥10 weekly admissions.

WHAT’S KNOWN ON THIS SUBJECT: Provider burnout is increasing in prevalence and has been associated with adverse quality of care measures. Burnout prevalence varies across NICUs and may be associated with higher rates of health care–associated infections, particularly in large NICUs.

WHAT THIS STUDY ADDS: Burnout prevalence is highest in larger and busier NICUs and those with electronic health records, with particularly prominent effects among nurses. Markers of patient acuity, status as teaching hospital, and in-house neonatologist presence do not reliably associate with burnout prevalence.

Burnout is a state of fatigue, detachment, and cynicism resulting from prolonged high levels of stress.\textsuperscript{1} Medical professionals in the critical care setting are at risk for burnout,\textsuperscript{2,3} fueled by frequent changes in technology and guidelines, endeavors for high-quality care, and emotional challenges of dealing with critically ill patients and their families.\textsuperscript{4–6} Burnout affects 25% to 50% of NICU providers,\textsuperscript{1,5} with up to one-half of nurses and physicians meeting criteria for severe burnout in all specialties.\textsuperscript{7–10} Burnout among health care providers has been linked to adverse patient events in multiple settings, including increased rates of health care–associated infections\textsuperscript{11,12} and self-reported errors.\textsuperscript{11,13} Furthermore, burnout may lead to clinician attrition and exacerbate staffing shortages.\textsuperscript{14}

Similar to findings among adult providers,\textsuperscript{15} the demands of caring for critically ill neonates may influence progression to burnout, although these relationships are incompletely characterized. NICUs vary greatly in the acuity and volume of infants for whom they care, which may in turn affect the prevalence of burnout within the unit. Furthermore, the overall NICU size, presence of trainees, institutional standards for physician presence, and medical record system may influence workloads and job satisfaction among different categories of providers.\textsuperscript{10}

The effect of organizational factors on NICU provider burnout is unknown. The objectives of this study were to:

- Describe the variation of NICU patient mix and organizational factors.
- Describe the relation between organizational factors and provider burnout.

**METHODS**

This cross-sectional study links survey data to concomitant patient demographic and outcome data derived from population-based clinical registries among 41 California NICUs.

### Setting and Study Design

#### Selection of NICUs

The California Perinatal Quality Care Collaborative (CPQCC) is a multistakeholder group of public and private neonatal health care units and other health industry specialists committed to improving care and outcomes for the state’s newborns. The collaborative includes >130 member hospitals, accounting for the majority of preterm infants needing critical care in California. This cross-sectional survey was performed among a voluntary sample of CPQCC NICUs participating in a Delivery Room Management Quality Improvement Collaborative.\textsuperscript{16} For the current study, we assembled a survey to investigate safety culture, engagement, and burnout by using existing validated metrics from several instruments, detailed below. We offered to analyze and provide survey feedback to all NICUs who participated in the delivery room management improvement initiative. Of 61 NICUs in the improvement initiative, 44 voluntarily chose to participate in the survey, with the survey administered at the beginning of the improvement initiative between June and September 2011. Of these 44 NICUs, 41 also provided clinical and organizational data to the California Office of Statewide Health Planning and Development (OSHPD) database and were included in the final analysis.

Staff members not present in routine meetings were hand-delivered a survey, pencil, and return envelope. This administration technique has generated high response rates,\textsuperscript{17,18} comparable to those of similar methods.\textsuperscript{14} CPQCC staff administered the survey and transmitted a deidentified data set to Drs Profit and Tawfik for analysis.

#### Selection of Patients

Clinical data routinely submitted to the OSHPD and CPQCC databases between January 1, 2011 and December 31, 2012 were linked to the survey data with unique identifiers for NICUs and patients. We used data across 2 years for the analysis because of the small number of infants cared for in some institutions.

### Measurements

#### Survey Data

Measures relevant for this study were part of a larger survey on safety culture and organizational determinants of quality. The 4-question emotional exhaustion subset of the Maslach Burnout Inventory\textsuperscript{19} was used, which has been shown to be reliable and valid in other settings.\textsuperscript{20} The question prompts were as follows: (1) “I feel fatigued when I get up in the morning and have to face another day on the job,” (2) “I feel burned out from my job,” (3) “I feel frustrated by my job,” and (4) “I feel I am working too hard on my job.” The questions were adapted to the survey format of the Safety and Attitudes Questionnaire,\textsuperscript{17} which changed its response scale and scoring to range from 1 (disagree strongly) to 5 (agree strongly). The psychometric properties of this 4-question emotional exhaustion subset have performed favorably in previous analyses (Cronbach’s coefficient $\alpha = .85$) and suggested its appropriateness as a marker of overall burnout climate (intraclass correlation coefficient $r = .95$).\textsuperscript{1}
A burnout score for each respondent was computed by taking the mean of the 4 items (1–5 points for each response) and transforming it to a 0- to 100-point scale via the following formula:

\[
\text{Burnout score for a respondent} = \frac{\text{(mean of the burnout items)}}{4} \times 25
\]

Each person thus could receive a minimum burnout score of 0 if all responses were strongly disagree, a maximum score of 100 if all responses were strongly agree, or intermediate scores reflecting any combination of responses. For the purposes of this study, we defined a burned-out person as one who agrees with the emotional exhaustion subset of the Maslach Burnout Inventory, because emotional exhaustion is considered the key component of burnout. To calculate the burnout prevalence of a NICU, one calculates the proportion of respondents who received a scale score of ≥50. This 50% threshold groups “neutral” responses together with “agree” responses as previously described in the literature. This metric has been found to be meaningful to providers when used in safety culture assessments.

The survey also captured respondent characteristics including job position, years in specialty, and gender. Job positions included attending physicians, fellow physicians, neonatal nurse practitioners, registered nurse, respiratory care practitioners, and other.

**Clinical Data**

NICU capacity, nurse staffing hours, and patient admission rates were extracted from the California OSHPD database for the years 2011 and 2012. Average admission rates were calculated as total admissions for that NICU divided by 730 study days. Nurse staffing was calculated as total reported nurse staffing hours for the 2-year study period divided by the total number of patient-days over the same period, and it is reported in units of nursing hours per patient day. California Children’s Services (CCS) level and use of an electronic health record (EHR) were extracted from routine yearly surveys of NICU directors.

High-risk infant demographics were extracted from the CPQCC database during the same time period, including all infants with birth weight between 401 and 1500 g or gestational age between 22 0/7 and 29 6/7 weeks, in addition to all infants admitted before 28 days of age and meeting any of the following criteria: death before discharge, acute transfer into NICU, acute transfer out of NICU, major surgery necessitating anesthesia, assisted ventilation for >4 hours, nasal intermittent mandatory ventilation for >4 hours, early bacterial sepsis, readmission for total serum bilirubin >25 mg/dL, or exchange transfusion. For each NICU, the number of patients who met this definition was divided by the total number of infants cared for and is reported as the high-risk proportion.

Patients transferred into each NICU of interest at >7 days of life were classified as late transfers. The proportion of all infants who met this late transfer definition was calculated for each NICU and used as a secondary surrogate marker for patient acuity, because our clinical experience has found these patients to be more likely to need increased medical interventions.

**Statistical Analyses**

Descriptive statistics including frequencies, medians, means, and SDs were used to describe survey responses and respondent demographics. Survey results nested within NICUs were aggregated to obtain a single-point estimate of burnout for each NICU, reported here as burnout prevalence. Burnout prevalence was calculated as described above, resulting in a proportion of total respondents per NICU reporting symptoms of burnout. Basic descriptive statistics examined the variation in infant factors and organizational factors across NICUs, and associations between burnout and organizational factors were evaluated via 2-tailed t test comparison of quartiles, Pearson’s correlation coefficients, and univariable regressions. After univariable analysis, all variables were entered in a least absolute shrinkage and selection operator (lasso) generalized regression model with corrected Akaike information criterion validation to achieve variable selection. Hierarchical modeling was used to account for respondent characteristics nested within NICUs. Sensitivity analysis limited to the nursing cohort was conducted to evaluate nursing burnout in isolation from physician burnout.

All statistical analyses were performed in SAS version 9.4 and JMP Pro version 13.0.0 (SAS Institute, Inc, Cary, NC). The study was approved by the Institutional Review Board at Stanford University with waiver of informed consent.

**RESULTS**

**Objective 1: Describe the Variation of NICU Patient Mix and Organizational Factors**

Forty-one NICUs participated in this study. Table 1 shows the characteristics of the clinical sample and organizational factors. Individual NICUs cared for 84 to 2906 infants during the study period, with an average daily admission rate of 1.3 ± 0.8 infants and average length of stay of 14.2 ± 5.1 days. Of the 37,568 infants included in the study, 14,998 (39.9%) were classified as high risk, and 3982 (10.1%) were late transfers. Twelve (29%) NICUs classified as teaching hospitals, and 16 (39%) reported in-house
neonatologist coverage. Thirty-three (80%) NICUs reported EHR use, with 19 of these reporting ≥2 years since EHR implementation.

Table 1 also lists characteristics of the 1934 survey respondents (of 2760 surveys distributed, 70% response rate). Respondents were primarily female (84.8%) and with >10 years’ experience in the NICU (59%). The 20 respondents identified as “other” consisted of licensed vocational nurses, clinical nurse leads, research nurses, and nurse aides. A total of 517 (26.7%) respondents reported symptoms consistent with burnout, with individual NICU burnout prevalence ranging from 7.5% to 42.9%.

**Objective 2: Describe the Relation Between Organizational Factors and Provider Burnout**

Figure 1 shows the prevalence of provider burnout in relation to average daily admission rates. Burnout prevalence was associated with NICUs with higher admission rates (r = 0.53, P < .001). None of the NICUs with >1.5 average daily admissions demonstrated a burnout prevalence <20%. The number of licensed NICU beds was collinear with admission rates (variance inflation factor 11.3) and showed a similar association with burnout (r = 0.55, P < .001). A less robust, nonsignificant association was observed between occupancy and burnout prevalence (r = 0.23, P = .15), with significantly higher burnout prevalence observed in the highest quartile than in the lowest quartile (28.1% ± 8.1% vs 19.9% ± 8.4%, P = .02).

Table 2 shows univariable and multivariable regression associations of burnout prevalence and organizational factors, along with mixed-model results from hierarchical analysis. Admission rates, number of licensed beds, average lengths of stay, EHR use, and regional CCS level were found to be significantly associated with burnout prevalence in univariable analyses. There was no association with burnout observed for nursing hours per patient day, occupancy, mortality rates, high-risk proportion, or late transfer proportion. Lasso regression selected for associations between burnout prevalence and average daily admissions, EHR use, and mortality rate. Of these variables, average daily admissions and EHR use were significant, demonstrating a 5.87% increase in burnout prevalence for each additional daily admission (P < .001) and a 3.36% increase in burnout prevalence associated with EHR use (P = .03).

Burnout prevalence in relation to EHR use is shown in Fig 2, with NICUs reporting ≥2 years of EHR use exhibiting higher burnout prevalence than units without EHR (28.3% ± 10.1% vs 18.4% ± 6.6%, P = .015). NICUs reporting EHR use did not differ significantly in number of licensed beds (39 ± 24 vs 33 ± 14, P = .53) or average daily admissions (1.36 ± 0.98 vs 1.04 ± 0.73, P = .38) when directly compared. No differences in burnout prevalence were observed by status as teaching hospital (28.5% ± 9.8% vs 24.9% ± 11.1%, P = .33) or in-house neonatologist presence (27.9% ± 10.3% vs 24.7% ± 11.1%, P = .36).
Multivariable regression for burnout prevalence within the nursing cohort showed overall stronger associations than the physician cohort. The nursing cohort model selecting for average daily admissions (parameter estimate \[PE\] 7.76 ± 0.80, \(P < .001\)), nursing hours per patient day (\(PE -0.03 (0.24), P = .91\)), late transfer proportion (\(PE -0.32 (0.15), P = .04^*\)), and nursing hours per patient day (\(PE 0.45 (0.30), P = .14\)).

**DISCUSSION**

The major findings of this study are the associations of higher burnout prevalence in referral NICUs, particularly those with higher volumes and higher admission rates. Many of the patient-specific characteristics queried associated with no significant difference in burnout prevalence among providers, suggesting that individual patient factors play a minor role, if any, in the propensity for providers to develop burnout symptoms.

NICU size may drive burnout by decreasing personal satisfaction among providers if they prefer to represent a larger relative contribution to the overall unit functioning. Larger NICUs are also more likely to have a greater number of employees, decreasing the quality of interpersonal interactions.
among people less familiar with their coworkers. Furthermore, the association of nursing burnout with average number of daily admissions suggests that the nursing workload associated with a new admission may be underappreciated, creating the potential for relative understaffing. Although there is a paucity of published data on the subject, new admissions may necessitate more rapid and efficient decision-making, increased intellectual effort to address diagnostic uncertainty, and emotional expenditure related to engaging and orienting new family members. It seems likely that the absolute numbers of nursing hours per patient provide an incomplete description of the nursing workload that may contribute to burnout. The development of an acuity-adjusted nurse staffing metric would benefit future investigations of the associations between organizational factors and staff and patient outcomes.

EHR use was associated with higher burnout prevalence, particularly among NICUs with the most long-standing EHR use, suggesting against unfamiliarity and initial inefficiency as primary drivers of any such association. Beyond the increased time necessary for documentation, reliance on an EHR for health care delivery may limit providers’ experience with interpersonal interactions or direct patient care. However, our findings should be interpreted with caution, because NICUs with recent EHR implementation did not demonstrate significant increases in burnout, and the NICUs with the most long-standing EHR use may also be more likely to care for larger numbers of high-acuity infants. The trend toward an association between mortality rate and burnout prevalence supports the hypothesis of increased acuity resulting in higher burnout, but the emotional toll of infant mortality may also directly contribute to provider burnout independent of overall patient acuity. Furthermore, the proportion of high-risk infants and late transfers did not associate with burnout prevalence in the full cohort.

Although it is the most significant risk factor identified in this study, large NICU size is not easily modifiable and may improve quality of patient care highlighting the need for robust vigilance to provider burnout in large, busy NICUs. In addition, burnout recognition education for providers and the implementation of burnout interventions at the individual and institutional level will be crucial, particularly because the current health care trend toward larger centralized units is likely to increase the prevalence of this risk factor. Increasing recognition of the organizational responsibility to combat burnout has led to the development of health care system-based initiatives such as the Mayo Clinic Physician Well-Being Program and the Stanford Medicine WeillMD Center, which has a mission to "improve the health and professional fulfillment of physicians and the associated health of their patients, their students, and other members of the medical teams they lead." Through practice efficiency improvements, provision of personal resilience tools, and cultivation of a culture of wellness, these provider wellness programs strive to support health care providers in high-risk environments and promote the overall well-being of the health care organization and its care of patients. This multipronged approach has arisen from the recognition that conventional strategies such as mindfulness practice are often time-consuming and challenging to administer. Brief and widely distributable burnout interventions based on mindfulness strategies are being prospectively evaluated in the
NICU setting, with good benefit seen in pilot studies. The interventions focus on expressing thankfulness (Gratitude), dwelling on positive events (3 Good Things), structured cultivation of awe and wonder (Awe), random acts of kindness (Signature Strengths), and relationship resilience.

This study must be interpreted in the context of its design. Emotional exhaustion was used as a surrogate for clinical burnout in these NICUs, so any comparison with other studies of burnout prevalence must account for differences in methods. The correlation analyses in this study cannot determine causality of the observed associations, although many of the patient-level variables examined here are conceptually unlikely to be influenced by provider burnout. The study is susceptible to response bias at both the NICU and individual respondent levels, but our response rate of 70% compares favorably with those of similar studies.

Because this was a hypothesis-generating study, no adjustment was made for multiple testing. Finally, although generalizability may be limited by regional practice variation, this study probably carries relevance for the population as a whole, because it stems from a large and diverse sample of NICUs across the state of California.

**CONCLUSIONS**

Burnout among neonatal providers is prevalent and strongly associated with higher-volume NICUs. Based on our findings in this cohort, large, complex NICUs need to be particularly vigilant for signs of burnout and implement interventions to combat its development.

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- Doctors Medical Center–Modesto, Modesto
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- Garfield Medical Center, Monterey Park
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- Hollywood Presbyterian, Los Angeles
- Huntington Memorial Hospital, Pasadena
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- UC Davis Medical Center, Sacramento
- UC San Francisco Medical Center, San Francisco
- Valley Presbyterian Hospital, Van Nuys

**ABBREVIATIONS**

- CCS: California Children’s Services
- CPQCC: California Perinatal Quality Care Collaborative
- EHR: electronic health record
- lasso: least absolute shrinkage and selection operator
- OSHPD: Office of Statewide Health Planning and Development
- PE: parameter estimate
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