Published in final edited form as:

Arch Dis Child Fetal Neonatal Ed. 2012 March ; 97(2): . doi:10.1136/archdischild-2011-300635.

Neonatal Intensive Care Unit Safety Culture Varies Widely

Jochen Profit, MD, MPH^{a,b,c}, Jason Etchegaray, PhD^d, Laura A Petersen, MD, MPH^{b,c}, J Bryan Sexton, PhD^e, Sylvia J Hysong, PhD^{b,c}, Minghua Mei, MS^{b,c}, and Eric J Thomas, MD, MPH^d

^aDepartment of Pediatrics, Baylor College of Medicine; Texas Children's Hospital; Houston, TX, USA

^bSection of Health Services Research, Department of Medicine, Baylor College of Medicine, Houston, TX, USA

^cHouston Veterans Affairs (VA) Health Services Research and Development Center of Excellence, Health Policy and Quality Program, Michael E. DeBakey VA Medical Center; Houston, TX, USA

^dUniversity of Texas – Memorial Hermann Center for Healthcare Quality and Safety, University of Texas Medical School, Houston, TX, USA

^eDepartment of Psychiatry, Duke University School of Medicine; Duke University Health System, Durham, NC, USA

Abstract

background—Variation in health care delivery and outcomes in NICUs may be partly explained by differences in safety culture.

objective—To describe NICU caregiver assessments of safety culture, explore the variability within and between NICUs on safety culture domains, and test for association with caregiver characteristics.

methods—We surveyed NICU caregivers in a convenience sample of 12 hospitals from a single health care system, using the Safety Attitudes Questionnaire (SAQ). The six scales of the SAQ include teamwork climate, safety climate, job satisfaction, stress recognition, perception of management, and working conditions. For each NICU we calculated scale means, standard deviations and percent positives (percent agreement).

results—We found substantial variation in safety culture domains among participating NICUs. A composite mean score across the six safety culture domains ranged from 56.3 to 77.8 on a 100-

Correspondence to: Jochen Profit, MD, MPH, Assistant Professor, Baylor College of Medicine, Section of Neonatology, Houston Center for Quality of Care & Utilization Studies, VA HSR&D (152), 2002 Holcombe Boulevard, Houston, TX 77030, Tel: 713.794.8609, Fax: 713.748.7359, profit@bcm.edu.

Address for reprint requests: Jochen Profit, MD, MPH, Houston VA HSR&D Center of Excellence (152), 2002 Holcombe Boulevard, Houston, TX 77030, phone: 713.794.8609, fax: 713.748.7359, profit@bcm.edu

The authors have no financial relationships relevant to this article to disclose.

AUTHOR CONTRIBUTIONS

JP - Designed the study questions, analyses, and drafted the manuscript. JE - Contributed to the design and framing of the study questions and the analyses. He also edited the manuscript. LP - Helped to frame the study question in a variation and performance measurement context. Helped interpret study findings, reviewed and edited the manuscript. BS - Conducted the original data collection, transmitted a de-identified data set to Dr. Profit, helped frame and design study questions, interpreted study findings, and reviewed and edited the manuscript. SH - Contributed to interpretation of analysis, framing of results in an industrial/organizational context, and edited the manuscript. MM - Developed an analysis plan, conducted analyses, reviewed results with study members, and edited the manuscript. ET - Acted as senior advisor to the project. Helped with framing of study questions, interpretation of results, contextual background and review/editing of manuscript.

point scale and NICUs in the top four NICUs were significantly different from the bottom four ($p < .001$). Across the six domains, respondent assessments varied widely, but were least positive on perceptions of management (3–80% positive; mean 33.3%) and stress recognition (18–61% positive; mean 41.3%). Comparisons of SAQ scale scores between NICUs and a previously published cohort of adult ICUs generally revealed higher scores for NICUs. Physicians composite scores were 8.2 ($p = .04$) and 9.5 ($p = .02$) points higher than nurses and ancillary personnel.

conclusion—Significant variation and scope for improvement in safety culture exists among this sample of NICUs. The NICU variation was similar to variation in adult ICUs, but NICU scores were generally higher than adult ICU scores. Future studies should validate whether safety culture as measured with the SAQ correlates with clinical and operational outcomes in the NICU setting.

Keywords

Infant; newborn; quality of care; patient safety; safety culture

INTRODUCTION

In neonatology there is persistent variation in health care delivery and outcomes.^{1–7} Differences among NICUs with regard to safety culture may in part explain this phenomenon. Preterm infants are fragile, often very ill, and exposed to complex and prolonged intensive health care interventions. This makes them vulnerable to lapses in teamwork and patient safety.

The Joint Commission requires that institutions measure their safety culture on an ongoing basis.⁸ The Safety Attitudes Questionnaire (SAQ) is one of the most widely used instruments to measure safety culture⁹, has good psychometric properties¹⁰, and is responsive to interventions.^{11,12} In the adult care setting, a growing literature links improvements in safety culture to improvements in care, such as reduced medication errors, length of stay, nursing turnover rates¹³, and central line associated blood stream infections.¹⁴

Unfortunately, investigations of safety culture and teamwork in the NICU are uncommon.^{15–18} Safety culture instruments, such as the SAQ, should be applied to specific settings to examine and ensure that their results are meaningful, interpretable, actionable, and reliable. This study adds to the empiric body of research by describing variation of safety culture domains in a sample of twelve NICUs, highlights opportunities for improvement, and investigates the influence of respondent characteristics safety culture scores. Additionally, we investigate the use of an SAQ composite measure, scale scores, and comparisons within and outside of NICUs.

METHODS

sample, procedure, and measures

Please refer to our accompanying paper in this issue for a detailed description of the patient sample, study procedures and instrument measures (data for both papers were handled in the same manner).¹⁹ In brief, the SAQ (ICU Version) was administered to all caregivers in twelve NICUs in a faith-based non-profit health system in 2004 using procedures, which had previously yielded high response rates.²⁰ Institutional Review Board approval was obtained for this research.¹⁹

analysis

This study addresses the following research questions (RQ) through a secondary analysis of prospectively collected data:

RQ1: What respondent characteristics are associated with a composite score of safety culture?—For each NICU a “composite score” was constructed as the arithmetic mean of the scale scores. We explored an aggregation of SAQ scores to a composite score¹⁹ following methods by Vogus et al.²¹

We investigated associations between the composite score and respondent characteristics in bivariate analyses and input characteristics associated at $p = .1$ in a hierarchical model. Respondents were nested within NICUs. The multivariate model was developed to adjust for potential confounding of scale scores due to respondent characteristics. A two-tailed p -value $< .05$ was considered statistically significant.

RQ 2: To what extent do NICUs in the same hospital system share common assessments of patient safety and teamwork related norms?—Mean scale scores were computed for each NICU. We tested for statistical differences in scale scores between NICUs ranking among the top and bottom four NICUs. Unadjusted analyses compared the combined means of relevant NICUs via Student’s t -tests. Adjusted analyses used fixed effect linear models informed by the previous multivariate analysis to compare adjusted mean scale scores between the top and bottom four NICUs.

RQ 3: Which domains and items of the SAQ signal the greatest opportunities for improvement?—For comparability with previously published literature using the SAQ we present scale and item level percent positives (percent respondents answering agree slightly or agree strongly). SAQ scale scores 60% positive or higher are considered favorable, with a goal of at least 80% positive. In addition to the 12 NICUs reported here, we also evaluated the percent positive scale scores between the NICUs and a previously published cohort of 71 adult ICUs²² using independent samples t -tests.

RESULTS

RQ1: What respondent characteristics are associated with a composite score of safety culture?—We received completed surveys from 547 of 639 respondents; overall response rate was 86% (range, 69–100%). Table 1 presents response rates and respondent characteristics. Appendix 1 displays respondent characteristics by site. After adjusting for respondent characteristics only NICU site was independently associated with the composite. There was a trend that job position was associated with the composite ($p = .06$). Comparisons between job positions and the composite revealed that on average, nurses and ancillary personnel rated safety culture 8.2 ($p = .04$) and 9.5 ($p = .02$) points lower than doctors. There was little difference between nurses and ancillary personnel. Figure 1 exhibits the differences in composite safety culture scores between nurses and doctors by NICU.

RQ 2: To what extent do NICUs in the same hospital system share common assessments of patient safety and teamwork related norms?—We found wide variation in mean scores across each of the domains, and even more so between percent positive scores (see Table 2). Safety culture composite scores varied by over 20 points across NICUs and individual scale scores ranged even greater. After adjusting for job position, patient safety attitudes varied widely between the top and bottom four NICUs

across all domains. For illustration, we exhibit mean item scores from the teamwork and perception of management scales (see Table 3).

RQ 3: Which domains and items of the SAQ signal the greatest opportunities for improvement?—Respondent and NICU level variability by scale and item are

exhibited in Table 4. These items are used for calculation of scale scores and constitute the SAQ Short Form, the version most widely used at this time. On average, about half of the respondents in a given NICU reported good teamwork climate (54%) and good safety climate (55%), one out of three reported positive perceptions of management (33%), and almost two out of three reported good job satisfaction (63%).

The lowest percent positive scale score across the 12 NICUs was perceptions of management: 37% agreed that administration supported their daily efforts, and 43% agreed that staffing levels were sufficient to handle the number of patients.

Compared with the adult ICU sample, NICUs exhibited significantly higher percent positive (percent agreement) domain scores for safety climate ($t = -2.588, p = .011$), job satisfaction ($t = -2.043, p = .044$), and working conditions ($t = -2.298, p = .024$).

DISCUSSION

Key findings include: (1) significant variation in safety culture domains among this sample of NICUs; (2) opportunities for improvement within all domains measured by the SAQ; (3) patterns of more positive safety culture domains in NICUs relative to a large sample of adult ICUs from the same time period and (4) a trend for an association between job position and safety culture where physicians assess teamwork and safety related norms more positively than nurses and other ancillary personnel.

variation and implications for improvement

Our finding of significant variation in patient safety culture among NICUs is consistent with the existing literature. We previously demonstrated significant between and within hospital variation in safety culture domains among 203 clinical sites from health care facilities in the United Kingdom, the United States, and New Zealand,¹⁰ consistent with Singer and colleagues' work.^{23,24}

Based on the mean scale scores, the safety profile of the participating NICUs was quite variable in that some NICUs excelled in one subscale but lagged in another. For example NICU E may find opportunities for improvement in interventions that address teamwork climate, whereas NICU F may focus on stress recognition and perceptions of management. This implies that one safety culture intervention bundle is unlikely to be useful for all; rather interventions may need to be tailored to individual NICU profiles. Moreover, a composite index of the 6 safety culture domains, while statistically justifiable, but may significantly dilute the domain-level variability within a NICU.

The variation demonstrated across the 12 NICUs suggests opportunities for improvement in safety culture and quality of care. A growing literature demonstrates such a link. For example, the SAQ has demonstrated sensitivity to quality improvement interventions in the operating room²⁵ and obstetric setting²⁶, and has been associated with reduced blood stream infections¹⁴, medication errors and lengths of stay.¹³ In addition, safety culture has been shown to predict success in implementing complex quality improvement projects²², implying that attention to safety culture may be a necessary co-intervention for many quality improvement projects.

specific opportunities for improvement

Responses to the SAQ exhibited two general themes: perceived lack of support from hospital management and concerns about aspects of teamwork and collaborative communication regarding errors. These issues are amenable to intervention that could be studied in future work.

With regard to perceptions of management, many providers expressed a lack of support in their daily efforts by management and that staffing may be insufficient to handle the work load. Managers may not easily be able to remedy such grievances because of financial constraints. However, administrators could employ several managerial tools to motivate staff and create a supportive work environment in which clinical providers feel that their concerns are being considered.²⁷ Management is essential to promoting an environment of collegiality, teamwork and common purpose. Good teamwork climate scores have been associated with lower levels of clinical caregiver burnout from their work which may have important implications for nurse retention and innovation readiness.²⁸

Additionally, item level scores from the teamwork and perception of management domains have been shown to be sensitive to interventions. For example, collaborative rounds²⁹, aviation based crew resource management training³⁰, or improved communication in hierarchy^{31,32} can improve teamwork whereas Leadership WalkRounds^{33,34} can improve perceptions of management.

comparisons between NICUs and adult ICUs

Compared to adult ICUs, NICU percent positive scale scores were higher in safety climate, job satisfaction, and working conditions. NICU teamwork climate and perceptions of management trended toward higher scores, though they did not reach statistical significance. Stress recognition scores were relatively low in NICUs and ICUs, and did not significantly differ between them. Overall, NICU and adult ICU samples exhibited similar amounts of variability, and the lowest percent positive scores for NICUs (perceptions of management and working conditions) were also the lowest percent positive scores for adult ICUs.

differences in safety attitudes by job position

Consistent with most reports across a variety of health care settings, NICU physicians rated patient safety culture significantly higher than nurses and ancillary personnel.^{10,16,24,35,36} In previous work, we found that compared to physicians, nurses were less comfortable to speak up, thought their input was not well received, felt conflict resolution was often inappropriate, and desired more input to decision-making.³⁶ Singer and colleagues suggested that nurses may experience safety deficiencies more acutely because of their tighter employment relationship with the hospital.²⁴

Since hospitals are required to assess their safety culture on an ongoing basis, safety culture surveys might be used for comparing hospitals or units within hospitals against their peers. Systematic differences in responses by job position suggest that NICU comparisons should use consistent survey inclusion criteria such that representative and meaningful results can be garnered through questionnaire assessments. This would reduce the ability of a NICU to improve its ratings artificially by preferentially asking physicians to respond.

The results of this study must be seen within the context of its observational design. Associations between safety attitudes and other variables do not necessarily indicate causality. Our findings may be confounded by unobserved variables, such as respondent income or experience in other health care settings. Within the confines of the available dataset, we have tried to maximize internal validity by adjusting for possible confounding

using multivariate modeling. Our accompanying paper further supports the use of SAQ scale scores as statistically valid consensus views for a specific NICU¹⁹.

Administration of the SAQ during departmental meetings may potentially introduce unwanted selection and response bias due to the social desirability of positive responses and the sample of providers who attend the meetings. However, if such bias existed, it would have likely resulted in higher SAQ scores, therefore strengthening our overall conclusions.

Finally, we studied a relatively small and non-random sample of care providers in twelve NICUs. It is unclear whether our results are generalizable to other NICUs, but the significant variability found here within a small sample of NICUs improves generalizability.

Conclusions

We found significant variation and scope for improvement in safety culture domains among this sample of NICUs. The NICU variation was similar to variation in adult ICUs, but NICU scores were generally higher than adult ICU scores. Future studies should validate whether safety culture correlates with clinical and operational outcomes in the NICU setting.³⁷

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Grant support: Jochen Profit's contribution is supported in part by the Eunice Kennedy Shriver National Institute of Child Health and Human Development #1 K23 HD056298-01 (PI: Profit). Dr. Petersen was a recipient of the American Heart Association Established Investigator Award (#0540043N) at the time this work was conducted. Drs. Petersen, Hysong, and Mr. Mei also receive support from a Veterans Administration Center Grant (VA HSR&D CoE HFP90-20). Dr. Hysong's contribution is supported in part by the Department of Veterans Affairs Health Services Research and Development Program (#CD 2-07-0818). Dr. Thomas' effort is supported in part by grants from the Eunice Kennedy Shriver National Institute of Child Health and Human Development #1 K24 HD053771-01 (PI: Thomas) and #1 PO1 HS1154401 (PI: Thomas). Dr. Sexton received support from an Agency for Healthcare Research and Quality (AHRQ) grant # 1UC1HS014246. Dr. Etchegaray's effort is supported by a K02 award from AHRQ #1 K02 HS017145-02 and the University of Texas at Houston-Memorial Hermann Center for Quality and Safety.

In addition to thanking the NICU personnel who participated by sharing their assessments, we would like to acknowledge the contribution of the study staff, Christen Fullwood, Chris Holzmüller, Angelina Barbosa and Linda Marcellino.

Abbreviations

NICU	neonatal intensive care unit
SAQ	Safety Attitudes Questionnaire

Reference List

1. Olsen IE, Richardson DK, Schmid CH, et al. Intersite differences in weight growth velocity of extremely premature infants. *Pediatrics*. 2002; 110:1125–32. [PubMed: 12456909]
2. Stoll BJ, Hansen N, Fanaroff AA, et al. Late-onset sepsis in very low birth weight neonates: the experience of the NICHD neonatal research network. *Pediatrics*. 2002; 110:285–91. [PubMed: 12165580]
3. Sankaran K, Chien L-Y, Walker R, et al. Variations in mortality rates among Canadian neonatal intensive care units. *Cmaj*. 2002; 166:173–8. [PubMed: 11826939]

4. Eichenwald EC, Escobar GJ, Zupancic JA, et al. Inter-NICU variation in discharge timing of moderately premature infants: earlier discharge does not affect outcome. *Pediatr Research*. 2004; 55(Pt2):372A.
5. Rogowski JA, Staiger DO, Horbar JD. Variations in the quality of care for very-low-birthweight infants: implications for policy. *Health Aff*. 2004; 23:88–97.
6. Morales LS, Staiger DO, Horbar JD, et al. Mortality among very low-birthweight infants in hospitals serving minority populations. *Am J Public Health*. 2005; 95:2206–12. [PubMed: 16304133]
7. Profit J, Zupancic JA, McCormick MC, et al. Moderately premature infants at Kaiser Permanente Medical Care Program in California are discharged home earlier than their peers in Massachusetts and the United Kingdom. *Arch Dis Child Fetal Neonatal Ed*. 2006; 91:245–50.
8. The Joint Commission. 2009 Comprehensive Accreditation Manual for Hospitals (CAMH): The Official Handbook. Chicago: Joint Commission Resources; 2008.
9. Hudson DW, Berenholtz SM, Thomas EJ, et al. A safety culture primer for the critical care clinician: the role of culture in patient safety and quality improvement. *Contemporary Critical Care*. 2009; 7:1–12.
10. Sexton JB, Helmreich RL, Neilands TB, et al. The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. *BMC Health Serv Res*. 2006; 6:44. [PubMed: 16584553]
11. Wolf FA, Way LW, Stewart L. The efficacy of medical team training: improved team performance and decreased operating room delays: a detailed analysis of 4863 cases. *Ann Surg*. 2010; 252:477–83. [PubMed: 20739848]
12. Pettker CM, Thung SF, Norwitz ER, et al. Impact of a comprehensive patient safety strategy on obstetric adverse events. *Am J Obstet Gynecol*. 2009; 200:492–8. [PubMed: 19249729]
13. Pronovost P, Weast B. Implementing and validating a comprehensive unit-based safety program. *J Patient Saf*. 2005:33–40.
14. Pronovost PJ, Berenholtz SM, Goeschel C, et al. Improving patient safety in intensive care units in Michigan. *J Crit Care*. 2008; 23:207–21. [PubMed: 18538214]
15. Thomas EJ, Sherwood GD, Mulhollem JL, et al. Working together in the neonatal intensive care unit: provider perspectives. *J Perinatol*. 2004; 24:552–9. [PubMed: 15141266]
16. Thomas EJ, Sexton JB, Lasky RE, et al. Teamwork and quality during neonatal care in the delivery room. *J Perinatol*. 2006; 26:163–9. [PubMed: 16493432]
17. Thomas EJ, Taggart B, Crandell S, et al. Teaching teamwork during the Neonatal Resuscitation Program: a randomized trial. *J Perinatol*. 2007; 27:409–14. [PubMed: 17538634]
18. Snijders C, Kollen BJ, van Lingen RA, et al. Which aspects of safety culture predict incident reporting behavior in neonatal intensive care units? A multilevel analysis. *Crit Care Med*. 2009; 37:61–7. [PubMed: 19050606]
19. Profit J, Etchegaray J, Petersen LA, Sexton JB, Hysong SJ, Mei M, Thomas EJ. The Safety Attitudes Questionnaire as a tool for benchmarking safety culture in the NICU. Under review at Archives of Disease in Childhood Fetal and Neonatal Edition.
20. Pronovost PJ, Sexton BJ. Assessing safety culture: guidelines and recommendations. *Qual Saf Health Care*. 2005; 14:231–3. [PubMed: 16076784]
21. Vogus TJ, Sutcliffe KM. The Safety Organizing Scale: development and validation of a behavioral measure of safety culture in hospital nursing units. *Med Care*. 2007; 45:46–54. [PubMed: 17279020]
22. Sexton JB, Berenholtz SM, Goeschel CA, et al. Assessing and improving safety climate in a large cohort of intensive care units. *Crit Care Med*. 2011
23. Singer SJ, Gaba DM, Geppert JJ, et al. The culture of safety: results of an organization-wide survey in 15 California hospitals. *Qual Saf Health Care*. 2003; 12:112–8. [PubMed: 12679507]
24. Singer SJ, Gaba DM, Falwell A, et al. Patient safety climate in 92 US hospitals: differences by work area and discipline. *Med Care*. 2009; 47:23–31. [PubMed: 19106727]
25. Defontes J, Surbida S. Preoperative safety briefing project. *The Permanente Journal*. 2004:21–7.

26. Pettker CM, Thung SF, Norwitz ER, et al. Impact of a comprehensive patient safety strategy on obstetric adverse events. *Am J Obstet Gynecol*. 2009; 200:492–8. [PubMed: 19249729]
27. Rhoades L, Eisenberger R. Perceived organizational support: a review of the literature. *J Appl Psychol*. 2002; 87:698–714. [PubMed: 12184574]
28. Sexton JB, Holzmüller CG, Pronovost PJ, et al. Variation in caregiver perceptions of teamwork climate in labor and delivery units. *J Perinatol*. 2006; 26:463–70. [PubMed: 16775621]
29. Uhlig, PN.; Haan, CK.; Nason, AK.; Niemann, PL.; Camelio, A.; Brown, J. *Improving Patient Care by the Application of Theory and Practice from the Aviation Safety Community*. Columbus, OH: 2001.
30. McCulloch P, Mishra A, Handa A, et al. The effects of aviation-style non-technical skills training on technical performance and outcome in the operating theatre. *Qual Saf Health Care*. 2009; 18:109–15. [PubMed: 19342524]
31. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and communication in providing safe care. *Qual Saf Health Care*. 2004; 13:i85–i90. [PubMed: 15465961]
32. Karima Velji GRB. Effectiveness of an adapted SBAR communication tool for a rehabilitation setting. *Healthcare Quarterly*. 2008; 11:72–9. [PubMed: 18382165]
33. Thomas EJ, Sexton JB, Neilands TB, et al. The effect of executive walk rounds on nurse safety climate attitudes: a randomized trial of clinical units. *BMC Health Serv Res*. 2005; 5:28. [PubMed: 15823204]
34. Frankel A, Grillo SP, Pittman M, et al. Revealing and resolving patient safety defects: the impact of Leadership WalkRounds on frontline caregiver assessments of patient safety. *Health Serv Res*. 2008; 43:2050–66. [PubMed: 18671751]
35. Pronovost PJ, Weast B, Holzmüller CG, et al. Evaluation of the culture of safety: survey of clinicians and managers in an academic medical center. *Qual Saf Health Care*. 2003; 12:405–10. [PubMed: 14645754]
36. Thomas EJ, Sexton JB, Helmreich RL. Discrepant attitudes about teamwork among critical care nurses and physicians. *Crit Care Med*. 2003; 31:956–9. [PubMed: 12627011]
37. Profit J, Gould JB, Zupancic JA, et al. Formal selection of measures for a composite index of NICU quality of care: Baby-MONITOR. *J Perinatol*. 2011 Feb 24. Epub ahead of print.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Patients receiving care in adult and neonatal ICUs experience wide variation in clinical care and outcomes.

In adult ICU settings higher safety culture ratings have been associated with safer care and better clinical outcomes.

WHAT THIS STUDY ADDS

In this sample of NICUs safety culture varied significantly and revealed widespread opportunities for improvement.

NICUs generally had higher safety culture domain scores than adult ICUs.

Figure 1.

SAQ composite score by neonatal intensive care unit (NICU) and job position. Hierarchical regression model (respondents nested within NICUs). The composite score is the average of the mean scale scores.

Figure 2.

SAQ percent positive scale scores by NICU and statewide sample of adult ICUs from Michigan (adapted from Sexton et al, 2011)²². NICUs marked with hashes.

Scale: ICU Mean Percent Positive (SD; range), NICU Mean Percent Positive (SD; range):

Teamwork Climate: 47.3 (14.9; 20–92), 54.0 (16.7; 26–76): $p = .162$

Safety Climate: 42.5 (15.7; 11–95), 55.3 (16.1; 26–79): $p = .011$

Job Satisfaction: 52.6 (15.6; 23–98), 63.0 (20.2; 28–100): $p = .044$

Stress Recognition: 42.6 (9.1; 22–70), 40.3 (12.2; 18–61): $p = .445$

Perceptions of Mngt: 25.7 (14; 0–70), 33.3 (20.7; 3–80): $p = .099$

Working Conditions: 30.3 (11.9; 6–60), 39.6 (18.6; 5–64): $p = .024$

Abbreviations: SAQ, Safety Attitudes Questionnaire; NICU, neonatal intensive care unit; SD, standard deviation; p , p-value; Mngt, management.

Table 1

Respondent characteristics and associations with the safety culture composite score

Predictors	Unadjusted				Adjusted		
	n	Mean	SE	p	Mean	SE	p
NICUs							
A	10	77.8	4.2	<.001	76.8	3.72	<.001
B	57	73.4	2.1		74.7	2.26	
C	25	73.3	2.8		74.2	2.97	
D	42	73.0	2.3		76.9	2.48	
E	71	71.0	1.9		70.4	2.39	
F	22	68.2	3.0		70.9	3.47	
G	39	67.2	2.4		69.5	2.43	
H	39	67.2	2.4		71.4	2.47	
I	12	66.4	3.9		71.0	4.28	
J	71	65.4	1.9		69.5	2.24	
K	50	59.3	2.2		62.9	2.41	
L	109	56.3	1.2		59.6	1.98	
Job position							
nurse	404	66.0	0.7	.006	67.1	2.87	.06
doctor	24	75.1	2.9		76.6	3.47	
ancillary staff	71	65.9	1.8		68.4	2.94	
Experience							
5 years	151	67.3	1.6	.10	71.75	2.55	.34
6 – 19 years	142	64.2	1.5		69.66	2.53	
20 years	210	65.8	1.2		70.59	2.51	
Gender							
male	20	73.0	3.2	.02	69.84	3.81	.69
female	492	65.5	0.6		71.49	2.35	
Race							
white	455	65.8	0.7	.08	70.23	2.35	.66
non-white	64	69.0	1.9		71.11	2.79	

Predictors	Unadjusted				Adjusted		
	<i>n</i>	<i>Mean</i>	<i>SE</i>	<i>p</i>	<i>Mean</i>	<i>SE</i>	<i>p</i>
Work Shifts							
days	217	66.4	2.1	.78	NA	NA	NA
evenings	22	66.9	3.5				
nights	159	67.6	2.2				
variable shifts	54	66.2	1.9				

Multivariate model includes all respondent characteristics with *p* < .10. 547 respondents. Not all categories add up to 547 due to missing responses. The composite score is the average of the mean scale scores. Abbreviations: NICU, neonatal intensive care unit; SE, standard error; *p*, *p*-value; NA, not applicable.

Table 2

Composite and mean scale scores

NICU	Composite Score	Teamwork Climate	Safety Climate	Job Satisfaction	Stress Recognition	Perceptions of Mngt	Working Conditions
A	77.8	73.3	79.3	88.0	73.1	79.4	73.8
B	73.4	80.0	80.0	77.5	61.7	65.6	75.2
C	73.3	76.5	79.7	80.2	68.0	67.0	68.2
D	73.0	80.0	82.6	79.3	63.1	60.7	72.5
E	71.0	67.8	73.1	76.0	71.3	70.0	67.6
F	68.2	75.2	73.5	76.6	54.6	60.8	68.3
G	67.2	66.9	71.4	71.8	62.0	67.9	63.2
H	67.2	79.3	70.3	78.7	63.1	55.5	56.2
I	66.4	71.0	72.7	80.8	50.5	60.9	62.5
J	65.4	70.3	78.5	68.7	57.6	52.4	64.6
K	59.3	53.2	63.7	66.5	70.8	47.0	54.6
L	56.3	60.6	61.6	57.8	67.6	37.0	53.2

Scale scores range from 0–100. NICUs ($n = 12$), responses ($n = 547$). The composite score is the average of the mean scale scores. Abbreviations: NICU, neonatal intensive care unit; Mngt, management.

Table 3SAQ Item descriptives used for perceptions of management and teamwork climate¹

	Overall Mean (SD)	Bottom 4 NICUs ² Mean (SD)	Top 4 NICUs ² Mean (SD)
Teamwork Climate			
It is easy for personnel in this ICU to ask questions when there is something that they do not understand	81.29 (7.17)	72.60 (4.58)	87.85 (0.52)
I have the support I need from other personnel to care for patients	78.42 (5.12)	73.16 (4.40)	83.73 (1.43)
Nurse input is well received in this ICU	68.73 (11.52)	56.87 (10.33)	79.86 (4.15)
In this ICU, it is difficult to speak up if I perceive a problem with patient care	37.59 (5.49)	31.76 (3.29)	43.35 (3.01)
Disagreements in this ICU are resolved appropriately (i.e., not <i>who</i> is right, but <i>what</i> is best for the patient)	64.05 (8.96)	54.21(6.01)	72.50 (5.16)
The physicians and nurses here work together as a well-coordinated team	71.74 (16.07)	53.11 (10.44)	86.79 (2.46)
Perceptions of Management			
Hospital management does not knowingly compromise the safety of patients	68.28 (11.88)	55.05 (4.40)	80.61 (6.34)
Hospital administration supports my daily efforts	56.15 (12.55)	41.93 (6.74)	68.14 (6.25)
I am provided with adequate, timely information about events in the hospital that might affect my work	61.42 (8.43)	52.89 (2.15)	71.77 (2.48)
The levels of staffing in this clinical area are sufficient to handle the number of patients	55.44 (22.04)	31.69 (22.38)	73.91 (5.83)

¹ Scale score for a respondent = ((mean of the item from NICUs)-1)*25).² P-value for the difference between the bottom and top NICUs is < 0.0001 for all items.

Abbreviations: SAQ, Safety Attitudes Questionnaire; NICU, neonatal intensive care unit; SD, standard deviation.

Table 4

Distribution of responses by NICU and across all respondents

<i>n</i> = 547	% Pos	Neutral	% Neg
Teamwork Climate % positive NICU mean (SD; range) = 54.0 (16.7; 26–76)			
It's easy for personnel in this ICU to ask questions when there is something they do not understand.	82.8	8.4	8.8
I have the support I need from other personnel to care for patients.	81.1	10.4	8.4
Nurse input is well received in this ICU.	62.3	19.7	18.0
In this ICU, it is difficult to speak up if I perceive a problem with patient care.	28.2	15.5	56.4
Disagreements in this ICU are resolved appropriately.	59.7	18.8	21.5
The physicians and nurses here work together as a well-coordinated team.	64.6	15.6	19.8
Safety Climate % positive NICU mean (SD; range) = 55.3 (16.1; 26–79)			
The culture in this ICU makes it easy to learn from the errors of others.	53.0	27.8	19.2
Medical errors are handled appropriately in this ICU.	78.3	13.4	8.3
I know the proper channels to direct questions regarding patient safety in this ICU.	87.6	6.4	6.0
I am encouraged by my colleagues to report any patient safety concerns I may have.	77.5	13.0	9.5
I receive appropriate feedback about my performance.	69.3	14.9	15.8
I would feel safe being treated here as a patient.	72.2	15.4	12.3
In this ICU, it is difficult to discuss mistakes.	22.7	20.9	56.4
Job Satisfaction % positive NICU mean (SD; range) = 63.0 (20.2; 28–100)			
This hospital is a good place to work.	75.1	16.4	8.5
I am proud to work at this hospital.	77.9	16.8	5.3
Working in this hospital is like being part of a large family.	58.8	20.2	21.1
Morale in this ICU area is high.	37.5	22.5	40.0
I like my job.	92.8	3.9	3.3
Stress Recognition % positive NICU mean (SD; range) = 40.3 (12.2; 18–61)			
When my workload becomes excessive, my performance is impaired.	75.2	9.4	15.4
I am more likely to make errors in tense or hostile situations.	66.5	13.4	20.2
Fatigue impairs my performance during emergency situations.	33.8	16.2	50.0
I am less effective at work when fatigued.	78.4	11.2	10.4
Perceptions of Management % positive NICU mean (SD; range) = 33.3 (20.7; 3–80)			
Hospital management does not knowingly compromise the safety of patients.	58.8	19.2	22.1
Hospital administration supports my daily efforts.	37.2	32.2	30.6
I am provided with adequate, timely information about events in the hospital that might affect my work.	53.5	25.3	21.3
The levels of staffing in this clinical area are sufficient to handle the number of patients.	43.2	12.8	44.0
Working Conditions % positive NICU mean (SD; range) = 39.6 (18.6; 5–64)			
All the necessary information for diagnostic and therapeutic decisions is routinely available to me.	72.0	14.9	13.1
This hospital constructively deals with problem physicians and employees.	29.8	32.4	37.9

<i>n</i> = 547	% Pos	Neutral	% Neg
Trainees in my discipline are adequately supervised.	65.2	17.7	17.1
This hospital does a good job of training new personnel.	66.5	14.9	18.6

The percent positive (% pos) results include the range and overall mean percent positive, which is the percent agreement (agree slightly plus agree strongly) within a given NICU. The percent negative (% neg) results include the range and overall mean percent negative, which is the percent disagreement (disagree slightly plus disagree strongly) within a given NICU. Abbreviations: NICU, neonatal intensive care unit; SD, standard deviation.