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A Quality Improvement Initiative to Increase Scoring Consistency and Accuracy of the Finnegan Tool

Challenges in Obtaining Reliable Assessments of Drug Withdrawal in Neonatal Abstinence Syndrome

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ABSTRACT

Background: Current practice for diagnosing neonatal abstinence syndrome and guiding pharmacological management of neonatal drug withdrawal is dependent on nursing assessments and repeated evaluation of clinical signs.

Purpose: This single-center quality improvement initiative was designed to improve accuracy and consistency of Finnegan scores among neonatal nurses.

Methods: One-hundred seventy neonatal nurses participated in a single-session withdrawal-assessment program that incorporated education, scoring guidelines, and a restructured Finnegan scale. Nurses scored a standardized video-recorded infant presenting with opioid withdrawal before and after training.

Results: Nearly twice as many nurses scored at target (Finnegan score of 8) posttraining (34.7%; mean error = 0.559, SD = 1.4) compared with pretraining (18.8%; mean error = 1.31, SD = 1.95; Wilcoxon, $P < .001$). Finnegan scores were significantly higher than the target score pretraining (mean = 9.31, SD = 1.95) compared with posttraining (mean = 8.56, SD = 1.40, Wilcoxon $P < .001$); follow-up assessments reverted to pretraining levels (mean = 9.16, SD = 1.8). Score dispersion was greater pretraining (variance 3.80) compared with posttraining (variance 1.96; Kendall's Coefficient, $P < .001$) largely due to score disparity among central nervous system symptomology.

Implications for Practice: Education, clinical guidelines, and a restructured scoring tool increased consistency and accuracy of infant withdrawal-assessments among neonatal nurses. However, more than 60% of nurses did not assess withdrawal to the target score immediately following the training period and improvements did not persist over time.

Implications for Research: This study highlights the need for more objective tools to quantify withdrawal severity given that assessments are the primary driver of pharmacological management in neonatal drug withdrawal.

Key Words: Finnegan, neonatal abstinence syndrome assessment, neonatal substance withdrawal, newborn infants, opioids

Video Abstract available at https://journals.lww.com/advancesinneonatalcare/Pages/videogallery.aspx.

Newborns exposed to opioids in utero often present with a variety of withdrawal symptoms and dysregulated behaviors referred to as neonatal abstinence syndrome (NAS).[1,2] Clinically significant physiological and behavioral symptoms include central nervous system (CNS) and vasomotor dysregulation (pathophysiological cardiorespiratory instability, seizures, tremors, hyperthermia), gastrointestinal dysfunction (vomiting, diarrhea, and poor feeding), and hyperirritability (excessive movement, excoriation, crying, disrupted sleep).[1,3-5] NAS is an increasingly common diagnosis among newborns in the United States due to epidemic proportions of opioid exposure during pregnancy, with estimates as high as 1 newborn infant diagnosed with NAS every half hour.[6] The current primary

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practice for diagnosing NAS and determining a need for pharmacological management for withdrawal is dependent on nursing assessments and repeated evaluation of clinical signs.[1,7,8] The rate of NAS diagnosis among at-risk newborns is highly variable, with estimates as low as 13% and as high as 94%.[3,9] Estimates also vary between 30% and 95% among NAS infants who require pharmacotherapy to treat withdrawal.[4,8,10,11] Such variability is likely due to different scoring tools used among institutions, which are further complicated by complex and subjective scales, insufficient training and inconsistent interpretation of scales, and disparate thresholds for guiding pharmacotherapy.[7,11] Consistency and accuracy in scoring among neonatal caregivers have implications for standardizing pharmacological management.

The Finnegan Neonatal Abstinence Scoring System (Finnegan Scale)[12] is one of the most commonly used tools by neonatal caregivers in hospital units nationwide to quantify the severity of NAS in newborns.[4,7,11,13] A withdrawal severity score is derived from 21 signs and helps guide pharmacotherapy used to treat withdrawal, including initiation, increase, wean, and cessation of pharmacotherapy (eg, morphine, phenobarbital).[7,12,14] Despite widespread use of different versions of the Finnegan Scale for defining severity of NAS and guiding pharmacological treatment, it remains a complex and complicated tool for routine use in many nurseries.[7,15] Furthermore, reliability and validity of the Finnegan Scale are not well established.[9,15] The purpose of this study was to identify and implement strategies for improving NAS scoring using the Finnegan Scale through a single-center quality improvement initiative. We tested whether a single-session training program incorporating a restructured version of the Finnegan Scale could improve accuracy and consistency of scores among nursing staff responsible for rating withdrawal in newborns with NAS.

What This Study Adds

- Strategies to increase consistency and accuracy among scorers assessing neonatal abstinence syndrome using the Finnegan Scoring Tool, which include a bedside reference guide and ongoing training and education.
- Ways to restructure the Finnegan Scoring Tool to cluster neonatal assessments to optimize developmentally appropriate approach to care.
- Discussion of new approaches to decrease subjectivity and improve reliability among caregivers responsible for evaluating infants with neonatal abstinence syndrome and to standardize and develop objective scoring tools to guide pharmacological treatment.

METHODS

This systematic, nonexperimental adaptive-design study was part of a larger quality improvement project (the Vermont Oxford Network [VON] NAS collaborative) conducted at the UMass Memorial Medical Center Neonatal Intensive Care Unit (NICU) and Newborn Nursery (NN) between August 2012 and July 2013. The UMass Memorial NICU is the Level III Perinatal Unit for Central Massachusetts (population 750,000), averaging 650 admissions a year with approximately 10% of infants requiring treatment for NAS due to opioid exposure during pregnancy. The NN is a separate Level 1 Nursery with approximately 4000 deliveries annually, with 2 to 3 infants/100 live births exposed to opioids in utero (90/year); approximately 75% of opioid-exposed newborns require prolonged hospitalization in the NICU for pharmacological management of NAS.

The multidisciplinary task force for this study was composed of 1 NICU physician, 3 NICU nurses, 1 NICU nurse educator, and 2 NN nurses. The Task Force members were all part of the larger year-long VON NAS collaborative who received, practiced, and developed specialized training in scoring infants for withdrawal. The group's objective for this project was to develop a plan to improve NAS scoring among nurses responsible for identifying and rating signs of drug withdrawal in newborns in the NICU and NN. Variability in nursing assessment of withdrawal signs was indexed by 2 key process measures, interrater accuracy and consistency of scores, using the Finnegan Scale. The task force developed a strategy in accordance with the Plan-Do-Study-Act Model for Improvement[16] to make the complex scoring tool more user-friendly and easier for bedside nurses to understand and implement. Per institutional policy, the institutional review board approval was not required for this quality improvement initiative.

Quality Improvement Program

Numerous educational focus groups and small tests of change among the Task Force contributed to the development of the following Quality Improvement Plan, which included 4 components; the first 3 focused on education and guidance, and the final component incorporated these into a training program.

Education and Guidance

Survey

The initial phase of the improvement plan consisted of an informal paper survey of 20 NICU and NN staff nurses to identify the 5 areas of greatest ambiguity of an established version of the Finnegan Scale that was used in the study site neonatal units.[14] Staff nurses from the 2 units were randomly sampled, given an unscored Finnegan Scale form, and asked to identify 5 signs they found most difficult to score. Nurses discussed with members of the Task Force specific challenges in scoring these items. The 5 most ambiguous scoring parameters of the modified Finnegan Scale

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were identified as the moro reflex, crying, sleep patterns, muscle tone, and tremors, all of which fall within disturbances of the CNS subcategory.[14]

Restructured Finnegan Scoring Tool

Based on findings from the survey, a Restructured Finnegan Scoring Tool (see Figure 1) was developed that reorganized the scoring parameters to enhance the work flow for scoring signs, decrease disturbance of the infant, and enhance developmentally appropriate care. The signs listed on the Finnegan Scale[14] were simply reorganized and clarified, but otherwise remained the same. For example, whereby the Finnegan Scale organizes signs of NAS according to physiological subcategories of disturbance [ie, dysregulation of the CNS, Metabolic/Vasomotor/Respiratory system (MVR), and Gastrointestinal function],[14] the Restructured Finnegan Scoring Tool was reorganized into categories according to *when* to record each sign: (1) Score before feeding if quiet and content; (2) score 30 minutes after feeding; and (3) score over the entire interval. In addition, ambiguous terminology and scoring criteria that were identified as problematic in the survey were more explicitly defined. For example, in the modified-version[14] that was currently used in the neonatal units, nurses were instructed to score either a 2 or 3 for "continuous high pitch (or other) cry"; whereas, in the restructured form nurses were instructed to score a 2 if "crying up to 5 min or difficult to console" or score as 3 if "crying more than 5 min or inconsolable." The Restructured Scoring Finnegan Tool is presented in Figure 1.

Bedside Reference Guide

A bedside information reference guide (see Figure 2) was established to increase awareness of conditions that could confound withdrawal symptoms (eg, wet diaper, sore buttocks, increased noise levels), and to more clearly define the steps to scoring an infant among the most ambiguous parameters (determined from the survey) using the Restructured Finnegan Scoring Tool. The Reference Guide provided nurses with instructions to adjust for corrected gestational age of the infant, which is particularly important when scoring preterm infants who often also exhibit immature feeding patterns that can be confused with signs of NAS. The Guide also highlighted that common environmental influences were not confounding the signs and symptoms of withdrawal (eg, infant is fed, swaddled, pacified, and placed in a clean diaper) before scoring the infant.

Training Program

NICU trainers consisted of 3 staff nurses and 1 nurse educator who provided training on scoring using the Restructured Finnegan Scoring Tool and Reference Guide to the NICU nurses; NN trainers consisted of 2 staff nurses who provided the same training to the NN nurses. NICU nurses were required to participate during their work time as part of their in-house NICU staff-education training requirement. NN nurses assigned to care for NAS infants volunteered to participate during their break. Training consisted of small groups, between 1 and 6 nurses and 1 trainer per group, conducted in the nurses respective neonatal unit (NICU or NN), either in a small conference room or in the infant unit. Each training session lasted approximately 30 minutes total, divided into 3 periods:

1. *Pretraining Assessment*: Nurses watched a 7-minute standardized-educational video (muted)[17] on a laptop depicting a newborn displaying signs of withdrawal and simultaneously scored the infant according to standard practice using the modified Finnegan Scale version currently used in the neonatal unit (pretraining score).[14] To help focus training on ambiguous areas of NAS scoring and because there were no video indications of gastrointestinal signs, nurses were informed that there were no vomiting or loose stools. All nurses scored the same video. The video[17] was selected because it was designed specifically for training purposes to facilitate interobserver reliability and because the infant depicted in the video was considered by the task force trainers to have a withdrawal severity score of 8 (excluding gastrointestinal symptoms as provided by video instructional guidelines),[17] a threshold score commonly used for determining pharmacological intervention in this and other neonatal units.[13] The Task Force Trainers used their clinical expertise and a consensus-building approach to agree upon the target score, which was based on the video guidelines for scoring withdrawal using the Finnegan Tool.[17] The trainer provided nurses with relevant information not available by watching the video (eg, respiratory rate, temperature) based on the information that was included in the accompanying manual.[17] Nurses were instructed to score the infant in the video independently, based on their previous unit training. Nurses worked independently without feedback regarding scoring technique or the correct score for the infant depicted in the video.

2. *Training Period*: Following the pretraining assessment, nurses discussed areas of ambiguity in their small group setting of nurses and trainer. The trainer centered the discussion on how to score signs of withdrawal using the Restructured Finnegan Scoring Tool (Figure 1) and clearly defined criteria for scoring signs using the Bedside Reference Guide (Figure 2). Explanations focused specifically on scoring areas of ambiguity determined from the survey.

3. *Posttraining Assessment*: Nurses watched the same 7-minute standardized symptomatic patient video (muted) and were instructed to score the infant independently, using the newly Restructured

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FIGURE 1

NEONATAL ABSTINENCE SCORING TOOL UMass Memorial/Modified				Date / /						
		Time								
	Signs & Symptoms	Score								
Score Before Feedings ONLY if Quiet & Content	Sleeps or Content < 3 hours	1								
	Sleeps or Content < 2 hours	2								
	Sleeps or Content < 1 hour	3								
	Hyperactive Moro Reflex	2								
	Hyperactive Moro w/Myoclonic Jerks	3								
	Mild Tremors when Disturbed	1	CNS							
	Moderate/Severe Tremors when Disturbed	2	CNS							
	Mild Tremors when Undisturbed	3	CNS							
	Moderate/Severe Tremors when Undisturbed	4	CNS							
	Increased Muscle Tone with Handling	1								
	Increased Muscle Tone at Rest	2								
	New (non-buttock) Skin Excoriation	1								
	Sweating	1								
	Low Grade Fever: 37.6-38.3°	1								
	High Grade Fever: >38.4°	2	MVR							
	Mottling	1	MVR							
30 Minutes after Feeding	Respiratory Rate >60 at Rest	1	MVR							
	Respiratory Rate >60 w/retractions at Rest	2	MVR							
	Excessive Sucking	1	GI							
	Poor Feeding	2	GI							
	Crying up to 5 minutes or Difficult to Console	2								
	Crying more than 5 minutes or Inconsolable	3	CNS							
Score over Entire Interval	Myoclonic Jerks	3	CNS							
	Seizure or Convulsion	5	CNS							
	Yawning 3 or more times over scoring interval	1								
	Nasal Stuffiness	1	MVR							
	Nasal Stuffiness w/nasal flaring	2	MVR							
	Sneezing 3 or more times over scoring interval	1	MVR							
	Regurgitation	2								
	Projectile Vomiting	3	GI							
	Loose Stools	2	GI							
	Watery Stools	3	GI							
		Total Score								
		Initials								

Restructured Finnegan Scoring Tool (adapted from the original Finnegan Tool[14]). CNS = central nervous system function; MVR = metabolic, vasomotor, and respiratory function; GI = gastrointestinal function.

Finnegan Scoring Tool and Bedside Reference Guide (posttraining score). Again, no feedback was provided to the nurses regarding the correct score for the infant depicted in the video. All nurses were assigned a 3-digit code to conceal their identity and allow for pre- and posttraining comparisons.

Statistical Analysis

Given the non-Gaussian distribution of scores, Finnegan scores were analyzed using percentages and nonparametric analysis. The percentages of agreement among nurses' Finnegan scores were calculated separately for pre- and posttraining periods (scoring consistency), and determined from each nurse's score compared with the target score (scoring accuracy). Related-Samples Wilcoxon Signed Rank and Kendall's Coefficient of Concordance were used to test the effects of the Quality Improvement Plan (Training, Bedside Study Guide, and Restructured Finnegan) on pre- and posttraining scores. Comparisons using Related-Samples-Wilcoxon Signed Rank were used to determine if the Training Program reduced error ratings to the target score between pre- and postconditions for the Total withdrawal severity score (target score of 8), as well as for the classically defined Finnegan physiological dysregulated subcategories[14]: CNS Score (target score of 5) and MVR Score (target score of 3); gastrointestinal scores were not included as there were no gastrointestinal symptoms depicted in the video.[17] Mean scores, standard deviation (SD), variance, and 95% confidence intervals (CI) were used to index dispersion of scores

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FIGURE 2

before proceeding...

- Did you adjust for the infant's corrected age (ex: 3 day old or 3 week old?
- Did you attempt non-pharmacological interventions?
- Did you feed the infant 30 minutes prior to scoring?
- Is there any other reason the infant could be unsettled? (wet diaper, sore buttocks, bright lights, increased noise)
- Was there a disruption that caused the infant to awaken?
- Has the infant been over or under-fed? Is the baby breast feeding?

~ Guide to using the Finnegan Scoring Tool ~

Sleeping or Content ☐ Score 0: if >3 hours ☐ Score 1: if <3 hours ☐ Score 2: if <2 hours ☐ Score 3: if <1 hours	**Moro (at rest)** ☐ Score 2: if Hyperactive (extension of arms or legs lasts a few seconds +/- tremors) ☐ Score 3: if Markedly Hyperactive (persistent extension of extremities + myoclonic jerks)	**Tremors (only 1 score)** ☐ Score 1: if mild tremors of only hands/feet only when fussing or crying ☐ Score 2: if moderate tremors involve arms/legs only when fussing or crying ☐ Score 3: if mild tremors when undisturbed ☐ Score 4: if moderate tremors when undisturbed
Tone ☐ Score 1: if increased tone w/handling ☐ Score 2: if increased tone at rest OR no head lag on exam	**Excoriation (except buttocks)** ☐ Score 1: if new excoriation since last score	**Sucking** ☐ Score 1: if frantic rooting/sucking or sucking blisters on hands
Feeding* ☐ Score 2: if un-coordinated suck/swallow in presence of rooting or sucking behavior *specialty nipple use does not warrant score of 2	**Crying** ☐ Score 2: if excessive or high pitched crying lasts < 5 minutes OR difficult to console ☐ Score 3: if excessive or high pitched crying >5 min OR inconsolable	**Myoclonic Jerks** Score 3: for presence of irregular and abrupt involuntary muscle contractions

Reference guide.

between pre- and posttraining conditions. A P value $< .05$ was used to determine significance.

RESULTS

Nursing Participants

A total of 170 nurses participated in the Training Program: 101/103 (98%) NICU nurses and 69/75 (92%) NN nurses completed the single-session training program. One NICU nurse did not participate because she was per diem and did not work during the training period and another did not participate because she was on leave during the study period. Six NN nurses did not participate for unknown reasons.

Training Program Assessment Scores

In the pretraining assessment, 18.8% (n = 32) of nurses scored the Total withdrawal severity score at the target rating (Finnegan score of 8), whereas 34.7% (n = 59) scored at the target rating in the posttraining assessment. This represented a significantly reduced error rate to the target score for posttraining (mean difference from target = 0.56, SD = 1.40) compared with pretraining (mean difference from target = 1.31, SD = 1.95; Wilcoxon, $P < .001$).

Among all of the nurses, the average Total withdrawal severity score was significantly higher for the pretraining assessment (Finnegan Scale mean = 9.31, SD = 1.95) compared with posttraining (Restructured Finnegan Scale mean = 8.56, SD = 1.40, Wilcoxon $P < .001$). The distribution of the Total withdrawal severity scores was more widely dispersed among nurses pretraining (variance 3.80) compared with posttraining (variance 1.96; Kendall's Coefficient, $P < .001$).

Figure 3 shows the frequency of withdrawal severity scores for pre- and posttraining assessments.

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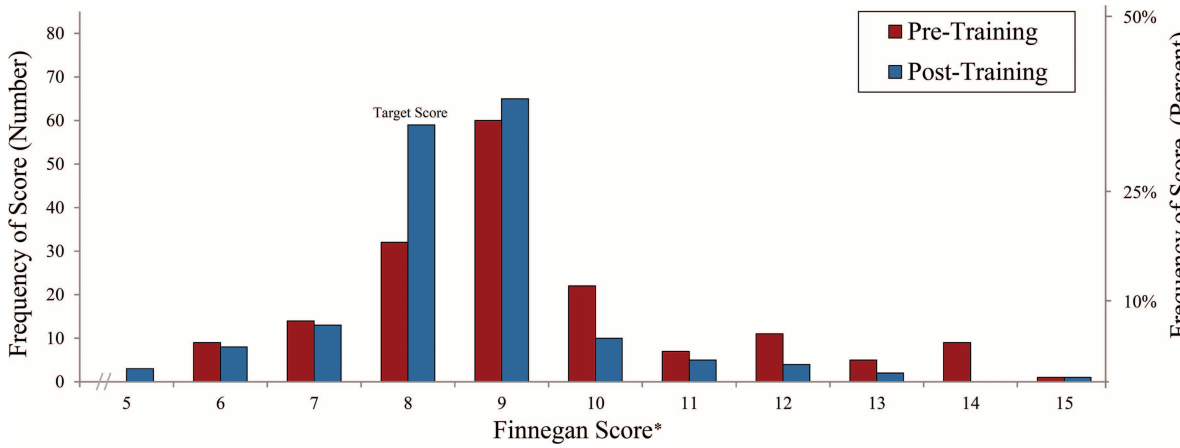
FIGURE 3



Frequency of neonatal abstinence syndrome (NAS) score pre- and posttraining.* Participants used the modified Finnegan Tool[14] pretraining and the Restructured Finnegan Scoring Tool posttraining. Target Score = Finnegan Score of 8 based on expert assessment of standardized video.[17]

In the pretraining assessment, 106 of the nurses (63%) scored within 1 point of the target score (range 7-9), whereas posttraining, 137 of the nurses (81%) scored within 1 point of the target score. In the pretraining assessment, 26 of the nurses (15%) scored the infant ≥12 (severe withdrawal) compared with 4% (n = 7) posttraining assessment.

Table 1 provides a summary of the Finnegan physiological disturbance scores for pre- and posttraining assessments. When analyzing the withdrawal scores by physiological system disturbance subcategories of CNS and MVR,[14] CNS scores were significantly higher pretraining assessment (mean = 6.24, SD = 1.93) compared with posttraining assessment (mean = 5.43, SD = 1.38; Wilcoxon, $P < .001$). The distribution of CNS scores was also more widely dispersed among nurses pretraining (variance 3.72) compared with posttraining (variance 1.90; Kendall's Coefficient, $P < .001$). In the pretraining assessment, 30 of nurses (17.6%) scored the CNS severity at the target rating (Finnegan score of 5), whereas 63 of nurses (37.1%) scored at the target rating in the posttraining period. This represented a significantly reduced error rate to the target CNS score of 5 for posttraining (mean difference from target 0.43, SD = 1.38) compared with pretraining (mean difference from target 1.24, SD = 1.93; $P < .001$). There was no statistically significant difference between pre- and posttraining scores or distributions for the MVR disturbances, which were close to target (Finnegan score of 3) for both conditions (Table 1).

Anecdotal Reports

Although not specifically studied, nurses provided feedback after training that they had "better understanding" of how to use the Finnegan, and had "concrete solutions to areas that were previously confusing." Nurses reported that the Restructured Finnegan Scoring Tool was easier to understand, that they had better awareness as to which items could be scored before and after feedings, and that they found the guide helped clarify the more ambiguous items. Nurses also reported that they felt more knowledgeable about conditions that may alter infants' scores that are unrelated to NAS (eg, hunger or discomfort due to soiled diaper), felt more confident in accurately scoring symptoms of infant withdrawal, and thought the restructured Finnegan Tool would prompt fewer disturbances to withdrawing infants during the scoring process.

TABLE 1. Pre- and Posttraining Finnegan Score[a]

Physiological System	Target Rating	Pretraining Mean (SD)	Posttraining Mean (SD)	*P*
Overall total score	8	9.31 (1.95)	8.56 (1.4)	<.001
CNS subcategory score	5	6.24 (1.93)	5.43 (1.38)	<.001
MVR subcategory score	3	3.08 (0.56)	3.09 (0.38)	.739

Abbreviations: CNS, central nervous system function; MVR, metabolic, vasomotor, and respiratory function.
[a]There were no video indications of gastrointestinal symptoms; accordingly, nurses were instructed to score the gastrointestinal symptoms as 0.

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Post Hoc Follow-Up Assessment

In 2016, NICU nurses were asked to assess the same video as part of their annual education program; 79 of the original 101 nurses participated in the retest (22 of the original nurses did not participate because they were no longer working on the unit, were on vacation, or were per diem nurses at the time of retest). Nurses were asked to score the original video using the Restructured Finnegan Scoring Tool, the tool nurses were currently using in the unit for NAS scoring. To test whether the Bedside Reference Guide helped improve scoring, approximately half (n = 37) of the nurses were given the Reference Guide and half (n = 42) of the nurses scored the video without the Reference Guide (randomly based on where nurses were seated during the education program). No additional training was provided. There was no difference in the average Total withdrawal severity score between nurses who used the Reference Guide and nurses who did not use the Reference Guide (mean = 9.16, SD = 1.8). Within this subset of nurses, this score was not significantly different from the original pretraining scores (mean = 8.89, SD = 1.63; $P = .29$ Wilcoxon), but was significantly higher than the original posttraining withdrawal severity score (mean = 8.15, SD = 1.16; Wilcoxon $P < .001$). Post hoc scores were also more widely dispersed (variance 3.27) compared with the scores immediately following the original training (variance 1.34, Kendall's Coefficient, $P < .001$).

DISCUSSION

This study tested a QI Initiative to increase accuracy and consistency of NAS scoring among nurses responsible with assessing withdrawal in opioid-exposed newborns. The QI initiative led the team to identify and clarify areas of ambiguity in the Finnegan Scale[14] and to design a Restructured Finnegan Scoring Tool (see Figure 1) and Bedside Reference Guide (see Figure 2). A single-session 30-minute Training Program was implemented in which 98% of the study site NICU staff and 92% of the NN staff participated. While the program was modest in scope, it significantly increased scoring accuracy and consistency among raters. There was a 16% increase in the number of nurses who accurately assessed overall withdrawal, with more than 81% of nurses scoring within ±1 point of the target score (up from 63% pretraining). There was also a significant reduction in overrating severity (scores ≥12 vs target of 8), with 15% of nurses overrating severity pretraining compared with 4% posttraining. Given that treatment protocols are based on multiple assessments over a period of time, for example 3 consecutive scores of 8 or 2 consecutive scores of 12, improving accuracy and consistency of a threshold target score, or ±1 point within a target score, can have significant clinical implications for deciding pharmacological treatment.[7,11,12] Scores were also less widely dispersed posttraining compared with pretraining, with score variance reduced by over 50% with training that included the use of the Restructured Finnegan Scoring Tool and Bedside Reference Guide. These findings corroborate studies that show routine training and education improve reliability in scoring among raters.[18,19] Standard clinical practice for decisions around pharmacological management of withdrawal is based on repeated assessments, so it is essential to improve consistency and accuracy among caregivers responsible for measuring withdrawal.

While our QI project demonstrated a significant increase in accuracy and consistency among nurses' assessments, it reflected only a small improvement since 65% of the nurses still did not meet the target score. Moreover, the modest improvement in scoring at target did not persist over time. A follow-up assessment in a subset of nurses found that scores using the Restructured Finnegan Scoring Tool a few years later, without routine standardized training, reverted to pretraining values using the standard Finnegan Scale.[14] Together, these findings suggest the importance of continuous education and training of nurses to bolster scoring accuracy and consistency when using the Finnegan Scale, independent of the structure of the tool, and points to the urgent need for more objective techniques for assessing withdrawal to ensure reliable and accurate assessments. This is particularly important as neonatal units move toward strategies of care such as rooming-in, where nurses rely more on parental observations for assessing withdrawal[20,21] and have less opportunity to incorporate frequent training and comparison-assessment with other nurses.[17-19]

Although this study was not designed to specifically compare the Finnegan Scale[14] and the Restructured Finnegan Scoring Tool (the initiative integrated the Restructured Tool with Training and a Bedside Reference Guide), nursing staff did report feeling more confident using the Restructured Tool, in part because the structure prompted fewer disturbances to the infant during the scoring process, aided their work flow, and supported developmentally appropriate care for these fragile newborns.

One goal of this QI Initiative was to identify the areas of the Finnegan Scale[14] that nurses found to be the most challenging and better define and guide scoring of these symptoms. The Survey revealed that the 5 most ambiguous scoring parameters of the modified Finnegan Scale[14] were the moro reflex, crying, sleep patterns, muscle tone, and tremors. All of these disturbances fall under the CNS subcategory on the Finnegan Scale.[14,22] We found that the QI initiative resulted predominantly in increased accuracy and consistency of the CNS scores among nurses; more than twice as many nurses scored at the target CNS

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score posttraining (compared with pretraining) and there was nearly a 50% decrease in variance among nurses' CNS scores posttraining. There was no notable effect of training on MVR scores, which were near target for the Pre- and Post-Training Assessments. We speculate that the improvement in CNS scores was due to better defining the more subjective items in this category whereas MVR items inherently consist of more objective measures (ie, numeric values) to gauge and score these particular signs.

This study highlights the need to better describe the signs of withdrawal and standardize training to reduce disparities in how nurses use the Finnegan Scale to document and quantify NAS. A limitation to this study is that it was a single-session assessment, using a single video. We also did not assess the interim education or the frequency of training that nurses received between the posttraining and post hoc follow-up assessments, nor did we quantify the experience nurses have with caring for NAS infants, factors that all may contribute to variation in scores. While this project demonstrated significant short-term benefit, it is not clear whether the training, reference guide, the restructured scale, or a combination led to the improved scores. In a future follow-up study, it would be beneficial to evaluate the independent influence of each of these interventions.

Implications for Practice and Future Research

Considering that withdrawal severity scores are the primary criteria used for guiding pharmacological treatment, it is important to increase accuracy and consistency of scoring among caregivers responsible for assessing NAS severity and develop assessment tools that incorporate objective signs and symptoms specific to withdrawal with guidelines to help differentiate from typical newborn behaviors.[15,19,20] Establishing criteria for severity thresholds is also important for ensuring pharmacological management is consistent among infants. Training, restructuring scales, and providing guides are a first step to ensuring reliability among nurses charged with assessing severity of withdrawal in drug-exposed newborns. Follow-up assessments of training efforts should be performed regularly to ensure that interventions are both effective and persistent, and at intervals that assess the impact of the intervention on the same staff population, such as 6-month follow-up. Moving forward, it is important that more objective measures are considered to quantify withdrawal, and that research collaborations include biomedical engineers to develop better measuring devices such as sensors that indicate pathophysiological instabilities of the cardiorespiratory system, sleep disturbances, and other automated detection systems that do not rely solely on caregiver estimations (eg, see the studies[23-25]).

CONCLUSION

Despite widespread use of comprehensive assessment scales to score withdrawal in newborns exposed to opioids and other drugs *in utero*, inconsistency in scoring withdrawal remains problematic. This study highlights the intrinsic widespread variation in scoring using the Finnegan Scale.[14] Clinical practice guidelines, restructured scoring, and education only temporarily improved scoring accuracy. This study illustrates the variation that is

Summary of Recommendations for Practice and Research	
What we know:	• Nursing assessments, including scoring tools, are utilized to evaluate and guide treatment of infants with neonatal abstinence syndrome (NAS). • Educational programs may improve scoring accuracy among caregivers, especially for central nervous system subscores, but training and education must be ongoing to maintain consistency among scorers. • Standardization of scoring tools will lead to more accurate assessments and management of NAS.
What needs to be studied:	• New approaches are needed to decrease subjectivity and improve reliability among caregivers responsible for evaluating infants with NAS and for guiding pharmacological treatment. • Comprehensive evaluation should include assessing pathophysiological instabilities of the cardiorespiratory system and gauging basic functions of the infant such as feeding and sleeping.
What we can do today:	• Provide ongoing medical staff education and training on using NAS scoring tools and apply a standardized approach. • If using the Finnegan Scoring System, cluster neonatal assessments to optimize developmentally appropriate approach to care. • Consider new approaches to improve consistency in assessing and guiding pharmacological management of NAS. For example, utilize a second neonatal caregiver to verify inconsistent scores or repeat scoring when critical treatment thresholds are met.

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commonly encountered when using the Finnegan Scale and highlights the need for more objective measures of withdrawal severity, and new approaches to improve consistency among caregivers charged with assessing NAS and guiding pharmacological management.

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References

1. Jansson LM, Velez M. Neonatal abstinence syndrome. *Curr Opin Pediatr*. 2012;24(2):252-258.
2. Kocherlakota P. Neonatal abstinence syndrome. *Pediatrics*. 2014;134:e547-e561.
3. Kaltenbach K, Holbrook AM, Coyle MG, et al. Predicting treatment for neonatal abstinence syndrome in infants born to women maintained on opioid agonist medication. *Addiction*. 2012;107(suppl 1):45-52.
4. O'Grady MJ, Hopewell J, White MJ. Management of neonatal abstinence syndrome: a national survey and review of practice. *Arch Dis Child Fetal Neonatal Ed*. 2009;94(4):F249-F252.
5. Jansson LM, DiPietro JA, Elko A, Velez M. Infant autonomic functioning and neonatal abstinence syndrome. *Drug Alcohol Depend*. 2010;109(1-3):198-204.
6. Patrick SW, Davis MM, Lehman CU, Cooper WO. Increasing incidence and geographic distribution of neonatal abstinence syndrome: United States 2009 to 2012. *J Perinatol*. 2015;35(8):650-655.
7. Jansson LM, Velez M, Harrow C. The opioid exposed newborn: assessment and pharmacologic management. *J Opioid Manag*. 2009;5(1):47-55.
8. Bio LL, Siu A, Poon CY. Update on the pharmacologic management of neonatal abstinence syndrome. *J Perinatol*. 2011;31(11):692-701.
9. Osborn DA, Jeffery HE, Cole MJ, Jeffery HE. Opiate treatment for opiate withdrawal in newborn infants. *Cochrane Database Syst Rev*. 2010;10:1-52.
10. Hudak ML, Tan RC; Committee on Drugs, Committee on Fetus and Newborn. Neonatal drug withdrawal. *Pediatrics*. 2012;129(2):e540-e560.
11. Kuschel C. Managing drug withdrawal in the newborn infant. *Semin Fetal Neonatal Med*. 2007;12:127-133.
12. Finnegan L, Kron R, Connaughton JF, Emich JP. Assessment and treatment of abstinence in the infant of the drug-dependent mother. *Int J Clin Pharm Biopharm*. 1975;12:19-32.
13. Bagley S, Wachman EM, Holland E, Brogly SB. Review of the assessment and management of neonatal abstinence syndrome. *Addict Sci Clin Pract*. 2014;9(1):19.
14. Finnegan LP. Neonatal abstinence syndrome: assessment and pharmacotherapy. In: Nelson N, ed. *Current Therapy in Neonatal–Perinatal Medicine*. 2nd ed. Ontario: BC Decker; 1990.
15. Zimmermann-Baer U, Nötzli U, Rentsch K, Bucher HU. Finnegan neonatal abstinence scoring system: normal values for first 3 days and weeks 5-6 in non-addicted infants. *Addiction*. 2010;105:524-528.
16. Langley GL, Moen RD, Nolan KM, Nolan TW, Norman CL, Provost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. 2nd ed. San Francisco, CA: Jossey-Bass Publishers; 2009.
17. D'Apolito K, Finnegan L. Assessing signs & symptoms of neonatal abstinence using the Finnegan Scoring Tool, an inter- observer reliability program. *Neo Adv*. 2010.
18. Maguire D, Cline GJ, Parnell L, Tai CY. Validation of the Finnegan Neonatal Abstinence Syndrome Tool-Short Form. *Adv Neonatal Care*. 2013;13(6):430-437.
19. Lucas KR. Implementing practice guidelines and education to improve care of infants with neonatal abstinence syndrome. *Adv Neonatal Care*. 2012;12(1):40-45.
20. Howard MB, Schiff DM, Penwill N, et al. Impact of parental presence at infants' bedside on neonatal abstinence syndrome. *Hosp Pediatr*. 2017;7(2):63-69.
21. Holmes AV, Atwood EC, Whalen B, et al. Rooming-in to treat neonatal abstinence syndrome: improved family-centered care at lower cost. *Pediatrics*. 2016;136(6):e1-e9.
22. Retskin CM, Wright M. Interobserver reliability of the Finnegan Neonatal Abstinence Scoring Tool in an acute care setting. *JOGNN J Obstet Gynecol Neonatal Nurs*. 2014;43(1):s61.
23. O'Brien C, Hunt R, Jeffrey HE, O'Brien C, Hunt R, Jeffery HE. Measurement of movement is an objective method to assist in assessment of opiate withdrawal in newborns. *Arch Dis Child Fetal Neonatal Ed*. 2004;89(4):F305-F309.
24. Oji-Mmuo CN, Michael EJ, McLatchy J, Lewis MM, Becker JE, Doheny KK. Skin conductance at baseline and postheel lance reflects sympathetic activation in neonatal opiate withdrawal. *Acta Paediatr Int J Paediatr*. 2016;105(3):e99-e106.
25. Zuzarte I, Indic P, Barton B, Paydarfar D, Bednarek F, Bloch-Salisbury E. Vibrotactile stimulation: a non-pharmacological intervention for opioid-exposed newborns. *Plos Comput Biol*. 2017;12(4):1-15.

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