

Development and testing of a resuscitation-specific measure of organizational culture for resuscitation teams

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ABSTRACT

Background: The organizational culture (shared beliefs, perceptions, and values) of teams informs their behaviours and practices. Little is known about organizational culture for resuscitation teams. Our objective was to develop a reliable and valid resuscitation-specific organizational culture instrument (ROCI) with the goal of improving team performance.

Methods: Using Neonatal Resuscitation Program principles, literature review, and discussion of existing culture measures with experts, we identified organizational culture components for resuscitation and adapted existing measures to resuscitation. We developed a ROCI with five subscales (role clarity, shared-mental models, closed-loop communication, team adaptability, and psychological safety) and administered it to neonatal resuscitation team members across a hospital network. Survey psychometric assessment included reliability analyses (Cronbach's α , Pearson correlation coefficients) and validity testing (confirmatory factor analysis [CFA] and regression models examining the association of culture with implementation outcomes: climate and perceived success).

Results: Across 11 hospitals there were 318 complete responses (41 % response rate). Of the 22-items tested, 18 were retained after iterative psychometric assessment. The ROCI had excellent overall reliability (Cronbach's $\alpha = 0.994$) and very good subscale reliability (Cronbach's $\alpha = 0.789$ – 0.867). The CFA goodness-of-fit statistics confirmed five constructs (subscales). At the individual-level, the ROCI and all subscales were associated with both implementation outcomes. At the hospital-level, the ROCI overall and three subscales were associated with perceived success.

Conclusion: The ROCI is a reliable and valid measure of the organizational culture of resuscitation teams. Future ROCI assessments may provide a foundation to inform culture change initiatives to improve resuscitation quality and outcomes across populations and contexts.

Introduction

Receipt of resuscitation either in or out of the hospital is associated with significant mortality and morbidity for adults, children, and infants.^{1–4} Therefore, ongoing efforts to optimize resuscitation team performance and care quality are paramount.^{5,6} The Utstein formula for survival, in which survival is the product of medical science, educational efficiency, and local implementation, is a commonly cited framework

guiding efforts to study and improve resuscitation.⁷ Similar to the Utstein formula, the Promoting Action on Research Implementation in Health Services (PARIHS) framework describes successful implementation as a function of evidence, facilitation, and context.⁸ Both formulas identify local context as a central factor driving outcomes (e.g., survival) and successful implementation (e.g., evidence-based resuscitation practices), respectively (Fig. 1). Established organizations like the International Liaison Committee on Resuscitation (ILCOR) and Neonatal

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Resuscitation Program (NRP) focus on medical science and educational efficiency. In contrast, local implementation is multifactorial and context dependent, and is less systematically addressed.^{9,10}

A key component of local context is organizational culture, an understudied aspect of resuscitation care.¹¹ Organizational culture is defined as the shared beliefs, perceptions, and values in an organization (e.g., team, unit, hospital) and can be identified through the behaviours of groups.¹² Research across industries indicates that organizational culture influences behaviours, practices, and processes (e.g., local implementation) within organizations.¹¹ In healthcare settings, organizational culture and culture interventions are associated with improved patient outcomes.^{13–17} Such studies suggest organizational culture may represent an important target for interventions to improve resuscitation practices and outcomes. A psychometrically sound instrument for assessing the organizational culture of resuscitation teams is needed to provide insight on current state and areas for improvement. Thus, our objective was to develop and test a Resuscitation-specific Organizational Culture Instrument (ROCI) to measure the organizational culture of resuscitation teams.

Methods

Survey development and adaptation

Given organizational culture manifests as behaviours, we based the ROCI development process on the NRP Textbook of Neonatal Resuscitation ten key behavioural skills for resuscitation: 1) know your environment, 2) use available information, 3) anticipate and plan, 4) clearly identify a leader, 5) communicate effectively, 6) delegate workload optimally, 7) allocate attention wisely, 8) use available resources wisely, 9) call for additional help when needed, and 10) maintain professional behavior.¹⁸ (Fig. 1) We sought to identify resuscitation-relevant components of organizational culture that influence these behaviours, which have downstream effects on clinical decisions, timeliness, and technical interventions during resuscitation.^{19,20}

The ROCI development process focused on identifying components of organizational culture that met the following criteria: relevant to resuscitation teams, well defined in the literature, tested in other

settings, focused on components of culture amenable to change and intervention, and collectively capturing all ten NRP key behavioural skills. Through examination of the literature, review of resuscitation textbooks, and discussion with three neonatal unit leaders, two international experts in resuscitation and one in organizational culture, five components of culture relevant to resuscitation teams were identified; 1) role clarity,^{21,22} 2) shared-mental models,^{23,24} 3) closed-loop communication,^{23,25} 4) team adaptability,^{26,27} and 5) psychological safety.^{28,29} Table 1 provides component definitions and associated NRP key behavioural skills. Published scales measuring these five components and validated in other settings were reviewed.^{26,30–33} We found no scales for these components used in resuscitation.

Initial survey content

The initial ROCI included 22 items assessed with a 7-point Likert scale: 4 role clarity items, 5 shared-mental model items, 4 closed-loop communication items, 5 team adaptability items, and 4 psychological safety items (Table 2). To capture organizational culture, the item stem asked respondents to reflect generally on delivery room resuscitation teams in their hospital. Items were adapted to reference resuscitation teams and reviewed for clarity by the multidisciplinary research team. To examine associations with implementation outcomes, 3 implementation climate and 3 perceived implementation success items were included referencing evidence-based resuscitation practices (Table 2). Outcomes were measured by staff-report.

The following respondent demographics were collected: primary site, work at ≥ 1 network site, role (e.g., advance practice provider [APP], nurse [RN], physician [MD/DO], respiratory therapist [RT]), age category (<25, 25–35, 36–45, 46–55, >55 years), gender, number of years at their primary site, and time in their current role at their primary site (the last two assessed as < 1, 1–5, 6–10, 11–15, 16–20, and > 20 years).

Survey population and administration

We administered the survey across a health system including 14 hospitals with neonatal units in the Mid-Atlantic region of the United

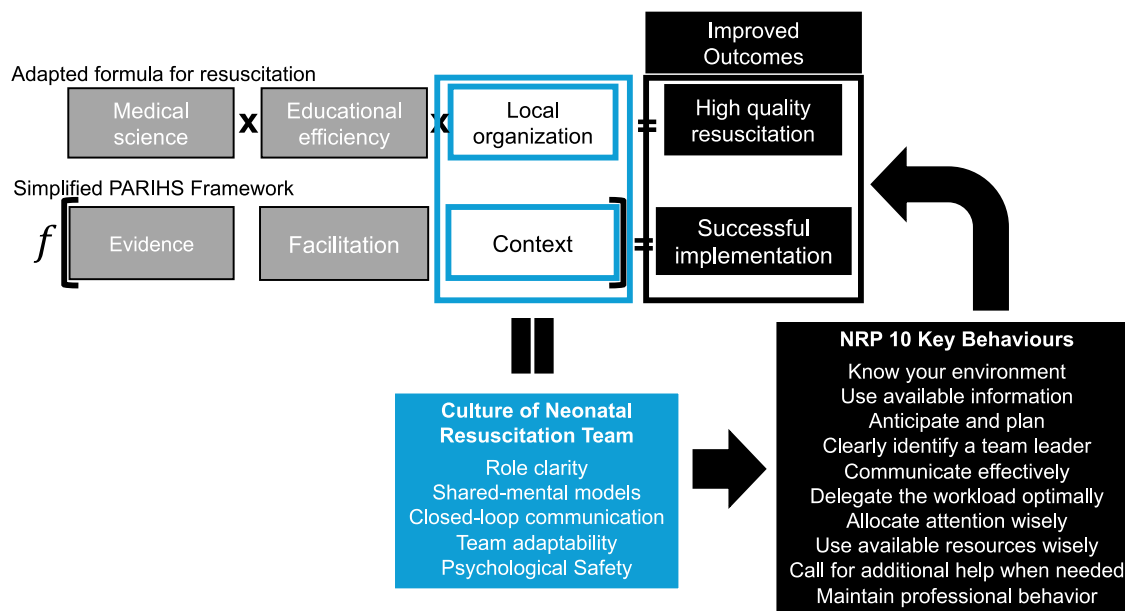


Fig. 1. Conceptual Framework: Relationship between Culture, Behaviour, and Outcomes This figure demonstrates the similarities between the Utstein formula for survival, the Promoting Action on Research Implementation in Health Services (PARIHS) framework, and organizational theory. The blue box highlights the factors that describe organizational culture. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 1
Components of organizational culture, definitions, and associated Neonatal Resuscitation Program key behavioural skills.

Organization components and definitions	Neonatal Resuscitation Program key behavioural skills									
	Know your environment	Use available information	Anticipate and plan	Clearly identify a team leader	Communicate effectively	Delegate workload optimally	Allocate attention wisely	Use available resources wisely	Call for additional help when needed	Maintain professional behavior
Role clarity Having or feeling adequate role-relevant information is present or provided, ²¹ including role identification				X	X	X				
Shared-mental models Shared understanding of team goals, individual team member tasks, and coordination of the team to achieve common goals ²³			X			X			X	
Closed-loop communication Communication in which the 1) sender initiates a message (call-out), 2) the receiver receives, interprets, and acknowledges the message (acknowledgement), and the sender ensures the intended message was received (check-back) ²³					X					
Team adaptability Team's ability to adjust strategies based on information gathered from the environment and alternate the course of action in response to changing conditions ²¹	X	X	X			X	X	X	X	
Psychological safety Shared belief within the team that the team is safe for interpersonal risk taking. ²⁸					X				X	X

States. At the time of the survey, the hospitals had a combined annual birth volume of ~ 38,000, with an estimated 3–8 % of all infants receiving positive pressure ventilation at birth.³⁴ The hospitals varied with respect to size (e.g., number of births, number of neonatal unit admissions) and level of care (e.g., the availability of subspecialty services).

We surveyed delivery room resuscitation team members, including APPs (nurse practitioners and physician assistants), RNs (in all types of roles), MD/DOs (fellows and attendings), and RTs. Staff who were ≥ 0.5 full time equivalent for ≥ 4 weeks prior to the survey and routinely attended deliveries were eligible. Eligibility based on routine delivery attendance was determined by sites given varied models of resuscitation team organization (e.g., all RNs vs a subset of RNs attend deliveries). To determine the response rate for each unit, we obtained staffing data from site leaders.

Introductory emails were sent to nursing, respiratory, and physician leadership in late April-early May 2022. Follow-up emails regarding preferred recruitment approaches, recruitment materials, and site response updates as well as phone calls with nursing leaders discussing survey recruitment were completed. Unit-lead recruitment activities included emails to staff listservs, announcements at meetings, and reminders at daily huddles facilitated by a QR code on flyers, newsletters, and screensavers. The timing of survey initiation was determined in collaboration with each site (late April-early August 2022). All surveys were completed by the end of September 2022.

The survey was administered via REDCap (version 14.1.2, Vanderbilt University, Nashville, TN), a secure online platform, and was used to track and provide interval site participation updates. The Children's Hospital of Philadelphia institutional review board reviewed this study and determined it as exempt.

Psychometric assessment

The goal for psychometric assessment and associated refinement of the ROCI was to identify the most reliable, valid, and concise combination of items capturing the five identified resuscitation-oriented components of organizational culture.³⁵ After removing incomplete and duplicate responses, we used standard psychometric analyses to iteratively test and refine the ROCI. We began with scale and subscale reliability assessments (Cronbach's α), which guided removal of items. We then performed confirmatory factor analysis (CFA) to assess construct validity of the ROCI as a five-dimensional measure of the organizational culture of resuscitation teams. The CFA goodness-of-fit statistics were reviewed to determine if items identified for removal based on subscale reliability improved psychometrics. After refining the ROCI, we performed additional reliability (Pearson correlation coefficients), aggregation statistics (intraclass correlation coefficients [ICCs]), and concurrent validity testing (assessing the association of individual and hospital ROCI scores with implementation outcomes).

Reliability refers to how consistently a concept is measured, with

Table 2

Initial and final items and internal consistency of the Resuscitation-specific Organizational Culture Instrument (ROCI).

ROCI items	22-item Cronbach α	18-item Cronbach α
<i>All ROCI items all items begin with: "In general, for delivery room resuscitation teams in my hospital..."</i>		
Role clarity *The leader is clearly identified. The expectations for team member behaviour are very clear. The roles of team members are very clear. The duties and responsibilities of team members are very clear.	0.8367	0.8438
Shared-mental models *All team members discuss goals for a resuscitation. All team members know the relationship between various components of resuscitation tasks. All team members evaluate their limitations in performing their resuscitation tasks. All team members know specific strategies for completing various resuscitation tasks. All team members know the general process involved in conducting a given resuscitation task.	0.8197	0.8401
Closed-loop communication All team members use clear verbal statements during resuscitations. *Team members direct verbal statements to a specific team member. All team members verbally acknowledge receipt of orders and instructions. All team members verbally verify that statements were received and interpreted correctly.	0.8285	0.8361
Team adaptability^a The team handles every challenge well. The team handles new and unknown situations well. The team quickly adapts to changes. The team always knows different ways to deal with sudden changes. The team remains calm during highly stressful events.	0.8668	0.8668
Psychological safety It is easy to speak up about what is on my mind. *If I make a mistake, it is often held against me. (reverse coded) I am able to bring up problems and tough issues. I am comfortable checking in with others if I have questions about the right way to do something.	0.7343	0.7888
Staff-reported implementation outcome items	Outcome Cronbach α	
Implementation climate One of our team's goals is to use evidence-based practices effectively. The team thinks implementation of evidence-based practices is important. Using evidence-based practices is a top priority for the team.	0.9464	
Perceived implementation success The team thinks implementation of evidence-based practices is making a difference in how we do things. The team members have changed their behaviours to match the evidence-based practices recommended. The team's work to implement evidence-based practices has improved the care we provide to our neonates.	0.9119	

Abbreviations: ROCI – Resuscitation-specific Organizational Culture Instrument.
Items with an asterisk were removed after initial subscale reliability testing.

higher reliability indicating greater similarity of items capturing the same concept. We assessed reliability of the ROCI overall, five subscales, and two implementation outcomes with two tests; Cronbach's α and Pearson correlation coefficients.³⁵ Cronbach's α measures internal consistency which is the shared variance among items (e.g., more closely related items have higher shared variance) and used a threshold of 0.70 for adequate internal consistency.^{35,36} Pearson correlation coefficients measure the strength of the relationship between items (or subscales) with coefficients of 0.5–0.75 indicating moderate reliability, 0.75–0.9 good reliability, and 0.9–1 excellent reliability; 1 indicates perfect consistency.³⁵ Perfect consistency is not the goal as it may reflect subscale/item redundancy, thus desirable surveys may have some degree of correlation between subscales and slightly higher correlation between subscale items.

Validity means a scale is measuring what it is supposed to. We examined two types of validity: construct and concurrent validity. Construct validity assesses whether a group of items all measure the same construct (e.g., all items in the same subscale measure the same concept), which we evaluated using CFA. A 5-factor CFA was completed because the ROCI was developed based on five previously tested scales.

The CFA used the Lavaan package in R with structural equation modelling and applied diagonally weighted least squares given the ordinal (Likert scale) and non-normal (left skewed) distribution of data.³⁷ We evaluated the CFA based on the following goodness-of-fit statistics: 1) the overall chi-squared, 2) standardized root mean square residual (SRMR), 3) the root mean square error of approximation (RMSEA), and the 4) comparative fit index (CFI) and 5) the Tucker–Lewis fit index (TLI).

We assessed concurrent validity by examining associations of the ROCI with two implementation outcomes at the individual and hospital level. Concurrent validity examines the extent to which a score correlates with another measure as expected and therefore supports its utility (e.g., better culture scores associated with better implementation outcomes).³⁵ To assess concurrent validity, we first calculated scores for the overall ROCI, five subscales, and two implementation outcomes by averaging responses across associated items. For our individual-level validity assessment, we then used linear regression models to assess the association of ROCI scores with implementation outcome scores because models allowed for incorporation of respondent characteristics (i.e., role and gender) that can influence reported organizational culture

and use of cluster-robust standard errors by hospital (to account for correlation within clusters [hospitals]).^{38,39} For our hospital level analysis, after assessing ICCs to determine that hospital (site) data could be aggregated, we re-ran models at the hospital-level and accounted for the proportion of nursing responses at the site. Individual and hospital level models were repeated for each ROCI subscale. Analyses were completed in Stata (v14.2, College Station, TX) and R (v3.6.1, Vienna, Austria).

Results

Of the 14 network sites, 11 opted to participate. We received 318 complete, non-duplicate responses from 776 potential participants (41 % response rate). The median number of respondents per site was 33

Table 3
Survey respondent characteristics.

Characteristic	N = 318
Gender	
Female	266 (83.6 %)
Male	45 (14.2 %)
Decline to answer	7 (2.2 %)
Age	
<25 years	9 (2.8 %)
25–35 years	69 (21.7 %)
36–45 years	105 (33.0 %)
46–55 years	73 (23.0 %)
>55 years	62 (19.5 %)
Role	
Advance Practitioner	18 (5.7 %)
Nurse	175 (55.0 %)
Physician	81 (25.5 %)
Respiratory therapist	43 (13.5 %)
Other	1 (0.3 %)
Primary Hospital in the Network	
A	33 (10.4 %)
B	38 (11.9 %)
C	21 (6.6 %)
D	35 (11.0 %)
E	16 (5.0 %)
F	60 (18.9 %)
G	24 (7.5 %)
H	33 (10.4 %)
I	10 (3.1 %)
J	11 (3.5 %)
K	37 (11.6 %)
Number of Network Hospitals in which respondent regularly works	
1	259 (81.4 %)
2	54 (17.0 %)
3	5 (1.6 %)
Time in primary Network Hospital	
<1 year	23 (7.2 %)
1–5 years	89 (28.0 %)
6–10 years	65 (20.4 %)
11–15 years	46 (14.5 %)
16–20 years	42 (13.2 %)
>21 years	53 (16.7 %)
Length of time in current role	
<1 year	20 (6.3 %)
1–5 years	72 (22.6 %)
6–10 years	61 (19.2 %)
11–15 years	40 (12.6 %)
16–20 years	43 (13.5 %)
>21 years	82 (25.8 %)

(interquartile range 18–36). Most respondents identified as female (84 %), were nurses (55 %), and had been working in their current role for > 5 years (71 %) (Table 3). ROCI item scores were positive and high (>4) yet the overall score distribution (mean 5.79, standard deviation 0.69) and individual items (Supplemental Table 1) showed variance.

Reliability and construct validity assessments

From the original 22-item ROCI, 4 items were removed after initial reliability assessment because they decreased subscale internal consistency (Table 2). Cronbach's α for the original 22-item ROCI was 0.9392, while the modified 18-item version was 0.9444. The 5 team adaptability items were retained, while one item was removed from each of the remaining four subscales. The decision to remove these four items, which changed reliability just slightly in some cases, was also informed by the CFA goodness-of-fit-statistics, which indicated that their removal produced a more valid 5-factor ROCI (Table 4). The resultant reliability of the five subscales was very good with Cronbach's $\alpha = 0.7888$ – 0.8668 (Table 2). Correlations between the five ROCI subscales ranged from 0.472 to 0.740 (Supplemental Table 2) and items within subscales were correlated between 0.444–0.727, with 3 item correlations < 0.50 (Supplemental Table 3).

Both implementation outcome scales had excellent internal consistency (Cronbach's $\alpha > 0.9$, Table 2). Items within these scales were highly correlated (0.727–0.905) (Supplemental Table 3).

Concurrent validity assessments

The individual-level, unadjusted and adjusted models showed that the ROCI overall and all five subscales were positively and significantly associated with more favourable perception of implementation climate and perceived success (Table 5). In adjusted models, a one-point increase in the ROCI overall (e.g., increasing from a score of 5 [somewhat agree] to a score of 6 [agree]) was associated with a 0.71-point increase (95 % confidence interval [CI] 0.55, 0.88) in implementation climate and a 0.74-point increase (95 % CI 0.58, 0.90) in perceived implementation success. Significant increases of smaller magnitude were found between each subscale and both implementation outcomes (Table 5).

Prior to the hospital-level analyses, ICCs were examined; they supported aggregation (<0.05) of individual-level data to the hospital-level. Unadjusted and adjusted models indicated significant associations of the ROCI overall with perceived implementation success at the hospital-level. In adjusted models, a 1-point increase in the overall ROCI score was associated with a 0.98-point increase (95 % CI 0.21, 1.75) in perceived implementation success. The subscales of role clarity, shared-mental models, and closed-loop communication were also significantly associated with better perceived implementation success (Table 5). The positive associations of team adaptability and psychological safety with perceived implementation success were not statistically significant.

Table 4
Confirmatory factor analysis goodness-of-fit statistics for 22-item and 18-item ROCI.

	22-item	18-item	Goal parameter
Overall Chi-Square	311($p < 0.001$)	171($p = 0.004$)	
Standardized Root Mean Square Residual	0.048	0.038	<0.05**
Root Mean Square Error of Approximation	0.042	0.034	<0.05**
Comparative Fit Index	0.90	0.951	>0.95**
Tucker–Lewis Fit Index	0.88	0.94	>0.90*

Abbreviation: ROCI – Resuscitation-specific Organizational Culture Instrument. ** indicates very good fit; * indicates good fit.

Table 5
Associations between ROCI scores and staff-reported outcomes at the individual and hospital level.

ROCI Measures	Climate		Success	
	Unadjusted β (95 % CI)	Adjusted β (95 % CI)	Unadjusted β (95 % CI)	Adjusted β (95 % CI)
Individual-level*				
ROCI Overall	0.74 (0.55, 0.93)	0.71 (0.55, 0.88)	0.73 (0.56, 0.90)	0.74 (0.58, 0.90)
Role clarity	0.59 (0.37, 0.82)	0.58 (0.36, 0.79)	0.57 (0.39, 0.78)	0.58 (0.39, 0.77)
Shared-mental models	0.57 (0.42, 0.73)	0.56 (0.42, 0.70)	0.57 (0.45, 0.69)	0.58 (0.47, 0.69)
Closed-loop communication	0.45 (0.30, 0.59)	0.45 (0.30, 0.60)	0.41 (0.27, 0.56)	0.45 (0.30, 0.60)
Team adaptability	0.60 (0.50, 0.71)	0.58 (0.49, 0.68)	0.63 (0.48, 0.78)	0.64 (0.49, 0.78)
Psychological safety	0.47 (0.30, 0.64)	0.48 (0.31, 0.65)	0.45 (0.32, 0.59)	0.46 (0.33, 0.59)
Hospital-level**				
ROCI Overall	0.39 (-0.40, 1.17)	0.24 (-0.66, 1.13)	0.84 (0.16, 1.52)	0.98 (0.21, 1.75)
Role clarity	0.73 (-0.21, 1.66)	0.59 (-0.45, 1.64)	1.10 (0.22, 1.98)	1.21 (0.23, 2.20)
Shared-mental models	0.32 (-0.30, 0.94)	0.19 (-0.55, 0.93)	0.65 (0.10, 1.20)	0.82 (0.19, 1.45)
Closed-loop communication	0.49 (-0.19, 1.17)	0.42 (-0.72, 1.56)	0.61 (-0.11, 1.33)	1.33 (0.37, 2.28)
Team adaptability	0.16 (-0.44, 0.77)	0.05 (-0.60, 0.70)	0.47 (-0.12, 1.06)	0.51 (-0.17, 1.18)
Psychological safety	0.10 (-0.59, 0.78)	0.15 (-0.53, 0.82)	0.58 (-0.05, 1.21)	0.60 (-0.07, 1.27)

Abbreviation: ROCI – Resuscitation-specific Organizational Culture Instrument. CI - Confidence Interval.

*Models adjust for respondent gender and role with clustering by site.

**Models adjust for the proportion of nursing responses at each site.

Analyses did not show a significant association of ROCI overall or subscales with implementation climate (Table 5).

Discussion

We developed and tested an instrument to measure organizational culture of delivery room resuscitation teams. Through our testing, we present initial evidence that the ROCI is a psychometrically sound measure of organizational culture in the context of delivery room resuscitation. The ROCI is a useful tool as it reliably measures culture at the individual-level and demonstrates concurrent validity through its positive association with individual-reported implementation outcomes and hospital-level (e.g., team) perceived implementation success.

Continuing advancement of resuscitation medical science, including ILCOR's regularly updated treatment recommendations, and efforts to improve educational efficiency, such as novel approaches to simulation, are essential but insufficient for optimal resuscitation performance and outcomes.^{7,40-42} Implementation and maintenance of new resuscitation practices also requires attention to local context, including culture.⁸ Yet, for culture to be understood and leveraged for improvement, it must first be measured. Published assessments for resuscitation teams are often designed to complement educational efforts and are typically conducted by a single outside observer, thus missing the perspective of resuscitation team members.^{43,44} Further, prior studies focus on resuscitation team leaders or champions and their associated characteristics.⁴⁵ While leaders influence culture, perception of culture often differs between leaders and other team members and between different roles (e.g., nurse and physician).⁴⁶

The ROCI adds to the measurement literature as it expands the scope of context by focusing on the organizational culture of resuscitation teams and garners the perspective of many clinical roles. Having five distinct subscales that capture how all team members handle, adapt, and communicate during resuscitations diversifies the aspects of culture that can be assessed and intervened upon to improve resuscitation. In our study population, we found high ROCI scores, which suggest positive perceptions of resuscitation team culture. While some hospitals surveyed had concurrent delivery room quality improvement initiatives inclusive of cultural components, we still observed variance in scores and meaningful associations with outcomes. This signals the ROCI's ability to serve as a useful assessment tool and indicator of opportunities for further improvement.

We tested the ROCI in the delivery room resuscitation environment. This environment reflects the clinical expertise and work setting of our

research team, yet the language used in the ROCI is not specific to delivery room resuscitation, potentially enabling use across different resuscitation contexts. Resuscitation team staffing varied across participating hospitals with respect to the team roles represented (e.g., some hospital staff includes APPs, others routinely have RTs attend deliveries) and potential pool of team members (e.g., all unit nurses vs a subset of nurses who participate in delivery room resuscitation) – further indicating the ROCI's potential for broad use. Given this variation, we integrated role into our models and testing demonstrated that ROCI scores can be aggregated and differentiate between hospital-based teams. The components of culture captured in the ROCI, word choice, and ability to assess across varying team structures allow for potential application of the ROCI in other populations (e.g., paediatric and adult patients) and environments (e.g., intensive care unit, emergency room, and out of hospital resuscitation events), though testing is needed to confirm broader applicability.

Using the ROCI to measure the culture of resuscitation teams has the potential to inform targeted culture interventions, which have been shown to affect guideline adherence and patient outcomes in other healthcare settings.^{14,47,48} Our data suggest that individual-focused efforts targeting any of the five components of culture are likely to increase implementation climate and perceived success. While significant associations at the hospital-level were less consistently demonstrated, some components of culture may be potential targets. For example, incorporating items that facilitate a culture of role clarity into checklists, which improve team consistency and performance, may be beneficial.^{49,50} The lack of significant associations detected of the ROCI with implementation climate, likely reflects the fact that implementation climate is a broader construct with more variability and therefore requires more power to detect a significant effect. The ROCI offers flexibility, with potential for more frequent administration during longitudinal improvement activities or assessment of a single component of culture (e.g., psychological safety) surrounding a specific culture change effort. Future work should examine the relationship of the ROCI and subscales with penetration of evidence-based practices and clinical resuscitation outcomes for delivery room resuscitation teams and neonates, respectively.

This study has limitations. First, the responding hospitals are all a part one hospital-affiliated network, limiting generalizability. Yet, the participating hospitals included a mix of community and academic hospitals with varying size and capabilities. Second, like many surveys, there is non-response bias (41 % response rate) and potential selection bias (43 incomplete responses without demographic data were

excluded). Demographic items were at the end of the survey, thus characteristics of those who completed vs did not complete the survey cannot be examined for bias. Third, while power ($n = 318$ respondents) was sufficient to conduct reliability assessments and CFA testing, the number of participating hospitals ($n = 11$) had limited power to detect hospital-level associations of the ROCI with implementation outcomes. Though future studies powered for hospital-level analyses are needed, the individual-level analyses showed significant positive associations of the ROCI and all five subscales with both implementation outcomes supporting concurrent validity. Fourth, perceived implementation success is a staff-reported proxy for implementing evidenced-based care. The ROCI has not evaluated patient-level care practices or outcomes, an important direction for future work.

In summary, the ROCI is a reliable and valid tool to measure the organizational culture of delivery room resuscitation teams. Integrating this tool and its associated data into resuscitation practice and systems is a novel and potentially valuable avenue to facilitate implementation of evidence-based resuscitation care and optimize resuscitation outcomes.

CRedit authorship contribution statement

Sara C. Handley: Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ingrid M. Nembhard:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Cecelia L. Corson:** Writing – original draft, Visualization, Project administration. **Molly Passarella:** Writing – review & editing, Software, Methodology, Investigation, Formal analysis, Data curation. **Charlotte Cecarelli:** Writing – review & editing, Project administration, Data curation. **Henry C. Lee:** Writing – review & editing, Methodology, Investigation, Funding acquisition, Conceptualization. **Jennifer Cohen:** Writing – review & editing, Resources, Project administration, Data curation. **John Chuo:** Writing – review & editing, Resources, Project administration. **Jennifer Tioseco:** Writing – review & editing, Resources, Project administration, Data curation. **Christopher P. Bonafide:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Elizabeth E. Foglia:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.resplu.2024.100796>.

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