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Abstract

Background: One critical factor in effective implementation of evidence-based practices (EBPs) in nursing is an organizational context that facilitates and supports implementation efforts. Measuring implementation climate can add useful insights on the extent to which the organizational context supports EBP implementation.

Aims*:* This study cross-validates and examines the psychometric properties of the Implementation Climate Scale (ICS), which measures nurses' perceptions of their unit's climate for EBP implementation.

Methods: This study analyzed ICS data from two cross-sectional studies, including 203 nurses from California and 301 nurses from Florida. Analyses included evaluation of internal consistency, multilevel aggregation statistics, and confirmatory factor analyses.

Results: The 18-item ICS demonstrated comparable psychometric properties to the original measure development paper in both samples. Confirmatory factor analyses provided support for the scale's factor structure in both samples.

Linking Evidence to Practice: The ICS is a pragmatic measure that can be used to assess unit implementation climate in nursing contexts. Results from the ICS from nurses and nurse leaders can provide insights into implementation-specific barriers and facilitators within the organizational context.

Introduction

Despite the widespread recognition that practices based on research evidence (i.e., evidence-based practices or EBPs) improve patient care and patient outcomes (Harper et al., 2017; Melnyk, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012; Wallen et al., 2010), the diffusion of research-based evidence to practice has been slow to gain traction with clinicians tasked with using EBPs in healthcare settings (Fink, Thompson, & Bonnes, 2005; Harding, Porter, Horne-Thompson, Donley, & Taylor, 2014; Melnyk et al., 2012). Because nurses are the largest proportion of healthcare staff globally and can be found in every facet of healthcare (e.g., policy, practice, administration), they play a particularly critical role in the implementation of EBP (Melnyk et al., 2018; Zullig, Deschody, & De Geest, 2020). Although research has begun to address how nurses can more effectively address the evidence-to-practice gap by successfully adopting and implementing EBPs into their continuum of care (Melnyk et al., 2018; Rycroft-Malone, 2004; Saunders & Vehviläinen-Julkunen, 2016), barriers to implementation remain (Harding, Porter, Horne-Thompson, Donley, & Taylor, 2014; Melnyk et al., 2012).

Implementation of EBPs within the healthcare industry is a dynamic process that brings about complex challenges for both organizations and practitioners (Rycroft-Malone et al., 2004). Researchers have identified a myriad of organizational and individual factors that influence the effectiveness of EBP implementation (Aarons, Hurlburt, & Horowitz, 2011; Damschroder et al., 2009). For example, success of EBP implementation has been linked to nurses' familiarity with, attitudes toward, beliefs about, and knowledge and skills related to EBP (Saunders & Vehviläinen-Julkunen, 2016; Stetler, Ritchie, Rycroft-Malone, & Chams, 2014). Research has also provided evidence for the role that organizational context plays in ensuring EBP implementation is met without failure (Melnyk et al., 2012; Sandström, Borglin, Nilsson, & Willman, 2011; Wallen et al., 2010; Wilson et al., 2015).

Although the nursing literature has often focused on the role of organizational culture in influencing implementation effectiveness (Kaplan, Zeller, Damitio, Culbert, & Bayley, 2014; Melnyk, Fineout-Overholt, Giggleman, & Cruz, 2010; Williams, Perillo, & Brown, 2015), research on implementation in health services has integrated the concept of strategically focused organizational climate from the industrial and organizational psychology and management literatures (Aarons, Ehrhart, Farahnak, & Sklar, 2014; Ehrhart, Aarons, & Farahnak, 2014; Weiner, Belden, Bergmire, & Johnston, 2011). Organization climate is defined as "the shared meaning organizational members attach to the events, policies, practices, and procedures they experience and the behaviors they see being

rewarded, supported, and expected" (Ehrhart, Schneider, & Macey, 2014, p. 69). The literature on organizational climate can be subdivided according to its focus on the overall work environment, which is sometimes referred to as the molar climate, versus a focus on those policies and practices tied to the accomplishment of a specific strategic outcome. Although the earliest work on organizational climate primarily took a molar climate perspective (Campbell, Dunnette, Lawler, & Weick, 1970), the focused and strategic climate perspective has evolved to become the dominant approach in the organizational psychology and management research literature, including commonly studied focused climates for customer service (Schneider, Ehrhart, Mayer, Saltz, & Niles-Jolly, 2005), safety (Zohar, 2002), and innovation (Newman, Round, Wang, & Mount, 2020).

Implementation climate is a type of strategic climate that captures employees' shared perceptions of implementation policies, practices, and procedures within their unit or organization (Ehrhart et al., 2014a; Klein, Conn, & Sorra, 2001). Building upon the literature on focused climates and on past research on computer technology implementation in organizations (Klein et al., 2001), recent research in the field of implementation science has highlighted the importance of implementation climate in supporting EBP implementation efforts (Aarons et al., 2014; Ehrhart et al., 2014a) and demonstrated its relationship with critical implementation outcomes (Jacobs et al., 2015; Williams, Wolk, Becker-Haimes, & Beidas, 2020).

One measure of an organization's climate for EBP implementation is the Implementation Climate Scale (ICS; Ehrhart et al., 2014a). This measure was originally developed in mental health services to capture a variety of organizational systems and practices that indicate the extent to which EBP implementation is an organizational priority. This instrument has subsequently been validated in other domains, including child welfare (Ehrhart, Aarons, Torres, Wright, & Martines, 2016) and substance use treatment services (Ehrhart, Torres, Hwang, Skaler, & Aarons, 2019). Furthermore, the instrument has been linked to implementation outcomes, such as increased use of EBPs by mental health providers over a five-year time period (Williams et al., 2020). Although initial work on the ICS in nursing is promising (Shuman et al., 2018; Shuman, Powers, Banaszak-Holl, & Titler, 2019), this research is descriptive, and there is currently no published work validating the scale in a nursing context.

The purpose of this study was to validate the ICS for use in a nursing population employed in hospital settings. Using data from two independent samples, this study evaluates

the proposed factor structure using confirmatory factor analysis. Although we anticipated that the measures would validate in a nursing sample, research has indicated that the nursing profession might require different strategies to effectively implement EBPs when compared to other healthcare providers (McKenna, Ashton, Keeney, 2004). Therefore, validating implementation context assessment measures in a sample of nurses will help elucidate if these constructs will hold within the nursing population and will open the door to future research in nursing on antecedents and outcomes of implementation climate.

Methods

Design

This study summarizes analyses of the ICS from two large cross-sectional survey efforts by two distinct research teams. The first study was conducted in 2016 in a multisite hospital system in California. The second study was conducted in 2018 in a Florida health system, which included both hospital and ambulatory sites. One published manuscript (Shuman et al., 2020) utilized data from the California sample to validate the Implementation Leadership Scale; there are no additional publications using data from the Florida sample at this time.

Ethical Considerations

For the California data collection, Institutional Review Board approvals from both the principal investigator's university and the hospital system were obtained. For the Florida data collection effort, approval was obtained from the hospital system. All participants were provided with detailed information regarding the data collection effort and provided consent for their participation.

Participants

For the California sample, nurses were recruited from four sites within a large community hospital system with permission from health system and hospital leadership. All registered nurses on staff at the four sites were eligible for participation. Recruitment occurred via an email announcement with follow-up in-person presentations at nurse unit meetings. During the in-person meetings, research personnel described the purpose of the study, disseminated a recruitment flyer, and answered questions.

For the Florida sample, nurses were recruited from one large, acute care hospital within a large, faith-based, community health system in Florida. All bedside clinical registered nurses employed for ≥ three months by their current unit were eligible to participate. Agency, travel, or contract nurses as well as new hires or internal transfers

employed < three months in their current unit were excluded. Participants were recruited using flyers posted in the unit and an email sent approximately one week prior to study commencement.

Measures

The original ICD (Ehrhart et al., 2014a) included 18 items capturing six dimensions (three items per dimension). The dimensions included focus on EBP, educational support for EBP, recognition for EBP, rewards for EBP, selection for EBP, and selection for openness. The response scale ranged from 0 ("not at all") to 4 ("to a very great extent"). Scores for each dimension are created by averaging the three subscale items, and the ICS composite score is created by calculating the mean of the subscale scores.

Commented [A1]: Au: Is this supposed to be ICS?

Prior to initiating data collection, the research team attended a nursing leadership meeting to review item content with approximately 30–40 nurse directors, nurse managers, and nurse educators and clinical nursing specialists within the California hospital system. The majority of the items were considered appropriate with minor wording adjustments for the nursing context (e.g., "nurse" instead of "employee," "unit" instead of "team"). Additional minor wording changes included replacing "evidence-based practice trainings or in-services" with "evidence-based practice education" (item 5, Educational Support) and replacing "open to new types of interventions" with "open to new practices" (item 18, Selection for Openness). Although minor wording changes were made, all the dimensions of the original ICS measure were retained. Data collection with the Florida nurses utilized the same modified version of the ICS measure. (See Table S1.)

Data Collection Procedure

In the California sample, all nurses on staff at four sites in the hospital system received an initial recruitment email that included a link to the study survey instrument. In addition, members of the research team provided hard copy versions at unit meetings, which were either mailed back to the research team or picked up from the hospital by the research team. The majority of the sample (n = 132) completed the online version of the survey instrument (n = 71 for the paper-and-pencil version). Analyses comparing the two methods of data collection showed no significant differences in ICS scores. In exchange for their participation, participants were provided a $5 gift certificate to a retail coffee chain.

In the Florida sample, research personnel distributed paper versions of the survey instrument to all eligible nurses over a two-week period during staff and unit meetings.

Participants placed completed copies in a sealed envelope and returned them to a secured collection box on the unit. Per hospital policy, no incentives were offered to participants.

Data Analysis

The majority of the analyses were conducted using SPSS (version 24), except for the confirmatory factor analyses, which utilized the Mplus statistical program (Muthén & Muthén, 1998–2017). After calculating preliminary descriptive statistics, Cronbach's alphas were calculated to examine the dimensions and composite scale's internal consistency.

Aggregation statistics. Because implementation climate is a unit-level construct, aggregation statistics were calculated to assess the extent to which individuals shared similar climate perceptions. For each ICS dimension and the composite, we calculated the average within-group agreement statistic (a_{wg}) and intraclass correlation coefficient, or ICC(1). Previous research has suggested that a_{wg} values of 0.60 or higher represent acceptable within-unit agreement (Brown & Hauenstein, 2005). ICC(1) provides a metric for the proportion of group-level variance accounted for, and common values in the applied sciences typically range from 0.05 to 0.20 (Bliese, 2000).

Confirmatory factor analysis. The factor structure of the ICS was evaluated using confirmatory factor analysis (CFA). Because of the nested data structure with nurses embedded within work units, maximum likelihood estimation with robust standard errors (MLR) was employed. MLR appropriately adjusts standard errors for each parameter included in the CFA and adjusts chi-square values, which are used to assess model fit. For missing data, we employed full information maximum likelihood (FIML), which utilizes all available information for each participant. To determine whether the CFA model results obtained acceptable model fit, we used Hu and Bentler's (1999) recommendations of comparative fit index (CFI) values ≥ 0.95, root mean square error of approximation values (RMSEA) ≤ 0.06, and standardized root mean square residual (SRMR) values ≤ 0.08.

Results

Participant Characteristics

For the California sample, 203 nurses working in 78 nursing units participated in the study. The nurses represented a variety of clinical settings, with the largest numbers coming from maternity (29.6%), medical-surgical (13.3%), telemetry and progressive care (13.3%), and psychiatric (12.8%) units. Participants averaged 38.15 (*SD* = 10.84) years of age and had a tenure of 11.15 years (*SD* = 10.17) working as a nurse. The majority held a bachelor's or higher degree (52.7%). Participants from the Florida hospital system included 301 nurses

working in 20 medical-surgical units. Approximately half of the nurses had been working in the field over 10 years (50.2%). A majority held a bachelor's or higher degree (83.7%).

Psychometric Evaluation

Scale descriptive statistics and internal consistency. Table 1 presents the descriptive statistics for the ICS dimensions and composite scale for both samples. Support was found for the internal consistency of the ICS dimensions and total scale in both samples. The six ICS dimensions had Cronbach's alpha internal consistency values ranging from 0.81 to 0.98. Additionally, the composite ICS had a Cronbach's alpha of 0.94 in the California sample and 0.95 in the Florida sample.

Aggregation statistics. Aggregation statistics were calculated for units with two or more responses (n = 39 units in the California sample; n = 18 in the Florida sample). Results are summarized in Table 1. For the ICS dimensions, a_{wg} values ranged from 0.74 to 0.81 in the California sample and 0.66 to 0.73 in the Florida sample. The overall composite had an a_{wg} of 0.78 in the California sample and 0.71 in the Florida sample, which is above the suggested minimum value, thus providing support that members of the same unit shared similar perceptions of the work unit's implementation climate in both samples. However, ICC(1) values did not provide as strong of support for agreement. In the California sample, ICC(1) values ranged from -0.04 to 0.17. In the Florida sample, the ICC(1) values ranged from 0.001 to 0.07. The overall ICS composite had an ICC(1) value of .08 in the California sample and 0.07 in the Florida sample.

Confirmatory factor analysis. CFA results in both samples indicated the model depicting the six-factor structure was consistent with the original ICS measure. In both samples, the hypothesized six-factor model's chi-square value was statistically significant at the $p < 0.001$ level (California: $\chi^2(120) = 266.36$; Florida: $\chi^2(120) = 356.27$). However, descriptive model fit indices collectively provided support for the psychometric soundness of the ICS. In both samples, CFI was higher than 0.95 (California: CFI = 0.954; Florida: CFI = 0.952), RMSEA was slightly higher than recommended values of 0.06 (California: RMSEA = 0.078, 90% C.I. [0.065, 0.090]; Florida: RMSEA = 0.081, 90% C.I. [0.071, 0.091]), and SRMR was below the recommended value of 0.08 (California: SRMR = 0.055; Florida: SRMR = 0.042). Thus, for all but the RMSEA, the indices met the recommended guidelines for well-fitting models (Hu & Bentler, 1999). Table 2 includes the factor loadings for each item in both samples. All factors loadings were statistically significant, with an average loading of 0.89 in the California sample and 0.91 in the Florida sample.

Correlations among the ICS dimensions can be found in Table 3 to allow for comparisons with past validation efforts using the ICS in other contexts. The correlations among the dimensions were all above 0.30.

Discussion

Although integrating research evidence is a priority in nursing and healthcare in general, successful implementation of EBPs has noticeably lagged, challenged by the organizational context in which nurses provide care. A more comprehensive understanding of the organizational context is critical to identify and address barriers to EBP implementation. The purpose of this research was to validate the ICS measure in the nursing context. After adjusting items to fit the nursing context, the instrument performed well across multiple psychometric indicators. For instance, the internal consistency reliability indicators for the overall ICS and its subscales were strong, the overall pattern of aggregation statistics provided support for the unit-level nature of the ICS, and the pattern of correlations among the subscales was comparable to past studies of the ICS. Most notably, confirmatory factor analyses indicated acceptable fit in both samples, providing strong support for the use of the ICS in a nursing context.

Strengths and Limitations

There were multiple strengths of the current research. The ICS has a strong foundation in theory (Ehrhart et al., 2014b) and research in other contexts (Ehrhart et al., 2014a, 2016, 2019). The measure is also efficient, with only three items per dimension for a total of 18 items, meeting calls for developing short measures in health settings to enhance practical utility (Glasgow & Riley, 2013). The study included samples from two healthcare systems collected from distinct research teams and demonstrated strong psychometric evidence across both samples, providing preliminary evidence for the generalizability of the instrument across a variety of nursing settings.

This research also had limitations. Both healthcare systems included in this study were fairly large and in urban and suburban settings; thus, research in additional hospital settings is needed. The agreement statistics could have been improved. Within-unit agreement was acceptable across both studies, but ICC(1) values were mostly in the small-to-medium effect size range (LeBreton & Senter, 2008). Because the units were all from the same systems, between-unit variability could have been restricted, which would suppress ICC(1) values. Future research with a larger sample of units and examining factors influencing within-unit variability of climate perceptions would be useful. Finally, the

rewards dimension had a fairly low mean in both samples, which may have affected the psychometric analyses for that scale. Although rewards related to EBP implementation may be uncommon in nursing settings, the retention of the scale is useful for practical purposes in terms of providing ideas for leaders on how they might improve the implementation climate in their units.

Future Research

Future research can build on this study in multiple ways. Additional validation across unit types, in different types of hospitals and patient care settings, rural areas, and even cross-cultural contexts would be useful in better understanding the generalizability of the instrument. Based on the supportive evidence for the measure in nursing, future research can shift to examining the antecedents and outcomes of implementation climate in nursing. For instance, research could investigate implementation leadership (Aarons, Ehrhart, & Farahnak, 2014; Aarons, Ehrhart, Moullin, Torres, & Green, 2017; Shuman et al., 2020; Shuman et al., 2018) as a primary antecedent of implementation climate and could identify the mechanisms through which a climate for EBP implementation influences nurses' behavior.

Implications for Practice

The ICS was designed to be brief and pragmatic and thus to be useful for both leaders and researchers working on implementation projects or attempting to improve the uptake of EBPs. It can serve as a temperature gauge to provide healthcare organizations and nursing leaders with knowledge regarding the extent to which their unit environment aligns with implementation efforts and to identify specific areas to target for intervention. Both researchers seeking to develop specific interventions geared toward improving the organizational context and organizations can use the ICS to understand the factors that are related to the creation of an environment that supports EBP and implementation outcomes.

Linking Evidence to Action

- Organization and unit climate play a critical role in EBP implementation in nursing, and thus brief, practical tools assessing this important context factor are needed.
- Few tools are available to measure implementation climate. The ICS can be used by nurse leaders to better assess the organizational context for EBP and to develop targeted strategies to improve the implementation climate among nurses in various healthcare settings.

- The ICS demonstrated validity and reliability for nursing contexts and can be used by researchers to identify the factors that influence effective implementation climate and downstream clinical performance outcomes.

Conclusions

Within nursing settings, the organizational context for implementation is a critical factor in establishing the foundation for subsequent implementation success. Having measurement tools that are valid and reliable, in addition to being brief and practical for applied use, provides hospitals with realistic tools that can be administered to better understand how to build a climate to support implementation and allows nursing researchers to better understand the role of that climate in implementation effectiveness.

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Table 1. Summary of Descriptive and Aggregation Statistics for the Implementation Climate Scale (ICS) Dimensions and Total Scale for California and Florida Nurse Samples

	California nurses					Florida nurses				
	Mean	**SD**	**α**	**ICC (1)**	**a_{wg}**	**Mean**	**SD**	**α**	**ICC (1)**	**a_{wg}**
ICS composite	2.11	.81	.94	.08	.78	2.51	.85	.95	.07	.71
ICS dimensions										
Focus on EBP	2.21	1.06	.95	.17	.81	3.09	.80	.90	.02	.73
Educational support for EBP	1.76	1.18	.95	.13	.77	2.61	1.04	.92	.01	.73
Recognition for EBP	2.48	2.48	.86	.001	.81	2.60	1.13	.93	.001	.68
Rewards for EBP	1.38	1.38	.81	.08	.74	1.73	1.26	.89	.01	.66
Selection for EBP	2.03	2.03	.90	-.04	.79	2.14	1.17	.95	.01	.71
Selection for openness	2.82	2.81	.97	.03	.79	2.85	.97	.98	.02	.73

Note. ICC = intraclass correlation coefficient. Due to missing data, the California n ranges from 194 to 203, and the Florida n ranges from 247 to 298. Aggregation statistics are based on 39 units for the California sample and 18 units for the Florida sample.

Table 2. Standardized Factor Loadings for the Implementation Climate Scale (ICS)

ICS factor items	California nurses	Florida nurses
1. Focus on EBP		
Main goal is to use EBP effectively	.93	.88
Think implementation is important	.91	.80
Using EBP is a top priority	.95	.94
2. Educational support for EBP		
EBP education	.95	.91
Conferences, workshops, or seminars	.92	.86
Training materials, journals, etc.	.93	.90
3. Recognition for EBP		
Held in high esteem	.98	.99
Seen as clinical expert	.86	.90
More likely to be promoted	.69	.86
4. Rewards for EBP		
Financial incentives for use of EBP	.79	.88
More likely to get a bonus/raise	.85	.91
Accumulate compensated time	.69	.79
5. Selection for EBP		
Previously used EBP	.88	.94
Formal education supporting EBP	.86	.95
Value EBP	.87	.91
6. Selection for openness		

Adaptable	.99	.96
Flexible	.98	.98
Open to new practices	.92	.96

Note. All loadings significant at $p < 0.001$.

Table 3. Implementation Climate Scale Subscale Intercorrelation Matrix for California and Florida Samples

	1	2	3	4	5	6
1. Focus on EBP	--	.63*	.61*	.40*	.49*	.50*
2. Educational support for EBP	.82*	--	.67*	.56*	.59*	.45*
3. Recognition for EBP	.49*	.48*	--	.63*	.62*	.42*
4. Rewards for EBP	.41*	.46*	.63*	--	.76*	.44*
5. Selection for EBP	.53*	.51*	.65*	.63*	--	.56*
6. Selection for openness	.45*	.44*	.31*	.37*	.57*	--

Note. EBP = evidence-based practice, and * = $p < 0.01$. The California nurse sample is represented below the diagonal (n = 201 to 203), and the Florida nurse sample is above the diagonal (n = 270 to 295).