Staff, space, and time as dimensions of organizational slack: A psychometric assessment

Running head: A measure of organizational slack

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ETHICS APPROVAL

We submitted the study titled “Developing an understanding of organizational slack” (study ID: Pro00007067) to the Health Research Ethics Board (Health Panel) on 7 July 2009. The ethics approval is valid until 15 July 2010, but it has been already renewed on 31 May 2010. The ethics approval is valid until 14 July 2011 (Renewal ID: Pro00007067 REN1; study ID: MS1 Pro00007067).

ABSTRACT

Background: In the theoretical and research literature, organizational slack has been largely described in terms of financial resources and their impact on organizational outcomes. However, empirical research is limited by unclear definitions and lack of standardized measures.

Purpose: To assess the psychometric properties of a new organizational slack measure in healthcare settings.

Methods: Seven hundred and fifty two nurses and 197 allied healthcare professionals (AHCP) employed in seven pediatric Canadian hospitals completed the Alberta Context Tool, an instrument measuring organizational context which includes the newly developed organizational slack measure. The nine-item, five-point Likert organizational slack measure includes items assessing staff perceptions of available human resources (staffing), time and space. We report psychometric assessments, bivariate analyses, and data aggregation indices for the measure.

Findings: The findings indicate that the measure has three subscales (staff, space, time) with acceptable internal consistency reliability (alphas for staff, space, time: 0.828, 0.633, 0.737 for nurses; 0.811, 0.524, 0.765 for AHCP), links theory and hypotheses (construct validity); and is related to other relevant variables. Within-group reliability measures indicate stronger agreement among nurses than AHCP, more reliable aggregation results in all three subscales at the unit vs. facility level, and higher explained variance and validity of aggregated scores at the unit level.

Practice Implications: The proposed organizational slack measure assesses modifiable organizational factors in hospitals and has the potential to explain variance in important healthcare-system outcomes. Further assessments of the psychometric properties of the organizational slack measure in acute and long term care facilities are underway.

Keywords: organizational slack, staff, time, space, excess resources

Staff, space, and time as dimensions of organizational slack: A psychometric assessment

INTRODUCTION

Healthcare organizations are constantly challenged to balance operational efficiency with quality and safety, and to allocate resources to address threats or opportunities arising from complex care processes and evolving environments– both internal and external. The construct of organizational slack has received considerable attention in both the organizational and management literatures. Authors argue that organizational slack buffers the organization from environmental uncertainty, stabilizes organizational coalitions by smoothing variability in performance levels and provides resources for change (Cyert and March, 1963). In a review of organizational slack, Bourgeois (1981) explicitly define organizational slack as a…

> …*cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy, as well as initiate changes in strategy with respect to the external environment.*

This definition is an extension of Cyert and March's (1963) work where organizational slack was described as the difference between total resources and total necessary payments to members of a coalition in excess required to maintain the organization. Penrose (1959) offers a more knowledge based view of slack and suggests a firm's knowledge and experience trigger the rise of "excess" resources, which can be deployed to explore and exploit productive opportunities leading to the achievement of firm goals. Other researchers have explored perspectives of organizational slack such as unabsorbed, absorbed, and potential slack (Iyer and Miller, 2008; Singh, 1986; Tan and Peng, 2003). More recently, Greenhalgh and colleagues (2004)

conceptually defined organizational slack as "…spare time, money, or expertise that can be channeled into new projects" (p.5). Kerfoot (2006) described slack as "thinking time" that is important in the healthcare industry. In light of the increasing trend toward healthcare providers as knowledge workers (Clay-Williams and Braithwaite, 2009; Windsor, 2006) the latter is particularly important.

Organizational slack plays a crucial role in shaping organizational behavior and performance (Cyert and March, 1963; Daniel et al., 2004; Greve, 2003), including innovation (Chen and Miller, 2007; Nohria and Gulati, 1996) and risk taking behavior (Bromiley, 1991; Singh, 1986). Despite these reports in the organization and management literature, evidence for the influence of organizational slack in healthcare is limited. In one recent study (Valdmanis et al., 2008), organizational slack in healthcare was shown to account for differences in quality and efficiency across healthcare organizations. When organizational slack has been studied in the healthcare literature, it has tended to be measured as financial slack and has relied on administrative data using Data Envelopment Analysis (DEA) to compare excess inputs among hospitals. For instance, in their analysis of 1,377 hospitals in 34 states in the U.S., Valdmanis and her colleagues (2008) showed that the differences in care quality and operational efficiency can, in part, be attributed to differential slack which they measured mainly via staffing levels. Similarly, Miller and Adam (1996) included measures of labour, facility, and supplies as their inputs in determining slack using DEA analysis. However, since individual behavior in organizations is influenced by people's enactment and perception of internal and external environments (Cyert and March, 1963; Simon, 1957), relying solely upon financial and objective measures of organizational slack may overlook other important perspectives of organizational slack that affect individual behaviors and outcomes in organizations.

There is limited research on organizational slack reported in the healthcare literature and there is no measure that reflects the front-line provider's perspective. In this paper we describe a new measure for organizational slack in healthcare organizations and present its preliminary psychometric properties. The measure captures the perceptions of those working in organizations and is based on the widely held assumption that the concept is multi-dimensional (Bourgeois, 1981; Cyert and March, 1963). The measure includes three dimensions of organizational slack: human resources (staff), time resources, and space resources. Taking into consideration the Canadian context of government supported hospital care these dimensions of organizational slack may be more realistic measures than cost and profit. In addition, we address whether slack is best considered as a unit or facility level measure in order to conduct appropriate future analyses.

Since organizational slack functions as a facilitator of certain behaviors within organizations and shapes actions that influence outcomes, we test the above mentioned organizational slack dimensions in association with instrumental and conceptual research use. *Instrumental research use* is defined as "a concrete application of the research" in a usable form into practice such as guidelines, protocols, care plans or procedures (e.g., pain assessment scales, catheter care, skin/wound care, and so on) (Estabrooks, 1999a). *Conceptual research use* is the process of changing a practitioner's thinking (but not necessarily their observable practice) about research-based knowledge (Estabrooks, 1999a). We chose instrumental and conceptual research use because previous research has shown that resources are related to research use (Cummings et al., 2007; Estabrooks et al., 2008), which in turn influences patient outcomes. Our hypotheses were that adequate staff, more slack time and space (Estabrooks et al., 2007b; Meijers et al., 2006), and organizational (Estabrooks et al., 2008; Meijers et al., 2006) and individual

(Estabrooks et al., 2007; Estabrooks et al., 2008) characteristics would be closely associated with instrumental and conceptual research use.

METHODS

In this study we used data from a larger longitudinal study where an online survey was administered to a variety of healthcare providers in pediatric hospitals. This survey included the Alberta Context Tool (ACT), an instrument measuring organizational context (Estabrooks et al., 2009). The new organizational slack measure is embedded in the ACT. All participants were assigned a study code number to ensure confidentiality and the Health Research Ethics Boards at all participating research sites approved this research.

Data from medical, surgical, and critical care units in seven paediatric hospitals in six Canadian provinces were included in the analyses reported here. On each of these nursing units, five health professional groups (i.e., nurses, physicians, managers, allied health professionals, and clinical specialists such as clinical nurse specialists, nurse practitioners, educators) were invited to complete a study questionnaire. Data from the two largest groups, nurses (registered nurses and licensed practical nurses) and allied healthcare professionals (clinical pharmacists, respiratory therapists, occupational therapists and physiotherapists) were used to assess the psychometric properties of the newly developed measure of organizational slack. Seven hundred and sixty four nurses and 209 allied healthcare professionals completed the survey questionnaire in English (response rate 43.5% in both groups). After data cleaning, the final usable sample was 752 nurses and 194 allied healthcare professionals.

Instrument

The ACT was conceptualized and developed to assess modifiable attributes of

organizational context and is based on the *Promoting Action on Research Implementation in Health Services* (PARiHS) framework (Kitson et al., 1998; Kitson et al., 2008), as well as other related literature (Estabrooks et al., 2009). It consists of eight contextual dimensions: leadership, culture, evaluation, organizational slack, structural and electronic resources, information sharing interactions, information sharing activities, and information sharing social processes.

Organizational slack was measured using nine items (Appendix 1), each with a 5-point Likert response scale, to assess staff perceptions of three dimensions of organizational slack (staff, time and space) that were identified based on the extant literature.

We also included in our assessment several variables known to be associated with instrumental and conceptual research use, including (a) demographic characteristics (age, education, and experience); (b) individual characteristics (attitude toward research use, belief suspension, and personal way for solving problems); and (c) organizational attributes (leader who mentors and coaches, supportive team, feedback on team's performance, and support for innovation). *Attitude toward research use* refers to a healthcare professional's perception that research makes a positive difference to patient care and outcomes. *Belief suspension* refers to the ability to suspend strongly held beliefs in the face of best practice evidence. *Instrumental* and *conceptual research use* were scored on a 5-point Likert scale (1=use of research less than 10% of the time to 5=use of research almost 100% of the time) (Estabrooks, 1999b).

Data analysis

Preliminary psychometric analysis included the use of exploratory factor analysis (EFA) (Principal Component Analysis using orthogonal rotation) to assess whether our survey items measured one or multiple dimensions of organizational slack. We examined Cronbach's coefficient alpha and item-total correlations to assess scale reliability. We assessed construct/

criterion validity of the three slack subscales (staff, space, time) by exploring the associations between each of the slack subscales and instrumental and conceptual research use (outcome variables), as well as other demographic, individual and organizational variables related to instrumental and conceptual research use noted above. To examine the extent to which slack is a unit or organizational level measure, we computed standard aggregation statistics at both unit and facility levels to assess reliability and within-group agreement (homogeneity of responses) by calculating the intra-class correlations [i.e., ICC(1) and ICC(2)], eta-squared (η^2), and omega-squared (ω^2) separately for nurse and allied health professional groups. Data analyses (except aggregation) were performed using the Statistical Package for the Social Sciences for Windows (SPSS 16.0). Aggregation statistics were computed using SAS 9.2.

FINDINGS

The nurse sub-sample (n=752, 80% of total sample) was 95% female. The majority had a baccalaureate degree (66%) and, on average, had been in their current position for approximately 8 years. In the allied professional sub-sample (n=194), 89% were female; 82% had a baccalaureate degree and on average seven years in their present position. Means, standard deviations, scale alphas, and Pearson correlations of the variables included in the assessment in the nurse group are displayed in Table 1. Figure 1 displays mean scores of slack human resources (staff), space, and time by unit for the nurse group.

Item loadings for the EFA on the slack scores for nurses and allied groups are shown in Table 2. Loadings <0.30 have been suppressed. In both groups, the EFA specified three factors consistent with our hypotheses and the theoretical literature. Factor 1 has four items and reflects the *slack time* dimension. In the nurse group, loadings ranged from .616 to .810 (explained

variance: ~37%). The largest loading refers to “time to talk about new clinical knowledge”. In the allied group, loadings ranged from .642 to .806 (explained variance: ~36%). The largest loading refers to “time to look something up”. Factor 2 has three items and reflects the *slack space* dimension. In nurses, the loadings range from .674 to .828 (explained variance: ~15%). The largest loading was on the “private space” item. In the allied group, loadings ranged from .503 to .839 (explained variance: ~15%) and the largest loading also referred to “private space”. Factor 3 has two items and reflects the human resources (*staff*) dimension of slack. In nurses, the loadings ranged from .844 to .902 (explained variance: ~12%). The strongest loading was on the “enough staff to get work done” item. In the allied group, the loadings ranged from .820 to .824 (explained variance: ~14%). The strongest loading was on the “enough staff to deliver quality care” item. In the allied sample, the item “adequate space to provide care” had a significant cross loading on the space and staff factors.

In the nurse group, the Cronbach’s alpha coefficients for the three subscales were 0.828 for staff, 0.737 for time, and 0.633 for space (Table 2). In the allied group (data not shown), the Cronbach’s alphas for the three subscales were 0.811 for staff, 0.765 for time, and 0.524 for space (although the alpha rises to 0.66 with the exclusion of the use of designated space item). In both groups, the (corrected) item-total correlation (the Pearson correlation of the item with the total of scores on all other items) indicated that all items included in the time, space, human resource subscales should be retained. We retained the "private space" item, which had the lowest item-total correlation (.410 in nurses and .064 in allied – data not shown), since the loadings were significant.

Bivariate analyses

To assess construct validity we examined the associations between the slack subscales

and levels of instrumental and conceptual research use. Table 3 shows that increasing levels of instrumental and conceptual research use were associated with a trend of increasingly positive and statistically significant correlations with each of the selected variables and the three slack subscales. With the exception of staff and instrumental research use, the bivariate relationships (Pearson's and Spearman's correlation coefficients) between the slack subscales and instrumental and conceptual research use were statistically significant.

Aggregation

Nurse and allied staff data were aggregated to both the unit and facility levels. One-way analysis of variance (ANOVA) was used to calculate the following complementary measures of within-group agreement (see Table 4): ICC(1) = [BMS – WMS] / [BMS + (k – 1) WMS], where BMS (Between-Mean-Square) is the variability between groups (e.g., facility, unit); WMS (Within-Mean-Square) is the variability within group; and k is the number of individuals per group (Forbes and Lee Taunton, 1994). ICC(1), an estimate of individual score variability about the group mean that can be interpreted as the proportion of total variance explained by group membership, ranges from -1 to +1; the higher ICC(1), the stronger perceptual agreement among individual responses within a group at a given level. However, the acceptable levels are between 0.05 – 0.30 (Vogus and Sutcliffe, 2007). For nurses, ICC(1) at the unit level for all three slack subscales were within the acceptable range providing evidence of homogeneity within unit. At the facility level, the ICC(1) values were not as strong as at unit level (e.g., time subscale was 0.02). Similarly, for the allied group, the ICC(1) values were stronger at the unit level than at the facility level except the time subscale values, which were at or below typical cutoffs at both levels (results not shown). ICC(2) = [BMS – WMS] / [BMS], an overall estimate of the reliability of group means, provides an index of mean rater reliability of the aggregated data. It

can be interpreted as the extent to which similar mean scores would be obtained if subsequent samples of respondents were drawn repeatedly from the same group. The closer ICC(2) to 1.00, the more reliably nursing units can be distinguished based on each nurse's perceptions on slack subscales. Acceptable values equal to or above 0.60 (James et al., 1984). For nurses, ICC(2) values were equally strong at the unit and facility levels (> 0.71 for slack subscales). For the allied group, ICC(2) were stronger at the facility level than at the unit level. Eta-squared (η^2) = SSB/SST, where SSB (between-sum of square) is the variability between groups and SST (total sum of square) the total variability. It ranges between 0 and 1 and is interpreted as R^2 in regression model. For both groups (nurse and allied), η^2 suggested greater agreement at the unit level, that is, the proportions of variance in each individual explained by group membership (Rosenthal and Rosnow, 1991). Omega squared (ω^2) = [SSB – (N – 1) WMS] / [SST + WMS] ranges between 0 and 1. Usually, $\omega^2 < 0.06$ means small effect, $0.06 \leq \omega^2 \leq 0.15$ medium effect, and $\omega^2 \geq 0.15$ large effect. For both groups (nurse and allied), ω^2 values showed greater internal consistency of each of the three slack subscales at the unit level than at the facility level. Both η^2 and ω^2 measure the relative strength of aggregated score at group level (Keppel, 1991).

DISCUSSION

The psychometric properties of the proposed measure of organizational slack scale are encouraging. The three organizational slack dimensions (staff, space, time) explained in total 64% of the variance in organizational slack in the nurse group and more than 65% in the allied health professional group. The high factor loadings indicate that the items are representative of the underlying factors we identified based on the theoretical literature. Factor 1 (slack time) clearly meets the criteria for a reliable factor outlined by Gaudagnoli and Velicer (1988) (with

four or more loadings above 0.60). The alphas for each of the three dimensions approach or exceed 0.70 – the level recommended for early stage research (Nunnally, 1978). Our data demonstrate variability in all three organizational slack dimensions across the nursing units we studied. In addition, our results indicate that slack resources can be treated as both unit and facility-level constructs. Given that units are nested in organizations, future research might examine the influence of organizational slack on unit-level slack in healthcare organizations. Based on the bivariate analyses, statistically significant relationships exist between varying levels of the instrumental and conceptual research use and slack subscales. This paper also contributes to evidence on the determinants of research use in organizations.

The magnitudes of the loadings on the staff and space factors are promising and these factors could be strengthened in future research with the inclusion of additional items to measure these dimensions of slack. However, the presence of a significant cross loading for one of the space items and the low alpha in the allied health professional group raises questions about the applicability of this dimension to providers who work across multiple patient care units and suggests examination of how these groups interpret space as a resource in their practice settings. Also, the fact that a statistically significant relationship was not present between human resources dimension of organizational slack and instrumental research use, which we cannot explain adequately, but will explore as additional data become available.

Practice Implications

There are at least three key practice implications for administrators and managers in healthcare organizations based on the findings of this study:

1. The construct of organizational slack is multi-dimensional. That is, not only financial resources are important for effectiveness in the healthcare sector, but are also other types of

resources necessary and sufficient for better outcomes. All three organizational slack resources should be adequate at both unit and facility-level. So, managers should ensure that each level of patient care unit needs adequate resources for efficiency, effectiveness, productivity, and excellence in healthcare organizations.

2. Organizational slack may influence patient care quality, safety, efficiency, and other outcomes in healthcare organizations, if it provides a cushion for organizations to adapt to their environments as suggested in the theoretical literature. Preliminary results of a theoretical model proposed by two of the authors (Chuang et al., 2007) indicate that organizational slack staff and slack time (using the same measure reported here) are important explanatory variables for another important organizational behavior – learning from patient safety failure events. Hence, managers and administrators should take seriously into consideration organizational slack resources as an important factor for achieving goals and desired outcomes for both patients and healthcare providers.

3. There is evidence that organizational characteristics (i.e., slack resources) influence research use. It is important for decision-makers, administrators, and researchers to recognize and understand the factors that influence research uptake in their organizations as it is widely held to be one contributor to quality care and better outcomes. Historically, organizational size has been associated with an organization's capacity to adopt innovations (Damanpour, 1987; Kimberley and Evanisko, 1981). It has also been identified as a proxy determinant of other factors such as slack resources (Greenhalgh et al., 2004) however, there is relatively little empirical evidence relating to an optimal level of resources required to facilitate research use (Buchanan et al., 2005). Our findings suggest that organizational slack resources in hospitals may be associated with the use of research. Managers and frontline healthcare

professionals may benefit from having extra time and space available in order to “get off the treadmill” and develop innovative ideas. Overall, our findings suggest that the organizational slack measure is linked to theoretical positions in the literature and to other variables including instrumental and conceptual research use – suggesting early evidence of construct validity.

Limitations

These findings should be interpreted with caution considering the study limitations. In the reported study we used a sample of nurses and allied healthcare professionals in pediatric acute care settings in one country and additional research will be required to examine whether the proposed dimensions of slack hold in different professional and managerial groups and in different care settings. The proposed measure will benefit from additional approaches to construct validation. The measure would likely be strengthened by the inclusion of additional items to measure the staff and space dimensions of slack. Following this, a full cross validation study, using confirmatory factor analysis would be useful. Finally, once the psychometric properties of the measure are more firmly established, additional research on the influence of slack on important healthcare processes and outcomes would enhance our knowledge.

CONCLUSION

The proposed organizational slack measure addresses modifiable features of the environment and has the potential to explain variance in important healthcare system processes and outcomes. While assessment of the organizational slack measure’s psychometric properties is ongoing in acute and long term care settings, this study provides needed empirical support and preliminary validation for the theoretical dimensions of organizational slack in healthcare.

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Figure 1. Distribution of mean slack scores (staff, space, and time) by unit - Nurses

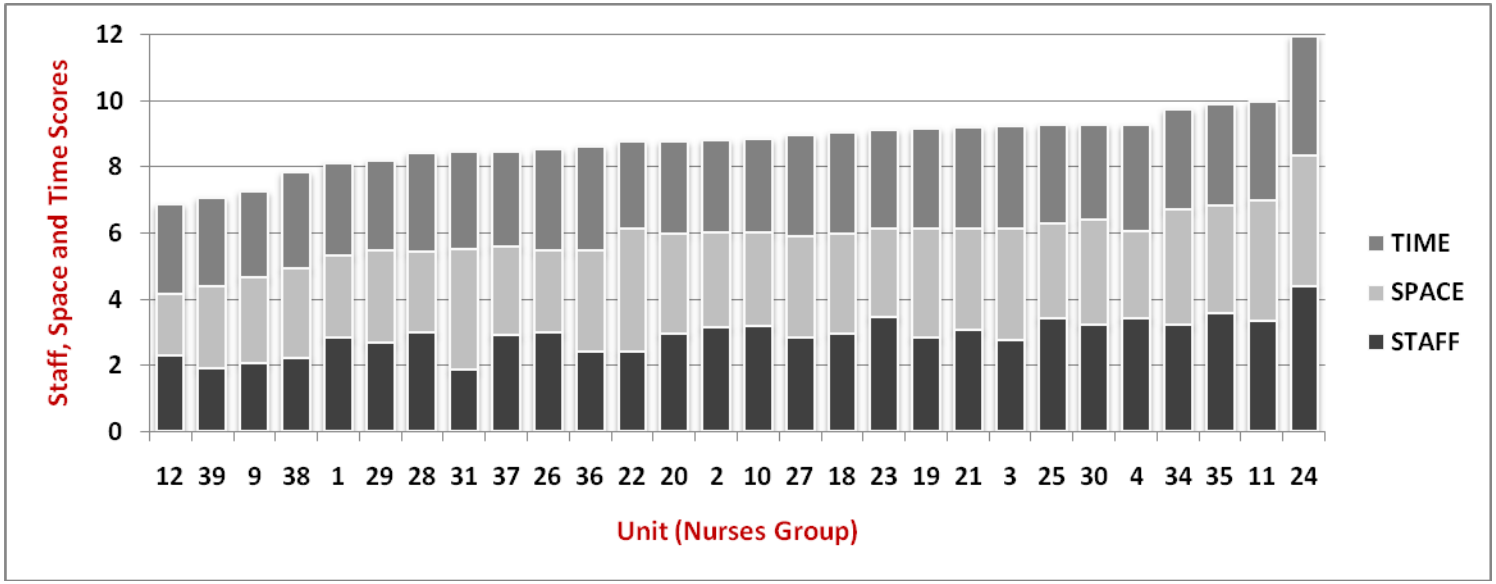

Table 1. Instrumental and conceptual research use means, standard deviations, scale alphas, and Pearson correlations - Nurses

	Variable	Mean	SD	Scale Alpha	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	**Instrumental research use (IRU)**	3.47	1.21	***	1.000												
2.	**Experience on unit**	7.67	7.44	***	-.153**	1.000											-.071
3.	**Leader mentors & coaches**	3.31	1.03	***	.038	-.089*	1.000										.034
4.	**Supportive team**	3.92	.82	***	.152**	-.113**	.317**	1.000									.071
5.	**Feedback on performance**	3.18	1.02	***	.125**	.010	.156**	.105**	1.000								.081*
6.	**Attitude toward research** (6 items)	4.16	.49	.804	.293**	-.152**	-.020	.095**	.021	1.000							.260**
7.	**Belief suspension** (3 items)	3.51	.82	.819	.179**	-.062	-.065	.010	.032	.331**	1.000						.199**
8.	**Problem solving** (10 items)	3.81	.33	.684	.183**	.075*	.023	.014	.038	.264**	.193**	1.000					.222**
9.	**Support for innovation**	3.28	.84	***	.182**	-.024	.348**	.341**	.221**	.115**	.053	.080*	1.000				.092*
10.	**Slack human resources (staff)** (2 items)	2.92	1.03	.828	.037	-.052	.153**	.305**	.051	.069	.009	.053	.271**	1.000			.124**
11.	**Slack space** (3 items)	2.94	.88	.633	.158**	.000	.197**	.190**	.139**	.096**	.003	.023	.328**	.283**	1.000		.118**
12.	**Slack time** (4 items)	2.93	.55	.737	.156**	-.009	.202**	.242**	.148**	.144**	.114**	.087*	.305**	.455**	.332**	1.000	.184**
13.	**Conceptual research use (CRU)**	3.51	1.19	***													1.000

*Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).
*** A single-item variable

Table 2. Exploratory factor analysis (EFA)

Health group	Items	Component			% Explained Variance (Cumulative)
		1	2	3	
Nurses	Time to talk about new clinical knowledge	**.810**			37.10 (37.10)
	Time to look something up	**.766**			
	Time to talk about plan of care	**.655**			
	Time to do something extra for patients	**.616**		.354	
	Private space		**.828**		14.88 (51.98)
	Adequate space to provide care		**.712**		
	Use of designated space		**.674**		
	Enough staff to get work done			**.902**	12.10 (64.09)
	Enough staff to deliver quality care	.308		**.844**	
Allied	Time to look something up	**.806**			36.33 (36.33)
	Time to talk about new clinical knowledge	**.800**			
	Time to do something extra for patients	**.719**			
	Time to talk about plan of care	**.642**			
	Private space		**.839**		14.99 (51.32)
	Use of designated space		**.685**		
	Adequate space to provide care		**.503**	.672	
	Enough staff to deliver quality care			**.824**	14.05 (65.37)
	Enough staff to get work done			**.820**	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Table 3. Correlation of slack subscales & other variables by increasing levels of IRU & CRU - Nurses

	Bivariate correlation with		Mean value (relative ∇ %) of slack subscales and other variables by increasing levels of IRU & CRU						P-value for mean differences
			1[5]	2	3	4	5[6]	Total[†]	
Experience on unit	**IRU**	-0.181**[1] -0.153**[2]	10.55 (37.6)	8.65 (12.8)	8.33 (8.70)	6.58 (-14.2)	6.80 (-11.3)	7.67	0.000[3] (0.000[4])**
	CRU	-0.089* -0.071	9.57 (24.68)	8.26 (7.78)	7.61 (-0.72)	7.39 (-3.56)	7.41 (-3.41)		0.297 (0.082)
Leader mentors & coaches	**IRU**	0.036 0.038	3.15 (-4.68)	3.32 (0.38)	3.33 (0.69)	3.28 (-0.76)	3.38 (2.13)	3.31	0.664 (0.642)
	CRU	0.049 0.034	3.41 (3.04)	3.18 (-3.95)	3.22 (-2.63)	3.32 (0.28)	3.39 (2.49)		0.401 (0.368)
Supportive team	**IRU**	0.135** 0.152**	3.64 (-7.17)	3.87 (-1.26)	3.84 (-1.93)	3.94 (0.51)	4.12 (5.26)	3.92	0.001 (0.004)**
	CRU	0.082* 0.071	3.85 (-1.78)	3.80 (-2.88)	3.88 (-0.85)	3.94 (0.45)	4.00 (2.11)		0.390 (0.229)
Feedback on performance	**IRU**	0.116** 0.125**	2.83 (-10.82)	3.02 (-4.88)	3.27 (2.79)	3.15 (-0.90)	3.37 (6.08)	3.18	0.002 (0.002)**
	CRU	0.065 0.081*	2.88 (-9.31)	3.05 (-3.86)	3.21 (0.97)	3.25 (2.44)	3.19 (0.44)		0.095 (0.095)
Attitude toward research	**IRU**	0.303** 0.293**	3.87 (-6.92)	4.04 (-3.01)	4.13 (-0.88)	4.18 (0.32)	4.41 (5.99)	4.16	0.000 (0.000)**
	CRU	0.249** 0.260**	3.85 (-7.42)	4.06 (-2.36)	4.15 (-0.40)	4.20 (0.86)	4.35 (4.40)		0.000 (0.000)**
Belief suspension	**IRU**	0.185** 0.179**	3.12 (-11.13)	3.40 (-3.16)	3.54 (0.88)	3.50 (-0.28)	3.74 (6.57)	3.51	0.000 (0.000)**
	CRU	0.202** 0.199**	3.09 (-11.87)	3.47 (-0.91)	3.41 (-2.79)	3.52 (0.49)	3.78 (7.90)		0.000 (0.000)**
Problem solving	**IRU**	0.151** 0.183**	3.70 (-3.02)	3.74 (-2.06)	3.81 (-0.15)	3.82 (0.03)	3.92 (2.64)	3.82	0.000 (0.001)**
	CRU	0.206** 0.222**	3.67 (-3.82)	3.76 (-1.37)	3.77 (-1.22)	3.82 (0.11)	3.95 (3.43)		0.000 (0.000)**
Support for innovation	**IRU**	0.183** 0.182**	2.94 (-10.41)	3.14 (-4.21)	3.24 (-1.23)	3.28 (-0.11)	3.53 (7.67)	3.28	0.000 (0.000)**
	CRU	0.102** 0.092*	3.29 (0.22)	3.04 (-7.24)	3.23 (-1.68)	3.37 (2.84)	3.36 (2.50)		0.014 (0.015)*
Slack human resources (staff)	**IRU**	0.023 0.037	2.76 (-5.50)	2.84 (-2.84)	2.94 (0.74)	3.02 (3.48)	2.85 (-2.31)	2.92	0.251 (0.289)
	CRU	0.103** 0.124**	2.58 (-11.42)	2.66 (-8.86)	2.95 (0.93)	3.04 (4.12)	2.97 (1.83)		0.003 (0.006)**
Slack space	**IRU**	0.149** 0.158**	2.63 (-10.70)	2.84 (-3.47)	2.91 (-1.19)	2.95 (0.42)	3.17 (7.68)	2.94	0.000 (0.001)**
	CRU	0.121** 0.118**	2.72 (-7.60)	2.92 (-0.82)	2.82 (-4.25)	3.01 (2.23)	3.09 (5.04)		0.012 (0.011)**
Slack time	**IRU**	0.137** 0.156**	2.68 (-8.75)	2.90 (-1.06)	2.91 (-0.80)	2.96 (1.03)	3.04 (3.44)	2.93	0.000 (0.001)**
	CRU	0.169** 0.184**	2.73 (-7.02)	2.81 (-4.17)	2.90 (-1.24)	2.97 (1.22)	3.08 (4.82)		0.000 (0.000)**

[1] Spearman's rho correlation coefficients
[2] Pearson's correlation coefficients
[3] P-value for ANOVA
[4] P-value for Kruskal-Wallis test
[5] use of research less than 10% of the time
[6] use of research almost 100% of the time

IRU: instrumental research use
CRU: Conceptual research use
* indicate significance at 0.05 levels
** indicate significance at 0.01 levels
∇%: % of difference with respect to the total sample average
[†]Total sample average

Appendix 1

1. Human resources (staff). Two 5-point Likert agreement scale from 1 (strongly disagree) to 5 (strongly agree):
    a. On my unit, we have enough staff to get the *necessary w*ork done.
    b. On my unit, we have enough staff to deliver *quality* care.
2. Space resources. Three 5-point Likert agreement scale from 1 (strongly disagree) to 5 (strongly agree) and one 5-point Likert frequency scale from 1 (never) to 5 (almost always):
    a. On my unit we have adequate *space* to provide patient care.
    b. On my unit we have "*private space*" to discuss confidential information about a patient/patient care.
    c. How often do you use this designated space to discuss care plans or new clinical knowledge?
3. Time resources. Four 5-point Likert frequency scale from 1 (never) to 5 (almost always):
    a. How often do you have time to do something extra for patients?
    b. How often do you have time to talk to someone about the plan of care for the patient?
    c. How often do you have time to look something up (e.g., in a journal, a book or on the internet)?
    d. How often do you have time to talk to someone about new clinical knowledge?