Résumé

La mise en œuvre d'une intervention multiple à deux volets, pratiquée dans un service : passer de la pratique fondée sur des données probantes à l'action

Judy Rashotte, Margot Thomas, Diane Grégoire et Sheila Ledoux

Les auteures de cette étude ont examiné l'incidence d'une intervention multiple à deux volets, pratiquée dans un service, sur l'utilisation par les infirmières en soins intensifs pédiatriques de lignes directrices pour de meilleures pratiques de prévention des plaies de lit. Au total, 23 infirmier(ère)s ont participé à un plan à mesures répétées, appliqué avant et après une intervention, afin de répondre à deux questions : *Y a-t-il une différence entre les pratiques des infirmier(ère)s fondées sur des données probantes après la mise en œuvre d'une intervention instructive uniquement et celles fondées sur des données probantes après la mise en œuvre d'une intervention instructive* et *d'une intervention innovatrice? Les changements sont-ils maintenus six mois après la fin de l'intervention?* Un changement important est survenu après la mise en œuvre de 2 des 11 pratiques recommandées suivant les deux interventions : l'évaluation du risque de plaies de lit à l'aide d'un outil adapté à l'âge ($p \leq 0{,}001$) et la documentation de la même pratique ($p \leq 0{,}001$). Ces changements peuvent avoir été maintenus. Ces résultats mettent en lumière les vrais défis posés par la tentative de mettre en œuvre et d'évaluer des stratégies multiples de traduction des connaissances, associées à des lignes directrices complexes pour de meilleures pratiques dans une pratique clinique.

Mots clés : lignes directrices pour de meilleures pratiques, soins intensifs, traduction des connaissances

CJNR 2008, Vol. 40 N° 2, 94–114

Implementation of a Two-Part Unit-Based Multiple Intervention: Moving Evidence-Based Practice into Action

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This study examined the impact of a 2-part unit-based multiple intervention on the use by pediatric critical care nurses of best practice guidelines for pressure-ulcer prevention. A total of 23 nurses participated in a repeated-measures design pre- and post-intervention to address 2 questions: *Is there a difference in nurses' evidence-based practices following implementation of an educational intervention only versus implementation of both an educational and an innovative intervention? Are the changes sustained 6 months after completion of the intervention?* A significant change occurred in the implementation of 2 of 11 recommended practices following both interventions: assessment of risk of pressure ulcers using an age-appropriate tool ($p \leq 0.001$), and the documentation of same ($p \leq 0.001$). These changes may have been sustained. The findings bring to light the real challenges encountered when attempting to implement and evaluate multiple knowledge translation strategies associated with complex best practice guidelines in clinical practice.

Keywords: research utilization, evidence-based practice, best practice guidelines, pressure-ulcer prevention, critical care, knowledge translation, knowledge-to-action

Introduction

A current focus in health care is the movement of research and/or best evidence into clinical practice. Despite the considerable effort expended in the research and practice arenas, this movement has been demonstrated to be slow, unpredictable, inefficient, and ineffective (Agency for Health Research and Quality, 2001). This evidence, combined with the fact that patients are consequently at risk for harmful outcomes, has fuelled interest in finding ways to minimize what Graham et al. (2006) call the knowledge-to-action (KTA) gap.

Best practice guidelines (BPG) have been identified as a promising tool for translating best-quality research findings into accessible nursing practice recommendations (Ciliska, Pinelli, DiCenso, & Cullum, 2001). However, the effectiveness of BPGs in changing nurses' practices and the measures to promote their use have not been fully explored. The purpose of this article is to report the findings of a study examining the impact of

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a two-part unit-based, multiple-intervention KTA program on pediatric intensive-care (PICU) nurses' use of a BPG for pressure-ulcer prevention. The Registered Nurses Association of Ontario (RNAO, 2002) BPG for pressure-ulcer prevention[1] was selected as the clinical focus in this study, for two reasons: (1) nurses were able to implement the interventions independent of medical orders, and (2) pressure ulcers are a patient problem that presents in PICU (Cockett, 2002).

One Canadian study found the prevalence of pressure ulcers (stages I through IV) to be 13.1% for pediatric patients, with over 75% of those ulcers assessed as stage I (Groeneveld et al., 2004). Pediatric intensive-care nurses can contribute to the prevention and early treatment of pressure ulcers by identifying patients at risk and implementing prevention strategies (Rycroft-Malone & McInnes, 2004).

Background

A large body of research has focused on exploring the KTA gap in clinical practice. Personal factors identified as influencing nurses' use of research in their clinical decisions include age, gender, and education; values and beliefs regarding evidence-based practice (EBP), change, and accountability; time spent on the Internet; level of emotional exhaustion; and the ability to understand research (Estabrooks, Floyd, Scott-Findlay, O'Leary, & Gushta, 2003; Estabrooks, Midodzi, Cummings, & Wallin, 2007; McCaughan, Thompson, Cullum, Sheldon, & Thompson, 2002). However, in their systematic review of the individual determinants of research use, Estabrooks et al. (2003) suggest that placing responsibility for research use only on the individual is misguided, as some practitioner characteristics, such as age and gender, are unchangeable.

Organizational context (e.g., culture, leadership, and evaluation) has been consistently identified as influential in research use (Gifford, Davies, Edwards, & Graham, 2006; Pepler et al., 2005). However, a systematic review of organizational infrastructure to promote EBP by the Cochrane Effective Practice and Organization of Care Group (Foxcroft & Cole, 2000) found no strong evidence to suggest that any one type of organizational infrastructural intervention is effective in addressing barriers and promoting KTA. Staff development, opportunity for nurse-to-nurse collaboration, and staffing and support services are hospital characteristics that positively influence research utilization (Cummings, Estabrooks, Midodzi, Wallin, & Hayduk, 2007). The availability of user-friendly and accessible resources, team work and collaboration, and BPG unit

[1] Although the RNAO BPG for pressure-ulcer prevention is not intended specifically for children, it has been suggested that measures identified in the adult literature are applicable to pediatric settings (Stewart & Box-Panksepp, 2004).

champions are factors that promote KTA at the unit level (Ploeg, Davies, Edwards, Gifford, & Elliott-Miller, 2007; Titler & Everett, 2001). On the other hand, it has been noted that nurses may choose not to implement BPGs for reasons such as unit norms, colleague expectations, clinical expertise, and experience in similar situations (Greenwood, Sullivan, Spence, & McDonald, 2000).

Passive single KTA strategies (e.g., educational interventions, reminders) are generally held to have limited success (Clarke et al., 2005), while multidimensional KTA interventions, such as written materials, educational meetings, clinical reminders, and coaching, are considered superior (Grimshaw et al., 2001). However, Grimshaw et al.'s (2004) follow-up review challenges these conclusions, finding multifaceted interventions to be no more effective than single ones and educational interventions to have a short-lived, modest effect on guideline implementation. Active educational strategies (e.g., educational meetings with discussions) were found to be more effective than passive dissemination of educational material. Despite these findings, the authors suggest that "multifaceted interventions built upon a careful assessment of barriers and coherent theoretical based may be more effective than single interventions" (Grimshaw et al., 2004, p. 65).

Research reveals that the KTA process is a complex, poorly understood, messy phenomenon (Kitson, Harvey, & McCormack, 1998), with no definitive prescriptive KTA interventions likely to result in nurses' use of BPGs. As a result, a number of conceptual frameworks concerned with EBP implementation have emerged to provide direction to change agents as to the issues that should be addressed and the activities that should be undertaken or to generate research questions that can be examined more systematically (Kitson et al., 1998). Several frameworks, such as the Ottawa Model of Research Use (Logan & Graham, 1998), Promoting Action on Clinical Effectiveness (Dopson, Locock, Chambers, & Gabbay, 2001), and Promoting Action on Research Implementation in Health Services (Rycroft-Malone et al., 2002), emphasize the interplay and interdependence of many factors and suggest that strategies for promoting KTA need to be multifaceted and targeted at specific cultural groups in the organization (Thompson & Learmonth, 2003).

We chose the Ottawa Model of Research Use (Logan & Graham, 1998) as an organizing framework for our study, as well as drawing on other theories relevant to KTA. The OMRU's elements include practice environment, potential adopters, evidence-based innovation, transfer strategies, adoption, and outcomes. To better elucidate the practice environment, we drew on Wenger's (1998) Communities of Practice Theory. This social learning theory guided the development of a questionnaire to examine the environmental factors that influence nurses' use or non-use

of a BPG. In addition, Wenger's social perspectives on learning principles, as elucidated in the theory, guided the development and delivery of the educational component of the intervention. These perspectives were congruent with the context of education and professional development within our PICU. Finally, we used the Socioecological Model (Stokols, 1992) and the Multiple Intervention Framework (Edwards, Mills, & Kothari, 2004) to inform the development of the interventional program. These models helped us to identify opportunities for integrated action across several levels of aggregation, such as individual, team, unit, organization, and profession, and provided direction for specific transfer strategies.

Purpose

The purpose of the study was to examine the impact of implementing a two-part unit-based multiple intervention called Pressure Ulcer Prevention Program in the PICU (PUPP). The study was guided by two questions: *Is there a difference in nurses' use of evidence-based pressure-ulcer prevention in the PICU following implementation of only part I of the intervention (educational component) versus parts I and II (innovative components)? Is any change in nurses' evidence-based pressure-ulcer prevention practices in the PICU sustained 6 months after completion of the PUPP?*

Intervention

Table 1 outlines the PUPP intervention program. Part I, targeted at the individual level, was a traditional educational component, consisting of both independent learning activities and a group learning session. The content delivery method was based on nurses' feedback from previous educational activities in our unit. Part II was designed to incorporate local and organizational strategies. At the local level, the unit-based champion promoted discussion of pressure-ulcer prevention during shift reports and daily clinical rounds and engaged in daily one-on-one coaching at the bedside. The hospital's Wound and Skin Care Specialist increased her visibility and accessibility by attending PICU clinical rounds once weekly. Each nurse received laminated pocket guides of the RNAO BPG interventions and the Braden (Braden & Bergstrom, 1988) and Braden Q skin assessment tools (Quigley & Curley, 1996). A decision-making algorithm identifying the appropriate interventions in response to the assessment of risk for pressure-ulcer formation was developed in consultation with the Wound and Skin Care Specialist and made available at each bedside. The PICU documentation record was revised to include the skin-assessment score. At the organizational level, standards of nursing care outlining EBP for prevention of pressure ulcers in critically ill children were developed and introduced on the unit.

Table 1 ***PUPP Intervention and Data-Collection Framework***

Time	Intervention and Data-Collection Activity
T1 (baseline)	• Collection of demographic data and baseline measures (self-reported and audited use of EBP) • Distribution to all eligible RNs
Part I (educational component) x 1 month ✓ independent learning activities (weekly article dissemination x 4, poster displays, FAQ sheet) ✓ group learning (standardized 1-hour didactic teaching session to all PICU staff)	
T2 (immediately after part I)	• Repeated measures (self-reported and audited use of BPG) • Distribution to all RNs who completed T1 questionnaire
Part II (innovative component) x 1 month ✓ unit-based champion (PICU Advanced Practice Nurse) ✓ hospital-based champion (Wound and Skin Care Specialist) ✓ introduction of practice tools and resources ✓ introduction of PICU standards of nursing care related to pressure-ulcer prevention	
T3 (immediately after part II)	• Repeated measures (self-reported and audited use of BPG) • Distribution to all RNs who completed T2 questionnaire
T4 (6 months after T3)	• Repeated measures (self-reported and audited use of BPG) • Distribution to all RNs who completed T3 questionnaire

Method

Design

Ethical approval for the study was obtained from the hospital's Research Ethics Board. This exploratory study used a quantitative, repeated-measures design.

Sample

All 48 full-time and part-time RN staff (excluding nurses on orientation and those scheduled to leave or retire from the PICU within 6 months of the study's launch) of a 10-bed quaternary Canadian PICU were invited to participate in the study. Nurses who declined to participate, as demonstrated by failure to return the time 1 (T1) questionnaire, received the educational program.

Figure 1 ***PUP Questionnaire***

Nursing intervention	**IF IMPLEMENTED** fill in the circle for the following statements that indicates your reason(s) for implementing this intervention. If none of these reasons apply, feel free to write in your explanation.	**IF NOT IMPLEMENTED** fill in the circle for the following statements that indicates your reason(s) for not implementing this intervention. If none of these reasons apply, feel free to write in your explanation.
Assessment of risk of pressure ulcers completed using assessment tool ❑ **YES** ❑ **NO**	❑ BPG ❑ Suggestion in an article I have read ❑ Suggestion by nursing colleague ❑ Requested by family member ❑ Requested by other member of health care team ❑ Usual practice (tradition) ❑ Kardex / Care Plan notation / directive ❑ Physician order ❑ Unit expectation **Other:**	❑ Lack of knowledge regarding indications ❑ Lack of technical skill or training ❑ Requested by member of health care team ❑ Requested by family member ❑ Usual practice (tradition) ❑ Physician order ❑ Unit expectation ❑ Patient too unstable ❑ Inadequate resources (e.g. people, resources) ❑ Inadequate time **Other:**

Note: Four times throughout the study, participants indicated which of the 11 BPGs they had implemented during their most recent clinical experience of a child at risk for pressure ulcer.

Table 2 *Self-Reported Use of BPG Interventions*

Intervention	T1–T2	T1–T3	T1–T4	T2–T3	T2–T4	T3–T4
1. Risk assessment using assessment tool	0.003	< 0.001*	0.003	0.070	0.687	0.625
2. Risk assessment using risk-assessment tool completed	0.031	< 0.001*	0.002	0.003	0.180	0.125
3. Risk, including risk-assessment score, discussed during rounds	0.500	0.250	0.250	0.625	0.625	1.000
4. Nutritional assessment considering risk for pressure ulcers completed	0.008	0.125	0.219	0.625	1.000	1.000
5. Consultation with dietitian related to nutritional needs initiated	1.000	1.000	0.453	1.000	0.453	0.375
6. Pressure-reducing or pressure-relieving support surface used	0.625	1.000	0.625	0.625	1.000	1.000
7. Lifting device used for patients too heavy to lift off mattress	1.000	0.625	0.289	0.375	1.000	0.125
8. Head of bed elevated to less than 30 degrees	0.039	0.388	0.344	0.453	0.250	1.000
9. Q2 hourly turning schedule implemented	0.508	0.125	0.289	0.687	1.000	1.000
10. Head repositioned side to back to side Q2 hourly	0.727	1.000	1.000	1.000	1.000	1.000
11. Protective skin barrier applied over bony prominences if voluntary or involuntary movements lead to friction injury	0.031	0.065	0.375	0.687	1.000	1.000

Note: Responses are based on participants' most recent clinical experience of a child at risk for pressure ulcer.
* Significant after Bonferonni adjustment for multiple testing.

Measurement Tools and Data Collection

Data on the use of the RNAO (2002) BPG on pressure-ulcer prevention were collected using an RN self-report questionnaire developed by the research team (see Figure 1 for the questionnaire format and Table 2 for a list of the RNAO's BPG nursing interventions). The Pressure Ulcer Prevention Questionnaire (PUP) was pretested for content, readability, and usability by three PICU nurses ineligible to participate in the study. It took 5 to 10 minutes to complete. Following a description of the study at two staff meetings and multiple walk-about, coffee-cart inservices on the unit, the nurses were invited via letter to complete the questionnaire either during their work hours (with the support of management) or after their shift. The questionnaire had an identifying code, known only to the research assistant, to enable matching of responses pre- and post-intervention. The Dillman (2000) method was used to enhance the return rate at four time points.

A research nurse collected daily weekday data on all patients in the PICU for 1 month at four times (T1, T2, T3, T4) using an audit tool developed by the research team (Table 3) based on the BPG. Frequency of use of the BPG interventions, as documented in the patients' clinical records or as observed at their bedside, was noted. Data were not collected in relation to the specific participants in the study; rather, overall BPG intervention use by the unit nurses was noted. Reliability of the audited data was determined during each time period via an independent check by the principal investigator of a random selection of 10% of the patients. The data for item 1 on the audit tool were provided by the PICU unit champion, who performed a risk assessment for pressure-ulcer development on all PICU patients. Table 1 shows the data-collection framework. Timing addressed the inherent risk of carryover effects that can occur with multiple-intervention and time-series studies and for the examination of sustainability of change.

Data Analysis

Descriptive statistics (i.e., percentages, means, standard deviations, medians, ranges) were used to summarize participants' baseline characteristics. The McNemar test was used to test the difference in nursing-intervention decisions (implemented/not implemented) between T1 and T2, T2 and T3, and T1 and T3. This same test was used to compare the nursing-intervention decisions (implemented/not implemented) between T3 and T4 and between T1 and T4 to determine whether the changes in nurses' use of BPG interventions were sustained 6 months later. In order to address multiple testing issues, results were compared with an alpha value of

Table 3 ***Audited Use of BPG Interventions***

Intervention	T1	T2	T3	T4
Number of patients at risk for pressure ulcer as assessed by Advanced Practice Nurse, mean *(sd)*	5.6 (1.5)	4.8 (1.6)	4.1 (1.7)	4.7 (1.8)
Number of risk assessments evident in nursing documentation	0 (0.0)	0 (0.1)	1 (0.5)	0 (0.2)
Number of evidence-based nursing practices documented	0 (0.1)	2 (0.5)	3.5 (1.6)	3 (1.6)
Number of dietitian consultations completed	0 (0.1)	0 (0.0)	0 (0.0)	0 (0.1)
Number of nutritional assessments completed	0 (0.0)	0 (0.0)	2 (1.6)	4 (2.7)
Number of pressure-relieving surfaces in use	4 (1.5)	2 (0.4)	1.5 (0.4)	2 (0.3)
Number of lifting devices in use for patients > 20kg	0 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Number of patient turning/repositioning schedules documented per chart or Kardex	0 (0.0)	0 (0.0)	3 (1.6)	3 (1.6)
Number of transparent dressings, liquid films, and elbow/heel protectors used to prevent friction injury	0 (0.1)	1 (0.3)	1 (0.3)	1 (0.3)
Number of patients with head and bed elevated to < 30°	5 (2.7)	4 (1.7)	4 (1.8)	4 (2.6)
Number of consultations with skin-care expert	0 (0.1)	1 (0.1)	1 (0.1)	0 (0.2)

* Unless otherwise indicated, data are presented with median and range.

0.0008 (rounded to 0.001), which corresponds to an alpha value of 0.05 adjusted for 66 tests using the Boneferonni criterion (i.e., 11 self-reported BPG practices compared between T1 and T2, T2 and T3, T1 and T3, T1 and T4, T2 and T4, and T3 and T4). Descriptive statistics were used to compare the audit results with the reasons for implementing/not implementing nursing interventions given in the questionnaire at T2 and T3. No a priori power analysis was undertaken, because the study was intended to be exploratory within a unit with a small nursing population.

Table 4 ***Demographic Profile (N = 23)***

	mean *(SD)*; median *(range)*
Years of experience in current position	10.2 (9.9); 5.0 (0.6, 30.0)
	***n* (%)**
Education	
Master's degree	0 (0.0)
Baccalaureate	16 (69.6)
In progress	2 (12.5)
Completed	14 (87.5)
Diploma	7 (30.4)
Research experience	
Designated investigator	0 (0.0)
Presented research study	1 (4.5)
Designated research assistant for a nursing research study	3 (13.6)
Review committee	0 (0.0)
Participant in a nursing study	9 (40.9)
Read nursing research studies	20 (87.0)
Changed practice in response to reading nursing research	16 (69.6)
Have attended educational sessions directly related to nursing research	15 (65.2)
Have been a research committee member (unit)	2 (9.1)
Have been a research committee member (hospital)	0 (0.0)

Results

Forty-eight percent (n = 23) of the RNs participated in the study, with one nurse lost at T4. The demographic profile of participants is shown in Table 4.

Table 2 shows the statistical difference in nurses' self-reported implementation of the 11 BPG practices at the four time points. Between T1 and T3, there was a statistically significant change in implementation in two of the 11 BPG interventions: assessment of risk of pressure ulcers using an age-appropriate tool ($p \leq 0.001$), and documentation of same ($p \leq 0.001$). At T1, 13% (n = 3) of the nurses reported performing an assessment and 9% (n = 2) reported documenting same. At T2, the percentages of nurses performing these activities were 61% (n = 14) and 35% (n = 8), respectively (not a statistically significant increase). At T3, the assessment of pressure ulcers had increased to 91% (n = 19) and was documented in 86% (n = 18) of charts. At T4, 78% (n = 14/18) and 67% (n = 12/18) of nurses reported these behaviours.

It was revealed (self-reported and audited) that more than half the nurses were already engaged in three of the 11 BPG interventions at baseline — #8 (52%), #9 (61%), and #10 (74%). *Usual practice/tradition* and *unit expectation* were the cited reasons for this behaviour. Five of the BPG interventions were rarely identified as self-reported or observed. These were #1 (13%), #2 (9%), #3 (4%), #4 (13%), #6 (13%), and #7 (22%).

There were 78 days of data collection, with 464 patients observed across the four time points. Table 3 shows the number of audited BPG interventions *(mean/SD).* Audited practice demonstrated a pattern similar to that for participants' self-reports at all four time points. The percentage of patients identified by the Advanced Practice Nurse as at risk for developing pressure ulcers was consistently higher than the percentage of documented assessments performed by the nursing staff (T1 = 88% vs. 0%; T2 = 83% vs. 2%; T3 = 67% vs. 30%; T4 = 84% vs. 9%).

Table 5 reports the nurses' rationale for implementing selected BPG interventions across the four time points. The most frequently selected reasons for using the interventions were *usual nursing practice, unit expectations, suggestions by a nursing colleague,* and *EBP guidelines.* Interestingly, the reasons given by participants to explain their use of interventions changed across the four time points. Rarely selected reasons for using the BPG interventions were *read in article, request by family or health-care team,* and *physician directive.*

Three themes emerged from the participants' written explanations for the decision not to implement a BPG intervention: patient characteristics, team characteristics, and resource availability. Patient characteristics included C-spine not cleared, high frequency oscillatory ventilation where oxygen saturations decreased with position change, and hemodynamic instability. Team characteristics included lack of knowledge about pressure-ulcer prevention, difficulties accessing clinical experts (e.g., unable to initiate independent dietitian consultations), and lack of attention to risk-assessment information by health professionals in other disciplines. Resource availability included lack of appropriate lifting devices and protective barriers and, at T1 only, lack of readily available assessment tools and guidelines at the bedside.

Discussion

Limitations

It is unusual to begin by presenting the study's limitations, yet further discussion must be framed in the context of the limitations we encountered while attempting to implement and evaluate multiple KTA inter-

Table 5 *Reasons for Implementing Selected BPG Interventions, T1–T4*

Intervention	Usual Practice				Unit Expectation				EBP Guideline				Suggestion by Nursing Colleague			
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)	% (*n*/*N*)
A	100 (3/3)	7.1 (1/14)	5.3 (1/19)	14.3 (2/14)	66.7 (2/3)	0.0 (0/14)	0.0 (0/19)	42.9 (6/14)	0.0 (0/3)	85.7 (12/14)	89.5 (17/19)	78.6 (11/14)	33 (1/8)	21.45 (3/14)	31.6 (6/19)	21.4 (3/14)
B	100 (2/2)	12.5 (1/8)	17.6 (3/18)	41.7 (5/12)	50 (1/2)	25 (2/8)	35.5 (6/18)	33.3 (4/12)	0.0 (0/2)	87.5 (7/8)	88.2 (15/18)	83.3 (10/12)	0 (0/2)	50 (4/8)	17.6 (3/18)	16.7 (2/12)
C	71.4 (10/14)	70.6 (12/17)	83.3 (15/18)	40 (6/15)	57.1 (8/14)	47.1 (8/17)	44.4 (8/18)	66.7 (10/15)	14.3 (2/14)	58.8 (10/17)	61.1 (11/18)	73.3 (11/15)	0 (0/14)	11.8 (2/27)	11.1 (2/18)	13.1 (2/15)
D	66.7 (2/3)	22.2 (4/18)	44.4 (8/18)	35.7 (5/14)	33.3 (1/3)	50 (9/18)	55.6 (10/18)	35.7 (5/14)	0.0 (0/3)	72.2 (13/18)	61.1 (11/18)	85.7 (12/14)	0 (0/3)	33 (6/18)	16.7 (3/18)	21.4 (3/14)

Notes: *n* = number of nurses who chose the item as a reason for implementing the practice.
N = number of nurses who implemented the BPG intervention.
A = risk assessment using assessment tool completed.
B = assessment documented based on risk-assessment tool.
C = Q2 hourly turning scheduling implemented.
D = use of a pressure-reducing or pressure-relieving support surface.

ventions associated with a complex BPG in clinical practice. The study design limits the conclusions we can reach from this study.

First, the presence of a comparison group in the same context would have strengthened the study design. However, we would not have been able to control for the extraneous confounding variables that could influence nurses' decisions to implement a particular intervention (e.g., informal sharing and learning among nurses, new institutional directives). The use of a counterbalance intervention (e.g., dividing the sample of nurses into two groups and changing the order of presentation of the interventions) to address the issue of progressive error would arguably have made for a stronger study, but this was not an option considering our small nursing population. Our study was exploratory, which met our objective of generating questions or hypotheses, and we leave it to the reader to decide whether our findings are useful.

The second limitation was the poor response rate. Although we had an almost 100% retention rate (with one participant lost at T4), the findings for the primary outcome measure (self-reported use) were based on less than half (48%) of the PICU nursing population. We cannot confirm the reason for such a low participation rate. It may be that nurses were reluctant to commit to a repeated-measures study over a full year. Furthermore, there were a number of missing responses to the 11-item PUP questionnaire. This resulted in an inconsistent *N* value (denominator) for each intervention at each time point and across time points. The low enrolment and missing data restricted our ability to determine whether there was a change in use of each BPG intervention.

The finding that more than 50% of the nurses were already engaged in several of the BPG interventions at baseline is important. To demonstrate a change in practice for these BPG items, we would need a larger sample size than needed for those interventions that were rarely performed at baseline. Based on this information, we performed a post hoc power analysis. We calculated that we would need the following sample sizes to demonstrate significant improvement to a standard established at 75% of nurses engaging in each of the identified practices (understanding that there are times when the intervention would be contraindicated): (a) if ≤ 10% of nurses performed a BPG intervention at baseline, then we would need $n = 10$; (b) if 30% performed the intervention, then $n = 32$; and (c) if 60% performed the intervention, then $n = 312$. We were underpowered to detect a change in the interventions where at least 30% of the nurses were performing them at baseline (i.e., interventions 5, 8, 9, 10, and 11).

A fourth limitation is associated with the audit tool. We used it to measure overall BPG intervention use by the unit nurses, not specific nurse use. As a result, we do not know if the factors that influenced the

subset of nurses who reported on their BPG behaviours were the same factors that influenced the other unit nurses. A larger sample would have given us the confidence to generalize the findings to the other nurses. A prospective cohort comparative design with repeated measures involving multiple PICUs would be ideal. However, organizational and unit-level contextual influences and strategies would need to be addressed. This type of study is costly to undertake and is time- and human-resource-intensive.

In the demographic profile, 87% of the 23 participants indicated that they read nursing studies and 70% of the 23 participants indicated that they had changed their practice in response to their readings. This may reflect a social desirability bias since the nurses understood that the research team was interested in research use. On the other hand, it may be that at baseline these nurses were indeed reading and using nursing studies and were different from those nurses who did not participate in the study. In other words, the study may have been flawed by a selection bias that resulted in overly optimistic findings. However, our finding of congruence between audited practice of all unit staff at four time points and participants' self-reports suggests otherwise. The participants did not indicate that information obtained from the research articles distributed in part II of the study was a factor influencing a change in their practice. It is also possible that the research integrated into the BPGs was considered more reliable by the nurses, consistent with the findings of Gifford et al. (2006).

Interpretation of Results

Our results reveal a statistically significant change in nurses' self-reported use of two BPG components (patient assessment using an age-appropriate risk-assessment tool and documentation of same) between T1 and T3. The change occurred after the educational intervention and implementation of the innovative KTA strategies (i.e., the unit-based champion activities and context-specific tools and resources). Given that no statistically significant change occurred between T1 and T2 (part I only) or between T2 and T3 (part II only), we cannot conclude that either of these interventions would be effective independent of the other. Rather, we believe that the bundle of KTA strategies (i.e., parts I and II combined) may have had a synergistic effect. This argument is supported by the Multiple Intervention Framework (Edwards et al., 2004). In this study, the data suggest that the practice may be sustained. Over 75% (n = 14/18) and 68% (n = 12/18) of nurses continued to use BPG #1 and BPG #2 at T4. Follow-up in the unit at 2 and 5 years would enable us to determine whether the change is sustained over time.

The theme "patient characteristics" identified in the qualitative data helps to explain why some PICU nurses chose not to implement a specific BPG intervention. The nurses' rationale for their decision did not ignore the evidence. Rather, the nurses weighed the consequences of performing the action in the particular patient situation and judged that implementing the recommended intervention would be more harmful than not implementing it (e.g., Q2H turning would result in oxygenation desaturation). Thomas and Fothergill-Bourbonnais's (2005) research on cue utilization by expert PICU nurses in making clinical judgements demonstrates that nurses actively weigh complex and contradictory evidence associated with their particular patients in order to determine the "best" course of action. If we apply the knowledge offered by Wenger's (1998) theory to this situation, nurses may choose not to comply with a BPG intervention that entails a loss of content and context and to instead create new relevance for the BPG in their own context. What they attempt to achieve involves multiple trade-offs, in part because of the complexity of the patient-care situation. Estabrooks (1999a) refers to this form of research utilization as conceptual utilization. This process of making judgements based on the weighing of evidence in clinical situations requires further investigation, particularly if we continue to examine KTA by measuring only instrumental utilization (i.e., documentation = BPG use). Unfortunately, not all the nurses indicated why they did not implement some of the recommended practices. The emergence of the theme "patient characteristics" from the limited qualitative data leads us to recommend the use of such research methods as ethnographic interviewing or think-aloud technique in subsequent studies.

Six of the questionnaire items showed no statistically significant change across the four time periods: interventions 5, 8, 9, 10, and 11. Two of the qualitative themes, "team characteristics" and "resources," both contextual influences, offer a possible explanation. For example, in our institution a dietary consultation must be initiated by a physician. The nurses perceived that pressure-ulcer prevention was not a priority of the health-care team. There was likely sufficient power to detect a difference in BPG #3 (discussion of pressure-ulcer prevention during clinical rounds = 4% at T1) as a result of the PUPP KTA strategies, yet no change occurred. Clinical rounds on our unit are traditionally driven by physicians and are attended by the interdisciplinary team. The issues most likely to be discussed are those that are shared by the team members. Pressure-ulcer prevention may not be considered important in a context where the focus is lifesaving measures. Wenger (1998) argues that we need to learn what is valued by the communities of practice in which we work. If others involved in patient care are not concerned with preven-

tion, then nurses may not be concerned either, or may not articulate their concerns. These contextual issues may help to explain why nurses in the present study were selective about which BPG interventions to implement in their practice, a finding also reported by Johnston et al. (2007).

Usual practice and *unit expectation* were the two reasons participants most frequently gave as influencing their practice at all time points. These reasons are congruent with the findings reported by other studies looking at factors associated with knowledge utilization (Estabrooks, 1999b). The present findings suggest that the BPG might have become an important factor influencing the nurses' practice after the implementation of both educational and innovative KTA interventions. It is also possible that the introduction of the BPG provided the nurses with an evidence-based rationale for sustaining those practices that were congruent with usual practice and unit expectations (e.g., Q2H turning, if possible). In other words, the BPG reinforced what they were seeing or doing in practice. In either case, this finding may reflect persuasive research utilization (Estabrooks, 1999a).

Lessons Learned and Recommendations

Based on what we have learned, we recommend that researchers establish baseline performance of BPG interventions prior to the KTA intervention study. Knowing which BPG interventions are already being implemented will permit researchers to determine the degree of change desired. A few specific BPG interventions could then be targeted as the focus for change and the study powered to detect clinically important changes. We also recommend that the questionnaire be administered in interview format. This would serve to reduce the number of non-responses per item and permit clarification when necessary. The strengths of continuing to conduct small pragmatic studies such as this are that they may be more feasible, less costly, and more resource-intensive and can potentially provide useful information specific to the setting. Eventually, specific types, timing, and dose of KTA strategies for that particular setting may be more clearly elucidated (Titler, 2004).

A third recommendation follows from our reflections concerning those questionnaire items that did not show a change across the four time points. Health-care providers who are gatekeepers to the implementation need to be engaged in the process of facilitating the uptake of BPG interventions by nurses. As noted in Davies et al.'s (2007) key recommendations related to facilitators for sustained or expanded use of BPGs, sustainability is more likely to be achieved when interdisciplinary partners are engaged and encouraged to be involved and when the BPGs are integrated with other quality-improvement initiatives. Both

the OMRU and the Multiple Intervention Framework support the use of KTA strategies that involve various layers of aggregation. This interdisciplinary approach to the prevention and treatment of pressure ulcers is supported by Trummer and Panfil (2003). Therefore, in future we would consider a KTA strategy that incorporates a team approach using the collective expertise of various disciplines, clinicians, educators, and managers. Finally, in a PICU context where prevention may not be of the utmost importance, it may be helpful to consider the use of patient-outcome audit feedback (e.g., incidence of pressure ulcers) that is both timely and repetitive as an additional incentive. If enough key stakeholders become genuinely concerned about the quality of care, best practice uptake may well result (Ferlie & Shortell, 2001).

Concluding Remarks

According to Melnyk, Rycroft-Malone, and Bucknall (2004), "If an organization is without a full-scale organizational plan for making a shift to EBP, a change can be instituted from the 'bottom up' with small groups of individuals embarking on evidence-based projects in their clinical settings and sharing positive outcomes of these projects with their administrators or leaders" (p. 83). Our study is an example of such an attempt at EBP research in a small clinical setting. Advancing KTA knowledge about what does and does not work, even within the confines of one's own clinical practice, is complex and messy. Despite our small sample size, the findings of and questions raised in our exploratory study have informed our research plans. Our next study will explore the role of weighing the evidence in nurses' decision-making on whether to implement BPG practices. We believe that this type of study is needed, to elucidate the concepts of conceptual and persuasive research utilization and, as recommended by Bucknall (2007), to interface decision theory with knowledge translation.

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Authors' Note

This research was funded by a Feasibility/Start-up Grant from the Children's Hospital of Eastern Ontario Research Institute.

The authors would like to thank Isabelle Gaboury, Jennifer Kryworuchko, and the anonymous referees for their constructive advice in the development of this article.

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