

# A qualitative examination of changing practice in Canadian neonatal intensive care units

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## Abstract

**Objective** The goal was to explore the perspectives of health care professionals on factors that influence change to policies, protocols and practices in the Neonatal Intensive Care Unit (NICU) with regard to nosocomial infection and chronic lung disease.

**Study design** An exploratory descriptive design using semi-structured individual and focus group interviews was used. Individual interviews ( $n = 76$ ) and focus group sessions ( $n = 14$  with a total of 78 participants) were conducted for a total of 154 health professional participants.

**Methods** Mayring's qualitative content analysis approach was used to analyse the data. All interviews were audio-taped, transcribed and analysed using inductive reasoning. The data were then organized into categories that reflected emerging themes.

**Results** Seven categories that influenced practice change were derived from the data including staffing issues, consistency in practice, the approval process, a multidisciplinary approach to care, frequency and consistency of communication, rationale for change and the feedback process. These categories were further delineated into three emerging themes related to human resources, organizational structure and communications. Pettigrew's conceptual framework provided a lens to view the results in relation to the process of change.

**Conclusions** This study has helped to further our understanding of individual and organizational factors that facilitate and hinder changes in clinical practice in the NICU. These factors will be used as a starting point for organizational change to enhance infant outcomes in the NICU.

## Introduction

There have been large practice variations reported in Neonatal Intensive Care Units (NICUs) across Canada [1] and the USA [2]. These variations have stimulated great interest from numerous stakeholders in neonatal outcomes. To achieve improvements in clinical and developmental outcomes for neonates, we must first understand the process of how proposed practice changes are embraced by health professionals within the NICU. The role of evidence, quality improvement efforts, and organizational structure and culture are key elements in the change process.

## Review of the literature

### Evidence-based practice strategies for change in the NICU

In the USA, there has been a coordinated programme to improve patient outcomes through the implementation of evidence-based practices. Through quality improvement projects, the Vermont Oxford Network has aimed to enhance the effectiveness and efficiency of care for infants in the NICU [2,3]. The research projects focused on four key habits for improvement: the habit for change, practice process, collaborative learning and evi-

dence-based practice [2]. Several studies were initiated at 34 NICU's across the USA. Improvements in nutritional support [4], chronic lung disease [5] and nosocomial infections practices [6,7] were reported as a result of evaluating, developing and implementing evidence-based practices in the NICU. The importance of creating a multidisciplinary collaborative culture for change with support from those in leadership positions was emphasized [5,8–10].

A collaborative group of researchers from across Canada designed the Evidence-Based Practice Identification and Change (EPIC) strategy for implementing practice change and improving outcomes in the NICU [11]. EPIC extends the use of evidence-based methods in health care quality improvement through (i) the use of existing evidence in the published literature; (ii) the use of a benchmarked database by hospitals to identify areas where their practice outcomes are not comparable to other NICU's, thus providing opportunities for targeted interventions at individual hospitals; and (iii) collaboration of a national network of experts in clinical care, research and administration.

During the preparation and baseline assessment phase of EPIC, key demographic, clinical practice, outcomes and process data were collected from infants in the NICU to use as a benchmark for outcome improvement. In-depth literature reviews were then conducted to identify best practices. Statistical methods were developed to utilize the national database to identify specific practice issues at individual hospitals associated with good or poor outcomes, and to quantify their attributable risks [12]. Multidisciplinary teams from hospitals were taught to examine the process of care and identify critical incidents and changes required. Targeted interventions were designed to match the needs at individual hospitals for quality of care improvement and a template for change was constructed and customized for each site.

In the intervention phase of EPIC, site investigators and their EPIC research and clinical teams made changes to practices in relation to the evidence and the areas that they felt required improvements. The Rapid Cycle Improvement Model of Alemi *et al.* [13] and Plsek [14] was used to implement a new cycle every three months to make small gains rapidly and provide frequent feedback regarding progress of the efforts and resultant outcomes using control charts. Repeated cycles over a 2-year period were designed to encourage re-appraisal, reinforce procedures, and generate further change cycles. In the evaluation phase, the impact of the interventions on outcomes after 2 years of interventions will be assessed.

The two clinical problems that were addressed in the EPIC study included nosocomial infection and chronic lung disease. These health conditions were chosen because of their prevalence and importance, based on their contribution to morbidity, mortality and resource use in the NICU. *Nosocomial infection* is one of the most common problems in the NICU with a prevalence of 16% and a range among sites of 7–75% for infants <1500 g birthweight [1]. *Chronic lung disease (CLD)* occurs in 26% of very low birthweight infants <1500 g at birth in Canadian NICUs, with a range among sites of 3–28% [1].

### Organizational structure and change

Baker *et al.* [15] have recently focused on organizational and behavioural issues and have created one organizational assessment

instrument to provide NICU's with feedback on team performance, organizational culture and leadership variables that could impact practice changes. The underlying premise was that the identification of these organizational factors would promote effective unit change. Evaluation of this measure was conducted through individual interviews at sites where the measure was implemented. Participants reported that the unit culture assessment provided 'concrete information that guided their improvement efforts' and stimulated the 'opportunity to discuss issues of organizational culture and leadership' ([15], p. 425). Baker *et al.* suggested that the individual NICUs benefited from receiving survey feedback that included their own unit's performance. This study highlights the importance of understanding the current organizational structures and systems of the NICU before improvements are implemented.

### Conceptual framework

Langley *et al.* [16] developed a model that addresses a process to create effective change in organizations. Langley emphasized the importance of identifying problems and the areas that needed improvement prior to introducing change strategies. Once organizations have identified the requisite changes, there are many challenges to a full-scale implementation of these improvements. Langley stipulated that those individuals who will be affected by the change need to understand the physical implications, the logical implications and the emotional aspect of the proposed change. Understanding these factors will, in turn, minimize or eliminate the resistance to the change.

This improvement process can be related to the contextualist change approach outlined by Pettigrew [17]. This theory of organizational change emphasizes the broad analytical categories of content, context and process of change. The content of change refers to 'what has changed' in regards to the particular area or areas of transformation under study. As outlined by Pettigrew, the context refers to the environment in which the changes have taken place and consists of the outer and inner context. The outer context describes aspects within and outside boundaries of the organization and inner context refers to how ideas for change proceed through various structural, cultural and political contexts [17]. The process of change is the 'how' and refers to the 'actions, reactions and interactions of the various interested parties as they negotiate around proposals for change' ([18], p. 7). A starting point to the analysis of strategic change is 'the notion that formulating the content of any new strategy inevitably entails managing its context and process' ([17], p. 657). This conceptual framework provided a lens to understand the broader EPIC project and the subsequent practice changes to be implemented.

The goal of the present study (as part of the baseline phase of the EPIC project outlined above) was to explore the perspectives of health care professionals on factors that influenced change to policies, protocols and practices in the NICU in relation to nosocomial infection and CLD. This study was based on the premise that successful implementation of the best practices (content of the change) identified in the literature would be reflective of the understanding of organizational factors that influence these changes within the NICU. The ultimate aim was to inform and enhance the interventions that would influence positive infant outcomes.

## Methods

### Study participants

After ethical approval was received from the Research Ethics Boards of the 13 sites participating in the EPIC study, health professionals from the NICU were asked to take part in individual and focus group interview sessions. Purposive sampling techniques were utilized to select participants from a broad disciplinary, role and experiential base [19]. These individuals represented the spectrum of health professionals who worked in the NICU. Individual interviews ( $n = 76$ ) and focus group interviews ( $n = 14$  with a total of 78 focus group participants) were conducted for an overall total of 154 participants. Approximately 6–8 individual interviews and 1 focus group with 4–7 participants were conducted at each research site. At one site, 2 focus groups were undertaken because of the greater number of participants. Participants took part in either the individual or focus group interview but not both. Table 1 outlines the health professionals who participated in the individual interviews. Table 2 summarizes the professions of the focus group participants.

### Data collection

Semi-structured interviews were conducted with health professionals using open-ended questions in both the individual interviews and focus group sessions. Participants were asked about: (i) existing policies and protocols dealing with infection and chronic lung disease; (ii) the most successfully and least successfully implemented policies and protocols; and (iii) factors that influenced the implementation of practice changes on the unit. This semi-structured interview style allowed participants to talk about specific events and to express their opinions on issues that they felt were particularly important. Focus group sessions promoted discussion and sharing of insights about the phenomena under study. Interaction in a group format often leads to a different understand-

ing of the issue [20] compared with the information derived from an individual interview. As well, the researchers gained insight into broad topic areas that could then be further explored in successive individual interviews.

Four experienced interviewers were trained to conduct the interviews with one individual (ML) as the primary interviewer at all sites to ensure consistency across the data collection process. Informed consent was obtained by the research site coordinator or interviewer prior to the interviews. Interviews were audio-taped with permission of the interviewees. Individual interviews lasted approximately 30 minutes in length and focus group sessions, on average, were 75 minutes.

### Data analysis

Mayring's [21] approach to content analysis was used to analyse the data. All audio-taped interviews were transcribed verbatim, printed and read to develop an overall sense of the data. Using inductive reasoning, the data were organized into categories that reflected emerging themes and early coding ideas. The qualitative approach of content analysis was used because it allowed the researchers to identify the most common issues that arose among the participants across sites. This process was achieved initially by examining key phrases and words and the general frequency of their occurrence. In the second stage of the analysis, emerging themes were revisited and the relationships between themes were examined. These relationships were further refined and combined into main categories that reflected the themes. To retain sight of the original context and meaning of the transcripts, the raw data were revisited repeatedly during the analysis process to make comparisons, identify similarities and to observe and account for differences [22].

The data were first analysed separately by site (i.e. each individual NICU) and then by health condition (i.e. nosocomial infection,

**Table 1** Demographics for individual interview participants

Interviews by site condition group	( $n = 76$ )
Infection	32
Chronic lung disease	44
Health profession	Total ( $n = 76$ )
Neonatologist	12
Staff nurse	11
Nurse practitioner	9
Respiratory therapist	8
Unit administrators	8
Nurse educator	7
Infection control practitioner	6
Clinical leader	4
Patient care manager	3
Pharmacist	2
Occupational therapist	2
Quality assurance nurse	1
Neonatal dietician	1
Lactation consultant	1
House keeper	1

**Table 2** Demographics for focus group participants

Focus groups	( $n = 14$ )
Mixed health professionals	10
All staff nurses	3
All neonatologists	1
Site condition group	( $n = 78$ )
Infection	45
Chronic lung disease	33
Health profession	( $n = 78$ )
Staff nurse	38
Neonatologist	15
Respiratory therapist	6
Nurse practitioner	4
Neonatal dietician	4
Unit administrators	2
Pharmacist	2
Discharge planner	2
Nurse educator	1
Infection control practitioner	1
Clinical leader	1
Patient care manager	1
Quality assurance nurse	1

CLD). The themes and subsequent categories were similar across sites and thus were aggregated by health condition to achieve a collective perspective. After extensive comparison of the themes in both the infection and CLD groups, the researchers determined that the data exhibited common themes and could be collapsed into one large analysis, despite differences in the health conditions. This result was not particularly surprising as the research focus was on organizational and individual health professional factors related to practice changes that were not specific to the infant's health condition.

### Rigour and reliability of results

Ensuring rigour in qualitative research is about managing sources of bias [23]. Working as a team on the analyses was a deterrent to several potential sources of bias and provided a form of investigator triangulation [23,24]. In addition, the data were subjected to individual analyst triangulation [25] where an experienced qualitative researcher not affiliated with the study read uncoded sections of transcripts and compared the themes that emerged from her reading of the data with themes of the original analyst to check for consistency in the results. Overall, the raters achieved a rate of 90% agreement when triangulating data either within the team or between independent analysts. Discrepancies in data categorization were resolved by the researchers through consensus discussion, which allowed for deeper insight into the phenomenon under study [25].

## Results

Seven categories that influenced practice change included staffing issues, consistency in practice, the approval process, a multidisciplinary approach to care, frequency and consistency of communication, rationale for change and the feedback process. These categories were further delineated into three overarching themes related to human resources, organizational structure and communications.

### Human resources

#### Staffing issues

Several staffing issues were viewed as factors that acted as barriers to practice changes. The size of the staff and the ratio of educators to staff were important when implementing changes in the NICU. Individuals involved in teaching new practices stated that it was difficult to ensure that the large number of staff in the unit had the opportunity to be taught at the bedside. As well, varying levels of education and experience could be challenges to change because of different embedded values and beliefs about existing practices. These beliefs were often underscored by inadequate or outdated knowledge in particular areas. In the larger units, the amount of staff turnover was deemed a barrier to change as an increased emphasis on educating new staff was required. However, lack of turnover could also be viewed as problematic. As one staff nurse comments:

... some people have been here for many years and don't really want to change anything. They want to do things like they've done all along. Then you have new people who don't really

know what they're doing and now you're implementing changes. (Participant 2)

### Consistency in practice

There were some sites that stated there were inconsistencies in the neonatologists' practices even after a new practice was introduced on the unit. This problem escalated when there were multiple neonatologists in the same unit who supported different management practices. Inconsistencies in practice among neonatologists resulted in confusion of other health professionals as to which practices were best practices or whose directives they should adhere to. As one of the nurses describes in regards to inconsistencies:

There are still problems within the unit in terms of implementing evidence-based practice, one [neonatologist] might be doing it and then the other four aren't. So then the nurses aren't too sure exactly what they should be doing. So, with that said, as long as everybody is doing the same thing then the nurses are able to buy in more. (Participant 59)

Health professionals stated that the support of leadership (e.g. unit managers and physicians) was imperative for practice changes to be successfully implemented. A quality assurance nurse commented:

You first need your neonatologists to be on board with it [the change in practice], they absolutely have to be on board with it ... cause if they model it, they [the rest of the unit] will follow it. (Participant 21)

### Organizational structure

#### Approval processes

At a majority of the sites, the health professionals reported that the organizational structure in place imposed an extensive review of the proposed practice changes. This approval process was long and tedious with many levels of approval that were required prior to enactment of a change. This cumbersome process was attributed to a loss in the momentum and enthusiasm for the change. One neonatologist reported:

I would take it [change in practice] to the clinical resource person and from there it would be a very long process to implement changes. We have committee structures and everything seems to have to go through half a dozen committees that would only meet at certain times. (Participant 70)

#### A multidisciplinary approach to care

Some sites had well-functioning multidisciplinary teams that they attributed to their success in making changes. Other sites suggested that having a team approach would improve their current change process. Ideally, this multidisciplinary team would be dedicated to assessing evidence that individuals would bring forward prior to making practice recommendations. Within these teams, it was stated that there was usually one main 'champion' of the change who was respected and trusted by peers and was instrumental in initiating and implementing the change. This champion would work with the multidisciplinary teams who would then take the approved recommendations back to their respective profes-

sional groups as *peer leaders* to make or prepare for the changes in their groups. As one nurse practitioner describes:

The team would meet to discuss and try to have all disciplines involved. We go over the evidence and then mostly how we roll things [changes to practice] out by having a training session with some of the key people involved in the process. There would be the in-servicing around the units at various times of the day and night. (Participant 43)

## Communications

### Frequency and consistency of communications

Certain methods of communicating new information were reported to negatively impact the implementation of the changes in practice. The participants indicated that it was not sufficient for the individuals responsible for disseminating the change to simply communicate changes, but rather the channels used for communication must be carefully selected to avoid overwhelming health professionals with excessive information. As described by a staff nurse about the posting of unit changes:

We [the nurses] have information overload as it is, and it needs to be filtered a little bit. The signs that we have in the room, well there are so many signs, people after a while don't even notice the signs . . . like just for your own sanity you just start to block out the signs. (Participant 11)

Participants reported that they were inundated with new information on a frequent basis and they felt that there was too much information and not enough time to read and comprehend how this information would influence their practice. Participants also reported that when a change was verbally communicated, locating this information was often difficult because the various communications methods (i.e. web site, manuals) were not updated with the new changes. This 'lag' time between the generation of new information and information processing in print and electronic materials was viewed as very problematic. As one clinical leader stated:

We generally in-service [teaching sessions] everyone and we try to put it [the change in practice] in the communications book but sometimes things get missed and they don't end up being in the communications book. (Participant 69)

Six methods of communicating change were identified by the participants, including posters, teaching moments, bedside teaching, bedside in-services, education days and computers. Individuals stated that printed posters were seen as effective modes of communicating new changes as long as they were updated and visually appealing. However, in many units, individuals reported not having enough time to read and digest the information presented in the poster. Face-to-face communication through bedside teaching and bedside in-service sessions were common methods used for educating staff on new changes. However, many staff members commented that being taught at the bedside was often ineffective because they were distracted by caregiving priorities and therefore were not always assured of receiving all of the information. As stated by a clinical leader:

We could never leave the bedside – it is impossible. The nurses come here [bedside in-service] and then she gets called back. So you really need to have those eight hours out of the unit where no one can bother you and you can just learn. (Participant 101)

Given the proper time and ability to focus on the teaching, and coverage for their patient care assignment, individuals stated that face-to-face methods were the most effective learning opportunities offered in the unit. However, not all nurses were afforded the same opportunities to be involved in bedside teaching moments (e.g. nurses working night shifts).

At half of the sites, education days were not financially compensated and health professionals were asked to attend education sessions on an unpaid basis on their off-duty days. This combination of factors resulted in low attendance and thus was ineffective in transferring the information on the practice change. At those sites where time for education was compensated, individuals reported that this education was an essential part of their success in implementing changes. As one clinical nurse practitioner stated:

You need a half day where you can just sit and learn. You have to have people focused and not having to be back in the unit. You've got to have their attention. To come in for two hours for paid education or just any incentive helps to get buy in from the staff and that is how they get us to come. (Participant 42)

Electronic methods of communication (e.g. computers) were also reported as an ineffective means for promoting the uptake of new information and subsequent change. A majority of the sites stated that their computers were slow, not easily accessible by clinical staff and the search engines provided precluded use. In addition, staff nurses reported that they had insufficient time to use web sites or to review email communications while at work and they were reluctant to do so outside the work environment.

### The rationale for change

All who were required to change their practice needed to understand why these changes were being made. Health professionals wanted to be provided with information on the evidence for the change, why the change was better than their current practice, how the change would affect their practice and how the change would improve the care and outcomes for infants. These messages were considered essential in the communication regarding the change. As one nurse stated:

There is nothing up in the unit to look towards about what studies are saying or what other units are doing or these are the 'whys'. I have just been told, now this is how we are doing it . . . so be it. (Participant 112)

### The feedback process

Participants stated that receiving updates and results on how the change(s) in practice had affected the clinical problems identified (e.g. infection rates or CLD rates) was beneficial. Having internal reports on how the unit was progressing with the new practice and the desired outcomes was recommended as a way to reinforce the change(s). A neonatologist suggested:

If everybody knows about it [infection rates of the unit], for example, if we're the unit with the highest infection rate in Canada, then I think that people will be much more motivated [to change] because we don't want to be the example of bad infection practices. (Participant 18)

Allowing for participants to be involved in the development, implementation and evaluation of the proposed change was also

seen as an effective way to ensure successful implementation of a new practice. As described by a nurse educator:

By all means with the staff it is letting them know and having them first of all be part of the process . . . I try to disseminate it [the change in practice] to as many people as possible in draft form so that everybody gets an opportunity to read it and have input into it . . . so it kind of stimulates the discussion around it. (Participant 25)

## Discussion

The goal of the study was to determine factors that influenced the process of changing practice in Canadian NICUs. Much of the research on factors that influence change has been focused on general change efforts in various health care settings. Unique to this study, is the focus on the NICU where high-risk premature infants are cared for in an environment that entails a number of stressors and organizational issues that are unique to its workforce. The present findings are generally consistent with existing research on factors that influence change and with Pettigrew's change theory. These findings have potential to inform multiple stakeholders as to the most effective processes for implementing evidence-based practice changes in the NICU and to be considered for use in other health care settings.

A key element identified both within Pettigrew's change theory and with the results of this study was the organizational structure and culture of the unit. The current study lends support to previous health research findings [5,8–10] regarding the importance of a multidisciplinary approach (e.g. a representative from each major discipline in the unit) for integrating clinical changes in a hospital unit. This inclusionary approach clearly emphasized the need to garner support and representation from a wide variety of health professionals as well as individuals in leadership positions [26,27]. This approach ensures that changes are implemented and that there is consistency in proposed management approaches or at least awareness and acceptance of diversity among the health professionals. Schein [28] has suggested that these subcultures by professional occupations (e.g. nursing, physicians, respiratory therapist) need to create a mutual understanding of each other's views and expertise that they bring to the organization in order to evolve solutions that will be understood and implemented.

Champions of change were identified by the sites as an essential part of the change process which is consistent with past research in change management [29]. However, these champions were discussed more in relation to their role on the multidisciplinary team, than as individuals with leadership capabilities. These health professionals initiated the change and then individuals in the team would become 'peer group champions' who would disseminate the changes to their respective profession groups. This finding is consistent with Lave and Wegner's [30] notion that individuals do not learn in isolation but rather in a community. Within this 'community of practice', a key characteristic is negotiation between health professionals concerning effectiveness of the innovation. The key concept underlying this thinking is that learning is socially constructed.

The multidisciplinary teams in the current study were generally more easily constituted in units where there was a sense of collegiality and respect for the different professional roles and individuals in those roles. This finding is similar to Ohlinger *et al.* [10]

who stated that collaboration is enhanced in a climate of trust including openness, honesty, consistency and respect. The health professionals in this study were desirous of incorporating multidisciplinary teams to implement the proposed practice changes; however, there is little empirical research linking effective teamwork with patient outcomes [31]. Researchers need to examine the characteristics of multidisciplinary teams (e.g. task design, team processes, team effectiveness measures) in the NICU specifically in relation to infant outcomes (e.g. functional status). These analyses will help to guide training strategies for teams in the NICUs in order to improve teamwork and subsequently ensure that infant outcomes will be ultimately enhanced.

Another key element identified as crucial to the process of change within Pettigrew's model was communication. This process involves effectively transmitting and translating recommended changes to the health professionals. Participants reported they would like to be informed of the changes through various methods of communications, but especially face-to-face methods or printed material that is updated, current and to the point. Within these communication methods, consistent and timely updating allows for the opportunity to understand why the change is important, while not being inundated with information. This approach is consistent with previous research findings in communications of change research [32]. However, it is notable that there is a disconnect between the advancement of electronic means of communication (e.g. using email and web-based communications) within institutions and nurses devaluing of these methods for receiving time-sensitive information around changing practices. Given the ever-increasing role of technology in communicating in the health care setting, this finding requires further examination to better delineate whether this is a preference issue or an access to resources issue if effective communication is to be streamlined and achieved. The importance of the context of the organization (e.g. resources, accessibility) as well the perception and attitudes of the staff towards the communications methods before implementing changes also needs to be considered. Estabrooks [33] suggest that assessing context attends to the complex organizational environments, such as the NICU, where we are trying to enhance evidence uptake to facilitate change. Validated assessments of leadership, readiness to change, organizational culture, organizational complexity, professional autonomy and support within the workplace are all important contextual factors to consider.

To address issues concerning communication of practice changes, a yearly communications review and plan, developed with the assistance of an expert in communication strategies, knowledge translation or brokering, for the dissemination of new practices could be implemented to ensure a constant, predictable flow of information to everyone in the unit. Many of the participants reported that they would like to be involved in the process by providing feedback in the preliminary stages of the proposed change, by helping to evaluate the change in practice and by being informed of the results of the change, which has also been highlighted in previous literature in change [34]. These steps allow not only participation in the process of the change but reinforcement of either positive or negative results. It is also well noted that sufficient resources need to be in place to 'roll-out' the change which means allowing individual time away from patient care to learn about new procedures and changes to practice [35]. Staffing issues also greatly impacted on educational interventions. For

example, it was suggested that it was difficult to implement changes in certain units because of the ratio of educators to staff and the patterns of staffing in the unit. Also frequent staff turnover resulted in difficulties in balancing educating new members and re-educating current staff. Consequently, a lack of turnover in other units impacted on improvement efforts because of the resistance to change from experienced individuals. Thus, understanding the organizations internal context or organizational culture is imperative when designing and implementing change in the NICU.

These findings are similar to those of Kilbride *et al.* [6] who reported that promoting initial successes was important so that staff who were less open to change became more motivated and enthusiastic about the process. Kilbride *et al.* also emphasize that to create staff involvement and 'buy-in', they had used a variety of different communication techniques that provided clear and enticing information. Some of these communication techniques included email, in-services sessions, regularly scheduled meetings, newsletters, open discussions and appealing posters. With the exception of the electronic communications, some of these suggestions could be amenable to enhancing practice changes in the EPIC project and should be further studied.

One limitation of the current study was that individual unit reports were unavailable because of the importance of maintaining anonymity of the participants. Many sites indicated that they would have found this information helpful. All interview data were aggregated according to the two clinical health conditions and each site had to determine the areas that they felt were most important to make improvements based on the main categories. The measure developed by Baker *et al.* [15] to provide site specific feedback would have addressed this request and will be included as part of the methodology in future research. However, the benefit of the anonymous interviews with selected health professions afforded more richness and in-depth insights that may have been more beneficial to our understanding of issues related to organizational change at this stage of the learning process. Ideally, a mixed design that incorporates a qualitative (i.e. a case study of each hospital unit) and a quantitative (i.e. organizational assessment instrument) approach could be utilized simultaneously to provide hospitals with site-specific information and a collective perspective.

For the second phase or intervention stage of the EPIC project, the sites were provided with the global results of the present study through a teleconference meeting to inform and enhance their quality improvement efforts and to provide the opportunity for group discussions. All of the participating hospitals were involved in a system designed to track the changes that they made in their units based on the results of this study and evidence-based clinical practices. The impact of this information generated from the baseline phase will not be known until the intervention and evaluation phases of EPIC are completed.

This study has helped to further our understanding of contextual and specifically, organizational culture, factors that facilitate and act as barriers [16] to changing clinical practice in the NICU. These factors will be used as a starting point for addressing organizational change issues to enhance infant outcomes in the NICU. The challenge of linking organizational factors to specific clinical outcomes will need to be addressed by researchers in the future. The results of this study, however, help to further our understand-

ing of how those affected by changes in practice view structural barriers and hindrances of change. Furthermore, an outline of process issues that must be considered when changing practice in the NICUs has been delineated. Future researchers should consider the organizational factors such as the implementation of effective multidisciplinary teams, developing and evaluating a communications plan, and monitoring of consistencies in practices in relation to clinical outcomes of infants in the NICU.

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## References

1. Lee, S. K., McMillan, D. D., Ohlsson, A., Peddray, M., Synnes, A., Whyte, R., Chien, L. Y. & Sale, J. and the Canadian Neonatal Network. (2000) Variations in practice and outcomes in the Canadian neonatal network: 1996–1997. *Pediatrics*, 106, 1070–1079.
2. Horbar, J. D. (1999) The Vermont Oxford Network: Evidence-based quality improvement for neonatology. *Pediatrics*, 103, 350–359.
3. Horbar, J. D., Plsek, P. E. & Leahy, K. (2003) NIC/Q 2000: Establishing habits for improvement in neonatal intensive care units. *Pediatrics*, 111 (4), 397–410.
4. Kuzma-O'Reilly, B., Duenas, M. L., Greecher, C., Kimberlin, L., Mujsc, D., Miller, D. & Walker, D. J. (2003) Evaluation, development, and implementation of potentially better practices in neonatal intensive care nutrition. *Pediatrics*, 111 (4), 461–470.
5. Sharek, P. J., Baker, R., Litman, F., Kaempf, J., Burch, K., Schwarz, E., Sun, S. & Payne, N. R. (2003) Evaluation and development of potentially better practices to prevent chronic lung disease and reduce lung injury in neonates. *Pediatrics*, 111 (4), 426–436.
6. Kilbride, H. W., Powers, R., Wirschafter, D. D., Sheehan, M. B., Charsha, D. S., LaCorte, M., Finer, N. & Goldmann, D. A. (2003a) Evaluation and development of potentially better practices to prevent neonatal nosocomial bacteremia. *Pediatrics*, 111 (4), 504–518.
7. Kilbride, H. W., Wirschafter, D. D., Powers, R. J. & Sheehan, M. B. (2003b) Implementation of evidence-based potentially better practices to decrease nosocomial infections. *Pediatrics*, 111 (4), 519–533.

8. Brown, M. S., Ohlinger, J., Rusk, C., Delmore, P. & Ittmann, P. (2003) Implementing potentially better practices for multidisciplinary team building: Creating a neonatal intensive care unit culture of collaboration. *Pediatrics*, 111 (4), 482–488.
9. Burch, K., Rhine, W., Baker, R., Litman, F., Kaempf, J. W., Schwarz, E., Sun, S., Payne, N. R. & Sharek, P. J. (2003) Implementing potentially better practices to reduce lung injury in neonates. *Pediatrics*, 111 (4), 432–436.
10. Ohlinger, J., Brown, M. S., Laudert, S., Swanson, S. & Fofah, O. (2003) Development of potentially better practices for the neonatal intensive care unit as a culture of collaboration: Communication, accountability, respect, and empowerment. *Pediatrics*, 111 (4), 471–481.
11. Lee, S. K., Aziz, K., Baker, G. R., *et al.* (2002) *Evidence-Based Practice Identification and Change (EPIC) in the NICU*. Canadian Institutes of Health Research Operating Grant MOP-53115.
12. McNab, Y., Qiu, Z., Gustafson, P., Ohlsson, A. & Lee, S. K. (2004) Hierarchical Bayes analysis of multilevel health services data. *Health Services and Outcomes Research Methodology*, 5 (10), 5–26.
13. Alemi, F., Moore, S., Headrick, L., Neuhauser, D., Hekelman, F. & Kizys, N. (1998) Rapid improvement teams. *Joint Commission Journal on Quality Improvement*, 24 (3), 119–129.
14. Plsek, P. E. (1999) Quality improvement methods in clinical medicine. *Pediatrics*, 103, 203–214.
15. Baker, G. R., King, H., MacDonald, J. L. & Horbar, J. D. (2003) Using organizational assessment surveys for improvement in neonatal intensive care. *Pediatrics*, 111 (4), 419–425.
16. Langley, G. J., Nolan, K. M., Nolan, T. W., Norman, C. L. & Provoost, L. P. (1996) *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. San Francisco, CA: Jossey-Bass.
17. Pettigrew, A. M. (1987) Context and action in the transformation of the firm. *Journal of Management Studies*, 24 (6), 649–670.
18. Pettigrew, A. M., Ferlie, E. & McKee, L. (1992) *Shaping Strategic Change*. London: Sage Publications.
19. Patton, M. Q. (2002) *Qualitative Research and Evaluation Methods*, 3rd edn. Thousand Oaks, CA: Sage Publications.
20. Rubin, H. J. & Rubin, I. S. (1995) *Qualitative Interviewing: the Art of Hearing Data*. Thousand Oaks, CA: Sage Publications.
21. Mayring, P. (2000) Qualitative content analysis. *Forum: Qualitative Social Research Online*, 1 (2). Available at: <http://www.qualitative-research-net/fqs-texte/2-00/2-00mayring-e.htm> (last accessed June 2004).
22. Kelle, U. (1997) Theory-building in qualitative research and computer programmes for the management of textual data. *Sociological Research Online*, 2 (2). Available at: <http://www.socresonline.org.uk/socresonline/2/2/1.html> (last accessed June 2004).
23. Morse, J. (1991) Evaluating qualitative research. *Qualitative Health Research*, 1 (3), 283–286.
24. Sandelowski, M. (1986) The problem of rigor in qualitative research. *Advances in Nursing Science*, 8 (3), 27–37.
25. Patton, M. Q. (1999) Enhancing the quality and credibility of qualitative analysis. *Health Services Research*, 34 (5), 1189–1208.
26. Zmud, R. W. (1984) An examination of push-pull theory applied to process innovation and knowledge work. *Management Science*, 30 (6), 727–738.
27. Labianca, G., Gray, B. & Brass, D. J. (2000) A grounded model of organizational schema change during empowerment. *Organization Science*, 11 (2), 235–257.
28. Schein, E. H. (1996) Three cultures of management: The key to organizational learning. *Sloan Management Review*, 38 (1), 9–20.
29. Redfern, S. & Christan, S. (2003) Achieving change in health care practice. *Journal of Evaluation in Clinical Practice*, 9 (2), 225–238.
30. Lave, J. & Wegner, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
31. Temkin-Greener, H., Gross, D., Kunitz, S. J. & Mukamel, D. (2004) Measuring interdisciplinary team performance in a long-term care setting. *Medical Care*, 42 (5), 472–481.
32. Mukherjee, A., Larpe, M. & Wassenhove, L. V. (1998) Knowledge driven quality improvement. *Management Science*, 44 (11), 35–49.
33. Estabrooks, C. A. (2003) Translating research into practice: Implications for organizations and administrators. *Canadian Journal of Nursing Research*, 35 (3), 53–68.
34. Greve, H. (1998) Performance, aspirations and risky organizational change. *Administrative Science Quarterly*, 43, 58–86.
35. Repenning, N. P. & Sternman, J. D. (2001) Nobody ever gets the credit for fixing the problems that never happened: Creating and sustaining process improvement. *California Management Review*, 43 (4), 64–88.