TRANSFORMING NURSING THROUGH KNOWLEDGE

Best Practices for Guideline Development, Implementation Science, and Evaluation

DORIS GRINSPUN, PhD, MSN, BScN, RN, LLD(hon), Dr(hc), O.ONT
IRMAJEAN BAJNOK, PhD, MScN, BScN, RN

RNAO
Registered Nurses' Association of Ontario
L'Association des infirmières et infirmiers autorisés de l'Ontario

UNIT

5

EVALUATING OUTCOMES, PROVING RESULTS: THIRD PILLAR FOR SUCCESS

CHAPTER

16

EVALUATING BPG IMPACT: DEVELOPMENT AND REFINEMENT OF NQUIRE

Valerie Grdisa, PhD, MS, BScN, RN
Doris Grinspun, PhD, MSN, BScN, RN, LLD(hon), Dr(hc), O.ONT
Gurjit Kaur Toor, MPH, BScN, RN
Yaw O. Owusu, PhD, MS, MSc, BSc
Shanoja Naik, PhD, MPhil, MSc, BEd, BSc
Kyle Smith, BSc

LEARNING OBJECTIVES

After reading this chapter, you will be able to:

- Understand the background, history, and purpose of the NQuIRE data system
- Understand the Donabedian Model and how it applies to the NQuIRE indicators
- Describe the stages of the NQuIRE indicator development process and the safeguards for NQuIRE security and privacy
- Describe the NQuIRE Data Quality framework and how it contributes to a robust data system
- Describe how health information data are critical for healthcare service provision and used for many secondary purposes including quality improvement, accountability, and research
- Be inspired by the impact of BPG implementation within BPSOs based on NQuIRE outcomes analysis
- Describe the RNAO evaluation methodologies that demonstrate the value and outcomes of BPG implementation in BPSOs and long-term care homes

This chapter focuses on RNAO's evaluation of its Best Practice Guidelines (BPG) impact. In particular it zeroes in and traces the history of NQuIRE, Nursing Quality Indicators for Reporting and Evaluation, from its conception stage through to the early beginning as a data system. The chapter highlights the current state of NQuIRE poised to produce comparative reports, the Nursing Trends Report, and to be a robust source of data for practitioners, administrators, educators, researchers, and policymakers. We describe NQuIRE's history, purpose, and infrastructure. Examples of structure, process, and outcome indicators are shared alongside the impact of BPGs around the world. We also discuss key supports for BPSOs, including capacity building to use NQuIRE and ensuring data quality.

INTRODUCTION

Evidence-based clinical guidelines aim to improve the quality of care and optimize health outcomes, organizational performance, and health system results. However, many efforts to implement programs designed to improve the quality and outcomes of clinical care have not always delivered on their promise.

While single studies and a few systematic reviews exist on the value proposition of clinical guidelines, a comprehensive and longitudinal approach is hard to find. Lugtenberg, Burgers, and Westert (2009) conducted a systematic review of studies evaluating the effects of Dutch evidence-based guidelines on both the process and structure of care and patient outcomes. A total of 20 studies were included, and 17 showed significant improvements in the process and structure of care. The effects of guidelines on patient health outcomes were studied far less. This is the reason behind the birth of NQuIRE, an international data system developed by the Registered Nurses' Association of Ontario (RNAO) in Canada (Grinspun, Lloyd, Xiao, & Bajnok, 2015).

RNAO's BPGs are being implemented in 550 Best Practice Spotlight Organizations (BPSO) worldwide, located on four continents. There is mounting evidence that shows that BPG implementation contributes to better outcomes at the client, nurse, team, organizational, and health system levels, and at a lower cost—thus achieving better value. Local evaluations report substantive improvements in patients' clinical outcomes and financial performance for BPSOs. Chapter 17, *Value for Money: Measuring the Economic Impact of BPSOs in Australia*, details such an impact in Australia.

As described in Chapter 1, *Transforming Nursing Through Knowledge: The Conceptual and Programmatic Underpinnings of RNAO's BPG Program*, the program is composed of three main pillars: development, implementation, and evaluation. This chapter focuses on the latter, and Figure 16.1 depicts the four areas of focus within the evaluation and monitoring pillar of the BPG Program. The BPSOs have created a platform for innovative evaluation methodologies for RNAO to measure the impact of evidence-based nursing care for both quality improvement and future research. NQuIRE consists of a database with an online data entry system; data dictionaries, including a set of organization-level structural indicators, as well as a set of process and outcome indicators for each clinical BPG; and data collection and reporting processes.

Through NQuIRE, RNAO collects, analyzes, and reports quality indicator data submitted by all of RNAO's BPSOs. The system is designed to support BPSOs in monitoring and evaluating the impact of

BPG implementation in their organizations, enabling them to track progress, do intra-organizational comparisons, and in the future, perform inter-BPSO comparative analysis. It sharpens the capacity of BPSOs to make effective practice improvements by identifying areas for intervention and/or areas for further investment to optimize clinical, organizational, and health system outcomes.

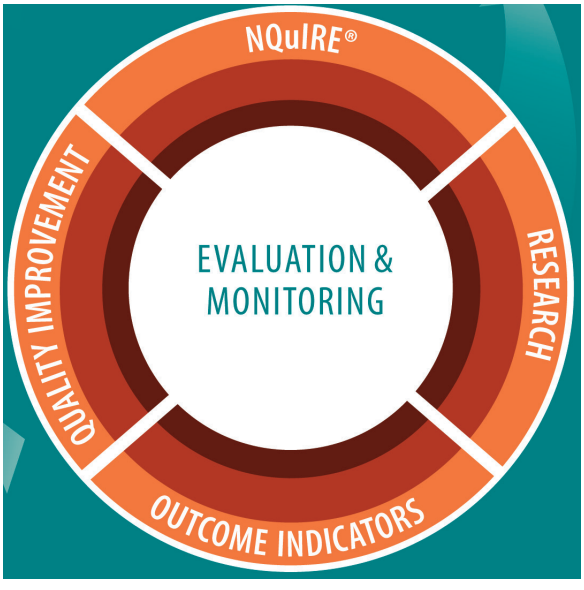


FIGURE 16.1 Evaluation & Monitoring pillar of RNAO BPG Program.
© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

"We see that we need to move to looking at NQuIRE being the first step and not the eighth step in the BPG implementation process. Understanding the data dictionaries was a learning curve for us, but a very helpful step in benchmarking against ourselves and similar BPSOs."

–Karen Cziraki
PhD student, MSc, BScN, RN
BPSO Lead Cambridge Memorial Hospital BPSO Direct

The nursing workforce forms the backbone of the health system, and it is essential to quantify nursing care and nurse-led quality-improvement initiatives that are informed by unit-level benchmarks and local, national, or international peer averages (VanDeVelde-Coke et al., 2012). Standardized measurement of nursing-sensitive indicators and outcome evaluation is essential to evaluate nursing interventions and implement quality-improvement initiatives (Doran, Mildon, & Clarke, 2011). RNAO's NQuIRE is the first international quality-improvement initiative of its kind, consisting of a data system of quality indicators derived from evidence-based guideline recommendations.

By monitoring, evaluating, and reporting quality improvements in nursing care across the globe, NQuIRE is producing BPSO-validated and -endorsed quality indicators that will contribute to sustainability and enhance understanding of the full impact of evidence-based nursing practice on healthcare quality and health outcomes. The RNAO BPSO Designation has created a platform for innovative evaluation methodologies to measure the impact of evidence-based nursing care (Lloyd,

Xiao, Albornos-Munoz, González-María, & Joyce, 2013), and NQuIRE is the data system to achieve it.

As the global population grows, migrates, and ages, health systems need to boldly transform to better meet population health needs. Governments and planning authorities are eager to spread, scale up, and scale out proven quality-improvement strategies such as RNAO's evidenced-based Best Practice Guidelines (BPG) and the Best Practice Spotlight Organization (BPSO) model.

REFLECTION

Why is it important to have measures that demonstrate the impact of evidence-based nursing practice?

HISTORY AND PURPOSE OF NQUIRE

NQuIRE, RNAO's groundbreaking international data system, was launched in August 2012 for BPSOs to monitor performance of RNAO BPG implementation and evaluate their impact on nursing practice, clients, organizations, and health system outcomes. Evidence shows that BPGs reduce variation in care, transfer research evidence into practice, help identify knowledge gaps, assist in clinical decision-making, redesign organizational processes, improve organizational and system performance, and reduce the cost of care. NQuIRE has a web-based user interface and database storage system that serves to collect, analyze, and report back to BPSOs comparative data on indicators reflecting the structure, process, and outcomes of care resulting from BPG implementation. From 2012 to 2014, NQuIRE was a voluntary option for BPSOs to join. In 2014, NQuIRE became a mandatory BPSO requirement to promote evaluation of nursing quality improvement and advance nursing knowledge through BPG implementation.

NQuIRE indicators have been developed for clinical BPGs based on the practice, education, and organization/policy recommendations to demonstrate how evidence-based nursing practice improves health outcomes and transforms healthcare. When the BPSO chooses the BPG for implementation, they also choose the specific indicators for each BPG. The BPSOs embrace the importance of evaluating the uptake and impact of their evidence-based implementation efforts and demonstrating the value of the nursing practice changes and improved outcomes. As the data system expands, NQuIRE will continue to impact practice, management and policy decisions, education, and health system research.

REFLECTION

Are you familiar with other data repositories that demonstrate the impact and value of evidence-based nursing care, such as NQuIRE?

THE DONABEDIAN MODEL OF STRUCTURE, PROCESS, AND OUTCOMES AND NQUIRE INDICATORS

The evaluation of nurses' contribution to improved health and healthcare using RNAO's evidence-based BPGs is based on a well-established theoretical evaluation framework. NQuIRE's architecture is based on the Donabedian Model, which categorizes the structural attributes of the settings in which care occurs, processes of care, and desired outcomes (Donabedian, 1966, 1988, 2005). The three dimensions include: structure (e.g., organizational structures, human resources, and material

resources), process (e.g., assessment, interventions, and education), and outcomes (e.g., patient, client or resident; healthcare provider; organization). The structure-process-outcome (SPO) model has been used to evaluate a diverse range of quality improvement initiatives, including the development and classification of nursing-sensitive indicators. Nursing-sensitive indicators are "based on nurses' scope and domain of practice, and for which there is empirical evidence linking nursing inputs and interventions to the outcome" (Doran, 2003, p. vii). The SPO model can be applied to a diverse range of quality improvement projects, such as:

- Introducing enhanced recovery pathways for elective colorectal surgery (Moonesinghe et al., 2017)
- Demonstrating the value of nurse-led teams in emergency departments designed to address the needs of frail older persons living in the community and residential aged care facilities (Marsden et al., 2017)
- Demonstrating the value of advanced practice nursing interventions in Switzerland (Bryant-Lukosius et al., 2016)
- Implementing evidence-based nursing interventions in a neonatal intensive care unit in China (Chen et al., 2016)
- Improving surgical procedures (Ingraham, Richards, Hall, & Ko, 2010)
- Improving the structures and processes of trauma care (Moore, Lavoie, Bourgeois, & Lapointe, 2015)

Kelley and Hurst (2006) use the SPO dimensions in a conceptual framework for the Organisation for Economic Co-operation and Development's (OECD) Health Care Quality Indicator Project. The OECD recently demonstrated the economic impact of the success or failure of patient-safety interventions within a patient-safety improvement context (Slawomirski, Auraaen, & Klazinga, 2017). With 5 decades of literature demonstrating the applicability of the SPO model, it has been an effective organizing framework for the NQuIRE data system to help BPSOs evaluate their structural inputs and impact of their implementation efforts on outcomes.

TAXONOMY OF QUALITY MEASURES

The NQuIRE data system collects structural indicators, as well as nursing-sensitive process and outcome indicators derived from the practice recommendations in RNAO's BPGs. Data dictionaries have been developed for 20 clinical BPGs of the 53 RNAO BPGs. Each data dictionary consists of the links to specific BPG practice recommendations, rationale for creating the indicator, operational definition, numerators and denominators, the target population, data collection frequency, and a list of comparable data sources. Each data dictionary has four to eight process and outcome indicators on average, for a total of 140 NQuIRE indicators.

STRUCTURAL INDICATORS

Within NQuIRE, the structural indicators represent organizational measures that are not BPG specific. Structural indicators capture staffing and other human resource characteristics of the BPSO implementation site. The six NQuIRE measures include: the number of nursing hours per patient

day or patient visit, nursing skill mix including hours worked and agency/purchased hours worked, nurse absenteeism and nurse turnover rates (as studied by Nantsupawat et al., 2017), type of education received, and the model of care delivery.

PROCESS INDICATORS

Process indicators capture nursing care provided to patients or clients, such as the assessments and interventions recommended in a specific BPG. The coding of process indicators for the NQuIRE data system generally follows the steps of the nursing process: assessment, planning, implementation/intervention, and evaluation. A numerical order (pro01, pro02, etc.) usually follows the steps of the nursing process. For example, falls_pro01 is falls risk assessment for new admissions and falls_pro02 is a falls risk assessment following a fall.

OUTCOMES INDICATORS

Outcome indicators capture the effects of nursing care on the patient's health status or their level of satisfaction with their nursing care. Thus, it is critical to ensure that planned changes in the processes of care are "validated by demonstrating their relationship to desirable outcomes" (Mainz, 2003, p. 527). To fully understand outcomes as measures of quality improvement, one must account for structural indicators related to the organization and/or sector, as well as variables specific to the patient. In addition, matters of data quality must be addressed to ensure that what we measure is valid and reliable. NQuIRE's Data Quality framework is discussed later in this chapter.

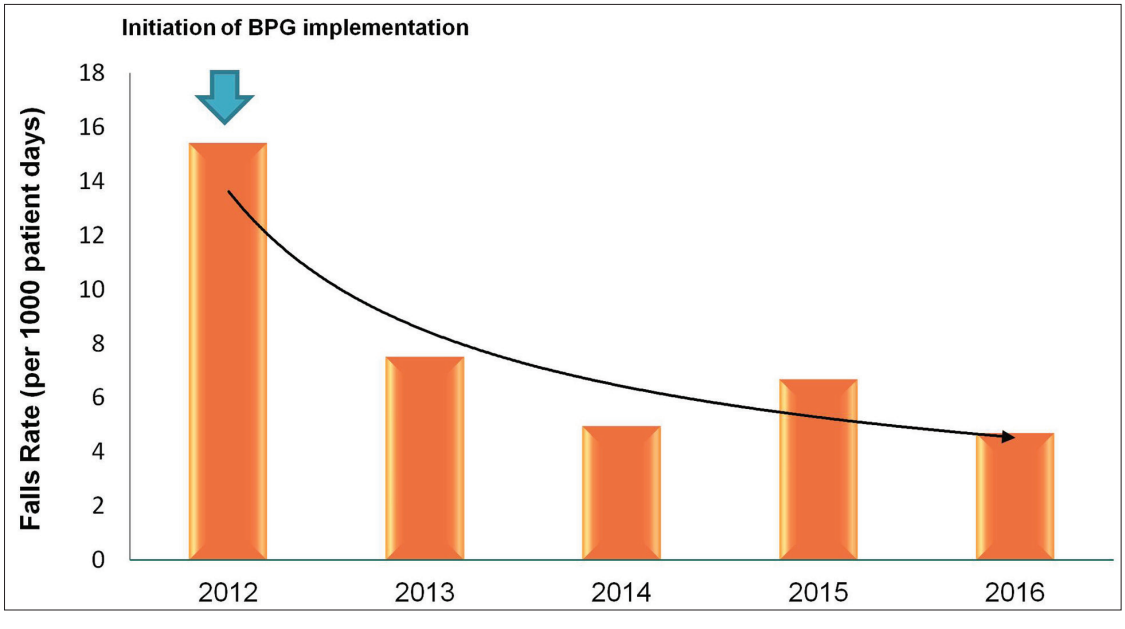


FIGURE 16.2 Average Rate of Falls (falls_out01) for Ontario Hospital BPSO.

© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

Given that long periods of time elapse before the manifestation of a desired outcome in specific sectors such as public health, implementing evidence-based practice interventions that have demonstrated effect in the systematic review is essential. Outcome indicators are derived from the BPG practice recommendations and purpose statements that identify desired outcomes and also follow a numerical order. For example, falls_out01 is for average rate of falls and falls_out02 is injury rate following a fall.

Figure 16.2 demonstrates a 70% (15.4 to 4.7) decrease in the NQuIRE outcome indicator, falls rate per 1.000 patient days, following implementation of the RNAO BPG *Prevention of Falls and Fall Injuries in the Older Adult* (2011) in one hospital BPSO. The nursing processes of care were changed in 2012 based on the BPG recommendations, and the desired outcomes have been sustained for 4 years.

REFLECTION

Using the Donabedian Model of Structure, Process, and Outcomes, can you identify indicators that are being measured or should be measured within your clinical practice?

FREQUENCY OF DATA COLLECTION

BPSOs collect indicator data monthly, quarterly, or annually depending on the type of indicator and the level of indicator utilization and/or stability. For example, data on initial assessment of new pressure injury patients on admission are collected monthly, whereas the numbers of educational visits on childhood obesity prevention to a school by the public health nurse are collected quarterly, and data on nurse turnover rate (structural indicator) are collected annually. The next section provides an overview of the NQuIRE indicator development process and planned refinements to align with the BPG development process and respond to BPSO feedback based on their lived experiences using NQuIRE.

NQUIRE INDICATOR DEVELOPMENT PROCESS

RNAO's International Affairs and Best Practice Guideline (IABPG) Centre staff work together with BPSOs throughout all phases—including development, implementation, and evaluation—to develop indicators. In 2012, the indicator development process was established based on steps identified within a systematic review of 48 articles (Kotter, Blozik, & Scherer, 2012). As an international data system, approaches used for indicator development by leading national and international organizations were examined. The World Health Organization (WHO) incorporates an advisory committee and statistical tests of indicators during its testing phase to enhance inter-jurisdictional comparisons (von Schirnding, 2002). The Organisation for Economic Co-operation and Development (OECD) maintains and continuously reviews and refines indicators (Kelley & Hurst, 2006).

The Centers for Disease Control and Prevention (CDC) uniquely uses logic models to understand the relationship amongst program goals, activities, outputs, and intended outcomes, and an explanation of baseline data (CDC, 2007). The National Institute for Health and Care Excellence (NICE) integrates an advisory committee's prioritization results and tests the prioritized indicators in their process (NICE, 2014).

Amongst Canadian agencies, the inter-Resident Assessment Instrument (inter-RAI) integrates algorithms and clinical assessment protocols in the indicator development process (inter-RAI, 2017). The Public Health Agency of Canada (PHAC, 2012) uses focus groups and content analysis of data

collected from survey participants. Health Quality Ontario (HQO), an advisory agency to the Government of Ontario, Canada, recently introduced a modified Delphi process into its process to build consensus on key indicators for public reporting (HQO, 2016). The RNAO uses a modified-Delphi process for building consensus on the BPG recommendation statements, and these findings lead to robust discussions amongst BPG Expert Panel members on potential evaluation measures.

The initial NQuIRE indicator development process (2012 to 2016) involved a five-step process which includes: 1) guideline selection; 2) extraction of recommendations; 3) quality indicator selection; 4) practice test/validation; and 5) implementation (see Figure 16.3). As previously indicated, 20 data dictionaries have been developed for 20 clinical BPGs for a total of 140 indicators. BPSOs receive education and training regarding the data dictionaries and engage in a discussion with the IABPG Centre team, including their BPSO coach, to select the NQuIRE indicators that would address the practice gaps and capture the impact of their implementation efforts for each BPG.

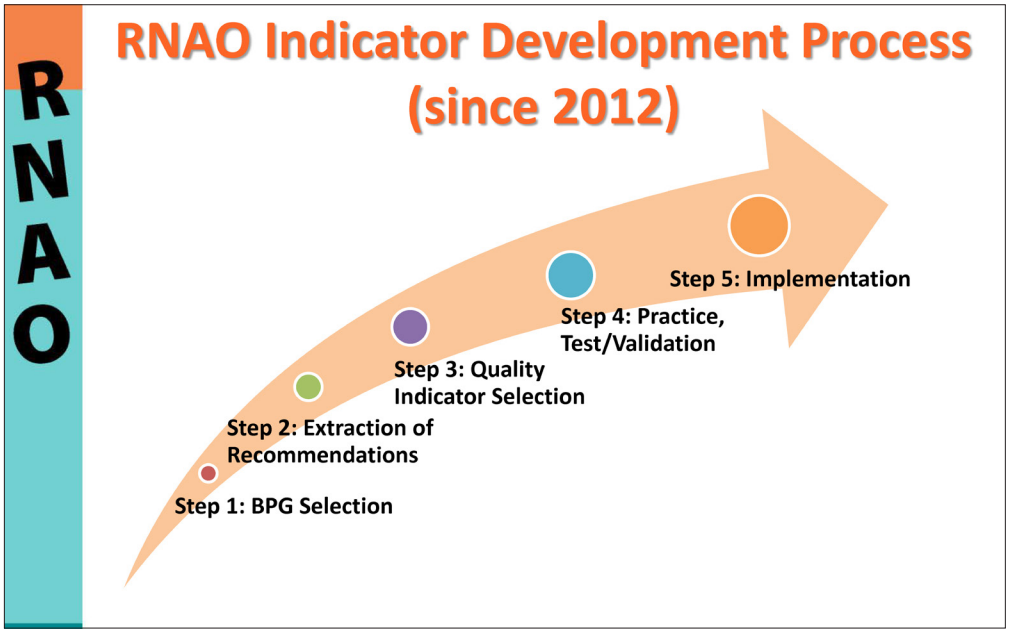


FIGURE 16.3 RNAO indicator development process (established in 2012).
© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

The RNAO indicator development process steps are summarized here:

1. **Guideline selection—**Indicators are developed for clinical BPGs that are focused on health system priorities, utilized most frequently, and/or requested by BPSOs.
2. **Extraction of recommendations**—Practice recommendations, potential measures identified in the BPG Evaluation and Monitoring chart, and RNAO Nursing Order Sets (if applicable) are reviewed to extract or identify potential measures for indicator development. The Nursing Order Sets are clear, concise, and actionable evidence-based intervention statements—derived from the BPG process recommendations—that can be readily embedded within an organization's electronic health information system (see Chapter 5, *Technology as an Enabler of Evidence-Based Practice*). Several criteria are considered when developing indicators, such as the strength of supporting evidence, impact on patient/client outcomes, or feasibility to measure and monitor. The practice recommendations that have significant policy implications and/or associated costs are also carefully considered.

3. **Quality indicator selection and development**—For new BPGs (new topics) or next edition BPGs (supplements with a literature review or subsequent editions with updated systematic reviews), indicators are identified using various established health information data libraries or repositories of quality measures, such as those from Accreditation Canada, Resident Assessment Instrument (RAI) Minimum Data Set, Canadian Institute of Health Information, Health Quality Ontario, and Joint Commission. For each next edition BPG with an updated systematic review, the previous NQuIRE indicators are reviewed for possible alignment with the updated and/or new practice recommendations. Most importantly, indicator definitions are aligned with available administrative data and existing performance measures wherever possible, adhering to a "collect once, use many times" principle. By complementing other established and emerging performance measurement systems, NQuIRE strives to leverage reliable and valid measures, minimize reporting burden, and align evaluation measures to enable comparative analyses.

4. **Practice test/validation**—Internal validation of face validity and content validity is conducted by the IABPG team, led by the Evaluation and Monitoring team. External validation of content validity and feasibility of data collection is conducted by the BPSOs. This process involves review of each draft data dictionary for new or next edition BPGs through a survey instrument. International BPSOs are included in the external validation to better understand the implications of the indicators in a global context. For example, our BPSO Host in Spain—Investén-isciii—which oversees about 80 service organizations and academic institutions across that country, conducted an expert review to select the NQuIRE indicators for the BPG, *Assessment and Management of Foot Ulcers for People with Diabetes*, 2nd Edition (RNAO, 2013).

   As the majority of BPSOs represent the hospital care sector, and most nursing-sensitive indicators measure nursing care in hospitals (Heslop & Lu, 2014), the IABPG team makes a concerted effort to work closely with BPSOs from other sectors (e.g., home care, long-term care, public health, and primary care) to validate sector-specific NQuIRE indicators. For example, the indicators *falls_pro05* (rate of daily physical restraint) and *falls_out02* (injury rate following a fall) were both developed for the long-term care sector and align with the long-term care mandatory reporting requirements.

5. **Implementation**—The data dictionaries are published on the NQuIRE website. The RNAO Information Management and Technology department and the Evaluation and Monitoring team create NQuIRE web forms and data import Excel spreadsheets for data collection. BPSOs are informed about the new indicators within the new or revised data dictionaries. BPSOs provide ongoing feedback regarding validity, feasibility of data collection, utilization of the automated NQuIRE reports, and recommendations for any future refinements.

Think of a clinical topic you are passionate about, and using the NQuIRE indicator development process, identify three ideal process indicators that would capture nursing interventions.

PURPOSEFUL EVOLUTION OF NQUIRE

As described in Chapter 1, RNAO's BPG Program engages in purposeful evolution to continuously reflect current science and respond to the needs in the field.

BPGs are updated every 5 years, at which time NQuIRE indicators are also revised for the new or updated recommendation statements. Importantly, if a next edition BPG has a STOP recommendation, then any indicator related to that STOP recommendation will be removed or revised in NQuIRE and the data dictionary. During review of each next edition BPG, the decision to remove or revise existing NQuIRE indicators is based on the following criteria:

- Indicator is not well defined and it cannot be further defined or clarified based on the BPG recommendation statement.
- Indicator is no longer relevant to nursing practice or overall client outcomes.
- Indicator does not permit useful comparisons.
- Indicator is not supported by the systematic review and evidence summaries.
- Indicator is not relevant or coherent, based on sufficient feedback from BPSOs.

NQUIRE INDICATORS: REFINEMENT

As RNAO's guideline development methodology evolves to assess the strength of recommendations using GRADE (Grading of Recommendations, Assessment, Development, and Evaluation), the indicator development process is being refined accordingly. As discussed in Chapter 2, *The Anatomy of a Rigorous Best Practice Guideline Development Process*, GRADE involves a focus on outcomes identification prior to the systematic review, which informs the research questions and affects the indicator development process.

The refined NQuIRE indicator development process will maintain the established five main steps with the addition of a sixth step that focuses on conducting the data quality assessments and ongoing evaluation to create a continuous cycle (see Figure 16.4). Within the refined NQuIRE indicator development cycle, changes include:

- Identify evaluation measures from the evidence profiles based on the systematic review (conducted by the BPG development team)
- Apply schematic algorithms to aid decision-making regarding potential indicators
- Make concerted efforts to consistently align new or revised indicators with other publicly reported measures that align with the BPG purpose, scope, and/or recommendation statements
- Apply and test the new organizing framework to categorize core, novel, and sector-specific indicators (see Figure 16.5)
- Enrich the current participation of BPSOs in the testing phase through a formalized, structured, modified-Delphi process for consensus building during external validation

"If we ask people to do more work for data collection, we need to be strategic about what we ask and how we support them so that it gets done."

–Sara Leblond, M.Sc.N., RN, IIWCC
BPSO Co-Lead
Montfort Hospital, Ontario
BPSO Direct

- Introduce new statistical tests to measure the degree of consensus (or concordance) amongst the reviewers of draft indicators as well as other psychometric tests such as reliability (Chen et al., 2016)
- Conduct annual data quality assessments to inform indicator revisions and identify the frequency of indicator utilization by BPSOs and robustness of the indicator dataset
- Create a checklist for each indicator to standardize data collection for the data elements identified in the data dictionaries
- Evaluate the indicators by conducting regular tests by BPSOs post-implementation to compare to the baseline to determine if further modifications are necessary

FIGURE 16.4 NQuIRE indicator development cycle (effective 2017).
© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

As RNAO evolves the NQuIRE indicator development process, the reporting burden is expected to lessen, and the core, new, or novel indicators are expected to be more specific to the practice setting and sector. Indicator definitions will be further aligned with available administrative data and mandatory performance measures from other data repositories wherever possible, to adhere to a "collect once, use many times" principle. BPSOs worldwide have access to NQuIRE's unique international data system to evaluate the uptake and impact of evidence-based clinical and Healthy Work Environment BPGs on nursing practice and health outcomes. This has been made possible through a collective sense of ownership of the BPSO Program and NQuIRE and an intense desire to make a difference that has led to a powerful collaboration of BPSOs globally. As described in Chapter 1, there is a

collective identity about BPSOs and about NQuIRE; together we shape the program and share our outcomes with the world.

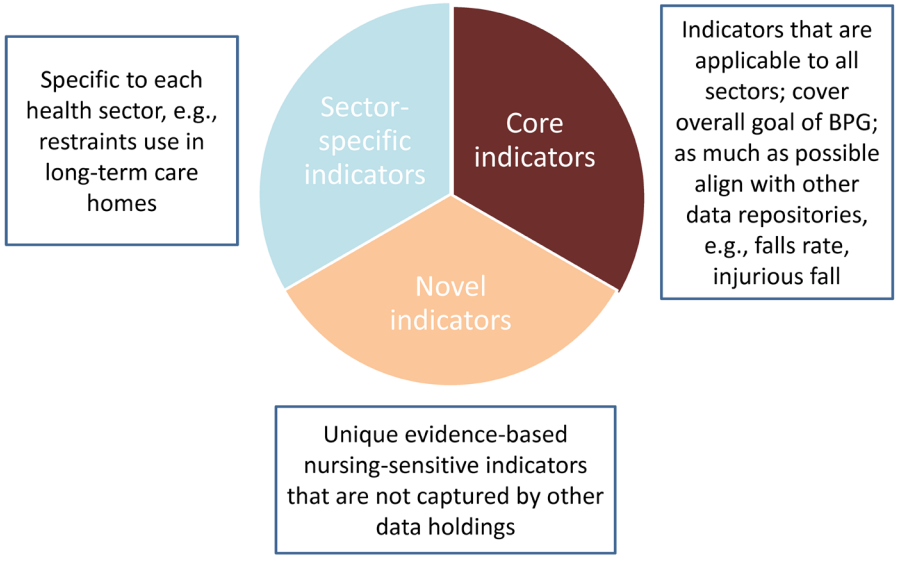


FIGURE 16.5 Categorization of NQuIRE indicators.
© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

ACADEMIC INDICATORS

The field of academic indicators and their testing is in an early stage of development. RNAO and its academic BPSOs are trailblazers of discovery in this area. Together, we have pilot initiatives underway to develop and test academic indicators for participating academic BPSOs (see Chapter 9, *Enhancing the Evidence-Based Nursing Curriculum and Competence in Evidence-Based Practice*).

NQUIRE INTERNATIONAL ADVISORY COUNCIL

In 2013, RNAO established the NQuIRE International Advisory Council (IAC) to provide strategic advice on the theoretical framework underpinning the use of indicators in research and evaluation. The IAC advises on ongoing quality-control processes and strategic use of NQuIRE data to inform research initiatives and practice, education, management, and policy deliberations at local, national, and international levels. This advisory council also recommends strategies for information analysis, including benchmarking, comparative reporting, and data triangulation.

The council meets twice a year for open discussions as RNAO continues to make strides in the field of nursing to impact health outcomes. Part of the IAC's recommendations has been to align indicators with national and international publicly reported indicators to reduce the reporting burden of BPSOs while maintaining the overall desired outcomes of the BPG. The IAC has been a source of expert advice on high-level directions and on subject-specific matters such as the NQuIRE Data Quality framework, as discussed in the next section.

"I have watched the BPG Program from its inception and have seen the amazing impact of BPSOs worldwide. With NQuIRE we have a real opportunity to prove once and forever that evidence-based nursing practice serves to optimize results for patients and health organizations. As already shown in several chapters of this book, NQuIRE will increasingly allow us to make the necessary connections between evidence-based practice and evidence-based policy—an essential link to ensure nurses' full contribution to the health and healthcare of people."

–Judith Shamian, PhD, MPH, BA, RN, D.Sc(hon), LLD(hon), FAAN
NQuIRE Founding Chair
ICN Past President

NQUIRE SECURITY AND PRIVACY

The RNAO data governance requirements are operationalized through RNAO's data governance policy and the related committees representing all departments. The Privacy Impact Assessment (PIA) provides documentation of RNAO's legal obligations toward privacy legislation, which includes Ontario's *Personal Information Protection and Electronic Documents Act, 2000* and the *Personal Health Information Protection Act, 2004*. RNAO, through NQuIRE, collects only de-identified aggregated data from BPSOs at the unit level, and not personal health information. The threat risk assessment details RNAO's legal responsibilities to BPSOs in the event of a data breach and provides evidence that RNAO has secured the NQuIRE data system at multiple levels—data, host, application, and network—against such a breach (see Figure 16.6).

The innermost layer details the security of the NQuIRE data. The NQuIRE data system includes the web-based interface, where BPSOs submit data and access their reports, and the NQuIRE database, which houses the NQuIRE data submitted by BPSOs. All data is encrypted in our secure database, and the encryption key is outside the database and the web root directory. NQuIRE datasets are subsets of the data housed within the NQuIRE database (e.g., falls data for a specific BPSO).

The second layer outlines security for the NQuIRE application. The web-based data system has role-based access control. There are two roles for BPSO users: a BPSO Lead role and an Implementation Site role. These roles are assigned automatically, and assignment is dependent on the initial invitation to NQuIRE. The data are stored in the database with access limited by the application to specific RNAO staff with a unique username and password login. Access to the application is logged and tracked through IP addresses. Access to the server and site is limited to authorized RNAO Information Management and Technology (IMT) department staff and specific IABPG Centre staff.

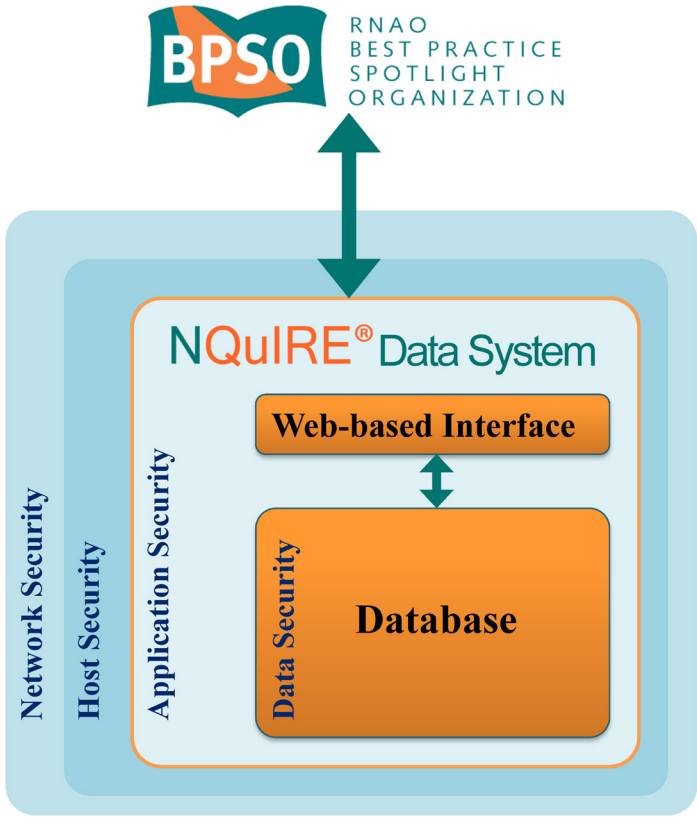


FIGURE 16.6 NQuIRE multilayer security.
© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

The NQuIRE application is developed using open source software that enables many data integrity and security features for its database. The NQuIRE application encrypts user data submissions before storing them in the NQuIRE database. The third layer includes security of the host. All data are stored entirely on RNAO-controlled and owned servers. The host is housed within RNAO's home office, and physically the server is restricted to IMT staff. The RNAO building has electronic security access, and additional electronic swipe entry is required for IMT staff to access a locked server room at the RNAO home office.

The fourth and outermost layer outlines security for RNAO networks. The networks are regularly monitored by IMT staff ensuring no unauthorized access to the network or any host or application. This multilayer security ensures that the NQuIRE data is protected at each layer. The practices for privacy and security of NQuIRE data have been established through RNAO's IMT governance processes and NQuIRE-specific data governance (i.e., the NQuIRE Data Usage Agreement). This multilayer approach to data security and privacy, combined with the NQuIRE Data Quality framework described next, are fundamental to overall data management.

REFLECTION

List three potential risks to data security and privacy

NQUIRE DATA QUALITY FRAMEWORK

The NQuIRE Data Quality framework was developed to support comprehensive data quality assessments. This required an in-depth understanding of the data system, including what the data represent and their use. Data represent selected characteristics of a phenomenon (i.e., events, concepts, and objects) and their interpretation. Specifically, data elements must be interpreted within the context of their creation, which determines "fitness for use" (Sebastian-Coleman, 2012; Wang & Strong, 1996). For NQuIRE the context is RNAO, led by the IABPG Evaluation and Monitoring team, and the fitness for use is tested by the BPSOs during BPG implementation. Data constitute an organizational asset, and appreciation of its value provides direction to reduce risks associated with flawed data (Loshin, 2011). In essence, NQuIRE must embed approaches that support high-quality data to demonstrate the impact and value of BPG implementation.

In health systems around the globe, data quality is impacted by the state of documentation systems, ranging from paper-based documentation to hybrid systems to fully electronic documentation. Data quality begins with the source, making it paramount to identify and mitigate the risks for collecting flawed data (Strome, 2013). Lack of documentation standards, duplicate records within and between organizations, different staff collecting and entering data, and outdated data-collection tools are common factors that affect data quality. According to Loeb (2004), data collection is also hindered by:

- Organizations that are unwilling or unable to change existing data-collection processes
- Ambiguous data requirements and definitions
- Challenges with data availability
- No internal, external, or independent audits of the data
- Variation in data collection and management within and across organizations
- Lack of support for those collecting data from database developers

Despite these challenges, healthcare data are critical to service delivery and used for the three categories of performance measurement (Solberg, Mosser, & McDonald, 1997): quality improvement (e.g., identifying practice issues, evaluating practice changes), accountability (e.g., reporting requirements, accreditation), and research (e.g., observational studies, case studies).

Both learning health systems and comparative effectiveness research programs use secondary health data from health information systems to apply evidence (i.e., patient, practice, and population level outcomes) in healthcare decision-making and quality improvement and to generate new knowledge (Institute of Medicine [IOM], 2007; Lopez, Holve, Sarkar, & Segal, 2012; Safran et al., 2007). Both utilize existing administrative and health information systems within and across health organizations to gather individual or aggregated data. The RNAO and BPSOs are part of learning health systems using secondary aggregated data in NQuIRE to evaluate guideline implementation. As BPSOs transform care and improve outcomes, high-quality data is critical to demonstrating the impact and value of the BPG implementation efforts (IOM, 2013; Kahn et al., 2015). The NQuIRE Data Quality framework provides the blueprint for continuously enhancing the quality of data received from BPSOs provincially, nationally, and internationally. The next section summarizes how BPSO perspectives and clinical and health data repositories from other data quality frameworks informed the development of RNAO's Data Quality framework.

RESPONDING TO THE BPSOs TO ENHANCE DATA QUALITY

Consistent with all aspects of the BPG Program and its BPSOs, end user engagement is critical to ensure uptake, sustainability, and program fidelity. In the case of NQuIRE, BPSOs are the data creators, users, and data stewards. Thus, to enhance data quality, it is important for RNAO to fully understand and account for BPSOs' perceptions, needs, and experiences in using NQuIRE.

ENRICHING THE UNDERSTANDING OF BPSOS' PERCEPTIONS, NEEDS, AND EXPERIENCES WITH NQUIRE

A comprehensive and iterative approach was used to engage BPSOs' experiences using NQuIRE and to identify data quality challenges and potential solutions. It entailed a focus group, seven onsite visits, and two virtual visits. The focus group participants consisted of a sample of BPSO Leads (n=5) representing five different sectors (i.e., public health, long-term care, hospital, home care, and primary care) within Ontario. The five BPSO Leads reported into NQuIRE for more than 6 months and had comprehensive knowledge regarding all aspects of the BPSO Designation. A semi-structured questionnaire was used to guide the focus group discussion on NQuIRE and barriers to data quality within their respective organizations. Interpretive descriptive analysis was applied to identify preliminary themes based on the verbatim transcription of the BPSO focus group.

To further understand and validate the identified themes, seven onsite visits and two virtual visits were conducted with a different subset of BPSOs with the same inclusion criteria: represented one of five sectors, reported to NQuIRE for more than 6 months, and had comprehensive knowledge of the BPSO Program. The two virtual visits were conducted with international BPSOs from Europe and Asia to ensure transferability of findings in other countries. For each visit, a structured questionnaire was used for data collection. To ensure credibility, three individual transcribers were present at each visit, and transcripts were compared and contrasted to assess consistency and reduce bias and gaps in information.

A secondary thematic analysis was conducted, and several themes were similar to the documentation and data-collection challenges previously summarized. The following were specific to NQuIRE data quality for RNAO BPGs:

- BPG purpose and scope may result in exceptions to NQuIRE indicators (e.g., BPG restricted to adults only is adapted for paediatric setting and indicator does not include paediatric population).
- NQuIRE indicators need to better represent sector-specific BPG implementation (e.g., falls intervention in public health is significantly different from hospital care).

"The client's chart is paper-based and kept at home and then only comes to office upon discharge at which point data is manually extracted for NQuIRE. This reporting burden may change once we complete transition to an electronic health record."

–Sandra M McKay, PhD
NQuIRE lead
VHA Home HealthCare, Ontario
BPSO Direct

- Data collection should start prior to BPG implementation to demonstrate effect.
- NQuIRE indicator data-collection cycle needs to be established to follow the implementation-to-sustainability cycle (e.g., pressure injury assessment indicator is collected months after steady state achieved and no data collection end date identified).
- Standardized training throughout predesignation period is required for specific topics: NQuIRE launch, data collection, data quality, data analysis, and indicator development.
- NQuIRE supporting documents such as the data dictionaries, training materials, and glossary should be more succinct and understandable for BPSO Leads to champion NQuIRE purpose and reporting.
- NQuIRE indicators should be better aligned with existing performance measures from other data repositories to decrease reporting burden.

COMPARATIVE REVIEW OF DATA QUALITY FRAMEWORKS

Data quality frameworks from other clinical and health data repositories were reviewed to develop the RNAO framework (see Table 16.1). The Canadian Institute for Health Information (CIHI) framework is based on three inputs: data quality literature, the principles of Continuous Quality Improvement (CQI), and methods and guidelines from Statistics Canada. CIHI's framework includes five data quality dimensions: accuracy, relevance, timeliness, comparability, and usability (CIHI, 2009). The New Zealand Ministry of Health (NZMH) developed a framework that includes the five CIHI dimensions and another dimension, security and privacy (Kerr, 2003; Kerr & Norris, 2004, 2007).

The Organisation for Economic Co-operation and Development (OECD), which houses international health and economic data, developed a framework that overlaps with three CIHI dimensions and has four additional dimensions—credibility, accessibility, interpretability, and coherence—and the factor of cost-efficiency (OECD, 2012). The Australia Capital Territory (ACT, 2013) Data Quality framework has seven dimensions, which include three dimensions common to all frameworks and overlaps with three of the OECD dimensions and introduces institutional environment.

Although there are differences in the dimensions between the four frameworks studied, there are many similarities and overlapping characteristics. The four frameworks informed the conceptualization and development of the NQuIRE Data Quality framework within the context of IABPG Centre initiatives and BPSO Designation goals and desired outcomes related to BPG implementation. With NQuIRE having a solid approach to security and privacy within the data system architecture, RNAO selected five similar dimensions: relevance, timeliness, interpretability, coherence, and institutional environment. It also introduced one new dimension, integrity.

TABLE 16.1 COMPARISON OF DATA QUALITY DIMENSIONS ACROSS FRAMEWORKS

DATA QUALITY DIMENSIONS	CIHI	NZMH	OECD	ACT	RNAO
Accuracy	✓	✓	✓	✓	
Relevance	✓	✓	✓	✓	✓
Timeliness	✓	✓	✓	✓	✓
Comparability	✓	✓			
Usability	✓	✓			
Security and Privacy		✓			
Credibility			✓		
Accessibility			✓	✓	
Interpretability			✓	✓	✓
Coherence			✓	✓	✓
Institutional Environment				✓	✓
Integrity					✓

THE DATA QUALITY FRAMEWORK

The NQuIRE Data Quality framework was developed to support comprehensive data quality assessments to ensure a robust data system that demonstrates the impact of BPG implementation within BPSOs.

FOUR COMPONENTS OF THE NQUIRE DATA QUALITY FRAMEWORK

The framework consists of four essential components (see Figure 16.7):

1. The BPSO is the data source where NQuIRE data is created and used (core).
2. The RNAO BPG cycle of guideline development, implementation, and evaluation impacts data quality during BPSO predesignation and designation phases (inner three circles).
3. The key features include culture of data quality, innovation and integration, and complexity and multiplicity to support high-quality data in NQuIRE (outer circle).
4. The six data quality dimensions of coherence, relevance, timeliness, institutional environment, integrity, and interpretability ensure NQuIRE data meet the goals and expectations of data users, producers, and stewards (outer pinwheel).

REFLECTION

Based on the data quality dimensions, which dimensions do you believe are most important to high quality data?

FIGURE 16.7 NQuIRE Data Quality framework.
© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

The four framework components are described in more detail in the next section.

BPSO CONTEXT AND DATA QUALITY RECOMMENDATIONS

RNAO has collaborative relationships with local, national, and international BPSOs, as all work together for the common goal of speaking out for nurses and speaking out for health, and to demonstrate the impact of their BPG implementation efforts. BPSOs analyze gaps between current practice and BPG recommendations and identify desired goals and outcomes prior to selecting relevant NQuIRE indicators and determining data sources and data-collection processes. Within each sector (i.e., public health, primary care, hospital care, long-term care, and home care), BPSOs consider the best approaches to optimize the data from their existing health information systems. The two BPSO types (service and academic) and two BPSO models (Direct and Host) have implications for which data elements are collected and reported. By placing BPSOs in the center of this framework, the RNAO is committed to actively involve BPSOs throughout the BPG cycle—from development to implementation to evaluation—to support high-quality data in NQuIRE.

To engage BPSOs in data quality improvement, the IABPG Evaluation and Monitoring team organized six in-person NQuIRE Boot Camps (autumn 2016) with local BPSOs, and five virtual NQuIRE Boot Camps (winter 2017) with international BPSOs, to collectively identify strategies to strengthen BPSOs' participation in NQuIRE, including the needs of different practice settings. The main purpose of the Boot Camp was to provide a knowledge-exchange forum for BPSOs to develop a collective understanding of NQuIRE's value to the nursing profession and enhance the quality of data in the NQuIRE data system. BPSOs recommended the development and/or refinement of sector-specific indicators, as many of the NQuIRE indicators are focused on hospital care. This recommendation would address variation in nursing care and service delivery in different practice settings and enable

"like sector" comparisons in the future. Currently, the absence of some sector-specific indicators results in exceptions and requests for customized indicators. The stratification of NQuIRE indicators by sector explains the need for this BPSO recommendation, as the data system has robust data for hospital care (60%) and long-term care (20%) and emerging data for home care (9%), public health (8%), and primary care (3%).

> *"Good job especially with international countries. The networking and knowledge exchange is great. It will be very interesting to compare the data between a Caribbean country and a Canadian site, similar in structure and size."*
>
> –Judy-Ann Henry, MScHA, CCRN, RN
> BPSO Lead
> University Hospital of the West Indies, Jamaica
> BPSO Direct

Boot Camp participant recommendations to improve data quality were also focused on institutional environment and timeliness of data collection, as monthly data collection was more challenging than quarterly data collection, which aligns with other mandatory reporting requirements. Participants recommended that NQuIRE indicators need more external validation and practice tests during the indicator development process to determine relevance and coherence with other data repositories. Participants highlighted the importance of using other data sources, both qualitative and quantitative, to improve the data quality and to champion robust evaluation that demonstrates the profound impacts of BPG implementation within BPSOs around the globe. Finally, participants highlighted the importance of defining the time period for data collection for process indicators that measure changes in the processes of care, and recommended ending data collection for specific indicators when a steady state has been sustained and targets have been achieved during the designation stage.

REFLECTION

Why do you believe it is important to establish a Data Quality framework for a large data system like NQuIRE? Have you been involved in such an initiative, and if yes, what did you learn?

BPG CYCLE AND ITS IMPACT ON DATA QUALITY

As described in Chapter 1, the BPG Program has three main pillars: development, implementation, and evaluation. As detailed in this section, each one of these pillars has a bearing on NQuIRE data quality.

BPG Development

During the BPG development phase, the purpose, scope, and inclusion and exclusion criteria form the basis for the research questions that guide the systematic review. The evidence summaries lead to the development of actionable and measurable practice recommendation statements. This initiates the early identification of NQuIRE indicators and comparison to other data repositories through the indicator development process. The practice recommendation statements lead to the identification of

process indicators while the outcome indicators are derived from the purpose, scope, and desired outcomes of the BPGs. This phase of the BPG cycle is critical to setting the foundation for data quality.

The BPSOs recognize the importance of evaluating evidence-based nursing interventions and nurse-led quality improvement initiatives as demonstrated by the number of BPSOs registered in the NQuIRE data system. Eighty-four percent are submitting data into NQuIRE, and the remaining portion (16%) are not yet submitting data because they are part of a new cohort of: service BPSOs and are in the early phase of selecting indicators and collecting data; academic BPSOs (piloting new academic-specific NQuIRE indicators); or service BPSOs that need data quality follow-ups. This level of participation contributes significantly to data quality.

BPG Implementation

The BPSOs interpret and adapt the evidence to their clinical context or practice setting during the predesignation phase. The BPSO Agreement ensures continuous flow of consistent data into NQuIRE. BPSOs identify practice gaps prior to BPG implementation to focus their efforts on changes in nursing and/or interprofessional care. RNAO BPSO coaches support organizations during implementation and evaluation activities to meet requirements for BPSO Designation. The training, support, and tools provided during this phase impact how BPSOs select indicators, identify data sources, develop data-collection processes, and submit data to NQuIRE. Each of these activities is pertinent to building capacity to comprehensively evaluate BPG implementation. These implementation efforts impact NQuIRE utilization, inform indicator selection for other BPSOs, and improve data quality throughout the 3-year period.

BPG Evaluation

BPSOs use NQuIRE indicators, other data elements from other data repositories, and their BPSO qualitative reports to evaluate BPG implementation. The unit of observation for NQuIRE data is at the implementation site level. This means aggregated data is collected at the source of BPG implementation within an organization (e.g., mental health unit in a hospital, public health program within a public health unit, or long-term care home within a long-term corporation). BPSOs need to pre-emptively plan for evaluation during the proposal stage to ensure they have an evaluation infrastructure and understand the evaluation culture. Their planning continues into the pre-implementation stage, while they conduct the gap analysis to embed necessary structures that support NQuIRE utilization. During predesignate phase, through discussions with their RNAO Coaches or the BPSO report review meetings, BPSOs discuss opportunities to further strengthen performance audit and feedback processes using NQuIRE data. These combined activities impact the data quality housed in NQuIRE. In conclusion, the interrelationships of the BPG Program pillars—1) guideline development; 2) dissemination, implementation, and sustainability; and 3) evaluation and monitoring—have a cascading effect on data quality.

Three key features were identified to support BPSOs and the IABPG team in ensuring high-quality data in NQuIRE:

1. Creating a culture of data quality is essential, because data quality is everyone's responsibility.
2. Innovation and integration throughout the BPG cycle supports high-quality data.

3. NQuIRE as a multipurpose international data system must proactively address the complexity and multiplicity of data quality needs within each BPSO.

CULTURE OF DATA QUALITY

A comprehensive and pervasive data quality culture is essential throughout the IABPG Program and all its components. This means that data quality is everyone's responsibility for all IABPG Program staff and BPSOs. Establishing data stewardship throughout the NQuIRE data lifecycle is essential and includes planning, creating, processing, analyzing, preserving, sharing, and reusing data (Faundeen et al., 2014). For NQuIRE, the data lifecycle starts with indicator development and data collection by BPSOs. The lifecycle ends with the NQuIRE reports and dashboard utilization by BPSOs to evaluate the impact of guidelines. This requires that NQuIRE data are governed and managed throughout the lifecycle with clear documentation; metadata; data quality; and data security, backup, and recovery procedures in place. Since its inception in 2012, NQuIRE's initial data architecture and design have evolved to meet the needs of BPSOs and the RNAO. These continuous data quality improvement efforts strengthen data quality.

INNOVATION AND INTEGRATION THROUGHOUT THE BPG CYCLE

Data-driven innovation is central to ensuring BPSOs have the right information to improve quality and make better decisions (Health Canada, 2015). As a high-quality data holding, NQuIRE generates automated reports and supports both real-time and retrospective decision-making regarding quality-improvement efforts. The nature of the relationship between RNAO and BPSOs, both collaborative and reporting, fosters innovation and a feedback loop that informs ongoing NQuIRE enhancements.

Integration of BPSO data submissions involves strategies to resolve the semantic conflicts between heterogeneous data sources from multiple BPSOs representing different sectors and jurisdictions (Streiner & Norman, 2008). As previously indicated, certain concepts and definitions in respective schemas such as "screening for pain upon admission" (*pain_pro01*) may have different meanings in different practice environments, organizations, sectors, and countries. RNAO works closely with the BPSOs in a continuous feedback loop to resolve such challenges throughout all phases of BPSO predesignation. The collaboration helps explicitly define or refine components of the indicators within the data dictionaries to resolve semantic conflicts and improve data quality. This enables the data sources to be directly comparable so they can be integrated even when the characteristics of the BPSOs are different.

COMPLEXITY AND MULTIPLICITY THAT IMPACT DATA QUALITY

BPSO participation in NQuIRE has implications on several levels (i.e., clinical, organizational, and health system), and the NQuIRE datasets for each BPG can be used for multiple purposes:

- Quality improvement for BPSOs to measure impact of BPG implementation
- Accountability as BPSOs submit and report on data to meet required deliverables
- Future research that will require the highest-quality data

The complexity and multiplicity of the NQuIRE data system and its multiple purposes impact data quality. The NQuIRE data system was primarily designed for clinical and organizational quality

improvement. Measurement for quality improvement occurs when: 1) identifying the practice gap or problem; 2) gathering preimplementation data; and 3) collecting post-implementation data. Measurement of quality improvement includes a small subset of "easy to collect" measures for a defined period of time (usually shorter) for a specific setting or process using a small sample size and simple data-collection processes.

For accountability purposes, measurement characteristics are more complex, with data being collected for specific indicators over a long period of time using large samples. This is done to manage performance and to compare to benchmarks for peer organizations.

For research, many precise and valid measures are collected for long time periods with large sample sizes and complex data-collection processes (Solberg et al., 1997). In 2012, NQuIRE was launched as a nursing quality-improvement database, and over the past 5 years, NQuIRE reporting and monitoring by BPSOs have demonstrated the impact of BPG implementation at the organizational level. NQuIRE has evolved into a robust data system that can be used for comparative reports and the Nursing Trends Report.

In conclusion, data quality requirements for quality improvement are less rigorous when compared to the requirements for accountability or research. The decision to mandate NQuIRE in 2014 has significantly enhanced data quality, and the datasets for the most-utilized BPGs are robust. This mandatory requirement added complexity to the data quality needs of NQuIRE and drove changes to the data system architecture and design to support the participation of all BPSO types, models, sectors, and countries. In anticipation of data usage for future research, data quality improvement procedures based on the framework dimensions are currently being tested.

Can you provide examples of how data have been used for the different purposes of quality improvement, accountability, and research?

DATA QUALITY DIMENSIONS

The data quality dimensions describe the fundamental components to ensure that high-quality data are inputted into NQuIRE. Each of these dimensions is integral, interrelated, and overlapping, which implies that failure in one dimension can result in failure in other dimensions. Six data quality dimensions were identified as crucial to NQuIRE and the BPG Program: integrity, relevance, interpretability, coherence, timeliness, and institutional environment. These dimensions are the core components of the Data Quality framework for continuous monitoring and data quality improvement implementation procedures. The characteristics of each data quality dimension are described here.

Integrity

This dimension determines accuracy of NQuIRE data in describing and representing the event, object, or concept they were intended to measure (e.g., goals for guideline implementation and impact on outcomes for target population). This includes the comprehensiveness of the BPG dataset for each BPSO and sensitivity to change to represent the impact of BPG implementation on nursing care and outcomes. Completeness of the NQuIRE dataset for each BPG by the BPSO is determined by the established data-collection processes. *Completeness* is defined by the proportion of data in the data system to the potential 100% complete data for any data element. The consistency of data reported within BPSOs and across BPSOs within a sector for specific data elements provides opportunity for comparability.

Potential data-collection and reporting errors are documented, and upon identification, corrections are made in a timely manner. Most BPSOs report one structural indicator, one process indicator, and one outcome indicator for each clinical BPG. RNAO conducts data quality assessments to improve data quality over time and identify inconsistencies in data submissions. Recently, a "missingness assessment," which involves identification and analysis of missing data, was conducted. It rank-orders valid data for each indicator based on the number of BPSOs submitting data for that particular indicator. The results of this missingness assessment supported improvements in the NQuIRE data system including the indicator development, indicator refinement, and data analysis to better demonstrate the impact and value of BPG implementation.

Relevance

This dimension refers to NQuIRE's ability to address the needs of users. For BPSOs, it refers to how well the data supports evaluation of BPG implementation (i.e., for the purpose of quality improvement). NQuIRE data dictionaries outline the operational definition of indicators with the target population. This includes inclusion and exclusion criteria to identify the relevance of the data to the user. A BPSO may implement a guideline organization-wide but only report data to NQuIRE for specific areas or settings within the organization. For example, a BPSO may report data on a single long-term care home when the BPG is being implemented across five long-term care homes. Finally, the NQuIRE reports and dashboard must meet the needs of the BPSOs.

Interpretability

This dimension differentiates whether BPSOs can correctly interpret their results and use their NQuIRE report and dashboard to support evaluation of their BPG implementation efforts. The data collected from BPSOs are de-identified and aggregated at the implementation site level, which is important to discern data quality challenges associated with analysis and interpretation. RNAO resources (e.g., data dictionaries, metadata, training materials, and other resources) provide BPSOs with information and context for analysis and interpretation of the NQuIRE reports and dashboard.

Coherence

This dimension ensures internal consistency and comparability of the NQuIRE data by the individual BPSO or with similar indicators from secondary data repositories (when applicable). Coherence should be apparent through standardized definitions, concepts, and data-collection processes over time. Coherence should also occur within a single NQuIRE dataset for each BPG by BPSO and across NQuIRE datasets for multiple BPSOs. Common definitions and concepts, with appropriate documentation, provide an opportunity for comparability of BPSO data. Coherent indicators within sectors and between countries are identified to allow for "like" BPSO-to-BPSO comparisons. Revisions to NQuIRE indicators may be required with new BPG editions, or data-collection practices change over time, resulting in restricted comparability of NQuIRE data to specific time periods, BPGs, and/or BPSO cohorts.

Timeliness

This dimension identifies the currency of the data (i.e., data is available when expected and needed). Acceptable differences in timing between guideline implementation and reporting data to NQuIRE need to be continuously examined and refined. The usefulness of the real-time and retrospective NQuIRE reports and dashboards at specific points in time (e.g., BPG launch, implementation, post-implementation phases) needs to be fully understood to further support implementation and sustainability efforts. The data collection stop date needs to be identified for relevant process indicators when steady state and/or desired outcomes are achieved (Mainz, 2003). The expected data collection frequency is clearly outlined, and adherence to monthly, quarterly, or annual submission is pertinent for this dimension.

Institutional Environment

This dimension identifies a BPSO's capacity to collect quality data for NQuIRE. Institutional factors such as adequacy of available resources and support (budget, human resources, time, equipment, processes, etc.) to collect data have a significant impact on BPSO data submission and NQuIRE data quality. Prior to participating in NQuIRE, the BPSO mandate to collect NQuIRE data is a key factor in ensuring BPSOs adhere to contractual requirements and submit data. The commitment of BPSO staff and support staff (e.g., information technology, decision support, clinical informatics, administration, etc.) to collect and report data with objectivity and transparency is fundamental.

INNOVATIVE DATA QUALITY ASSESSMENT APPROACHES TO IMPROVE DATA QUALITY

These six dimensions led to the development of subjective and objective metrics to conduct data quality assessments. *Subjectivity* considers the perception, needs, and experiences of data producers, consumers, and stewards. The BPSO focus group and visits (onsite and virtual) to develop the framework inform the subjective metrics. *Objectivity* includes measures to test whether the criteria and characteristics of each dimension are met. Objective data quality metrics can be developed within the context of data usage or independently. For the integrity dimension, considerable analysis for completeness and usability was completed.

The following metrics were developed: missing percentage, valid percentage, and weighted measure. The "missing percentage" is the proportion of missing data from the total data submissions by BPSOs. The "valid percentage" is the proportion of valid data from the total data submissions by BPSOs. Using the "valid percentage" and the number of BPSOs submitting data for a specific NQuIRE measure, a "weighted measure" was calculated. The "weighted measure" provides insight regarding the most reliable and frequently used BPG-specific indicators. Sector-specific analysis was also conducted to develop a better understanding of data quality by sector and inform areas for improvement. Data quality metrics for all dimensions are being developed to support comprehensive assessments to continuously monitor and improve NQuIRE data quality. By comparing the number of BPSOs using each indicator along with the valid data percentage, RNAO identified inconsistencies in data submission which have led to technological enhancements to the data system. Also, the weighted measure by NQuIRE indicator revealed the most robust datasets for 30 indicators that can be further examined to demonstrate the impact of BPG implementation within individual BPSOs (see Figures 16.8 and 16.9). This analysis also provides the foundation for choosing NQuIRE indicators that can be used in comparative reports and the Nursing Trends Report to demonstrate the value of the BPSO Designation.

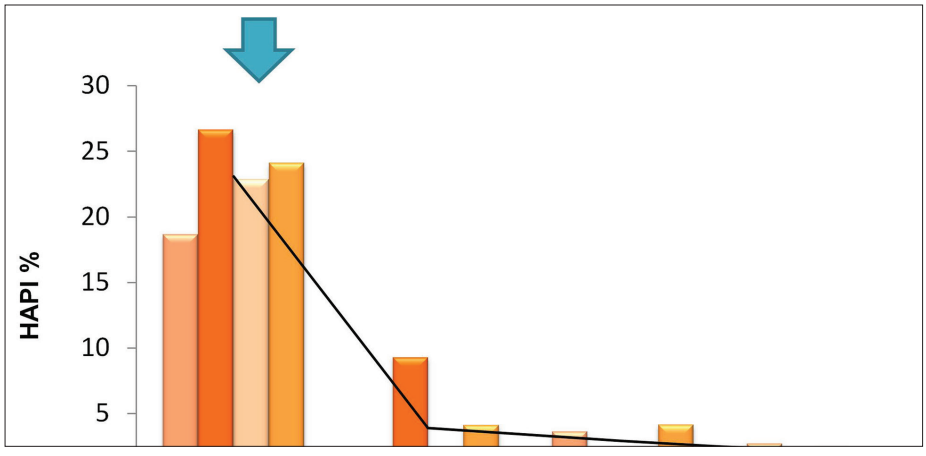


FIGURE 16.8 Quarterly average of HAPI for international hospital BPSO (ulcerprev_out01). Used with permission.

Figure 16.8 demonstrates a 91% (23.08 to 2.09) decrease in the NQuIRE outcome indicator, health-care-acquired pressure injury (HAPI), following implementation of the RNAO BPG *Risk Assessment and Prevention of Pressure Ulcers* (2005) in an international hospital BPSO. The nursing processes of care were changed in 2013 based on the BPG recommendations, and the desired outcomes have been sustained for 3 years.

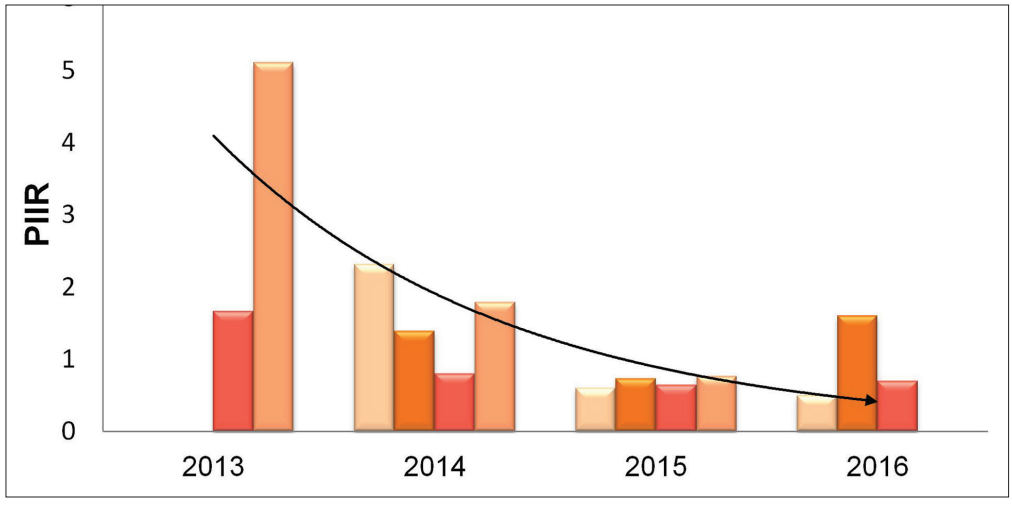


FIGURE 16.9 Quarterly average of pressure injury incidence rate for international hospital BPSO. Used with permission.

Figure 16.9 demonstrates an 86% (5.1 to 0.7) decrease in the NQuIRE outcome indicator, pressure injury incidence rate (PIIR), following implementation of the RNAO BPG *Risk Assessment and Prevention of Pressure Ulcers* (2005) in a different international hospital BPSO than the previous example. The nursing processes of care were changed in 2013 based on the BPG recommendations, and the desired outcomes have been sustained for 3 years.

SUMMARY OF NQUIRE DATA QUALITY FRAMEWORK

The NQuIRE data system, a technology-enabled data profiling and reporting system for the evaluation of BPG implementation by BPSOs, is a first-in-its-class innovation by RNAO. The NQuIRE Data Quality framework highlights the key features and dimensions required for focused data quality improvement efforts. The six data quality dimensions are fundamental to assessing data quality and continuous data quality improvement. In comparison to existing frameworks, the NQuIRE Data Quality framework puts the BPSO at the center and integrates the BPG cycle. BPSOs, the main data producers from multiple sectors and diverse jurisdictions, have their own health information systems and data-collection processes, which leads to unique data quality challenges and opportunities for NQuIRE. This framework demonstrates the rigor behind the NQuIRE data system and increases BPSO confidence in the value of NQuIRE for quality improvement, accountability, and research.

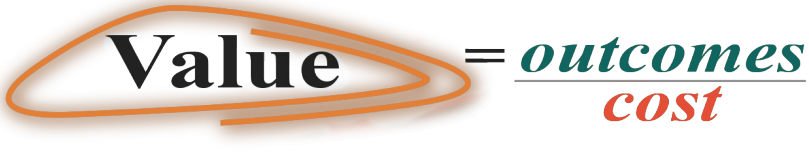
FUTURE DIRECTIONS: EVIDENCE BOOSTERS AND BPSO-NQUIRE EVALUATION MODEL

Over the past 5 years, there has been a continuous feedback loop with BPSOs around the globe regarding their NQuIRE experience, insights, and advice. RNAO has formally and continuously engaged BPSOs for the NQuIRE indicator development process, NQuIRE orientation sessions, NQuIRE Boot Camps, and RNAO evaluation workshops. RNAO engages the NQuIRE IAC to receive strategic advice on the theoretical framework underpinnings, quality-control processes, as well as future directions and use for the data system. Our active participation in the Guidelines International Network (GIN) allows us to contribute learnings from our experience and glean insights from others on guideline development, implementation strategies, and performance measures.

RNAO regularly reviews the literature, assesses processes and frameworks of other jurisdictions, and consults its partners, such as Health Quality Ontario, Accreditation Canada, and Resident Assessment Instrument (RAI) Minimum Data Set. All of these efforts inform enhancements to the NQuIRE data system, the refined NQuIRE data indicator development process, and NQuIRE's Data Quality framework for ongoing BPSO Program evaluation and future research. With a robust BPG Program, active BPSO engagement, and a strong measurement system, RNAO is now confident in its ability to demonstrate value of the BPSO efforts. We discuss this next.

Value is defined as the relationship between outcomes and costs. Health systems worldwide are focusing on enhancing value by engaging in quality-improvement strategies in which:

- Outcomes remain stable, but costs are decreased
- Outcomes improve, but costs remain stable
- Outcomes improve *and* costs are decreased



ECONOMICS OF NURSING

Health systems are complex, and at any moment there are many ideas for ways to improve the system, but in order to achieve the health system goals and improve health system sustainability, no major initiatives should move forward without clearly addressing value enhancement. Value must become the backbone of global health transformation strategies. RNAO has developed two-page value proposition reports: RNAO Evidence Boosters (EBs). They demonstrate the value and impact of BPG implementation by BPSOs using NQuIRE indicators. The NQuIRE indicators chosen for the RNAO EBs have achieved high scores in the weighted measure of the data quality assessment. The Evidence Boosters are trending reports from BPG launch to implementation to sustainability and demonstrate the economic impact (see Figure 16.10).

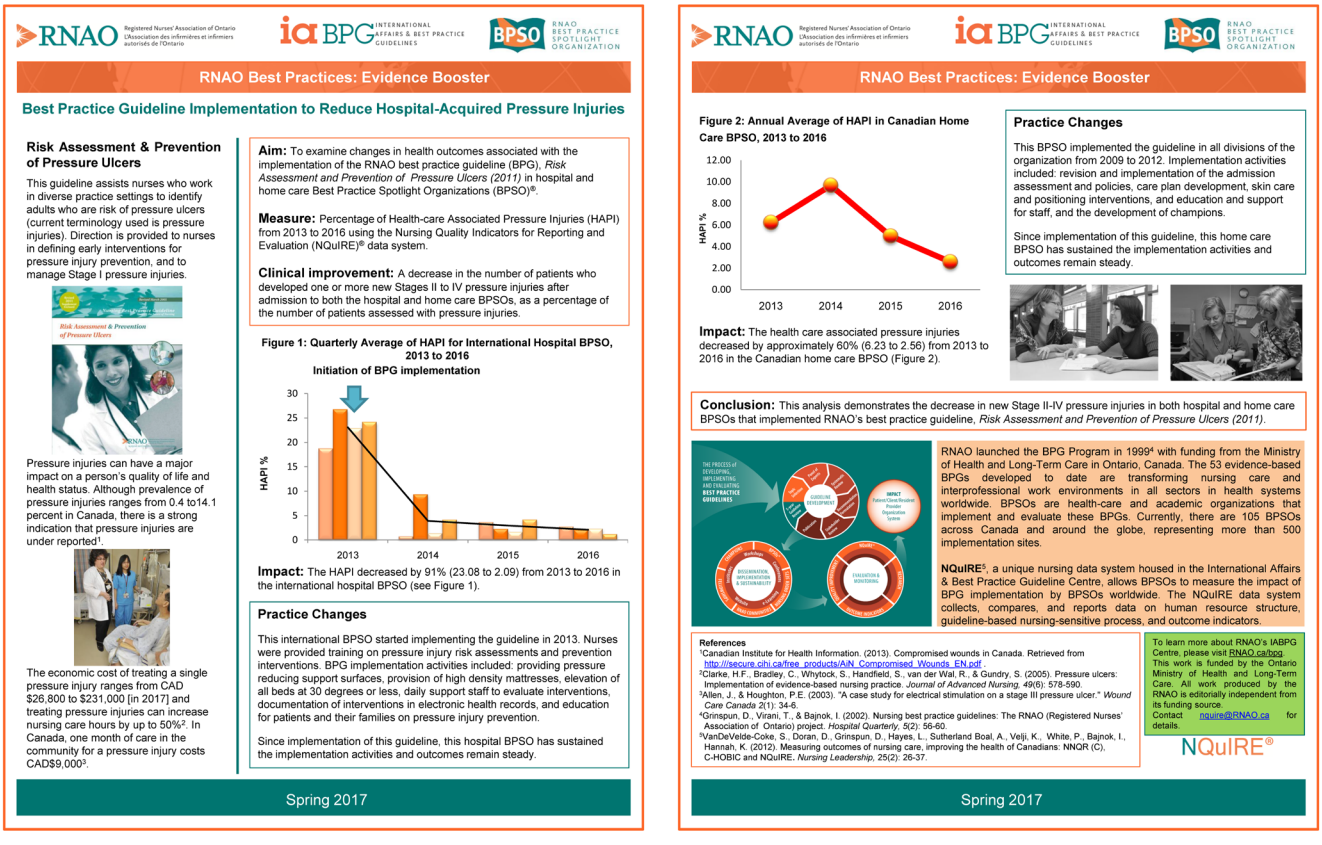


FIGURE 16.10 Examples of RNAO Evidence Boosters: Pressure injury incidence rate and hospital-acquired pressure injuries.

© Registered Nurses' Association of Ontario. All rights reserved.

The Evidence Boosters (EB) depicted in Figure 16.10 showcase the BPG implementation results in a graphic and include a brief description of the BPG in the upper-left corner and the BPSO aim, measure, clinical improvement, and practice changes in the right column. In the bottom-left corner, the economic impacts are reported. For example, treating pressure injuries increases nursing care hours by

up to 50% (Clarke et al., 2005), and 1 month of care in the community for a pressure injury costs approximately CAD $9,000 (Allen & Houghton, 2003). An 86% decrease in pressure injury incidence rate and a 91% decrease in hospital-acquired pressure injuries would result in significant cost savings to the patient, organization, and health system. See Appendix A at the end of this chapter for a full view of each EB.

REFLECTION

Is the impact and value of evidence-based nursing care depicted in your workplace? Would you benefit from using a data system such as NQuIRE to demonstrate the impact of nurse-led quality improvement? If yes, in which way would you benefit and how can you introduce it?

BPSO-NQUIRE EVALUATION MODEL: STRATEGIC FOCUS

The BPSO-NQuIRE Evaluation Model (see Figure 16.11) encompasses: 1) the NQuIRE Data Quality framework; 2) the rigorous indicator development and revision cycle for each clinical BPG; and 3) the BPSO reporting and data collection that occurs within NQuIRE and myBPSO, which is the online reporting system. The five pillars within the model represent RNAO's analytic approaches to robust evaluation to demonstrate the health impact and value of BPG implementation by BPSOs. These analytic approaches include:

1. Quantitative data analysis of the NQuIRE datasets
2. Qualitative data analysis based on case studies from myBPSO reports
3. Data mapping and secondary data analysis of other health system data repositories (e.g., inter-RAI and CIHI) to complement NQuIRE and myBPSO data analysis
4. Data analysis focused on implementation science indicators that complement the Donabedian Model (see Chapter 4, *Forging the Way with Implementation Science*)
5. Inter-BPSO comparative analysis for publication of NQuIRE comparative reports and Nursing Trends Report

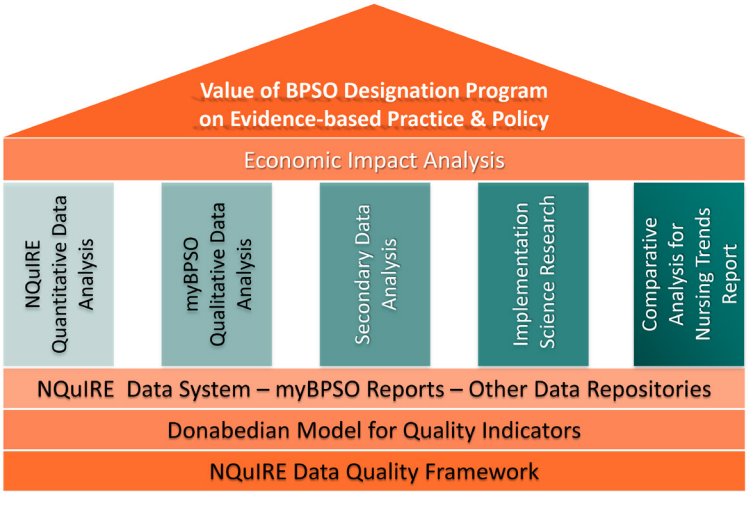


FIGURE 16.11 BPSO-NQuIRE Evaluation Model.

© Registered Nurses' Association of Ontario. All rights reserved. Used with permission.

As shown in Figure 16.11, RNAO's multimethod approach supports BPSOs to demonstrate the value of their implementation efforts and ultimately the value of the RNAO BPGs to BPSOs and health systems.

CONCLUSION

Health systems need to fully embrace evidence to boldly transform and meet population health needs. As discussed in Chapters 1 and 12, scaling up, scaling out, and scaling deep programs that have demonstrated results are urgently needed to meet this challenge. RNAO's BPG Program is revolutionizing nursing's contribution to patients', organizational, and health system outcomes worldwide. The NQuIRE data system will increasingly make this contribution visible by quantifying processes of nursing care and its value locally, nationally, and internationally. The RNAO BPSO Designation has created a platform for robust evaluation methodologies to measure the impact of evidence-based nursing care, as well as the impact of evidence and structural indicators such as staffing on patients' outcomes. RNAO has developed rigorous approaches to development of NQuIRE indicators, establishment of the NQuIRE Data Quality framework, and completion of data quality assessment using innovative statistical techniques. With the current state of NQuIRE and the BPSO Evaluation Model, RNAO is poised to produce comparative reports, the Nursing Trends Report, and be a source of data for practitioners, administrators, educators, researchers, and policymakers, now and into the future.

KEY MESSAGES

- Quantifying the impact of evidence-based nursing practice on patient, organizational, and health system outcomes enables us to showcase nurses' full contributions.
- The Donabedian Model is an effective framework to build structure, process, and outcome indicators to evaluate the impact of BPG implementation.
- A robust indicator development process that is evidence-based and informed by RNAO's BPG development methodology, BPSOs, other data repositories, end users, and other RNAO partners is foundational to evaluate the uptake of, and impact of, RNAO BPGs.
- Security and privacy safeguards, as well as ensuring data quality, are central features of a robust data system.
- The NQuIRE Data Quality framework puts the BPSO at the center, demonstrates the rigor behind the NQuIRE data system, and increases BPSO confidence in the value of NQuIRE for quality improvement, accountability, and research.
- Purposeful evolution of NQuIRE indicator development with a programed refinement cycle is critical to ensuring that the BPG evaluation measures remain abreast with new BPG editions and current research.
- Access to data in daily practice is critical in understanding gaps in care, measuring improvement, and demonstrating impact of evidence-based practice on outcomes.

REFERENCES

Allen, J., & Houghton, P. E. (2003). A case study for electrical stimulation on a stage III pressure ulcer. *Wound Care Canada*, *2*(1), 34–36.

Australian Capital Territory (ACT) Health. (2013). *ACT health Data Quality framework*. Retrieved from http://health.act.gov.au/sites/default/files/Policy_and_Plan/Data%20Quality%20Framework.pdf

Bryant-Lukosius, D., Spichiger, E., Martin, J., Stoll, H., Kellerhals, S. D., Fliedner, M., . . . De Geest, S. (2016). Framework for evaluating the impact of advanced practice nursing roles. *Journal of Nursing Scholarship*, *48*(2), 201–209.

Canadian Institute for Health Information (CIHI). (2009). *The CIHI Data Quality framework.* Retrieved from https://www.cihi.ca/en/data_quality_framework_2009_en.pdf

Centers for Disease Control and Prevention (CDC). (2007). *Developing evaluation indicators.* Retrieved from https://www.cdc.gov/std/Program/pupestd/Developing%20Evaluation%20Indicators.pdf

Chen, L., Huang, L.-H., Xing, M.-Y., Feng, Z.-X., Shao, L.-W., Zhang, M.-Y., & Shao, R.-Y. (2016). Using the Delphi method to develop nursing-sensitive quality indicators for the NICU. *Journal of Clinical Nursing*, *26*, 502–513. doi: 10.1111/jocn.13474

Clarke, H. F., Bradley, C., Whytock, S., Handfield, S., van der Wal, R., & Gundry, S. (2005). Pressure ulcers: Implementation of evidence-based nursing practice. *Journal of Advanced Nursing*, *49*(6), 578–590.

Donabedian, A. (1966). Evaluating the quality of medical care. *Millbank Memorial Fund Quarterly*, *44*(Suppl.), 166–206.

Donabedian, A. (1988). The quality of care: How can it be assessed? *Journal of American Medical Association*, *260*, 1743–1748.

Donabedian, A. (2005). Evaluating the quality of medical care. *Milbank Quarterly*, *83*, 691–729.

Doran, D. M. (2003). Preface. In D. M. Doran (Ed.), *Nursing-sensitive outcomes: State of the science* (2nd ed.) (pp. vii–ix). Sudbury, MA: Jones and Bartlett.

Doran, D., Mildon, B., & Clarke, S. (2011). Towards a national report card in nursing: A knowledge synthesis. *Canadian Journal of Nursing Leadership*, *24*(2), 38–57.

Faundeen, J. L., Burley, T. E., Carlino, J. A., Govoni, D. L., Henkel, H. S., Holl, S. L., . . . Zolly, L. S. (2014). *The United States geological survey science data lifecycle model: U.S. geological survey open-file report 2013–1265*. Retrieved from https://pubs.usgs.gov/of/2013/1265/

Grinspun, D., Lloyd, M., Xiao, S., & Bajnok, I. (2015). Measuring the quality of evidence-based nursing care: NQuIRE – Nursing Quality Indicators for Reporting and Evaluation Data-System. *Revista MedUNAB*, *17*(3), 170–175.

Health Canada. (2015, July). *Unleashing innovation: Excellent healthcare for Canada.* Report of the Advisory Panel on Healthcare Innovation. Retrieved from https://www.canada.ca/en/health-canada/services/publications/health-system-services/report-advisory-panel-healthcare-innovation.html

Health Quality Ontario (HQO). (2016, October). *Quality standards: Process and methods guide.* Retrieved from http://www.hqontario.ca/portals/0/documents/evidence/quality-standards/qs-process-guide-1610-en.pdf

Heslop, L., & Lu, S. (2014). Nursing-sensitive indicators: A concept analysis. *Journal of Advanced Nursing*, *70*(11), 2469–2482.

Ingraham, A. M., Richards, K. E., Hall, B. L., & Ko, C. Y. (2010). Quality improvement in surgery: The American College of Surgeons National Surgical Quality Improvement Program approach. *Advances in Surgery*, *44*(1), 251–267.

Institute of Medicine (IOM). (2007). *The learning healthcare system: Workshop summary*. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK53481/

Institute of Medicine (IOM). (2013, 26 March). *Digital data improvement priorities for continuous learning in health and health care: Workshop summary*. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK207329/

inter-RAI. (2017). Instruments: An overview of the inter-RAI suite. Retrieved from http://www.interrai.org/instruments/

Kahn, M. G., Brown, J. S., Chun, A. T., Davidson, B. N., Meeker, D., Ryan, P. B., . . . Zozus, M. N. (2015). Transparent reporting of data quality in distributed data networks. *eGEMs*, *3*(1), 1052.

Kelley, E., & Hurst, J. (2006, March 9). *Health care quality indicators project conceptual framework paper. Organisation for Economic Co-operation and Development* (OECD), *Health Working Paper No. 23*. Retrieved from http://www.oecd.org/els/health-systems/36262363.pdf

Kerr, K. (2003). *The development of a Data Quality framework and strategy for the New Zealand ministry of health.* Department of Information Systems and Operations Management, University of Auckland, New Zealand. Retrieved from http://mitiq.mit.edu/Documents/IQ_Projects/Nov%202003/HINZ%20DQ%20Strategy%20paper.pdf

Kerr, K., & Norris, T. (2004). *The development of a healthcare Data Quality framework and strategy.* Proceedings of the ninth international conference on information quality (ICQ-04). Retrieved from http://mitiq.mit.edu/ICIQ/Documents/IQ%20Conference%202004/Papers/TheDevelofaHealthcareDQFramework.pdf

Kerr, K., & Norris, T. (2007). The development of a health Data Quality programme. In L. Al-Hakim (Ed.), *Information quality management: Theory and applications* (pp. 94–118). Hershey, PA: Idea Group Publishing.

Kotter, T., Blozik, E., & Scherer, M. (2012). Methods for the guideline-based development of quality indicators—A systematic review. *Implementation Science*, *7*(21), 1–22.

Lloyd, M., Xiao, S., Albornos-Munoz, L., González-María, E., & Joyce, A. (2013). Measuring the process and outcomes of foot ulcer care with guideline-based nursing quality indicators. *Diabetic Foot Canada*, *1*(2), 15–19.

Loeb, J. M. (2004). The current state of performance measurement in health care. *International Journal for Quality in Health Care*, *16*(Suppl.), i5–i9.

Lopez, M. H., Holve, E., Sarkar, I. N., & Segal, C. (2012). Building the informatics infrastructure for comparative effectiveness research (CER): A review of the literature. *Medical Care*, *50*(Suppl.), 38–48.

Loshin, D. (2011). *The practitioner's guide to data quality improvement*. Burlington, MA: Elsevier.

Lugtenberg, M., Burgers, J. S., & Westert, G. P. (2009). Effects of evidence-based clinical practice guidelines on quality of care: A systematic review. *BMJ Quality & Safety*, *18*(5), 385–392.

Mainz, J. (2003). Methodology matters: Defining and classifying clinical indicators for quality improvement. *International Journal for Quality in Health Care*, *15*(6), 523–530.

Marsden, E., Taylor, A., Wallis, M., Craswell, A., Broadbent, M., Barnett, A., . . . Glenwright, A. (2017). A structure, process and outcome evaluation of the Geriatric Emergency Department Intervention model of care: A study protocol. *BMC Geriatrics*, *17*, 76.

Millar, A., Simeone, R. S., & Carnevale, J. T. (2001). Logic models: A systems tool for performance management. *Evaluation and Program Planning*, *24*, 73–81.

Moonesinghe, S. R., Grocott, M. P. W., Bennett-Guerrero, E., Bergamaschi, R., Gottumukkala, V., Hopkins, T. J., . . . The Perioperative Quality Initiative (POQI) I Workgroup. (2017). American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on measurement to maintain and improve quality of enhanced recovery pathways for elective colorectal surgery. *Perioperative Medicine*, *6*, 6.

Moore, L., Lavoie, A., Bourgeois, G., & Lapointe, J. (2015). Donabedian's structure-process-outcome quality of care model: Validation in an integrated trauma system. *The Journal of Trauma and Acute Care Surgery*, *78*(6), 1168–1175.

Nantsupawat, A., Kunaviktikul, W., Nantsupawat, R., Wichaikhum, O.-A., Thienthong, H., & Poghosyan, L. (2017). Effects of nurse work environment on job dissatisfaction, burnout, intention to leave. *International Nursing Review*, *64*, 91–98.

National Institute for Health and Care Excellence (NICE). (2014, April). *Health and social care directorate indicators process guide*. Retrieved from https://www.nice.org.uk/media/default/Standards-and-indicators/Quality-standards/Quality-standards-process-guide-April-2014.pdf

Organisation for Economic Co-operation and Development (OECD). (2012, 17 January). *Quality framework and guidelines for OECD statistical activities version 2011/1*. Retrieved from http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=std/qfs(2011)1&doclanguage=en

Personal Health Information and Protection Act, 2004, S.O. 2004, c. 3, Sched. A. Retrieved from the Ontario Laws website: https://www.ontario.ca/laws/statute/04p03

Personal Information Protection and Electronic Documents Act, S.C. 2000, c. 5. Retrieved from the Government of Canada Justice Laws website: http://laws-lois.justice.gc.ca/eng/acts/P-8.6/index.html

Public Health Agency of Canada (PHAC). (2012). *Canadian sexual health indicators survey—Pilot test and validation phase*. Retrieved from http://publications.gc.ca/site/eng/415217/publication.html

Registered Nurses' Association of Ontario (RNAO) (2005). *Risk assessment and prevention of pressure ulcers.* (Revision Supplement 2011). Toronto, ON: Registered Nurses' Association of Ontario.

Registered Nurses' Association of Ontario (RNAO). (2011). *Prevention of falls and fall injuries in the older adult.* Toronto, ON: Registered Nurses' Association of Ontario.

Registered Nurses' Association of Ontario (RNAO). (2013). *Assessment and management of foot ulcers for people with diabetes* (2nd ed.). Toronto, ON: Registered Nurses' Association of Ontario.

Safran, C., Bloomrosen, M., Hammond, W. E., Labkoff, S., Markel-Fox, S., Tang, P. C., & Detmer, D. E. (2007). Toward a national framework for the secondary use of health data: An American Medical Informatics Association white paper. *Journal of American Medical Informatics Association*, *14*(1), 1–9.

Sebastian-Coleman, L. (2012). *Measuring data quality for ongoing improvement: A Data Quality assessment framework*. Waltham, MA: Morgan Kaufmann.

Slawomirski, L., Auraaen, A., & Klazinga, N. (2017, 26 June). *The economics of patient safety: Strengthening a value-based approach to reducing patient harm at national level.* OECD Health Working Papers, No. 96., OECD Publishing, Paris. Retrieved from https://www.bundesgesundheitsministerium.de/fileadmin/Dateien/3_Downloads/P/Patientensicherheit/The_Economics_of_patient_safety_Web.pdf

Solberg, L. I., Mosser, G., & McDonald, S. (1997). The three faces of performance measurement: Improvement, accountability, and research. *Journal of Quality Improvement*, *23*(3), 135–147.

Streiner, D., & Norman, G. (2008). *Health measurement scales: A practical guide to their development and use* (4th ed.). New York, NY: Oxford University Press Inc.

Strome, T. (2013). *Healthcare analytics for quality and performance improvement*. Hoboken, NJ: John Wiley & Sons.

VanDeVelde-Coke, S., Doran, D., Grinspun, D., Hayes, L., Sutherland Boal, A., Velji, K., . . . Hannah, K. (2012). Measuring outcomes of nursing care, improving the health of Canadians: NNQR (C), C-HOBIC and NQuIRE. *Nursing Leadership*, *25*(2), 26–37.

von Schirnding, Y. (2002). *Health in sustainable development planning: The role of indicators.* Geneva, CH: World Health Organization. Retrieved from http://www.who.int/wssd/resources/indicators/en/

Wang, R., & Strong, D. M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of Management Information Systems*, *12*(4), 5–33.

APPENDIX A: EVIDENCE BOOSTERS DEMONSTRATING BPG IMPACT IN BPSO

RNAO Registered Nurses' Association of Ontario L'Association des infirmières et infirmiers autorisés de l'Ontario

iaBPG INTERNATIONAL AFFAIRS & BEST PRACTICE GUIDELINES

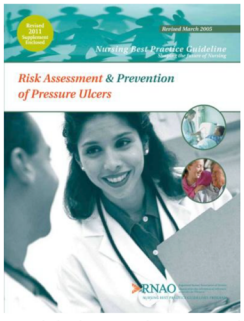
BPSO RNAO BEST PRACTICE SPOTLIGHT ORGANIZATION

RNAO Best Practices: Evidence Booster

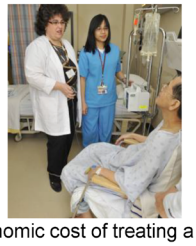
Best Practice Guideline Implementation to Reduce Hospital-Acquired Pressure Injuries

Risk Assessment & Prevention of Pressure Ulcers

This guideline assists nurses who work in diverse practice settings to identify adults who are risk of pressure ulcers (current terminology used is pressure injuries). Direction is provided to nurses in defining early interventions for pressure injury prevention, and to manage Stage I pressure injuries.



Pressure injuries can have a major impact on a person's quality of life and health status. Although prevalence of pressure injuries ranges from 0.4 to14.1 percent in Canada, there is a strong indication that pressure injuries are under reported[1].



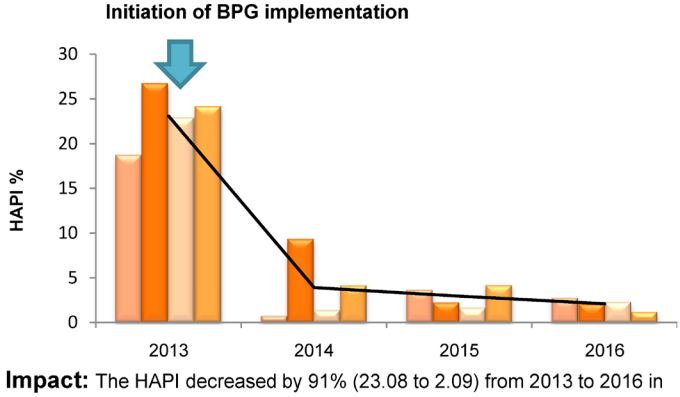
The economic cost of treating a single pressure injury ranges from CAD $26,800 to $231,000 [in 2017] and treating pressure injuries can increase nursing care hours by up to 50%[2]. In Canada, one month of care in the community for a pressure injury costs CAD$9,000[3].

Aim: To examine changes in health outcomes associated with the implementation of the RNAO best practice guideline (BPG), *Risk Assessment and Prevention of Pressure Ulcers (2011)* in hospital and home care Best Practice Spotlight Organizations (BPSO)®.

Measure: Percentage of Health-care Associated Pressure Injuries (HAPI) from 2013 to 2016 using the Nursing Quality Indicators for Reporting and Evaluation (NQuIRE)® data system.

Clinical improvement: A decrease in the number of patients who developed one or more new Stages II to IV pressure injuries after admission to both the hospital and home care BPSOs, as a percentage of the number of patients assessed with pressure injuries.

Figure 1: Quarterly Average of HAPI for International Hospital BPSO, 2013 to 2016



Impact: The HAPI decreased by 91% (23.08 to 2.09) from 2013 to 2016 in the international hospital BPSO (see Figure 1).

Practice Changes

This international BPSO started implementing the guideline in 2013. Nurses were provided training on pressure injury risk assessments and prevention interventions. BPG implementation activities included: providing pressure reducing support surfaces, provision of high density mattresses, elevation of all beds at 30 degrees or less, daily support staff to evaluate interventions, documentation of interventions in electronic health records, and education for patients and their families on pressure injury prevention.

Since implementation of this guideline, this hospital BPSO has sustained the implementation activities and outcomes remain steady.

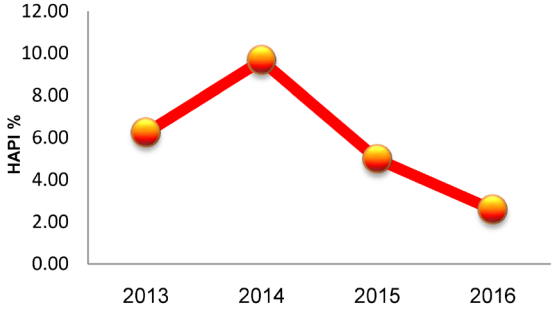
RNAO Registered Nurses' Association of Ontario L'Association des infirmières et infirmiers autorisés de l'Ontario

iaBPG INTERNATIONAL AFFAIRS & BEST PRACTICE GUIDELINES

BPSO RNAO BEST PRACTICE SPOTLIGHT ORGANIZATION

RNAO Best Practices: Evidence Booster

Figure 2: Annual Average of HAPI in Canadian Home Care BPSO, 2013 to 2016



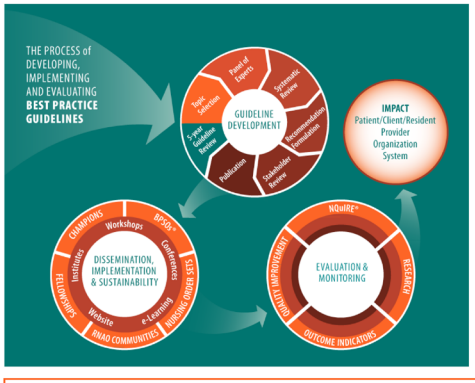
Impact: The health care associated pressure injuries decreased by approximately 60% (6.23 to 2.56) from 2013 to 2016 in the Canadian home care BPSO (Figure 2).

Practice Changes

This BPSO implemented the guideline in all divisions of the organization from 2009 to 2012. Implementation activities included: revision and implementation of the admission assessment and policies, care plan development, skin care and positioning interventions, and education and support for staff, and the development of champions.

Since implementation of this guideline, this home care BPSO has sustained the implementation activities and outcomes remain steady.

Conclusion: This analysis demonstrates the decrease in new Stage II-IV pressure injuries in both hospital and home care BPSOs that implemented RNAO's best practice guideline, *Risk Assessment and Prevention of Pressure Ulcers (2011)*.



RNAO launched the BPG Program in 1999[4] with funding from the Ministry of Health and Long-Term Care in Ontario, Canada. The 53 evidence-based BPGs developed to date are transforming nursing care and interprofessional work environments in all sectors in health systems worldwide. BPSOs are health-care and academic organizations that implement and evaluate these BPGs. Currently, there are 105 BPSOs across Canada and around the globe, representing more than 500 implementation sites.

NQuIRE[5], a unique nursing data system housed in the International Affairs & Best Practice Guideline Centre, allows BPSOs to measure the impact of BPG implementation by BPSOs worldwide. The NQuIRE data system collects, compares, and reports data on human resource structure, guideline-based nursing-sensitive process, and outcome indicators.

References

[1]Canadian Institute for Health Information. (2013). Compromised wounds in Canada. Retrieved from http:///secure.cihi.ca/free_products/AiN_Compromised_Wounds_EN.pdf .

[2]Clarke, H.F., Bradley, C., Whytock, S., Handfield, S., van der Wal, R., & Gundry, S. (2005). Pressure ulcers: Implementation of evidence-based nursing practice. *Journal of Advanced Nursing, 49*(6): 578-590.

[3]Allen, J., & Houghton, P.E. (2003). "A case study for electrical stimulation on a stage III pressure ulcer." *Wound Care Canada 2*(1): 34-6.

[4]Grinspun, D., Virani, T., & Bajnok, I. (2002). Nursing best practice guidelines: The RNAO (Registered Nurses' Association of Ontario) project. *Hospital Quarterly, 5*(2): 56-60.

[5]VanDeVelde-Coke, S., Doran, D., Grinspun, D., Hayes, L., Sutherland Boal, A., Velji, K., White, P., Bajnok, I., Hannah, K. (2012). Measuring outcomes of nursing care, improving the health of Canadians: NNQR (C), C-HOBIC and NQuIRE. *Nursing Leadership,* 25(2): 26-37.

To learn more about RNAO's IABPG Centre, please visit RNAO.ca/bpg.

This work is funded by the Ontario Ministry of Health and Long-Term Care. All work produced by the RNAO is editorially independent from its funding source.

Contact nquire@RNAO.ca for details.

NQuIRE®

RNAO Registered Nurses' Association of Ontario / L'Association des infirmières et infirmiers autorisés de l'Ontario

iaBPG INTERNATIONAL AFFAIRS & BEST PRACTICE GUIDELINES

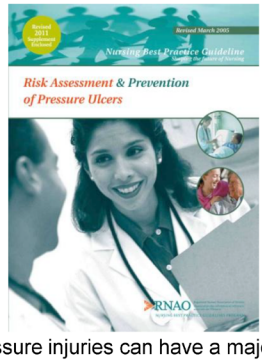
BPSO RNAO BEST PRACTICE SPOTLIGHT ORGANIZATION

RNAO Best Practices: Evidence Booster

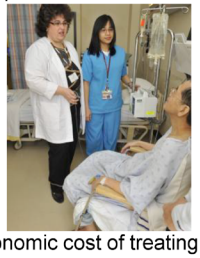
Best Practice Guideline Implementation to Reduce Pressure Injuries Incidence Rate

Risk Assessment & Prevention of Pressure Ulcers

This guideline assists nurses who work in diverse practice settings to identify adults who are at risk of pressure ulcers (current terminology used is pressure injuries). Direction is provided to nurses in defining early interventions for pressure injury prevention and to manage Stage I pressure injuries.



Pressure injuries can have a major impact on a person's quality of life and health status. Although prevalence of pressure injuries range from 0.4 to14.1 percent in Canada, there is a strong indication that pressure injuries are under reported[1].



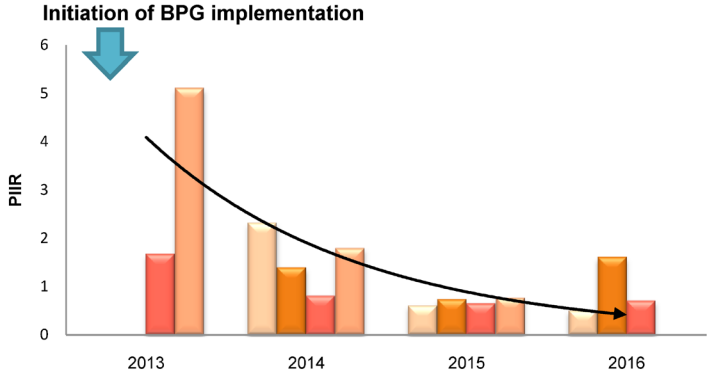
The economic cost of treating a single pressure injury ranges from CAD $26,800 to $231,000 [in 2017] and treating pressure injuries can increase nursing care hours by up to 50%[2]. In Canada, one month of care in the community for a pressure injury costs CAD$9,000[3].

Aim: To examine changes in health outcomes associated with the implementation of the RNAO best practice guideline (BPG), *Risk Assessment and Prevention of Pressure Ulcers (2011),* in two hospital-based Best Practice Spotlight Organizations (BPSO)®.

Measure: Incidence rate of pressure injuries from 2013 to 2016 based on Nursing Quality Indicators for Reporting and Evaluation (NQuIRE)® data system.

Clinical improvement: A decrease in number of patients who developed one or more new Stages II to IV pressure injuries after admission to hospital BPSOs, as a percentage of the number of patients assessed with pressure injuries.

Figure 1: Quarterly Average of Pressure Injury Incidence Rate (PIIR) for International Hospital BPSO-I, 2013 to 2016



Impact: The pressure injury incidence rate decreased by 86% (5.1 to 0.7) from 2013 to 2016 in the international hospital BPSO-I (see Figure 1).

Practice Changes

This hospital BPSO-I implemented the guideline between 2012 to 2015. Implementation activities included: policies and procedures aligned with the guideline recommendations; standardized orientation and workshops for staff with learning materials; consistent changes in practices across the organization for admissions, transfers and discharges; and hourly rounding.

Since implementation of this guideline, BPSO-I has sustained the implementation activities and outcomes remain steady.

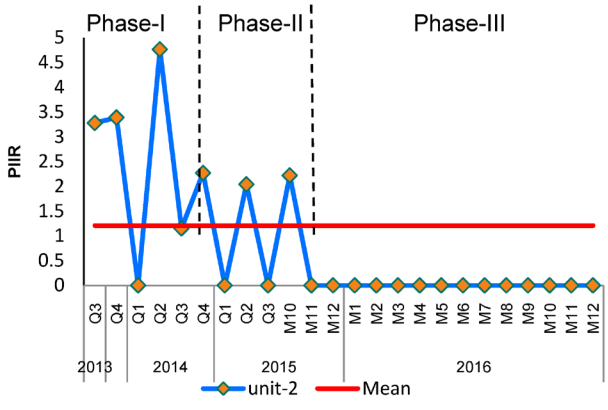
RNAO Registered Nurses' Association of Ontario L'Association des infirmières et infirmiers autorisés de l'Ontario

iaBPG INTERNATIONAL AFFAIRS & BEST PRACTICE GUIDELINES

BPSO RNAO BEST PRACTICE SPOTLIGHT ORGANIZATION

RNAO Best Practices: Evidence Boosters

Figure 2: Pressure Injury Incidence Rate (PIIR) in Canadian Hospital BPSO-II, 2013 to 2016



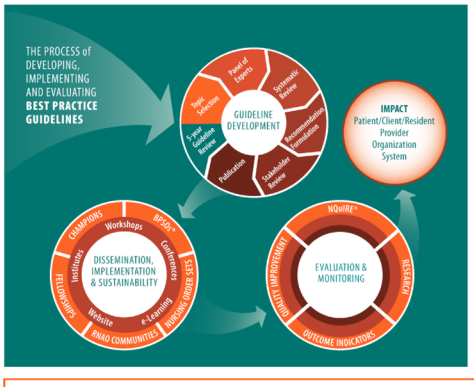
Impact: In Phase-I, the PIIR decreased by 63% (3.28 to 1.21) and had the highest variation in data. In Phase-II, the PIIR had consistent variations in data. By Phase-III, the PIIR decreased by 100% (3.28 to 0) between 2013 to 2016 and has remained at zero pressure injuries (see Figure 2).

Practice Changes

This hospital BPSO-II implemented the guideline from 2012 to 2015. Implementation activities included: standardized assessment tools, education and related materials for staff and patients, documentation changes, and standard therapeutic surfaces to reduce pressure for all patients.

Since implementation of this guideline, BPSO-II has sustained the implementation activities and outcomes remain at zero.

Conclusion: This analysis demonstrates a decrease in new Stage II-IV pressure injuries in two BPSOs (Canadian and International) that implemented RNAO's best practice guideline, *Risk Assessment and Prevention of Pressure Ulcers (2011)*.



RNAO launched the BPG Program in 1999[4] with funding from the Ministry of Health and Long-Term Care in Ontario, Canada. The 53 evidence-based BPGs developed are transforming nursing care and interprofessional work environments in all sectors in health systems worldwide. BPSOs are health-care and academic organizations that implement and evaluate these BPGs. Currently, there are 105 BPSOs across Canada and around the globe, representing more than 500 implementation sites.

NQuIRE[5], a unique nursing data system housed in the International Affairs & Best Practice Guideline Centre, allows BPSOs to measure the impact of BPG implementation by BPSOs worldwide. The NQuIRE data system collects, compares, and reports data on human resource structure, guideline-based nursing-sensitive process, and outcome indicators.

References

[1]Canadian Institute for Health Information. (2013). Compromised wounds in Canada. Retrieved from http:///secure.cihi.ca/free_products/AiN_Compromised_Wounds_EN.pdf .

[2]Clarke, H.F., Bradley, C., Whytock, S., Handfield, S., van der Wal, R., & Gundry, S. (2005). Pressure ulcers: Implementation of evidence-based nursing practice . Journal of Advanced Nursing, 49(6): 578-590.

[3]Allen, Jill, and Pamela E. Houghton. "A case study for electrical stimulation on a stage III pressure ulcer." *Wound Care Canada* 2.1 (2003): 34-6.

[4]Grinspun, D., Virani, T., & Bajnok, I. (2002). Nursing best practice guidelines: The RNAO (Registered Nurses' Association of Ontario) project. *Hospital Quarterly, 5*(2): 56-60.

[5]VanDeVelde-Coke, S., Doran, D., Grinspun, D., Hayes, L., Sutherland Boal, A., Velji, K., White, P., Bajnok, I., Hannah, K. (2012). Measuring outcomes of nursing care, improving the health of Canadians: NNQR (C), C-HOBIC and NQuIRE. *Nursing Leadership,* 25(2): 26-37.

To learn more about RNAO's IABPG Centre, please visit RNAO.ca/bpg. This work is funded by the Ontario Ministry of Health and Long-Term Care. All work produced by the RNAO is editorially independent from its funding source. Contact nquire@RNAO.ca for details.

NQuIRE®