

Nurses' Perceptions of Bar Code Medication Administration Best Practices to
Increase Bar Code Scanning Rates in a Mental Health Setting

By

Ningshi (Lauren) Xie
B.Sc., University of British Columbia, 2014

A project submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in the School of Health Information Science

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University of Victoria

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Abstract

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As barcode medication administration (BCMA) technologies emerge as a potential solution to decrease medication administration errors, there is little evidence on how to ensure high levels of BCMA compliance in the form of scanning rates in mental health settings.

After performing a literature review of existing best practices to increase BCMA compliance and a review of organizational BCMA data for the largest mental health and addictions research and teaching hospital in Canada, ten interviews were conducted with inpatient nurses to understand their perceptions of how the best practices may be implemented to increase BCMA scanning rates.

Interview analysis was performed using a conventional content analysis approach, resulting in the identification of five themes: clinical workflow, safety, education, accountability, and strategies for BCMA compliance. Recommendations to increase BCMA compliance in this context include: reduce workarounds, implement a device strategy, establish a multi-faceted education approach, demonstrate leadership commitment, empower nurses, and maintain ongoing evaluation of compliance.

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1. Introduction

1.1 Background

Medication administration errors are one of the leading preventable causes of adverse drug events (ADE) (Armitage & Knapman, 2003; Bates et al., 1995; CIHI, 2004; Institute for Safe Medication Practices Canada, 2013a; Krähenbühl-Melcher et al., 2007; Leape et al., 1995; Leape et al., 1991).

To ensure that the rights of medication administration (right patient, time, route, medication and dosage) are adhered to, bar code medication administration (BCMA) technology was developed as a promising strategy to reduce medication administration errors (Acheampong, Anto, & Koffuor, 2014; Bates & Gawande, 2003; Bates, 2007; Berdot et al., 2016; Cummings, Bush, Smith, & Matuszewski, 2005; Helmons, Wargel, & Daniels, 2009; Institute for Safe Medication Practices Canada, 2013b; Keers, Williams, Cooke, Walsh, & Ashcroft, 2014; Young, Slebodnik, & Sands, 2010). In addition, BCMA also ensures the accurate and timely documentation of medication administration by requiring nurses to scan a patient's bar coded wristband identification to confirm the patient, followed by the scanning of each medication bar code to verify its correct correspondence to the patient's medication orders prior to medication administration (Patterson, Cook, & Render, 2002; Poon et al., 2010).

In April of 2004, the American Food and Drug Administration (FDA) mandated that bar codes must be present on all new drugs to detect and reduce medication errors and to encourage the adoption of BCMA technologies (Food and Drug Administration, 2004). In Canada, a Canadian Pharmaceutical Bar Coding Project led by a national advisory group began meeting in January 2008 to establish a national consensus on Automated Identification for pharmaceuticals. The project was, and still is, a collaborative partnership between the Institute for Safe Medication Practices ISMP Canada and the Canadian Patient Safety Institute (CPSI), and has received widespread endorsements from major Canadian healthcare organizations. In September 2013, a Medication Bar Code System Implementation Planning resource guide was published to provide bar code systems knowledge, strategic arguments, and implementation guidance for all care environments (Institute for Safe Medication Practices Canada, 2013b).

1.2 Research Rationale

As one of the world's leading mental health and addictions research facilities, the Centre for Addiction and Mental Health (CAMH) is the largest mental health and addictions research and teaching hospital in Canada (CAMH, n.d.). In May 2014, BCMA technology was implemented at CAMH as a part of the organization's clinical information system (CIS) to reduce medication administration errors and increase patient safety. An internal audit of CAMH's 2015 inpatient unit scanning rates performed by the Information Management Group reported average scanning rates of 65% and 47% for medications and patient wristbands, respectively. This means that although the technology was implemented, it was not being fully used by nurses at the organization. One of the implications of a low level of use of the technology by nurses is that the technology cannot prevent medication errors if it is not being used. At the time of the internal

audit of scanning rates, the reasons for the low levels of scanning by nurses of medications and patient wristbands were not known.

1.3 Research Objectives

The goal of this study was to determine best practices that could be utilized in a mental health inpatient setting to increase scanning rates, in an effort to improve medication safety.

Specifically, this study was conducted to identify:

- Published best practices to increase BCMA compliance post-implementation of the technology
- Nurses' perceptions of how well the implementation of identified best practices may increase BCMA compliance in the form of unit scanning rates at CAMH
- Recommendations to improve BCMA compliance at CAMH

1.4 Organization of Report

This report is organized into five chapters. Chapter 1 provides an introduction to the research while Chapter 2 presents a literature review of topics and definitions relevant to this research. Chapter 3 focuses on the design and methodology of this research with an overview of the research methodology and data collection processes. Chapter 4 presents details of the study findings from all phases of the study, and Chapter 5 provides a discussion of the findings as well as study implications and suggestions for future research.

2. Literature Review

2.1 Current State of Knowledge

A review of literature was performed to gain an understanding of medication errors, the potential for BCMA to support medication safety, existing BCMA workarounds in clinical settings, medication administration in mental health, and best practices to increase BCMA scanning rates. It was found that medication errors may occur frequently due to numerous factors with far-reaching effects. Though previous studies have identified BCMA as an effective solution in reducing medication errors, many clinical workarounds have been found to exist when using the technology post implementation, which limits the usefulness of such technology. The methods of the literature review are described in appendix 1. The results of the literature review are described in this chapter.

2.2 Medication Errors

A medication error is defined as “any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labeling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use” (National Coordinating Council for Medication Error Reporting and Prevention, n.d.). According to the United States Food and Drug Administration (USFDA), frequent causes of medication errors include miscommunication, poor procedures,

and poor understanding or directions of use of the medications. These factors in turn can contribute to the introduction of errors throughout the medication distribution and administration process, including: prescribing, repackaging, dispensing, and administering (USFDA, 2016).

In 2002, the Commonwealth Fund International Health Policy Survey of Sicker Adults from 5 different countries found that 11% of Canadian respondents had previous experiences with medication errors (Blendon, Schoen, DesRoches, Osborn, & Zapert, 2003). Furthermore, in the document entitled ‘October 2011 to December 2012 Ontario Hospital Critical Incidents Related to Medications or IV Fluids Analysis Report’ by the Institute for Safe Medication Practices (ISMP) Canada, it was stated that 50% of critical medication incidents reported to the Canadian Institute for Health Information (CIHI) National System Incident Reporting (NSIR) by 36 Ontario hospitals during the reporting period, had occurred during the medication administration stage (Institute for Safe Medication Practices Canada, 2013a). In addition, in the 2008 “Correlates of Medication Errors in Hospitals” report released by Statistics Canada based on the 2005 National Survey of the Work and Health of Nurses, 19% of all RNs providing direct care in Canadian hospitals responded that medication errors, involving patients who were in their care, had occurred "occasionally" or "frequently" in the previous year (Wilkins & Shields, 2008)

2.3 BCMA and Medication Safety

In previous studies, it was found that 90-97% of nurses familiar with BCMA technology agreed that BCMA does reduce the risk of medication errors and increase medication safety (Coyle &

Heinen, 2005). In 2010, a pre-post study found that the deployment and use of BCMA resulted in a 50.8% reduction of potential ADEs (Poon et al., 2010). Similarly, other studies have also observed reductions in medication administration errors as an outcome of implementing BCMA technology (Hassink, Jansen, & Helmons, 2012; Paoletti et al., 2007; Waneka & Spetz, 2010).

In a study by Hurley et al. (2007), though some nurses thought that BCMA was more time-consuming, they admitted that the increased sense of medication safety was worth the extra time spent during medication administration. This result is in line with Coyle & Heinen's (2005) finding that BCMA is more readily accepted by nurses who understand the potential safety benefits of the technology.

2.4 BCMA Workarounds in Clinical Settings

Within the context of bar code scanning, many definitions for workarounds exist. Previous definitions have related the term to non-compliance, deviation, deviance, violations, shortcuts, detours, and creative methods (Lee, Lee, Kwon, & Yi, 2015). According to Debono et al. (2013), "Workarounds are observed or described behaviours that may differ from organisationally prescribed or intended procedures. They circumvent or temporarily 'fix' an evident or perceived workflow hindrance in order to meet a goal or to achieve it more readily (pg 2)." Despite the potential of BCMA technology to assist nurses in the reduction of medication errors and ADEs, nursing adherence and adoption to the use of this technology can be challenging (Rack et al, 2012; van Onzenoort et al., 2008; Wulff, Cummings, Marck, & Yurtseven, 2011). As a result, nurses may stray from the intended BCMA procedures and develop or adopt undesirable workarounds that can contradict the purpose of BCMA and further augment medication safety

(Debono et al., 2013; Koppel, Wetterneck, Telles, & Karsh, 2008; Lee et al., 2015; Patterson et al., 2002; Patterson, Rogers, Chapman, & Render, 2006; Voshall, Piscotty, Lawrence, & Targosz, 2013).

A review of published literature suggests that BCMA workarounds are common and require the implementation of best practices to reinforce BCMA compliance and expectations (Bates et al., 2001, Debono et al., 2013; Koppel et al., 2008; Patterson et al., 2002; Patterson et al., 2006; van Onzenoort et al., 2008). In a study by Rack et al. (2012), it was found that the majority of nurses surveyed reported that they had administered medications without scanning the patient or medications bar codes during their last shift worked. As a result, this behavior would directly negatively impact BCMA scanning rates and potentially compromise patient safety.

In a mixed-method multihospital study of BCMA workarounds, Koppel et al., (2008) identified 31 causes of BCMA workarounds including unreadable medication and patient wristband bar codes, malfunctioning scanners, non-bar coded medications, failing batteries, wireless connectivity issues, device issues, and user training gaps. Additionally, the authors also found 15 types of workarounds, including inappropriate fixation of patient identification bar code to objects and the concurrent transportation of more than one patient's scanned medications at the same time. Furthermore, Carayon et al. (2007) identified 18 different BCMA workflow sequences at an academic hospital, demonstrating large variations in the order of medication administration process steps performed.

Though some studies have noted time and workload to be a factor in BCMA workarounds (Bagby, Mims, Schneider, & Petrich, 2011; Keohane et al., 2008; Koppel et al., 2008; Patterson et al., 2002, Rack et al., 2012), other studies have found that for a BCMA system to meet nursing needs, there is no increase in time required to perform medication administration between using BCMA and paper records (Dwibedi et al., 2011; Huang & Lee, 2011; Poon et al., 2008) and no decrease in the rate of BCMA use with increase number of patients and medications (van Onzenoort et al., 2008). This indicates that BCMA compliance is highly dependent on factors related to BCMA technology, workflow, and training.

2.5 Medication Administration in Mental Health

Previous studies which have examined medication administration in mental health settings have been limited to non-scanning environments (Maidment, Lelliott, & Paton, 2006; Procyshyn, Barr, Brickell, & Honer, 2010). When performing medication administration using paper documentation methods, it was found that though nurses working in mental health settings are aware of latent conditions that may risk safe medication administration (Hemingway et al., 2015), incorrect medication and medication dose are the most frequent type of administration error in mental health settings (Procyshyn et al., 2010). Observational and nurse interview studies have found that gaps in written and verbal information exchange, and sharing between nurses and patients, are contributing factors to unsafe medication administration practices (Duxbury, Wright, Bradley, & Roach, 2009; Duxbury et al., 2010).

2.6 Best Practices to Increase BCMA Compliance

To date, a number of studies have identified and recommended best practices that may be implemented increase BCMA scanning rates (Table 1). From a technology perspective, it is suggested that BCMA technology needs to be tailored to the care environment (Patterson et al., 2006) and the needs of the end user (Koppel et al., 2008; Rack et al., 2012), which may be accomplished by involving front-line staff in the selection, implementation, and optimization of the technologies. Additionally, solutions should be developed to ensure successful scanning and any malfunctioning technologies must be resolved quickly and efficiently to minimize the impact on clinical performance (Bagby et al., 2011; Harrington, Clyne, Fuchs, Hardison, & Johnson, 2013; Patterson, Rogers, & Render, 2004; Rack et al., 2012).

To increase BCMA compliance, several studies highlighted the importance of ongoing training, education, and updating of education materials and organization policies and guidelines to reflect BCMA requirements (Bagby et al., 2011; Harrington et al., 2013; Koppel et al., 2008; Patterson et al., 2004; Rack et al., 2012; van Oozenoort et al., 2008). Furthermore, it was also found that organization and nursing leadership may have a big role in bringing about the cultural change that is necessary to increase BCMA scanning rates. While Bagby (2011) recommends the establishment of an annual conference to focus on improving processes to support BCMA, others suggested ongoing leadership review of new workarounds, technological challenges, patient circumstances, and organizational scanning rates in order to ensure that any potential challenges are addressed in a timely manner, and to demonstrate leadership commitment to BCMA (Carayon et al., 2007; Early, Riha, Martin, Lowdon, & Harvey, 2011; Koppel et al., 2008; Patterson et al., 2004).

Table 1. Best Practices to Increase BCMA Compliance From Literature

	Author (s); Year; Setting	Relevant Purpose/Aims	Methods	Challenge(s) identified	Best Practices Recommendation
1	Bagby et al. (2011) Veterans Health Administration, United States	Project review		<ul style="list-style-type: none"> • Poor bar code scanning success rates (wristbands and medications) • Non-harmonized workflow processes • Nurses spent an inordinate amount of nonproductive time attempting to scan wristbands and medications, negatively impacting other patient-care activities 	<ul style="list-style-type: none"> • A bar code verification program analyzed and provided corrective action for problematic bar codes (both wristbands and medications) submitted by facilities • Facilities submitted annually at least one wristband from each type of wristband printer and print media used in their facility to the BCRO for verification testing • Annual conferences focused on improving business workflow processes in support of BCMA • BCMA software enhancement provided real-time reporting of problematic bar codes on

					medications and patient wristbands to local BCMA support personnel
2	Carayon et al. (2007) 472-bed Midwestern academic medical center and a 60-bed children's hospital, United States	Explores nurses' use of BCMA technology from a human factors viewpoint	Structured observation; nurse interviews post observations	<ul style="list-style-type: none"> Eighteen different sequences were identified and represented very large variability in the medication administration process; some of the sequences can be considered as potentially unsafe acts Various working conditions that can hinder the medication administration process 	<ul style="list-style-type: none"> It is important to assess changes in workflow and tasks that may result from the use of the technology
3	Early et al. (2011)	To report the incidence of medication safety	Integrated approach	<ul style="list-style-type: none"> Identified equipment problems, internal process problems, human factors, and non-bar code 	<ul style="list-style-type: none"> Bring key leadership teams on board to implement this cultural change Leadership & staff education

	Integrated healthcare system composed of seven hospitals, United States	events before and after the implementation of BCMA.		issues	<ul style="list-style-type: none"> • Ongoing vigilance of scanning rate data • Facility recognition and celebration of the hard work of departments, units, and individuals • Implement changes to address known issues
4	Harrington et al. (2013) 260-bed acute-care, teaching hospital, Midwestern United States.	To determine whether use of BCMA complied with current evidence as to how it should be used	Gap-analysis using an evidence-based checklist	<ul style="list-style-type: none"> • 72% compliance rate with current evidence-based practices using BCMA 	<ul style="list-style-type: none"> • Identify and address the problem of scanning failures • Implement solutions to ensure for successful scanning • Update policies and procedures to reflect current evidence and system requirements • Inform and educate nurses on new processes •
5	Koppel et al.	To understand the	Mixed-method	<ul style="list-style-type: none"> • Identified 15 types of 	<ul style="list-style-type: none"> • Efforts to address workarounds should include

	<p>(2008)</p> <p>470-bed</p> <p>Midwestern</p> <p>academic</p> <p>tertiary-care</p> <p>hospital and a</p> <p>four-hospital,</p> <p>929-bed East</p> <p>Coast health</p> <p>care system</p> <p>during</p> <p>2003 to 2006,</p> <p>United States</p>	<p>impact of BCMA</p> <p>on medication</p> <p>administration</p> <p>accuracy and</p> <p>errors.</p>	<p>study: structured</p> <p>observations;</p> <p>unstructured and</p> <p>semi-structured</p> <p>interviews;</p> <p>participated in</p> <p>hospital</p> <p>staff meetings</p>	<p>workarounds and 31 types of</p> <p>causes of workarounds</p>	<p>investigation of technology, task,</p> <p>organization, patient-related, and</p> <p>environmental circumstances</p> <ul style="list-style-type: none"> • BCMA implementation requires meticulous attention to its actual use in situ. If possible, use multidisciplinary teams to review both qualitative and quantitative data • Evaluators and implementation teams should work with technology vendors to align hardware, software, user, policy, workflow, and patient safety needs. However, hospitals must maintain ultimate control • Ensure BCMA system design incorporates up-to-date standards for user interface design • Negotiate contracts that maximize vendor responsiveness to clinical, workflow, user, and
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					<p>safety needs, and especially oblige them to address technical problems that lead to invalid alerts and the need to override</p> <ul style="list-style-type: none"> • Pre-implementation assessments to identify user, environment, policy, workflow, and patient issues are critical • Post-implementation assessments should drive hospital educational efforts, policy, workflow changes, and requests to vendors • New workarounds will emerge in response to changes in technology, workflow, and patient types. Evaluation of actual technology use must be ongoing.
6	Patterson et al. (2006)	To see if the implementation of BCMA will	Prospective ethnographic study using	<ul style="list-style-type: none"> • Noncompliance with recommended practice observed in all settings and facilities 	<ul style="list-style-type: none"> • BCMA should be tailored to the care setting

	Small, medium, and large Veterans Administration hospitals, United States.	decrease the number of medication administration errors	targeted observation during medication administration	<ul style="list-style-type: none"> BCMA workaround strategies increased efficiency but created new potential paths to adverse events 	
7	Patterson et al. (2004) Veterans Health Administration, United States	To propose a set of best practice recommendations to address barriers to BCMA's n to improve patient safety	Direct observations; BCMA simulations; surveys to nursing informatics specialists regarding policies and procedures;		<ul style="list-style-type: none"> Introduce a standing interdisciplinary committee Train all nurses; cross-train others Communicate known problems Contact information for types of problems No double documentation as a backup Schedule downtimes to minimize disruptions Replace malfunctioning equipment during its servicing Procedures to clean equipment

			unstructured interviews with diverse stakeholders		<ul style="list-style-type: none"> • Scan wristbands and medications prior to administration • Caregiver documents at time of administration • Verify displayed allergy information • Use printed worksheet as overview • Print missed medications report once a shift • Alert nurses to new stat orders • Periodic replacement of wristbands
8	Rack et al. (2012) 765-bed academic medical Center, United States	To analyze registered nurse workarounds using bar code medication administration technology	Focus groups; surveys	<ul style="list-style-type: none"> • 63% of nurses surveyed indicated that they administered medications without scanning the patient or medications during the last shift worked • 18 scenarios for why medications were not scanned prior to administration were 	<ul style="list-style-type: none"> • When implementing bar code medication administration technology, consider how the development of workarounds in practice may be minimized • Hospital leaders should acknowledge workarounds identified as well as those cited in the literature and understand the circumstances that are creating the need to

				<p>described</p> <ul style="list-style-type: none"> • Various workarounds exist 	<p>develop workarounds</p> <ul style="list-style-type: none"> • Evaluate whether the projected savings or efficiencies gained with implementation of BCMA are realistic • Consider strategies to include frontline users in BCMA product design • Systems should enhance nurse efficiency and without compromising nurse workflow • Further education may be necessary • Operational leaders need to identify new or modified processes that support successful implementation of technology
9	<p>Savage et al. (2014)</p> <p>University of</p>	<p>Discuss the organization's journey to achieve BCMA scanning</p>		<ul style="list-style-type: none"> • Several patient scanning and medication scanning issues were described 	<ul style="list-style-type: none"> • Collaborate with pharmacy to address medication bar coding issues • Work with leadership to share BCMA compliance rates with unit leaders

	Pittsburgh Medical Center (UPMC) Presbyterian Shadyside campus	compliance of above 95%			
10	Van Onzenoort et al. (2008) University Hospital Maastricht (UHM), Netherlands	To assess factors influencing the bar code verification by nurses during medication administration	Monitoring of BCMA compliance from eMAR; Nurse interviews for why bar code verification was not always used	<ul style="list-style-type: none"> Five most cited reasons for not verifying bar codes were: <ul style="list-style-type: none"> Difficulties scanning medication bar codes Lack of awareness of bar codes Delays in responses from the computerized system Shortage of time Administration of 	<ul style="list-style-type: none"> More education regarding medication safety is warranted to increase compliance to a BPOC system

				medication before prescription	
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2.7 Gaps in Literature

Though existing literature have documented and provided best practices to many existing BCMA issues (Brunetti & Suh, 2012; Koppel et al., 2008; Mims, Tucker, Carlson, Schneider, & Bagby, 2009; Patterson, Rogers, & Render, 2004), research on medication administration in mental health settings is limited (Maidment et al., 2006), and little is known about the challenges and requirements of BCMA in mental health settings. This is problematic in that medication administration in mental health settings may differ from other hospital settings as psychiatric patients are a more vulnerable patient population that may use aggressive behaviour during medication administration, and that mental health units may have significant differences in the types of medications administered to patients (Haw, Stubbs & Dickens, 2007). In addition, differences between medication administration processes may also differ between mental health settings and other hospital settings, as psychiatric patients are generally independent and mobile, and may receive medications from a central location, such as the care station (Cottney & Innes, 2015). In comparison, the common practice in many other hospital settings entails bedside medication administration. As a result, these dissimilarities may produce differences in scanning barriers within mental health settings, meaning that best practices to increase BCMA compliance in mental health settings require further investigation.

2.8 Motivations for this Study

Due the potential for BCMA technology to decrease medication errors and the lack of existing evidence of how to increase BCMA scanning rates in mental health environments, it would be beneficial to gain insights into how BCMA scanning rates may be increased from the perspective of point of care nurses working in a mental health care setting. This study hopes to first identify

existing best practices to increase post-implementation compliance rates from literature. Then, the nurse perceptions of how these best practices may affect scanning rates in a mental health environment will be identified in order to make recommendations on potential strategies to increase BCMA compliance at CAMH.

3. Research Approach

3.1 Objectives

The goal of this study was to determine best practices that could be utilized in a mental health inpatient setting to increase scanning rates, in an effort to improve medication safety.

Specifically, this study was conducted to identify:

- Published best practices to increase BCMA compliance post-implementation
- Nurses' perceptions of how well the implementation of identified best practices may increase BCMA compliance in the form of unit scanning rates at CAMH
- Recommendations to improve BCMA compliance at CAMH

3.2 Research Design

This study was conducted using a qualitative descriptive (QD) approach as outlined by Sandelowski (2000). Amongst other qualitative research methodologies, the QD approach was selected due to its low-inference interpretative nature. Though not free of interpretation, QD allows descriptions to be less interpretative than other qualitative methodologies in the sense that QD does not require abstract rendering or conceptualization of data. An emphasis is placed on the focus to stay close to the surface meaning of words and events as recorded to produce straight descriptions of data. In this manner, QD allows researchers to more readily reach a consensus regarding the outcome of results.

The methods used in this study cover:

1. Analysis of organizational data on current BCMA practices at CAMH;

2. Use of literature and organizational data to develop an interview questions instrument;
3. Interviews with CAMH inpatient nurses to elicit perceptions of how well the implementation of identified best practices may increase scanning rates at CAMH; and
4. Qualitative analysis of the interviews using content analysis

Based on the study findings, a set of recommendations were derived to improve BCMA compliance at CAMH for considerations by CAMH management and leadership.

3.3 Setting and Participants

This study took place at the Centre for Addiction and Mental Health (CAMH) in Toronto, Ontario. The target population of this study was full-time and part-time nurses who were working on a CAMH inpatient hospital unit providing direct patient care at the time the study took place. On hospital units, both Registered Nurses (RNs) and Registered Practical Nurses (RPNs) administer medications to patients. Inpatient nurses are the most intensive users of BCMA as up to 40% of their time during a shift may be spent performing medication administration (Armitage & Knapman, 2003). At CAMH, both RNs and RPNs share the same scope of practice for medication administration.

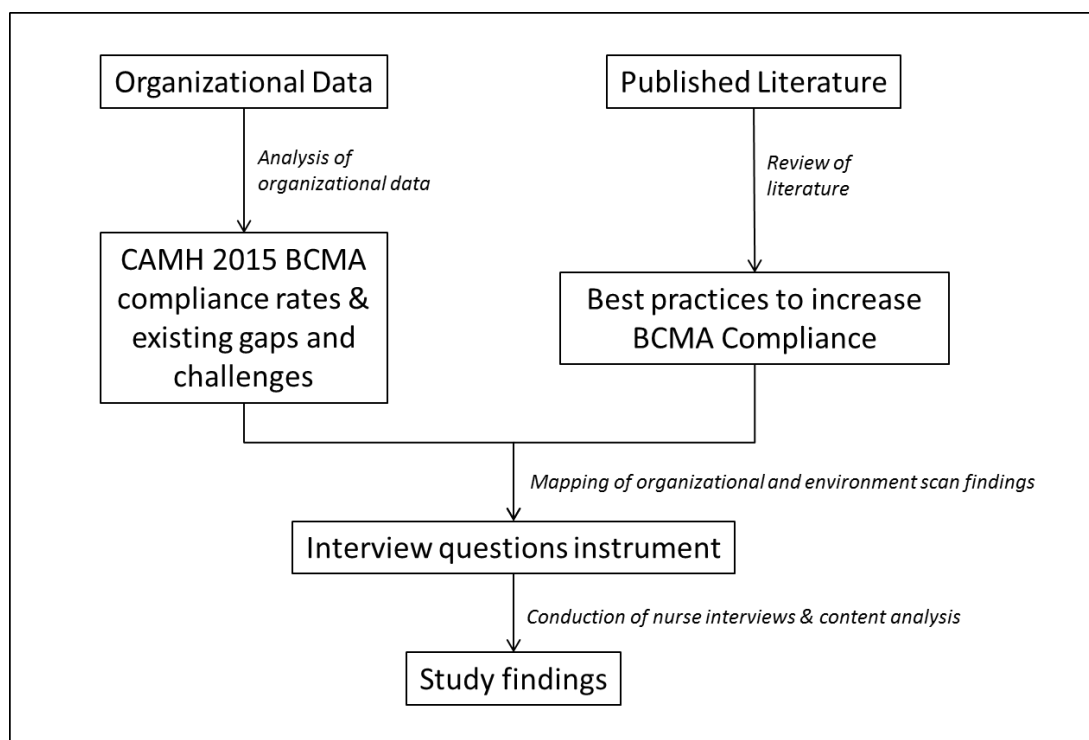
Agency nurses were not included in this study. These nurses are from an external provider and are not employees of CAMH. They do not regularly work at the organization, and were therefore not included in the study. Normally, agency nurses are given training materials prior to beginning to work at CAMH, including BCMA-related information. Part-time nurses were included as they are employees of CAMH and share identical BCMA training and medication administration scope of practice as full-time nurses. The Collective Statement between CAMH

and Ontario Nurses' Association states that part-time nurses at CAMH are assigned a predetermined number of shifts per week that each nurse has committed to, and additional shifts will only be offered based on written availability up to full-time hours (CAMH, 2015).

3.4 Data Sources

There are 3 data sources for this study as shown in figure 1: organizational data on current BCMA practices, literature review of published best practices to increase BCMA compliance, and interviews with CAMH inpatient nurses. These data sources are described below.

Figure 1. Research Approach Outlining Data Sources, Data Collection, and Analytical Techniques



3.4.1 Organizational Data

Prior to the development of the interview questions, an internal Device & Technology Integration report was analyzed to identify existing workarounds and specific nursing feedback regarding BCMA technology-related issues that may be impairing BCMA scanning rates. In addition, BCMA compliance rate at the organization was also obtained from a CAMH internal 2015 inpatient unit scanning rate report.

3.4.1.1 Current Clinical Workflow and Workarounds

To gain an understanding of current BCMA clinical workflow, workarounds, and perceived challenges, an internal Device & Technology Integration report was analyzed prior to the development of the interview questions.

As many technology-related concerns and workarounds may only be identified after a new technology has been implemented (Carayon et al., 2007), CAMH began a centre-wide optimization project in October of 2015 to increase the usability and user satisfaction with all aspects of the CAMH CIS. As a part of CIS optimization, a Device & Technology Integration initiative was formed to better understand inpatient nurses' technology usage and needs during medication administration, amongst other workflows, in order to further support their clinical needs.

As a result of the Device & Technology Integration initiative, an internal report was completed in April of 2016 after assessing the 25 inpatient units at CAMH. The report details nurse feedback of current clinical workflows, including medication administration, on every inpatient

unit and the perceived challenges with using the existing technologies when providing care. Furthermore, the report also outlines reported challenges and potential causes of BCMA workaround in the forms of people, process and technology gaps.

3.4.1.2 CAMH BCMA Compliance

Overall BCMA compliance rates for all inpatient units at CAMH in 2015 was obtained through the CAMH internal 2015 inpatient unit scanning rate report generated by the CAMH Information Management Group.

During medication administration, all details, including the scanning or lack of scanning of bar codes are recorded in the electronic medication administration record. BCMA scanning reports may then be generated by running customized reports to view individual inpatient unit and clinician BCMA scanning history and details across the entire organization.

3.5 Development of the Interview Question Instrument

An interview question instrument was created for this research where each question was developed based on existing literature and organizational data. Best practices to increase BCMA scanning rates identified from literature were reviewed to perform preliminary mapping to existing gaps and challenges identified from the CAMH internal Device & Technology report (Table 2). Three iterations of the interview question instrument were made prior to finalizing the interview question instrument. The initial version of the instrument was created by the student researcher, and was then reviewed by 2 CAMH subject matter experts (SMEs) to provide feedback. The second iteration included modifications suggested by the SMEs, and was then

shared with a third SME to gain further feedback regarding the clarity and relevance of the questions to known BCMA gaps within the organization. After the third iteration, the interview questions instrument was piloted with 2 frontline nurses to verify that the questions were clear and understandable. Minor word changes were made after the pilot, and the resulting questions were finalized with no further revisions required by the student researcher's supervisor and the 2 initial SMEs.

Table 2. Mapping of Best Practices With Organizational Findings to Develop the Interview Question Instrument

Best Practice From Literature Review	Potential Issues Identified From Organizational Data	Interview Question
Conduct technology evaluations and address causes of workarounds and unintended consequences (Harrington et al, 2013; Patterson et al., 2006)	There were 46 unique reported issues associated with the use of mobile nurse workstations, desktop PCs, laptops, and scanners. Of all the devices, the nurses had the most concerns about mobile nurse workstations, with 17 unique issues	Many inpatient nurses reported that they dislike using mobile workstation to perform medication administration. The most common reasons given were that the mobile workstations are too slow, have short battery lives, and that the drawers are not compatible with large medication carts. If these issues were resolved, how would this impact your scanning consistency?
Ensure an adequate number of devices, such	Nurses from 9 out of 25 inpatient units reported	Many nurses expressed that one major barrier to scanning compliance

as scanners, on each unit to reduce noncompliance (Patterson et al., 2004)	challenges locating a scanner when performing medication administration	is there are not enough scanners on each unit. How do you feel providing more scanners to units will impact scanning rates?
Implement a feedback process to report non-scanning or difficult-to-scan medications (Bagby et al., 2011)	Several recurring bar code issues were highlighted, including wrong medication bar codes, non-scanning bar codes, and difficult to scan bar codes. One gap identified in the report was the lack of feedback from nurses to communicate known issues	Many nurses reported that there are often label-related issues when scanning medications. If a more formal feed-back procedure is in place for nurses to report wrong, difficult-to-scan, or non-scanning bar codes, how do you think this may affect scanning rates?
Make available a guide outlining the contact information of different resources to contact as issues arise (Early et al., 2011; Patterson et al., 2004)	One gap identified in the report was the lack of feedback from nurses to communicate known issues	If there was a guide outlining the contact information of different resources to contact for resolving different types of technology problems, how would this additional support encourage nurses to increase scanning consistency? Where should this information be located?
More education regarding BCMA safety	It was found that there are varying levels of expectations	In literature, it was found that many nurses bypass scanning as a result of

benefits to increase nursing awareness of this technology (Early et al., 2011; Patterson et al., 2004; Rack et al., 2012; Van Onzenoort et al., 2008)	and enforcements from nurse managers regarding the use of technology. Also, some nurses reported that they exclusively use their preferred device, while other nurses reported that they are forbidden to use certain devices that do not align with the approved practice	unawareness of the technology and the benefits of the technology for patient safety. If nurses are better educated about the possible medication safety risks at each step of medication administration the safety benefits of bar code scanning, how do you think this would affect scanning rates?
Ongoing education refreshers to readdress BCMA safety benefits and keep nurses up-to-date (Harrington et al., 2013; Van Onzenoort et al., 2008)	It was found that nurses will stop using any device that does not effectively support their workflows, leading to a lack of standardization. In turn, this also limits the usefulness of BCMA technology	How do you think ongoing education refreshers regarding safety benefits and the latest bar code scanning processes will affect scanning rates?
Ongoing monitoring and reporting of scanning rates (Bagby et al., 2011; Early et al., 2011; Savage et al.,	It was found that there is a lack of awareness and motivation for the scanning of medication and patient ID bar codes during medication	If regular reports on individual unit average scanning rates were made available and sent to each clinical manager to share with nurses, how do you think this will affect scanning

2014)	administration. The average scanning rate for all inpatient units in 2015 was found to be 56%	rates?
Demonstration of organizational support is vital for nursing compliance (Rack et al., 2012; Patterson et al., 2004)	Causes of inconsistent workflow have been attributed to the existence of varied unit manager expectations, and inconsistent enforcement of workflow standards	What actions can be taken by executive leadership and clinical managers to promote and better support bar code scanning at CAMH?

3.6 Participant Recruitment

The researcher emailed each inpatient unit manager a communication (Appendix 2) requesting each manager to forward the *Participant Invitation Letter* (Appendix 3) to eligible participants, who met the selection criteria:

- Must be a full-time or part-time RN or RPN currently working in a CAMH inpatient unit providing direct patient care
- Must not be an agency nurse

Potential participants were encouraged to contact the researcher by email or phone for their questions or to confirm their interest in participating in the study. After receiving the initial notification of agreement (email or phone call from the participant) to participate in the study,

the participant was sent a consent form through CAMH Outlook email system by the student researcher and a meeting request to conduct the interview.

Prior to beginning each interview, the student researcher ensured that each participant had read the consent form (Appendix 4) and answered all questions that the participant had about the project. Finally, the consent form was signed by the participant voluntarily. The student researcher collected the signed consent form prior to each interview.

3.7 Data Collection

The collection and analysis of organizational data was performed in April 2016. Permission to use the CAMH internal 2015 inpatient unit scanning rate report and the internal Device & Technology Integration report as a part of this project was granted by the Directors of Information & Privacy and Information Management Group at CAMH (Appendix 5).

Data collection of nurse interviews was planned for the period of July and November of 2016 by the student researcher through individual interviews using a pre-determined set of non-structured questions (Appendix 6) to guide the interview process and to ensure consistency across interviews. Questions used during the interviews were developed by the student researcher based on findings from the literature review and current state findings from the organization's Device & Technology report in order to assess nurses' perceptions of how the best practice may impact BCMA scanning rates. The same questions were used for every interview to ensure consistency across interviews. Pilot-testing of the interview questions took place prior to data collection with one nurse to ensure that the questions were clear.

Each interview took place in a private office at CAMH during the nurse's work hours and lasted under 1 hour. Probes such as "Can you tell me more about that?" were used to encourage nurses to expand on their answers. All interviews were audio-recorded and transcribed (verbatim transcription) for analysis following a CAMH standardized Qualitative Data Preparation and Transcription Protocol (Appendix 7).

3.8 Analysis of Interview Data

The data was analyzed using a conventional content analysis approach as outlined by Hsieh and Shannon (2005). Conventional content analysis has also been referred to as inductive category development by Mayring (2000), where central meanings are deduced from reoccurring units of analysis. For this research, content analysis technique was selected over thematic analysis in order to provide emphasis on reoccurring similar words and patterns, which may indicate greater importance of certain trends. In addition, themes were developed as the final product of analysis instead of categories to provide considerations to the latent content of the data during analysis (Vaismoradi, Turunen, & Bondas, 2013).

All interviews were transcribed verbatim. Three transcriptions were randomly selected and verified independently by one of the site principal investigators, to ensure accuracy of transcriptions. As transcripts were completed, the first three initial transcripts were thoroughly read to identify words or sentences which encompass key ideas and phrases by reasoning. These highlighted key ideas and phrases were then used to form an initial set of codes, which are meaningful units of analysis. Afterwards, all transcriptions were analyzed and coded. When a section of data does not fit any existing codes, a new code was created.

After coding all transcripts, similarities and differences among the codes were compared to categorize the codes according to their resemblance to each other. The result was the formation of categories and subcategories. The student researcher and a CAMH co-PI conducted initial content analysis independently, and then came together to discuss the findings collectively to verify the findings.

3.9 Rigour

In this study, strategies to ensure rigour include the independent verification of interview transcriptions by a CAMH co-PI. The co-PI listened to the interview while reading the transcription to ensure its adherence to the transcription protocol. The data analysis was also performed by the student researcher and a separate CAMH co-PI independently, and then compared to assure that the findings are trustworthy and confirmable.

3.10 Ethical Approval

This study was approved by the University of Victoria Human Research Ethics Board and the CAMH Research Ethics Board. Participation was voluntary and participants provided signed informed consent forms prior to beginning each interview. The use of all organizational data was approved by the organization's directors of Information & Privacy and Information Management Group.

4. Findings

The findings section is organized into three sections. Section 4.1 summarizes organizational findings of existing medication administration workflows and workarounds, as well as the organization's BCMA scanning rate in 2015. Section 4.2 describes the characteristics of the participants of the study. Lastly, section 4.3 presents the findings from the content analysis of the interviews.

4.1 Organizational Data

4.1.1 Current Clinical Workflow and Workarounds

When medication administration occurs, a nurse will use a handheld scanner attached to a laptop or mobile nursing workstation (MNW) to first scan the patient's bar coded wristband, followed by all medication to be administered. All medications are bar coded by pharmacy prior to being sent onto the units. By scanning both the patient wristband and medication, the CIS will match the medication scanned to all existing medication orders of the identified patient to ensure that the medication name, quantity, administration time, administration route, and patient are correct as prescribed. If the CIS cannot identify a match, a visual alert will appear to alert the nurse of a potential error. In non-scanning situations, a nurse will manually bypass BCMA by overriding all scanning prompts and BCMA safety features.

In order to assess the adoption of BCMA, an internal Device & Technology Integration report was completed in April of 2016 after assessing the 25 inpatient units at CAMH and identified

several causes of BCMA workarounds in the forms of people, process and technology gaps.

Amongst others, the report highlighted the following findings:

- 46 unique reported issues associated with the use of mobile nurse workstations, desktop PCs, laptops, and scanners
- The existence of various nursing workflow workarounds amongst different units. Causes of inconsistent workflow have been attributed to the existence of varied unit manager expectations, and inconsistent enforcement of workflow standards.
- Nurses will stop using any device that does not effectively support their workflows. Examples include slow computer systems, short battery life of devices, and physical environment limitations.
- There is a perceived lack of available and accessible devices on the inpatient units, which disrupt nursing workflow.

4.1.2 BCMA Compliance

The average scanning rates were found to be 65% and 47% for medications and patient wristbands, respectively, for an overall average scanning rate of 56% across all CAMH inpatient units.

4.2 Study Participants

Interview data from participants was collected for the period of July and November of 2016. Ten inpatient mental health nurses were recruited for this study, with a mean nursing experience of 14.2 years. The mean number of years that the nurses have worked in mental health and CAMH

are 10.9 years and 9.3 years, respectively. Descriptive characteristics of the nurse participants are presented in table 3.

Table 3. Characteristics of individual participant

Characteristic	Number
Age Group	
21-30	1 (10%)
31-40	3 (30%)
41-50	4 (40%)
51+	2 (20%)
Mean Years of Nursing Experience	14.2
Mean Years Worked in Mental Health	10.9
Mean Years Worked at CAMH	9.3
Familiarity with Computerized Technology	
Beginner	0 (0%)
Low Intermediate	0 (0%)
Intermediate	2 (20%)
high Intermediate	5 (50%)
Advanced	3 (30%)

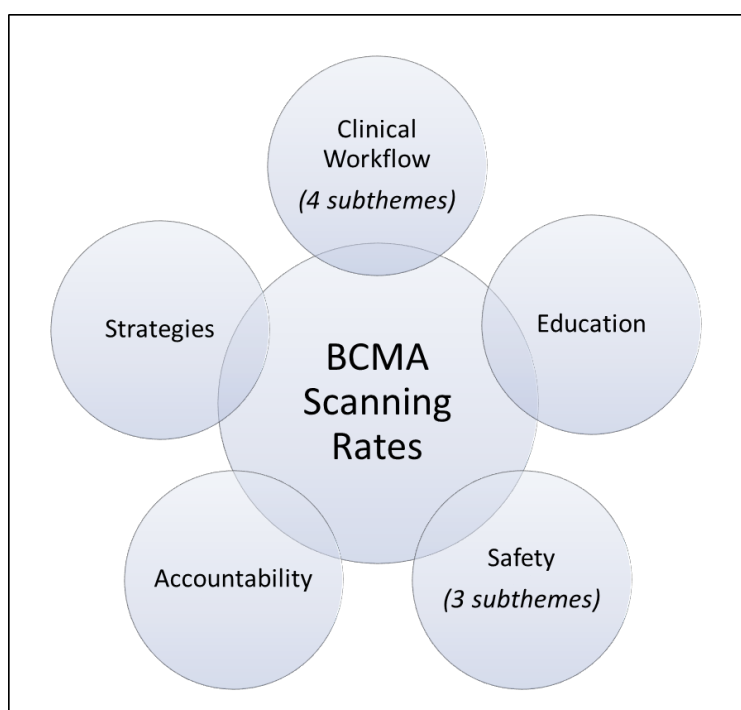
4.3 Content Analysis

Initially, the content analysis and identification of themes were performed separately by the student researcher and a CAMH co-PI independently. The themes generated by the 2 persons

were then compared and discussed to confirm the validity of the themes generated. This resulted in the identification of 5 themes, as outlined in Figure 2.

The theme of Clinical Workflow describes device and non-device related factors that influence the current state clinical workflow. The theme of safety highlights the nurses' perceptions of utilizing technology in relation to the prevention of danger, risk, or injury in the mental health inpatient setting context. A third theme of Education highlights factors pertaining to the giving or receiving of clinician knowledge, training, and instructions which affect bar code scanning rates. The fourth theme is Accountability, which describes nurses' expectations of the responsibilities and liabilities associated with a position. Finally, a fifth theme of Strategies outlines the suggested possible plans of action which may positively affect scanning rates. An example of the content analysis process may be found in appendix 8.

Figure 2. Key themes found from content analysis of clinician interviews



4.3.1 Clinical Workflow

The theme of clinical workflow encompasses factors (device and non-device related) that influence current state medication administration process. Four clinical workflow subthemes were found whereby nurses described existing challenges and approach to comply with the current expected workflow.

4.3.1.1 Time

One of the most common challenges identified by all the participants is the time required to complete all the steps involved in a process. Furthermore, time was perceived as a constraint in many activities related to BCMA. For example, the majority of participants highlighted the lack of time to scan bar codes during medication administration. As a result, they would bypass the time-consuming scanning process to speed up the medication administration process.

In addition, time required to perform scanning is further strained when presented with a device-related issue, which may delay a nurse's ability to scan until the issue is resolved. In one instance, a participant described that if each bar code must be scanned more than once for the system to recognize and capture the information, and there are multiple patients waiting to receive medications, this will greatly delay the time when the last patient will be able to receive his or her medication.

When the participants were asked about the reporting of device-related challenges to resolve the existing issues, the participants shared that there is no time and the current reporting process "is not very efficient and convenient (P3)." Furthermore, one participant also explained that

because the medication administration process is often so rushed as a result of the high volume of medications that need to be administered, when one medication is not scanning, no one would stop the whole process to “call someone and be put on hold and wait and go through 10 minutes, to figure out what’s going on (P6).”

4.3.1.2 Existing Device-Related Challenges

Throughout the interviews, all participants identified technological barriers which hinder scanning practices. The barriers included physical environments and the expected use of devices which were described as not supportive of nursing clinical workflows. Several participants described that the current medication rooms are too small to fit more than one person comfortably, which means that nurses must take turns administering medication from the medication room.

In addition, the majority of the participants also highlighted the issue that the medication drawers in the medication cart are not interchangeable with mobile nursing workstations, which prevents safe and efficient transfer of medications delivered by Pharmacy into the mobile nursing workstations.

On the topic of device-related challenges, the participants also revealed that some devices do not work as well as expected, which may cause frustration when providing care. For example, one participant explained in detail that medication bar codes “are difficult to scan to begin with (P4),” and when the bar codes are attached to irregular shaped packaging, such as vials, it becomes even more difficult to scan. Furthermore, when technology does not work, such as

when a bar code scanner does not scan, it is frustrating to have to troubleshoot devices in the middle of administering medications.

4.3.1.3 Existing Non-Device-Related Challenges

In addition to device-related challenges, the participants also identified non-technological barriers that hinder scanning practices. One nurse highlighted that psychological barriers, such as nurses' motivation and attitude toward BCMA practices, also need to be considered and overcome, as both technology and psychological adherence are required to ensure practice adherence.

Another challenge that emerged is the need for support by interdisciplinary teams to address any issues. One participant described that when previous medication bar code-related issues have been sent to the Pharmacy, no action was taken to address any of the issues, and the nurses subsequently felt discouraged to report any further issues.

4.3.1.4 Troubleshooting

When describing the existing challenges around BCMA, it was clear that nurses have also developed their own approaches to resolve identified issues as described by one of the participants. This participant stated that: "nurses are very task oriented and they are problem solvers (P7)." When describing challenges associated with the hand-held scanning devices, another participant indicated that the technology issues do not prevent the adherence to BCMA. Instead, the participant will try to troubleshoot or locate a different device to complete the BCMA process if one device is not working. For example, if the bar code scanner is not

working, the participant detailed that: “I will unplug and plug [the scanner], and usually that works (P10).”

4.3.2 Safety

When speaking about the use of devices in the care environment, safety was identified as a primary concern for the nurses. Three subcategories are described below to highlight the nurses’ perceptions of utilizing technology related to prevention of danger, risk, or injury in the context of mental health inpatient setting.

4.3.2.1 Scanning Ensures Safety

When speaking about BCMA and safety, nurse perceptions of the impact of BCMA on patient & nurse safety are mostly positive. One participant shared that for nurses who are familiar with using BCMA technology, have used the technology for longer periods of times, and have prevented errors by scanning, this technology is welcomed and fully supported because it not only ensures “patient safety, it’s the providers’ safety as well (P4).”

4.3.2.2 Safety of Nurse

When describing their perceptions of proposed solutions on how resolving reported issues with existing devices may impact their scanning rates, several nurses voiced concerns relating to workplace and patient safety. One nurse described feelings of discomfort when walking around the unit while wheeling the mobile nursing workstations “with a cart that’s full of medication, especially if there’s clients who are drug seeking and they know there’s like a lorazepam on the go (P10),” which may compromise safety for nurses and the patients. In addition, a nurse also

showed concern with using devices in the care environment in that a patient may want to take the mobile nurse workstations, or hit nurses with the scanner, subsequently further hindering the use of mobile nursing workstations by nurses to support the medication administration workflow.

4.3.2.3 Patient Confidentiality

A minority of nurses also voiced concerns relating to the preservation of patient privacy, security, and trust when using technology in the care environment to perform documentation, such as when documenting observations in client charts using mobile nursing workstations. The participants explained that when a nurse is typing, patients “tend to get paranoid and look at the screens (P1).” Additionally, the participants highlighted that patients are also concerned about other close-by patients potentially being able to see their health record.

4.3.3 Education

Regarding factors pertaining to the giving or receiving of clinician knowledge, training, and instructions, the majority of the participants agreed that education is necessary in order to increase BCMA scanning rates, and several of the participants also shared ideas on how future education efforts may target specific nursing needs and interests. One participant mentioned that though it may seem that everyone is aware of the reason why BCMA is important, people will still think that “the technology is there to make things faster, but that’s not the case (P6),” and thus the assurance of safety needs to be emphasized.

Additionally, this participant also mentioned the importance of education for patients as well, including notifying patients of the BCMA process that will take place prior to medication

administration, educating them on their rights and the importance of BCMA, as well as how BCMA can ensure their safety. The participant suggests that if the patients are aware of the nurses' scanning practices and expectations, they can also help reinforce the BCMA practice when receiving their medications.

On another note, one participant described the importance of emphasizing critical thinking and clinical judgement during BCMA-related education for nurses as it is still important to read the medication being administered and question why the medication is being administered. The scanning does not replace the critical thinking for the nurses, thus there may be a risk that nurses will not look at the medication intentionally once the scan is completed.

One other participant suggested that education may be made more interesting and relevant by communicating best practices, successes, and learning from previous incidents, rather than only BCMA training. The participant suggested that the sharing of new research findings about BCMA or stories of medication errors that have been prevented with nurses may be a powerful way to encourage scanning. The sharing of stories about methods that have worked or not worked to increase scanning rates on other units may also promote scanning rates as well.

When asked about the potential benefits of education, some participants agreed that ongoing education is necessary and should be mandatory, while other participants showed concerns regarding the time-consuming nature of education.

4.3.4 Accountability

Another evident theme from the interviews was the participants' expectations regarding the nursing role, as well as the responsibilities and liabilities associated with leadership roles and the organization in order to support the safe use of BCMA by nurses. In one case, a participant described that some administrative tasks, such as uploading patient photos into the patient chart, always fall on nurses with the knowledge to complete such tasks, which then results in those nurses becoming burdened to complete those tasks during their own time.

In response to how BCMA may be better supported by leadership, one participant highlighted that each unit manager has a big role of "making their expectation very clear and making the expectation very straight forward (P6)." Other participants also echoed the need for leadership to demonstrate commitment to facilitating the adoption of new technologies. Particularly, participants highlighted the need to "fix [the devices that] are not working (P4)" and "[make] sure that resources are available (P1)." The participants explained that if the organization has decided to rely on technologies to optimize care, "the organization needs to be able to provide those resources, and [consider] what kind of setting we're in as well (P1)." In addition, several participants also highlighted the need to be better prepared for change by the organization, including updates from leadership to communicate change before it occurs.

Lastly, one participant also shared thoughts on the importance of emphasizing the responsibilities of nurses and importance of nursing judgement, as technology may sometimes "numb [nurses'] thinking (P3)." The participant explained that though nurses are aware to not fully rely on technology, the technology may cause automatic functioning in that when the

medications scan well and everything looks fine, nurses will fail to perform manual checks prior to administering the medications.

4.3.5 Strategies

When sharing their perceptions of the identified best practices, the participants identified numerous possible plans of action which may positively impact, or contribute, to improved scanning practices in the future.

With regards to how scanning rates would be affected if existing devices-related challenges were resolved, one participant described that the scanning rates will definitely improve as the technology will better meet nurses' expectations, and therefore improve adherence to the use of technology. Other nurses also suggested that ensuring there are enough resources available and having routine maintenance on BCMA-related devices would also improve BCMA compliance rates. In particular, one participant expressed "I wish that...we don't have to call for every problem with the computer (P10)."

When asked about nurse perceptions of how individual unit average BCMA scanning reports would affect BCMA scanning rates if such reports were made available and sent to each clinical manager to share with nurses, the majority of the participants agreed that it would be a good idea as many nurses are competitive and want good work reflected. The majority of the participants agreed that having qualitative data would be a good incentive to promote good work.

5. Discussion

5.1 Summary of Findings

The purpose of this study was to identify published best practices to increase BCMA compliance post implementation, and mental health nurses' perceptions of how well the best practices may be implemented in an inpatient mental health setting to increase BCMA compliance in the form of scanning rates.

The first objective of the study was accomplished by performing a review of existing best practices to increase BCMA scanning rates. To accomplish the second objective of this study, 10 nurses were interviewed using an interview question instrument created by mapping potential BCMA barriers identified from the organizational data with the best practices to increase BCMA scanning rates from the literature review.

From analyzing organizational data, it was found that the organization had an average scanning rate of 56% in 2015, and a Device & Technology Integration review in 2016 collected 46 unique nurse reported issues associated with the use of mobile nurse workstations, desktop PCs, laptops, and scanners when performing clinical tasks. In addition, it was found that various nursing workflow workarounds exist amongst different units during medication administration, and that the causes of such inconsistent workflows were attributed varied unit manager expectations, enforcement of workflow standards, and perceived availability of devices.

Following the interviews of 10 front-line inpatient nurses who work at CAMH, 5 themes were identified by using content analysis: clinical workflows, safety, education, accountability, and strategies. Within the clinical workflows theme, 4 subthemes were also identified: time, existing device-related challenges, existing non-device-related challenges, and troubleshooting. Safety was also found to have 3 subthemes: scanning ensures safety, safety of nurse, and patient confidentiality.

The findings from this study revealed that nurses in mental health settings experience similar challenges when using BCMA technology in comparison to nurses in other hospital settings. In particular, participants of this study highlighted device and non-device related challenges, a perceived lack of time to complete BCMA-related activities, the ongoing need for education to strengthen nurses' understanding of the expectations and benefits around BCMA, and the need for leadership and interdisciplinary support for the entire BCMA process. All these findings are supportive of previous literature as barriers which may induce the development of undesirable BCMA workarounds and hinder BCMA compliance.

One new insight from this study is the significance of perceived nurse and patient safety in influencing the use of BCMA technology in care environments. In particular, participants highlighted the potential for devices to be used as weapons by patients, feelings of discomfort when transporting medications in the mental health care environment, and the potential for technologies to cause paranoia in the mental health patient population.

5.2 Recommendations

In response to the study findings, recommendations for how BCMA scanning compliance may be increased at CAMH were generated to reflect the best practices that the participants perceived to be effective.

5.2.1 Reduce Workarounds

From the organizational data and interview findings, it was shown that various BCMA workarounds currently exist as a result of various device and non-device related barriers. According to previous research, BCMA workarounds are common and may even contribute to medication errors and compromise patient care, and therefore defeating the safety intention BCMA technology (Debono et al., 2013; Koppel et al., 2008). As a result, the existence of new workarounds that do not comply with expected practice need to be continuously identified and discouraged to increase medication safety and to prevent the potential development of new sources of medication errors.

As workarounds may arise during any point of the BCMA process in response to a perceived barrier (Koppel et al., 2008), there need to be a concerted interdisciplinary approach to achieve the reduction of workarounds. Consequently, not only does the technology and associated workflow need to meet nurse expectations, education, technological, and human resources for the BCMA process must also be available to support ongoing efforts to address workarounds. Potential strategies to identify and address workarounds may include the implementation of a device strategy, establishment of a multi-faceted education strategy, demonstration of leadership commitment to BCMA, empowerment of nurses, and ongoing monitoring of BCMA compliance. These strategies are described in further details below.

5.2.2 Implement a Device Strategy

Findings from this study are congruent with the suggested best practices from literature which recommends that technology evaluations should be performed to address the causes of workarounds and to ensure that an adequate number and type of devices are available to nurses. Throughout the interviews in this study, the participants highlighted the challenges of using technology which do not support nursing workflows, and described the tendency to stop using such devices as a result of perceived inefficiencies. In previous literature, the need to continuously assess and tailor BCMA technologies to meet nursing needs has been widely agreed upon, and methods of technology evaluation include the establishment of a bar code quality program to identify and repair difficult to scan bar codes on an ongoing basis (Bagby et al., 2011), quality improvement initiatives to target specific issues (Patterson et al., 2006), a quality monitoring program to continuously improve BCMA technologies (Mims et al., 2009), and a 4-phased BCMA evaluation program (Kelly, Harrington, Matso, Turner, & Johnson, 2015). A similar approach may be beneficial to help the organization realize BCMA technology gaps and implement solutions. However, it will also be important to ensure ongoing frontline nurse involvement and collaboration at every step of the process when implementing and updating technologies in the future. This will allow the incorporation of greater nursing feedback on how the changes may influence practice in order to minimize future technology challenges.

In addition, study participants described that the current reporting process for technology feedback is not efficient and that previous attempts to report issues were not addressed. A technology strategy should also include an efficient and standardized process for nurses to report

issues and to ensure that the issues submitted are actioned and addressed in a timely manner (Early et al., 2011; Nagle & Catford, 2008). For example, one patient confidentiality concern that was identified was the potential for patients to read the computer screen when nurses document in the care environment, subsequently leading to reluctance to use mobile workstations in the care environment. In this case, there need to be an effective and formal reporting process for nurses to report this issue, ensure leadership acknowledgement of the feedback, as well as to facilitate timely responses to address the issue.

5.2.3 Establish a Multi-Faceted Education Approach

A number of potential education strategies were identified from this study, all of which will be valuable in contributing to a multi-faceted education approach. While it is generally agreed that education is an important strategy to address nursing attitude towards BCMA and perceptions of BCMA usefulness (Harrington et al., 2013; Patterson et al., 2004), the participants provided several suggestions on how education on BCMA may be made more effective, engaging, and relatable. Firstly, due to the unique needs of mental health patients, the scanning of wristbands may not be welcomed if patients do not understand the benefits of BCMA for patient safety, and potentially present resistance to wear the wristbands (Strudwick, Clark, McBride, Sakal, & Kalia, 2017). As a result, a patient education strategy may be an effective strategy to engage with patient and to encourage cooperation during BCMA to support medication safety (Strudwick, Reisdorfer, Warnock, Kalia, Sulkers, Clark & Booth, In Press).

Another important education topic that should be included in future education is to recognize that technology does not replace nursing competence. Several participants highlighted the potential

tendency for nurses to become less aware of the medications that are being administered due to increased reliance on technology, which may result in failure to manually inspect each medication. In this case, it will be important to emphasize during education and training the importance of clinical judgement and critical thinking throughout the BCMA process.

A third finding from this study is related to safety. Nurses reported that they were particularly concerned about the potential for a patient to try to take a device to use as a weapon in the care environment. Education is needed to be provided regarding the proper storage of devices and strategies to perceive risk. It will also be important to reinforce reasons behind the need to use technology in the care environment, and to communicate the lack of literature documentation of patients using technology as weapons.

Last, the amount of time required to perform BCMA was highlighted by the majority of the participants as a barrier to BCMA adoption as the process of scanning has been perceived as troublesome and time-consuming. However, several previous research on nursing activities have found that nurses spend the same (Poon et al., 2008) or less amount of time (Dwibedi et al., 2011; Huang & Lee, 2011) on medication-related activities when using BCMA as compared to traditional workflows. Interestingly, the studies all agreed that BCMA was able to reduce inefficiencies during medication administration to allow more time to perform other activities. Furthermore, a study on nurses' satisfaction with BCMA found although some nurses perceived that BCMA was more time consuming than the traditional paper method, they recognized that the extra time spent is justified in order to increase patient and medication safety (Hurley et al.,

2007). The inclusion of these previous research findings may be an effective way to increase nurses' BCMA compliance.

5.2.4 Demonstrate Leadership Commitment

Similar to previously suggested best practices, participants in this study also voiced the importance of understanding and being aware leadership commitment and expectations towards CLMA. Examples of initiatives to involve organization leadership include annual organizational conferences focused on improving BCMA (Bagby et al., 2011) engaging with leadership teams to generate a cultural shift in nurse attitudes towards BCMA (Early et al., 2011), and the creation and distribution of Chief Nursing Officer report cards to unit leaders highlighting individual clinician BCMA compliance (Savage, Titus, Manns, & Lee, 2014). As participants of the study agreed that the sharing of qualitative BCMA compliance data with nurses would be a good incentive to improve scanning rates as nurses are competitive and wants good work to be recognized, the creation and distribution of a regular report may be an effective method to increase BCMA scanning rates at CAMH.

5.2.5 Empower Nurses

From the findings of this research, one additional recommendation for the organization would be to empower nurses to take advantage of the benefits of BCMA. Some of the ways to achieve this may be the provision of resources, such as education, posters, pamphlets, and guides, to nurses to emphasize the benefits of BCMA to both patients and providers. In addition, documents outlining ways to troubleshoot each device and resources that nurses may contact for assistance with different types of problems should also be provided to encourage and support high levels of

BCMA compliance (Patterson et al., 2004). In addition, the organization may also identify and appoint nurse champions who will act as BCMA super users on the units to encourage and provide education to their peers. In previous research, it was found that the appointment of a nurse champion significantly contributed to the demonstration of meaningful use for electronic health records (Shea, Reiter, Weaver, & Albritton, 2016).

5.2.6 Ongoing Evaluation of BCMA Compliance

In addition to the sharing of individual clinician's BCMA compliance rates by leadership (Savage et al., 2014), it may also be important for the organization to establish a formal process for the ongoing monitoring and evaluation of BCMA scanning rates. In particular, it would be beneficial for the organization to be able to assess how system changes and best practices impact BCMA compliance rates over time, if implemented. For example, Early and colleagues (2011) reviewed the benefits of monitoring hospital-level, unit-level, and provider-level analysis of BCMA compliance rates over time, including the continuous review of medication override reasons for unscanned medication in order to continuously enhance the BCMA process.

5.3 Study Implications

The findings of this research will help mental health care settings to identify and implement best practices to increase the BCMA scanning rates. It is important for leadership teams to gain a clear understanding of existing barriers associated with BCMA in order to acknowledge, understand, and implement solutions to remove factors associated with BCMA non-compliance. In particular, strong and thoughtful device, education, and communication strategies need to be

established and communicated by the organization to demonstrate commitment to BCMA. However, these strategies will need to be realistic and will require the efforts of many teams to create and implement. As a result, the organization must also be staffed adequately to provide the level of support needed. For example, the allocation of time for IT specialists to respond to device problems in a timely manner may be necessary, and additional nurse educators may be needed to carry-out new education modules that become added to the existing curriculum.

5.4 Study Limitations

One of the limitations of this study is that the findings may not be generalizable due to this research being a single site study heavily influenced by findings from a secondary organizational data source, and there was no control over the quality and validity of the organizational data. Additionally, the potential best practices identified are the results of the perceived gaps which existed at the time of the study, and may not be reflective of the needs of the organization at a later time. The sampling technique used may have excluded nurses who do not check emails on a regular basis or do not have interest BCMA. Furthermore, it was difficult to determine the true technological skillset of this group as the participants were only asked to rate their own familiarity with computerized technology.

6. Conclusion

With BCMA receiving more and more attention and acceptance as an effective strategy to decrease medication errors, it will be important for hospitals to understand and consider the implementation of best practices that may discourage workarounds and increase BCMA compliance in the form of BCMA scanning rates. As different care environments have unique needs and preferences, it will also be necessary to tailor BCMA compliance solutions by considering and understanding the specific challenges of existing clinical workflows for each environment and patient population. As there is currently little research on the BCMA use and needs of nurses in mental health settings, this study has highlighted the perceptions of mental health nurses towards the implementation of best practices to increase BCMA scanning rates from other care environments. While most of the proposed best practices were perceived to be able to help increase BCMA compliance rates, the unique needs of mental health nurses were prevalent in the considerations of how each best practice may impact future BCMA scanning rates.

References

- Acheampong, F., Anto, B. P., & Koffuor, G. A. (2014). Medication safety strategies in hospitals—A systematic review. *International Journal of Risk & Safety in Medicine*, 26(3), 117-131.
- Armitage, G., & Knapman, H. (2003). Adverse events in drug administration: a literature review. *Journal of nursing management*, 11(2), 130-140.
- Bagby, J., Mims, E., Schneider, R., & Petrich, R. (2011). Realizing efficiencies with bar code medication administration. *Nursing management*, 42(11), 51-54.
- Bates, D. W., Cullen, D. J., Laird, N., Petersen, L. A., Small, S. D., Servi, D., ... & Vander Vliet, M. (1995). Incidence of adverse drug events and potential adverse drug events: implications for prevention. *Jama*, 274(1), 29-34.
- Bates, D. W., Cohen, M., Leape, L. L., Overhage, J. M., Shabot, M. M., & Sheridan, T. (2001). Reducing the frequency of errors in medicine using information technology. *Journal of the American Medical Informatics Association*, 8(4), 299-308.
- Bates, D. W., & Gawande, A. A. (2003). Improving safety with information technology. *New England journal of medicine*, 348(25), 2526-2534.
- Bates, D. W. (2007). Preventing medication errors: A summary. *American Journal of Health-System Pharmacy*, 64(14).
- Berdot, S., Roudot, M., Schramm, C., Katsahian, S., Durieux, P., & Sabatier, B. (2016). Interventions to reduce nurses' medication administration errors in inpatient settings: A systematic review and meta-analysis. *International Journal of Nursing Studies*, 53, 342-350.
- Blendon, R. J., Schoen, C., DesRoches, C., Osborn, R., & Zapert, K. (2003). Common concerns amid diverse systems: health care experiences in five countries. *Health Affairs*, 22(3), 106-121.
- Brunetti, L., & Suh, D. C. (2012). Medication Errors: Scope and prevention strategies. *Journal of Hospital Administration*, 1(2), p54.

- Carayon, P., Wetterneck, T. B., Hundt, A. S., Ozkaynak, M., DeSilvey, J., Ludwig, B., ... & Rough, S. S. (2007). Evaluation of nurse interaction with bar code medication administration technology in the work environment. *Journal of Patient Safety*, 3(1), 34-42.
- CAMH. (2015, March 5). *Collective Agreement Between: Centre for Addiction and Mental Health and: Ontario Nurses' Association*. Retrieved from https://www.ona.org/documents/File/pdf/cas/hospitals/CentreForAddictionAndMentalHealth_March312016.pdf.
- CAMH. (n.d.). Who We Are. Retrieved from http://www.camh.ca/en/hospital/about_camh/who_we_are/Pages/who_we_are.aspx.
- CIHI. (2004). Healthcare in Canada. Retrieved from: https://secure.cihi.ca/free_products/hcic2004_e.pdf.
- Cottney, A., & Innes, J. (2015). Medication-administration errors in an urban mental health hospital: A direct observation study. *International journal of mental health nursing*, 24(1), 65-74.
- Coyle, G., & Heinen, M. (2005). Evolution of BCMA within the Department of Veterans Affairs...Bar Code Medication Administration. *Nursing Administration Quarterly*, 29(1), 32-38 7p.
- Cummings, J., Bush, P., Smith, D., & Matuszewski, K. (2005). Bar-coding medication administration overview and consensus recommendations. *American Journal Of Health-System Pharmacy*, 62(24), 2626.
- Debono, D. S., Greenfield, D., Travaglia, J. F., Long, J. C., Black, D., Johnson, J., & Braithwaite, J. (2013). Nurses' workarounds in acute healthcare settings: a scoping review. *BMC health services research*, 13(1), 1.
- Duxbury, J. A., Wright, K. M., Bradley, D. M., & Roach, P. (2009). A study of the views of patients and nurses about the administration of medication in the acute mental health setting. *Journal of psychiatric and mental health nursing*, 16(7), 672-677.
- Duxbury, J. A., Wright, K. M., Hart, A., Bradley, D., Roach, P., Harris, N., & Carter, B. (2010). A structured observation of the interaction between nurses and patients during the administration of medication in an acute mental health unit. *Journal of clinical nursing*, 19(17-18), 2481-2492.

- Dwibedi, N., Sansgiry, S. S., Frost, C. P., Dasgupta, A., Jacob, S. M., Tipton, J. A., & Shippy, A. A. (2011). Effect of bar-code-assisted medication administration on nurses' activities in an intensive care unit: A time-motion study. *American Journal of Health-System Pharmacy*, 68(11).
- Early, C., Riha, C., Martin, J., Lowdon, K. W., & Harvey, E. M. (2011). Scanning for safety: an integrated approach to improved bar-code medication administration. *CIN: Computers, Informatics, Nursing*, 29(3), 157-164.
- Food and Drug Administration, HHS. (2004). Bar code label requirement for human drug products and biological products. Final rule. Federal register, 69(38), 9119. Retrieved from: <http://www.fda.gov/OHRMS/DOCKETS/98fr/04-4249.htm>.
- Harrington, L., Clyne, K., Fuchs, M. A., Hardison, V., & Johnson, C. (2013). Evaluation of the use of bar-code medication administration in nursing practice using an evidence-based checklist. *Journal of Nursing Administration*, 43(11), 611-617.
- Hassink, J. J. M., Jansen, M. M. P. M., & Helmons, P. J. (2012). Effects of bar code-assisted medication administration (BCMA) on frequency, type and severity of medication administration errors: a review of the literature. *European Journal of Hospital Pharmacy: Science and Practice*, 19(5), 489-494.
- Haw, C., Stubbs, J., & Dickens, G. (2007). An observational study of medication administration errors in old-age psychiatric inpatients. *International Journal for Quality in Health Care*, 19(4), 210-216.
- Helmons, P. J., Wargel, L. N., & Daniels, C. E. (2009). Effect of bar-code-assisted medication administration on medication administration errors and accuracy in multiple patient care areas. *Am J Health Syst Pharm*, 66(13), 1202-1210.
- Hemingway, S., McCann, T., Baxter, H., Smith, G., Burgess-Dawson, R., & Dewhirst, K. (2015). The perceptions of nurses towards barriers to the safe administration of medicines in mental health settings. *International journal of nursing practice*, 21(6), 733-740.
- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative health research*, 15(9), 1277-1288.

- Huang, H. Y., & Lee, T. T. (2011). Impact of bar-code medication administration on nursing activity patterns and usage experience in Taiwan. *Computers Informatics Nursing*, 29(10), 554-563.
- Hurley, A., Bane, A., Fotakis, S., Duffy, M., Sevigny, A., Poon, E., & Gandhi, T. (2007). Nurses' satisfaction with medication administration point-of-care technology. *Journal Of Nursing Administration*, 37(7/8), 343-349 7p.
- Institute for Safe Medication Practices Canada. (2013a). Ontario Hospital Critical Incidents Related to Medications or IV Fluids Analysis Report. Retrieved from: http://www.ismp-canada.org/download/ocil/ON_Critical_Incidents_Analysis_Report_31May2013.pdf.
- Institute for Safe Medication Practices Canada. (2013b). Medication Bar Code System Implementation Planning: A Resource Guide. Retrieved from: <https://www.ismp-canada.org/barcoding/download/ResourceGuide/BarCodingResourceGuideFINAL.pdf>.
- Keers, R. N., Williams, S. D., Cooke, J., Walsh, T., & Ashcroft, D. M. (2014). Impact of interventions designed to reduce medication administration errors in hospitals: a systematic review. *Drug safety*, 37(5), 317-332.
- Kelly, K., Harrington, L., Matos, P., Turner, B., & Johnson, C. (2016). Creating a Culture of Safety Around Bar-Code Medication Administration: An Evidence-Based Evaluation Framework. *Journal of Nursing Administration*, 46(1), 30-37.
- Keohane, C. A., Bane, A. D., Featherstone, E., Hayes, J., Woolf, S., Hurley, A., ... & Poon, E. G. (2008). Quantifying nursing workflow in medication administration. *Journal of Nursing Administration*, 38(1), 19-26.
- Koppel, R., Wetterneck, T., Telles, J., & Karsh, B. (2008). Workarounds to barcode medication administration systems: their occurrences, causes, and threats to patient safety. *Journal Of The American Medical Informatics Association*, 15(4), 408-423 16p.
- Krähenbühl-Melcher, A., Schlienger, R., Lampert, M., Haschke, M., Drewe, J., & Krähenbühl, S. (2007). Drug-related problems in hospitals. *Drug Safety*, 30(5), 379-407.
- Leape, L. L., Bates, D. W., Cullen, D. J., Cooper, J., Demonaco, H. J., Gallivan, T., ... & Nemeskal, R. (1995). Systems analysis of adverse drug events. *Jama*, 274(1), 35-43.

- Leape, L. L., Brennan, T. A., Laird, N., Lawthers, A. G., Localio, A. R., Barnes, B. A., ... & Hiatt, H. (1991). The nature of adverse events in hospitalized patients: results of the Harvard Medical Practice Study II. *New England journal of medicine*, 324(6), 377-384.
- Lee, B. C., Lee, S., Kwon, B. C., & Yi, J. S. (2015). What Are the Causes of Noncompliance Behaviors in Bar Code Medication Administration System Processes? *International Journal Of Human-Computer Interaction*, 31(4), 227-252.
- Maidment, I. D., Lelliott, P., & Paton, C. (2006). Medication errors in mental healthcare: a systematic review. *Quality and safety in Health Care*, 15(6), 409-413.
- Mayring, P. (2000). Qualitative Content Analysis. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 1(2). Retrieved from <http://www.qualitative-research.net/index.php/fqs/article/view/1089/2385>.
- Mims, E., Tucker, C., Carlson, R., Schneider, R., & Bagby, J. (2009). Quality-monitoring program for bar-code-assisted medication administration. *American Journal Of Health-System Pharmacy*, 66(12), 1125-1131 7p.
- Nagle, L. M., & Catford, P. (2008). Toward a model of successful electronic health record adoption. *Healthcare Quarterly* (Toronto, Ont.), 11(3), 84.
- National Coordinating Council for Medication Error Reporting and Prevention. (n.d.). What is a Medication Error? Retrieved from <http://www.nccmerp.org/about-medication-errors>.
- Paoletti, R. D., Suess, T. M., Lesko, M. G., Feroli, A. A., Kennel, J. A., Mahler, J. M., & Sauders, T. (2007). Using bar-code technology and medication observation methodology for safer medication administration. *American journal of health-system pharmacy*, 64(5).
- Patterson, E. S., Cook, R. I., & Render, M. L. (2002). Improving patient safety by identifying side effects from introducing bar coding in medication administration. *Journal of the American Medical Informatics Association*, 9(5), 540-553.
- Patterson, E. S., Rogers, M. L., & Render, M. L. (2004). Fifteen best practice recommendations for bar-code medication administration in the Veterans Health Administration. *The Joint Commission Journal on Quality and Patient Safety*, 30(7), 355-365.
- Patterson, E. S., Rogers, M. L., Chapman, R. J., & Render, M. L. (2006). Compliance with intended use of Bar Code Medication Administration in acute and long-term care: an observational study. *Human Factors*, 48(1), 15-22.

- Poon, E. G., Keohane, C. A., Bane, A., Featherstone, E., Hays, B. S., Dervan, A., ... & Gandhi, T. K. (2008). Impact of barcode medication administration technology on how nurses spend their time providing patient care. *Journal of Nursing Administration*, 38(12), 541-549.
- Poon, E. G., Keohane, C. A., Yoon, C. S., Ditmore, M., Bane, A., Levitzion-Korach, O., ... & Churchill, W. W. (2010). Effect of bar-code technology on the safety of medication administration. *New England Journal of Medicine*, 362(18), 1698-1707.
- Procyshyn, R. M., Barr, A. M., Brickell, T., & Honer, W. G. (2010). Medication errors in psychiatry. *CNS drugs*, 24(7), 595-609.
- Rack, L. L., Dudjak, L. A., & Wolf, G. A. (2012). Study of nurse workarounds in a hospital using bar code medication administration system. *Journal Of Nursing Care Quality*, 27(3), 232-239 8p.
- Sandelowski, M. (2000). Focus on research methods-whatever happened to qualitative description? *Research in nursing and health*, 23(4), 334-340.
- Savage, B. A., Titus, A. E., Manns, J. G., & Lee, R. A. (2014). BCMA Scanning Stars: A Sustainable Best Practice: A Sustainable Best Practice. *CIN: Computers, Informatics, Nursing*, 32(9), 413-419.
- Shea, C. M., Reiter, K. L., Weaver, M. A., & Albritton, J. (2016). Quality improvement teams, super-users, and nurse champions: a recipe for meaningful use? *Journal of the American Medical Informatics Association*, ocw029.
- Strudwick, G., Clark, C., McBride, B., Sakal, M., & Kalia, K. (2017). Thank you for asking: Exploring patient perceptions of barcode medication administration identification practices in inpatient mental health settings. *International Journal of Medical Informatics*.
- Strudwick, G., Reisdorfer, E., Warnock, C., Kalia, K., Sulkers, H., Clark, C., & Booth, R. (In Press). The effect of barcode medication administration on medication errors, and factors associated with its use that contribute to patient safety: An integrative review. *Journal of Nursing Care Quality*.
- USFDA. (2016). Medication Error Reports. Retrieved from:
<https://www.fda.gov/Drugs/DrugSafety/MedicationErrors/ucm080629.htm>

- Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & health sciences*, 15(3), 398-405.
- van Onzenoort, H., van de Plas, A., Kessels, A., Veldhorst-Janssen, N., van der Kuy, P., & Neef, C. (2008). Factors influencing bar-code verification by nurses during medication administration in a Dutch hospital. *American Journal Of Health-System Pharmacy*, 65(7), 644-648.
- Voshall, B., Piscotty, R., Lawrence, J., & Targosz, M. (2013). Barcode medication administration work-arounds: a systematic review and implications for nurse executives. *Journal of Nursing Administration*, 43(10), 530-535.
- Waneka, R., & Spetz, J. (2010). Hospital information technology systems' impact on nurses and nursing care. *Journal of Nursing Administration*, 40(12), 509-514.
- Wilkins, K., & Shields, M. (2008). Correlates of medication error in hospitals. *Health reports*, 19(2), 7.
- Williams, C. (2004). Inside a closed-loop medication strategy. *Nursing Management*, 358-24 3p.
- Wulff, K., Cummings, G. G., Marck, P., & Yurtseven, O. (2011). Medication administration technologies and patient safety: a mixed-method systematic review. *Journal of Advanced Nursing*, 67(10), 2080-2095.
- Young, J., Slebodnik, M., & Sands, L. (2010). Bar code technology and medication administration error. *Journal of patient safety*, 6(2), 115-120.

Appendices

Appendix 1: Description of Literature Review Methodology

The initial review of literature identified the prevalence of medication errors, the potential for BCMA to support medication safety, existing BCMA workarounds in clinical settings, medication administration in mental health, and best practices to increase BCMA scanning rates. These findings were then used to support the development of the structured interview questions. The following electronic databases were searched for relevant publications: Medline, PubMed, CINAHL, and Business Source Complete. The keywords used for searching were “medication error,” “medication administration,” “safety,” “bar code,” “BCMA,” “workflow,” “workaround,” “noncompliance,” and “mental health.” Various combinations of these keywords were used in the database search. Full papers of the titles and abstracts that were relevant were retrieved and read. Additional manual searches were performed by searching titles of interest listed in the selected publications' lists of references. Only articles written in English and published in peer-reviewed journals were included.

The search strategy for a further literature review of existing best practices to increase BCMA compliance included using the following key words and phrases in various combinations: “Medication,” “barcode,” “bar code,” “closed loop medication,” “BCMA,” “nursing,” and “scanning.” Medline, PubMed, CINAHL, and Business Source Complete databases were searched for peer reviewed journals published after 2000. This process produced 2025 results: 920 from Business Source Complete; 918 from Medline; and 214 from CINHALL. When

reviewing these papers, only post-implementation studies of BCMA workarounds with a focus on nurses being the end user were included. Studies with pre-post designs or non-nursing focus (e.g. pharmacy) were excluded. As a result, 10 papers were selected for inclusion.

Appendix 2: Unit Manager Communication Letter

Subject Line: Research study for inpatient nurses

Dear Clinical Inpatient Manager,

My name is Lauren Xie. I am a graduate student in the School of Health Information Science at the University of Victoria (Uvic). Currently, I am working as a student at CAMH with the I-CARE Optimization team, and will be conducting this study as a part of my graduate degree requirements.

The purpose of this study is to identify bar coded medication administration (BCMA) recommendations for the Centre for Addiction and Mental Health (CAMH) based on previously identified CAMH BCMA gaps, and published best practices to better support nursing needs. Previous studies have revealed that medication errors are common in the administration of medications and that the use of BCMA technology can significantly reduce error rates and adverse drug events during medication administration. Currently, there is little known about the challenges of BCMA in mental health and addiction inpatient settings.

This project will attempt to understand nurses' perceptions of how well the implementation of identified best practices may increase BCMA adoption in the form of unit scanning rates at CAMH.

I would like to invite Registered Nurses (RNs) and Registered Practical Nurses (RPNs) from your clinical area(s) to participate in the research study. Each participant's involvement will be a one-hour interview during the nurse's shift between 9AM and 7PM.

At this time I am seeking your assistance with supporting nurses to attend a one-hour interview with me during their regularly scheduled shift. **I ask that you please forward the *Participant Invitation Letter to eligible participants***, who meet the selection criteria below:

- Must be a RN or RPN currently working full-time or part-time in a CAMH inpatient unit providing direct patient care
- Must not be an agency nurse

I understand that a nurse's clinical work is the first priority. A participant may cancel an interview at any time and reschedule the interview even after it has started. I will inform every RN about the limits to confidentiality.

Questions regarding this research may be sent to:

The student researcher: **Lauren Xie**

Email: Lauren.xie@camh.ca

CAMH extension: 30583

Cell phone: 403-918-5881

If you have any questions about the ethical conduct of this project, please contact:

Dr. Padraig Darby, Chair, Research Ethics Board, CAMH

Centre for Addiction and Mental Health

U3-4 1001 Queen St W. Toronto ON M6J 1H4

Phone: 416-535-8501 ext 36876

In addition, you may also contact the Human Research Ethics Office at the University of Victoria at 250-472-4545 or ethics@uvic.ca.

The supervisors of this study:

Francis Lau, BSc, MSc, MBA, PhD, Professor^a

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Thank you in advance for your interest in this project

Lauren Xie (researcher)

MSc in Health Information, University of Victoria

Student, Clinical Info System Transformation

Enterprise Project Management Office, CAMH

Phone: 416-535-8501 ext 30583 / Email: lauren.xie@camh.ca

Appendix 3: Research Study Invitation Letter

Dear Nurses,

My name is Lauren Xie. I am a graduate student in the School of Health Information Science at the University of Victoria (Uvic). Currently, I am working as a student at CAMH with the I-CARE Optimization team, and will be conducting this study as a part of my graduate degree requirements.

The purpose of this study is to identify bar coded medication administration (BCMA) recommendations for Centre for Addiction and Mental Health (CAMH) based on previously identified CAMH BCMA gaps, and published best practices to better support nursing needs. Previous studies have revealed that medication errors are common in the administration of medications and that the use of BCMA technology can significantly reduce error rates and adverse drug events during medication administration. Currently, there is little known about the challenges of BCMA in mental health and addictions inpatient settings.

This project will attempt to understand nurses' perceptions of how well the implementation of identified best practices may increase BCMA adoption and compliance in the form of unit scanning rates at CAMH. Participants must meet the eligibility criteria of:

- Is a Registered nurse (RN) or Registered Practical Nurse (RPN) currently working full-time or part-time in a CAMH inpatient unit providing direct patient care
- Is not an agency nurse

Each participant's involvement will be a one-hour interview during the nurse's regularly scheduled shift between 9AM and 7PM. Your unit manager has been notified of this study and has already acknowledged the need for this study. Participation in this project is voluntary. Participation or non-participation will have no effect on your standings with CAMH.

I understand that clinical work is your first priority. You may cancel the interview at any time. You may reschedule the interview even after it has started.

If you are interested, please contact me by email or phone and I will send you the *Consent Form*. This form has more detailed information about the study. After sending you the *Consent Form*, I will confirm a date and time with you for the interview. Prior to the interview, I will confirm that you have no additional questions about the study and that you have carefully read the *Consent Form* before signing the *Consent Form*. Your signed *Consent Form* will be collected prior to the interview; a copy of the consent form will be provided to you and the original signed consent form will be retained in the study records.

Benefits

There are some possible benefits from the study. You may become more aware about your BCMA practices.

Risks

This study poses minimal risk to the participants and investigators. The limit to confidentiality may include that your co-workers may guess that you have participated in the study due to the small numbers of nurses working in a unit at any time.

Contact Information

If you are interested or have any questions, please contact:

The researcher: **Lauren Xie**
 Email: Lauren.xie@camh.ca
 CAMH extension: 30583
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If you have any questions about the ethical conduct of this project, please contact:

Dr. Padraig Darby, Chair, Research Ethics Board, CAMH
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 U3-4 1001 Queen St W. Toronto ON M6J 1H4
 Phone: 416-535-8501 ext 36876

In addition, you may also contact the Human Research Ethics Office at the University of Victoria at 250-472-4545 or ethics@uvic.ca.

Thank you in advance for your interest in this project,

Lauren Xie (researcher)
 MSc in Health Information, University of Victoria
 Student, Clinical Info System Transformation
 Enterprise Project Management Office, CAMH

Phone: 403-918-5881 (cell), 416-535-8501 ext 30583 (office), Email: lauren.xie@camh.ca

Appendix 4: Participant Consent Form

Nurse' Perceptions of Bar Code Medication Administration Best Practices in a Mental Health Setting to Increase bar Code Scanning Rates

You are invited to participate in a research study on nurses' perceptions of bar coded medication administration (BCMA) best practices that may be implemented to help increase BCMA scanning rates at CAMH.

Lauren Xie is conducting this study. Ms. Xie is a graduate student in the School of Health Information Science at the University of Victoria (Uvic).

If you have questions, please contact:

The student researcher: **Lauren Xie**
 Email: Lauren.xie@camh.ca
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Study Goal and Objectives

The goal of this study is to determine which BCMA best practices may be utilized in a mental health and addictions inpatient setting to increase scan rates and improve medication safety.

Specifically, this study will attempt to identify:

- Published causes of BCMA noncompliance post-implementation and possible best practices to increase BCMA compliance
- Nurses' perceptions of how well the implementation of identified best practices may increase BCMA compliance in the form of unit scanning rates at CAMH

Importance of this Research

Previous studies reveal that medication errors are common in the administration of medications and that the use of BCMA technology can significantly reduce error rates in, and potential adverse drug events during, medication administration. Nurses, both Registered Nurses (RNs) and Registered Practical Nurses (RPNs), are the single most significant group who will be charged with the tasks of medication administration in hospital units and inpatient nurses are the intensive users of BCMA.

Though BCMA challenges and best practices acute settings have been well reported in literature, little is known about the challenges and requirements of BCMA in mental health and addiction inpatient settings. As a result, the unaddressed challenges of BCMA at CAMH are evident in poor 2015 BCMA compliance rates. Ongoing initiatives at CAMH have identified various potential causes of BCMA non-compliance. Thus, the goal of this qualitative study will be to focus on understanding nurses' perceptions of best practices for increasing BCMA compliance and how well these best practices may be implemented at CAMH.

Participants Selection

- You are a RN or RPN currently working full-time or part-time in a CAMH inpatient unit providing direct patient care
- You are not an agency nurse

What is involved?

Participation in this study will entail a one-hour interview about your perceptions of published BCMA best practices and how these best practices may be implemented at CAMH.

Inconvenience

The interview will take up to 1 hour during your work day as a part of your regular scheduled shift. It is important that you inform your Manager of your interview date/time to ensure coverage may be arranged for you to attend the interview off the unit.

Benefits

There are no direct benefits but the potential benefits for you may include gaining awareness on your current BCMA practices.

Risks

This study poses minimal risk to the participants and investigators. The limit to confidentiality may include that your co-workers may guess that you have participated in the study due to the small numbers of nurses working in a unit at any time. In addition, three interviews will be randomly selected by a co-Principal Investigator, who is an Advanced Practice Nurse not assigned to any units, for transcription verification. To minimize the possibility that a nurse may

be recognized by the co-Principal Investigator during transcription verification, the participant will not be addressed by name after the recording has begun. In the case that the student researcher inadvertently addresses the study participant by name during the interview, a pseudo name (E.g. Participant 1) will be used to replace the participant's name during the transcription of the interview.

Voluntary Participation

- You do not have to participate in this study. It is completely voluntary.
- You can stop at any time.
- You can stop without giving us a reason.
- If you quit the study, we will not use your data and the data will be destroyed.

Anonymity

We will randomly assign a number for each participant. Your personal information is confidential.

Confidentiality

- We will collect your data using a number code system. We will protect your personal information
- We will use password-protected encryption for data storage. Ms. Xie will be the only person who can access the data. She will use a laptop with an access password. She will store the laptop in a locked cabinet in her office when not in use
- The results of the study will not include any information that may identify you
- The observation will happen at CAMH. Your co-workers may find out that you are participating due to the small number of RNs working on each unit. This could limit confidentiality. The researcher will speak to you about this issue prior to beginning the interview
- Once the interview is complete, it will be transcribed into a document for analysis. Three interviews will be randomly selected by a co-Principal Investigator, who is an Advanced Practice Nurse not assigned to any units, to verify that the interview has been transcribed according to protocol. This could limit confidentiality. The researcher will speak to you about this issue prior to beginning the interview

Sharing Results

The results of this study may be shared with others in the following ways:

- Presentation at a meeting
- Master of Science project to be submitted to the University of Victoria
- Publication in a research journal

The results will not contain any personal identifying information.

Disposal of Data

Data will be kept for 10 years after the completion of this study. After 10 years, all data will be destroyed. The researcher will shred papers and erase all information from the laptop.

Contacts

You may contact Lauren Xie (student researcher), Francis Lau (Uvic supervisor), Kamini Kalia (CAMH Co-principle investigator) or Gillian Strudwick (CAMH Co-principle investigator). Their contact information is on the first page.

If you have any questions about the ethical conduct of this project, please contact:

Dr. Padraig Darby, Chair, Research Ethics Board, CAMH
 Centre for Addiction and Mental Health
 U3-4 1001 Queen St W. Toronto ON M6J 1H4
 Phone: 416-535-8501 ext 36876

In addition, you may also contact the Human Research Ethics Office at the University of Victoria at 250-472-4545 or ethics@uvic.ca.

As part of the Research Services Quality Assurance Program, this study may be monitored and/or audited by a member of the Quality Assurance Team. Your research records and CAMH records may be reviewed during which confidentiality will be maintained as per CAMH policies and extent permitted by law.

Please sign the line below to indicate you:

- Understand the conditions of participation in this study
- Had the opportunity to ask the researcher any questions you have
- Consent to participate in this research project

_____	_____	_____
<i>Name of Participant</i>	<i>Signature</i>	<i>Date</i>

A copy of the consent form will be provided to you and the original signed consent form will be taken by the researcher to retain in the study records.

Appendix 5: Evidence of Permission for Use of Organizational Data

RE: Approval for document use Inbox x

Daniela Mucuceanu 9:51 PM (13 minutes ago) ☆ ↩ ▼
to Lauren, me

Hi Lauren,
It is fine to use these documents to support your graduate project. As discussed, the Device technology report wouldn't not be released but it will be used as supporting document.
Thank you for your great work.
Daniela

From: Lauren Xie
Sent: Thursday, April 28, 2016 10:20 AM
To: Daniela Mucuceanu
Cc: Kamini Kalia
Subject: RE: Approval for document use

Hi Daniela,

I was just about to connect with you . The documents will be used to support my graduate project on Nurses' Perceptions of Best Practices to Increase Barcode Scanning Rates as part of my Master's degree, which is being co-supervised by Kama and Gillian Strudwick, APN. To streamline the process, I have attached both documents for you to view, as well as my research protocol highlighting areas where these documents will be used. Please kindly let me know if you may be able to give approval for the use of these documents. I will be submitting the REB next Monday.

Thanks,
Lauren Xie

From: Gillian Judkins
Sent: Thursday, April 28, 2016 9:46 AM
To: Lauren Xie
Cc: Daniela Mucuceanu
Subject: RE: Approval for document use

Hi Lauren,

My apologies, I mentioned this to Daniela Mucuceanu, IMG Director as these documents were more technical in nature and really didn't have any personal health information or personal information contained in them so it wouldn't be appropriate for privacy to sign off on this. I had intended to connect you two earlier this week. I have copied Daniela on this email for you to discuss with her.

Thank you,
Gillian

From: Lauren Xie
Sent: Tuesday, April 26, 2016 11:57 AM
To: Gillian Judkins
Subject: Approval for document use

Hi Gillian,

I hope you have been well.

We had met a couple of months ago regarding the use of internal CAMH data as a part of my student project at Uvic and CAMH.
I just wanted to let you know, as well as obtain an up-to-date written permission, for the 2 documents that I hope to use as a part of the student project.
I have attached the 2 documents for you to review.

Thanks,

Lauren Xie
Student, Information Management Group - EPMO
Centre for Addiction and Mental Health (CAMH)
[416-535-8501 ext. 30583](tel:416-535-8501)
Lauren.xie@camh.ca

Appendix 6: Interview Instrument

Demographic information

What age group you belong to?

21-30 31-40 41-50 51-61+

How many years of nursing experience do you have?

How many years have you worked in Mental Health?

How many years have you worked at CAMH?

Are you a RN or RPN?

How would you rate your familiarity with computerized technology in general?

Beginner Lower Intermediate Intermediate
High Intermediate Advanced

Questions

During a recent CAMH inpatient unit technology assessment, it was found that there are various technology-related challenges which impede the use of bar coded medication administration technology.

1. Many inpatient nurses reported that they dislike using mobile workstation to perform medication administration. The most common reasons given were that the mobile workstations are too slow, have short battery lives, and that the drawers are not compatible with large medication carts. If these issues were resolved, how might this impact your scanning rates?
2. Many nurses expressed that one major barrier to scanning compliance is there are not enough scanners on each unit. If more scanners are provided to each unit, how would this impact your scanning rates?

3. Many nurses reported that there are often label-related issues when scanning medications. If a more formal feed-back procedure is in place for nurses to report wrong, difficult-to-scan, or non-scanning bar codes, how do you think this may affect your scanning rates?
4. If there was a guide outlining the contact information of different resources to contact for resolving different types of technology problems, how do you think this additional support may encourage nurses to increase scanning rates? Where should this information be located?
5. In literature, it was found that many nurses bypass scanning as a result of unawareness of the technology and the benefits of scanning technology for patient safety. If additional education support is provided about the possible medication safety risks at each step of medication administration and the safety benefits of bar code scanning, how do you think this may impact scanning rates?
6. How do you think ongoing education refreshers regarding safety benefits and up-to-date approved bar code scanning processes may affect scanning rates?
7. If regular reports on individual unit average scanning rates were made available and sent to each clinical manager to share with nurses, how do you think this may affect scanning rates?
8. How can executive leadership and clinical managers promote and better support bar code scanning at CAMH?
9. Of the best practices we talked about today, which one do you perceive to be most effective for increasing bar code scanning rates at CAMH?
10. Do you have any additional comments or feedbacks?

Appendix 7: Organizational Qualitative Data Preparation and Transcription Protocol

TEXT FORMATTING

General Instructions

The **transcriber** shall transcribe all individual and focus group interviews using the following formatting:

1. Arial 10-point face-font
2. One-inch top, bottom, right, and left margins
3. All text shall begin at the left-hand margin (no indents)
4. Entire document shall be left justified
5. Page numbered in right justified

Labeling Focus Group Transcripts or Interviews

Individual interview transcript shall include the following labeling information at the top of the document:

<u>Example FGs:</u> Focus Group Name: Leadership Group 3 Focus Group Location: Date of Focus Group: Number of Attendees (if known): Name of Transcriber: Number of Tapes: Digital recorder Name of Interviewer(s):	<u>Example Interviews:</u> Interview Name: Interview #1 Interview Location: Date of Interview: Type of Interview: Semi-structured/in-depth Name of Transcriber: Number of Tapes: Digital recorder Name of Interviewer(s):
--	---

Audiotape Changes (does not apply if using a digital recorder)

The transcriber shall indicate when the interview is recorded on a new tape and include information verifying that the second side of the audiotape is blank as well as the total number of audiotapes associated with the focus group. This information shall be typed in uppercase letters.

Example:

END OF TAPE 1 (3 TAPES TOTAL); VERIFIED THAT SIDE B OF TAPE 1 IS BLANK
 START OF TAPE 2 (3 TAPES TOTAL)
 END OF TAPE 2 (3 TAPES TOTAL); VERIFIED THAT SIDE B OF TAPE 2 IS BLANK

Documenting Comments

Comments or questions by the Interviewer or Facilitator should be labeled with by typing **I:** at the left margin and then indenting the question or comment.

Any comments or responses from participants in a **focus group** should be labeled first with the focus group number or code **FG1** and with **P:** at the left margin with the response indented. A response or comment from a different participant should be separated by a return and than a new **P:** at the left margin with consecutive numbering **P1: P2: P3:** etc. If it is an interview **P:** can be used throughout.

Example

I: OK, before we begin the interview itself, I'd like to confirm that you have read and signed the informed consent form, that you understand that your participation in this study is entirely voluntary, that you may refuse to answer any questions, and that you may withdraw from the study at anytime.

FG1P1: Yes, I had read it and understand this.

FG1P2: I also understand it, thank you.

I: Do you have questions before we proceed?

End of Interview

In addition, the transcriber shall indicate when the interview session has reached completion by typing **END OF INTERVIEW** in uppercase letters on the last line of the transcript along with information regarding the total number of audiotapes associate with the interview and verification that the second side of the tape is blank. A double space should precede this information.

If a digital recorder was used, the transcriber shall indicate when the interview session has reached completion by typing **END OF INTERVIEW** only in uppercase letters on the last line of the transcript.

Example:

I: Is there anything else that you would like to add?

P: Nope, I think that about covers it.

I: Well, thanks for taking the time to talk with me today. I really appreciate it.

END OF INTERVIEW—(3 TAPES TOTAL); VERIFIED THAT SIDE B OF TAPE 2 IS BLANK

CONTENT

Audiotapes shall be transcribed verbatim (i.e., recorded word for word, exactly as said), including any nonverbal or background sounds (e.g., laughter, sighs, coughs, claps, snaps

fingers, pen clicking, and car horn).

Nonverbal sounds shall be typed in parentheses, for example, (short sharp laugh), (group laughter), (police siren in background) (long pause).

If interviewers or interviewees mispronounce words, these words shall be transcribed as the individual said them. The transcriptionist shall remove foul language, slang, grammatical errors, or misuse of words or concepts.

If an incorrect or unexpected pronunciation results in difficulties with comprehension of the text, the correct word shall be typed in square brackets.

Example:

P: I thought that was pretty pacific [specific], but they disagreed.

Filler words such as *hm, huh, mm, mhm, uh huh, um, mkay, yeah, yuhuh, nah huh, ugh, whoa, uh oh, ah*, and *ahah* shall be transcribed.

Inaudible Information

The transcriber shall identify portions of the audiotape that are inaudible or difficult to decipher. If a relatively small segment of the tape (a word or short sentence) is partially unintelligible, the transcriber shall type the phrase “**inaudible segment.**” This information shall appear in square brackets.

Example:

The process of identifying missing words in an audiotaped interview of poor quality is [inaudible segment].

If a lengthy segment of the tape is inaudible, unintelligible, or is “dead air” where no one is speaking, the transcriber shall record this information in square brackets. In addition, the transcriber shall provide a time estimate for information that could not be transcribed.

Example:

[Inaudible: 2 minutes of interview missing]

Overlapping Speech

If individuals are speaking at the same time (i.e., overlapping speech) and it is not possible to distinguish what each person is saying, the transcriber shall place the phrase “cross talk” in square brackets immediately after the last identifiable speaker’s text and pick up with the next audible speaker.

Example:

P: Turn taking may not always occur. People may simultaneously contribute to the conversation; hence, making it difficult to differentiate between one person’s statement [cross talk]. This results in loss of some information.

Pauses

If an individual pauses briefly between statements or trails off at the end of a statement, the

transcriber shall use three ellipses. A brief pause is defined as a two- to five second break in speech.

Example:

P: Sometimes, a participant briefly loses . . . a train of thought or . . . pauses after making a poignant remark. Other times, they end their statements with a clause such as but then . . .

If a substantial speech delay occurs at either beginning or the continuing a statement occurs (more than two or three seconds), the transcriber shall use “long pause” in parentheses.

Example:

P: Sometimes the individual may require additional time to construct a response. (**Long pause**) other times, he or she is waiting for additional instructions or probes.

Questionable Text

If the transcriber is unsure of the accuracy of a statement made by a speaker, this statement shall be placed inside parentheses and a question mark is placed in front of the open parenthesis and behind the close parenthesis.

Example:

P: I wanted to switch to **?(Kibuli Hospital)?** if they have a job available for me because I think the conditions would be better.

Sensitive Information

If an individual uses his or her own name during the discussion, the transcriber shall replace this information with the appropriate interviewee identification label/naming convention.

Example:

P: My supervisor said to me, “P1, think about things before you open your mouth.”

P: I agree with P1; I hear the same thing from mine all the time.

If an individual provides others’ names, locations, organizations, and so on, the transcriber shall enter an equal sign immediately before and after the named information. Analysts will use this labeling information to easily identify sensitive information that may require substitution.

Example:

P: My colleague =**John Doe**= was very unhappy in his job so he started talking to the hospital administrator at = **Kagadi Hospital** = about a different job.

REVIEWING FOR ACCURACY

The transcriber/proofreader shall check (proofread) all transcriptions against the audiotape/digital recording and revise the transcript file accordingly. The transcriber/proofreader

shall adopt a two-pass-per-tape policy whereby each tape/recording is listened to two times against the transcript after it has been transcribed and before it is submitted. All transcripts shall be audited for accuracy by the interviewer who conducted the interview or by the study data manager or research assistant.

SAVING TRANSCRIPTS

The transcriber shall save each transcript as a document file with a .doc or docx extension by the name of the focus group and the date it took place.

Example:

Leadership Focus Group_18Aug15

If there is more than one Leadership Focus Group:

Leadership Focus Group 2_18Aug15

Appendix 8: Content Analysis Sample

During content analysis, key ideas and phrases from the interview transcripts were highlighted, analyzed, and coded. After coding all transcripts, similarities and differences among the codes were compared to categorize the codes according to their resemblance to each other to form categories and subcategories.

Figure 3. Content Analysis Process

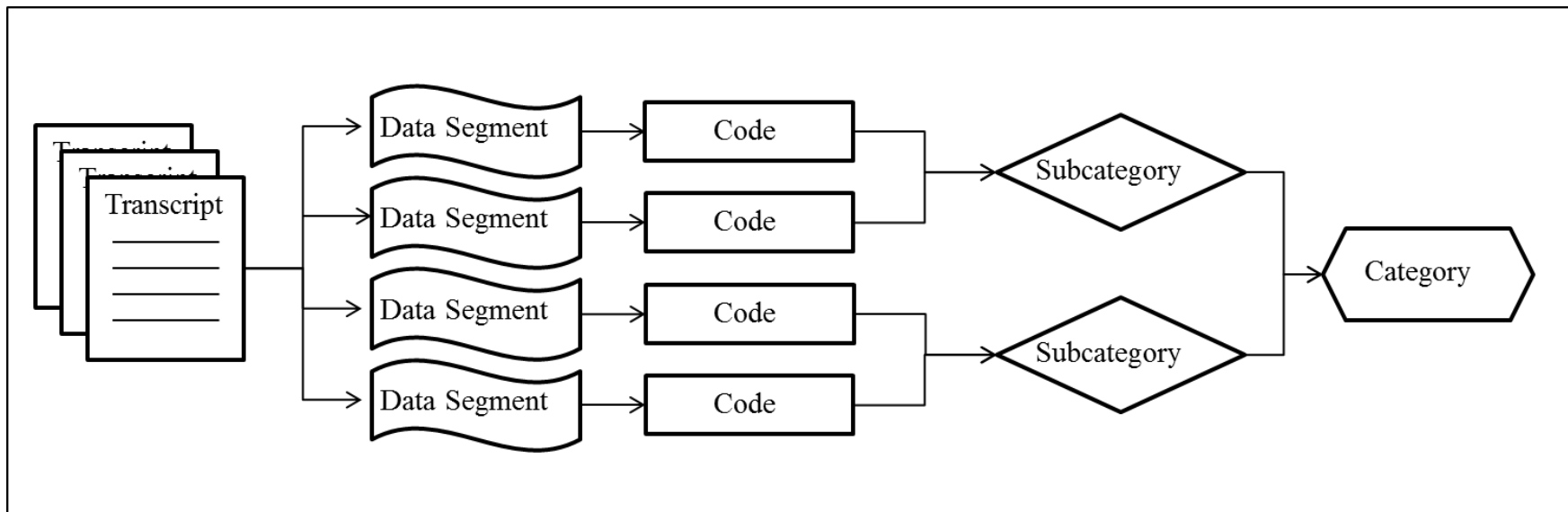


Table 3. Example of Content Analysis

Data Segment	Code	Subcategory (Subtheme)	Category (Theme)
“We have to wait until somebody’s finished and then go in and one after the other... we have a room with 3 or 4 mobile carts that just sit there... because we can’t pull the drawers out and put them in as we should, you know, exchange the drawers.”	Mobile nurse workstations do not support workflow	Existing device-related challenges	Clinical Workflow
“Little bar codes are difficult to scan to begin with, and even worse when they’re attached to something that’s cylinder.”	Bar code scanning challenges	Existing device-related challenges	Clinical Workflow
“The other thing is, which is really really upsetting, the scanner, doesn’t scan when it needs to. So sometimes you’re scanning and you’re scanning 2, 3 times, you don’t have the time to waste. It’s frustrating.”	Scanner challenges	Existing device-related challenges	Clinical Workflow
“My honest belief there is always mechanical	Psychological	Existing non-device-related	Clinical Workflow

technological components and also psychological adherence to practices. So those 2 things, so once you improve the technology and accessibility to uh devices, there's also going to be that psychological barrier to overcome.”	adherence to expected practice	challenges	
“On other occasions when we have mentioned [these problems to pharmacy], we've basically have been told you know what, this is what we have to deal with.”	Interdisciplinary team challenges	Existing non-device-related challenges	Clinical Workflow
“Usually if one doesn't scan, I just try a different one and that usually works, or some of the time I would unplug the scanner thing. I will unplug and plug them and usually that works.”	Nurses troubleshooting at point of care	Troubleshooting	Clinical Workflow
“Nurses are very task oriented and they are problem solvers.”	Nurses troubleshooting device challenges	Troubleshooting	Clinical Workflow
“There's so little time, and reporting in the	Lack of time to report	Time	Clinical Workflow

hospital... is not very efficient and convenient.”			
“Education is too time consuming.”	Education time consuming	Time	Clinical Workflow
“People are in a rush and someone’s standing there and they’ve got 20 medication[s] and one’s not scanning, are they really going to stop and call someone and be put on hold and wait and go through 10 minutes, to figure out what’s going on.”	Lack of time to contact resources	Time	Clinical Workflow
“We just don’t have time to scan... So, there were times where I would bypass it because it just consumes a lot of time.”	Lack of time to complete BCMA	Time	Clinical Workflow
“If you have 5, 6 clients and you’re scanning everything twice or 3 times, you know how far behind you’re going to be?”	Lack of time to complete BCMA	Time	Clinical Workflow