Electronic Record Adoption and Use Among Nurse Practitioners in British Columbia

Elizabeth Borycki, Esther Sangster–Gormley, Rita Schreiber, Mindy Swamy, April Feddema, Janessa Griffith

There has been a research focus on physician adoption of electronic medical records (EMRs). However, there has been less research into nurse practitioner (NP) use of EMRs. The authors present findings on the adoption and use of EMRs by NPs arising from a survey of the patterns of NP practices in the Canadian province of British Columbia. The research reveals a high rate of NP adoption of EMRs, with 82% of respondents indicating that they were using the technology. However, only 19% of NPs were using fully electronic records while 63% were using hybrid records, with only components of the electronic record being available. Respondents were found to be using several EMR features and functions, namely patient demographics, clinical notes, medication lists, laboratory results, and patient problems. NPs' high rate of EMR adoption suggests that there is much to be learned regarding the effect of eHealth strategies on EMR adoption.

Keywords: electronic medical record, electronic patient record, electronic health record, adoption, nurse practitioner, hybrid electronic–paper records

Résumé

L'adoption et l'utilisation d'un système électronique de tenue de dossiers chez les infirmières praticiennes en Colombie-Britannique

Elizabeth Borycki, Esther Sangster-Gormley, Rita Schreiber, Mindy Swamy, April Feddema, Janessa Griffith

L'adoption par les médecins de la tenue de dossiers médicaux électroniques (DME) a fait l'objet de nombreuses recherches. Toutefois, les recherches portant sur l'utilisation de DME par les infirmières praticiennes (IP) se font beaucoup plus rares. Les auteures présentent les résultats d'une étude portant sur les tendances relevées chez les IP œuvrant dans la province canadienne de la Colombie-Britannique, relativement à l'adoption et l'utilisation de DME. L'étude révèle un taux élevé d'IP travaillant avec des DME, 82 % d'entre elles indiquant qu'elles utilisent maintenant cette technologie. Cependant, seulement 19 % d'IP travaillent avec des dossiers entièrement informatisés alors que 63 % utilisent des dossiers hybrides, la partie électronique du dossier ne comportant que certains éléments. Les personnes qui ont répondu utilisent plusieurs fonctions électroniques, notamment celles permettant la gestion des données démographiques du patient, des notes cliniques, des listes de médicaments et des résultats de laboratoire ainsi que des données sur les troubles du patient. Le taux élevé d'adoption de cette technologie chez les IP suggère la nécessité d'étudier davantage les effets des stratégies de cybersanté sur l'utilisation de DME.

Mots clés : dossier médical électronique (DME), adoption, infirmière praticienne, dossier hybride, stratégie de cybersanté

Introduction

Worldwide, electronic medical records (EMRs) are being implemented in an effort to modernize health-care delivery. EMRs allow clinicians, at the individual or clinic level, to enter and access patient data electronically and also allow for integration of decision support and regionally stored health data (Hodge, 2011). Globally, there has been significant interest in understanding the factors that promote physician adoption of EMRs as well as in documenting the rate of adoption within health care. International reports of physician adoption of EMRs have provided benchmarks and insights as to the types of eHealth and public policy strategies that can be employed by national and regional governments to increase the rate of uptake and use of this technology (Jha et al., 2009; National Physician Survey, 2010). Less attention has been given to EMR adoption rates among other health professionals — for example, nurse practitioners (NPs).

NPs are an important group of health professionals working in primary care settings. They sometimes work with physicians, and they provide health care to families and chronically ill individuals. In Canada, NPs are defined as RNs with additional education and experience "who possess and demonstrate the competencies to autonomously diagnose, order, and interpret diagnostic tests, prescribe pharmaceuticals, and perform specific procedures within their legislated scope of practice" (Canadian Nurse Practitioner Initiative, 2006, p. 26). There is very little literature on the rate of adoption and use of EMRs among NPs either in Canada or internationally. Yet in North America there are more than 170,000 NPs providing care in over 600 million patient visits per year (American Association of Nurse Practitioners, 2013). NPs would benefit from the decision support and population health management features and functions embedded within an EMR as well as the ability of EMRs to connect to electronic health record (EHR) information stored locally or regionally (i.e., EMR interoperability with a national EHR) (Canada Health Infoway, 2011).

In this article we report on NPs' adoption and use of electronic records in the province of British Columbia. To date, little research has been reported on NP adoption and use of EMRs. This study represents a new contribution to the Canadian and international literature, as it attempts to determine the extent to which NPs use electronic records in the region where they practise. Such research will inform policy-makers in those countries where NPs represent a significant portion of the health-care workforce (e.g., United States) and those Canadian health-care regions that are introducing the role.

The work reported here is part of a multi–year mixed-method study of NP role integration into the health-care system in British Columbia.[1]

We begin by providing background on British Columbia and the history of NPs as a profession in the province. We follow with a discussion of the current state of research involving nurse and NP adoption of electronic records. Finally, we discuss the implications for future research and policy initiatives involving NP use of EMRs.

Background

At 944,735 square kilometres, British Columbia is Canada's third–largest province — larger than France, Germany, and the Netherlands combined. The majority of the population live in two cities: Vancouver and Victoria. The Okanagan Valley is the most populated inland region (BC Stats, 2011). Health-care delivery takes place across a wide variety of urban, rural, and remote settings, and NPs practise in each setting. To address the unique needs of each setting, health-care delivery and management are divided into five health authorities. Additionally, a Provincial Health Authority manages and delivers province-wide programs such as cancer care (British Columbia Ministry of Health, n.d.) and a new First Nations Health Authority is dedicated to advancing the quality of care delivered to First Nations and Aboriginal people.

History of the Nurse Practitioner Role in British Columbia

In the early 1990s the British Columbia health ministry became interested in implementing the NP role as a cost-effective means to increase access to primary health care (Haines, 1993), and in 2005 legislation enabling the role was enacted. Because the role is new in British Columbia, the number of NPs is relatively small; as of 2013, there were just 226 NPs registered in the province. There are approximately 2,800 NPs in Canada (Canadian Institute for Health Information, 2013). NPs have been hired by health authorities throughout British Columbia over the past 7 years, and they practise in acute, long-term, and primary health care settings. Implementation of the NP role represents a significant shift in the delivery of primary health care, and with it a need to identify those technologies, such as EMRs, that would best support NP practice.

eHealth and Policy Initiatives Involving EMR Adoption

Worldwide, there has been considerable work undertaken by researchers and governments to accelerate EMR adoption and use by physicians. Some countries, such as Australia, Denmark, the Netherlands, New

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Zealand, and Sweden, have achieved nearly 100% adoption by physicians (McCarthy, How, Fryer, Radley, & Shoen, 2011). Others, such as Canada and the United States, are still striving to have the majority of physicians adopt the technology (Jha et al., 2009; McCarthy et al., 2011; National Physician Survey, 2010). In an effort to understand the links between eHealth, policy initiatives, and physician adoption and use of EMRs, surveys have been conducted at the country level and cross-country comparisons made using the survey data (Jha et al., 2009; McCarthy et al., 2011; Nohr & Boye, 2008). To illustrate, the Commonwealth Survey's focus on EMR adoption in industrialized nations has led to policy shifts in Canada and the United States in terms of developing eHealth strategies aimed at incentivizing physicians to adopt EMRs and identifying ways to measure EMR use (McCarthy et al., 2011). Some countries, including Canada, have borrowed eHealth strategies from countries that have high rates of EMR adoption, such as Denmark and Sweden. Scandinavian countries have pioneered approaches that encourage physician use of EMRs, such as ensuring that EMRs in physician offices can exchange data across a country-wide secure network. Physicians in these countries have been motivated to use EMRs because of the opportunities they afford for improving the quality and safety of patient care as well as communication between physician offices and acute-care facilities (Nohr & Boye, 2008; Protti, 2008, 2009). Such information has been used to inform Canadian work on the interoperable electronic health record and US work on regional health information exchanges (McCarthy et al., 2010; Protti, 2008, 2009).

In North America, surveys regarding EMR adoption have focused on physician adoption in Canada (National Physician Survey, 2010) and physician and nurse adoption in the United States (DesRoches, Campbell, et al., 2008; DesRoches, Donelan, Buerhaus, & Zhonghe, 2009; McCarthy et al., 2011). In response to the results, the Office of the National Coordinator for Health Information Technology (ONC) (2011) in the United States has developed an eHealth strategy whereby physicians are incentivized to use EMRs over time. In Canada, the National Physician Survey, which has been used to build knowledge about physician-related current and future health-care issues and trends, has seen the inclusion of questions specific to physician adoption and use of EMRs in recent years (National Physician Survey, 2012a); information from the survey has helped to show researchers, policy-makers, and chief information officers how EMRs are adopted by physicians over time as well as to determine strategies for promoting EMR adoption and use. Canada Health Infoway, the organization responsible for the creation of a pan-Canadian EHR and for facilitating adoption of health technologies across

the country, has used information from the survey to drive its eHealth strategy (Canada Health Infoway, 2011). Despite the usefulness of this survey, no equivalent survey has been used, in Canada or elsewhere, to examine NPs' adoption and use of the technology.

EMR Strategy in British Columbia

In British Columbia, the Physician Information Technology Office (PITO) was created in 2006 to "co-ordinate, facilitate and support information technology planning and implementation for physicians, including the development and implementation in BC of standardized systems of electronic medical records (EMR)."[2] PITO is funded by the provincial government and Canada Health Infoway. Its steering committee, composed of practising physicians from the BC Medical Association and representatives from the provincial government, reports to the e-Health Steering Committee, which in turn reports to the BC Health Leadership Council (whose membership includes CEOs of the health authorities and senior executives from the health ministry). Most of PITO's programs concern physician adoption of EMRs. PITO funds physicians on a cost-shared basis: government, 70%; physicians, 30%, to purchase EMRs. Four vendors are currently approved by PITO: Intrahealth, MedAccess, Osler Systems, and Wolf (Telus Health Solutions). According to Smith (2011), "around 60% of physicians in private practice offices are using an EMR" (p. 460). In fact, 90% of large, full-service family practice clinics in the province have adopted EMR. Adoption rates are approximately 50% for small to medium-sized family practice clinics (i.e., 2–5 physicians) and between 5% and 10% for solo family physicians (Smith, 2010, p. 289). Recently, PITO extended its work to NPs by providing self-assessment, educational, and tailored practice support opportunities around electronic records. In summary, physicians in large, full-service family practices have the highest adoption rates and solo-practice physicians the lowest. EMR adoption by physicians is an important issue at the national and jurisdictional levels in Canada. For NPs it is also becoming an important issue.

NPs as Stakeholders in EMR Initiatives

Recently, NPs have emerged as important stakeholders and key users of EMRs in clinics, physician offices, and hospital ambulatory-care settings. NPs have been identified by some governments (e.g., British Columbia, Saskatchewan) as health professionals who should receive support in

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[2] All information in this section concerning the Physician Information Technology Office is taken from the organization's Web site (pito.bc.ca/), retrieved August 8 and 11, 2012.

order to learn about the technology and use it effectively (PITO, 2012). There is little research literature specifically reporting on NPs' adoption and use of EMRs in clinics, physician offices, and hospitals in Canada or internationally. There is even less literature documenting how NPs adopt EMRs and use the technology in their day-to-day practice. Only a few countries (e.g., the United States) have undertaken nationwide studies to determine the rate of EMR adoption among nurses and how nurses are using the technology in their practice. The focus of these studies has been nurses (e.g., DesRoches et al., 2008) and not NPs, who are the predominant users of EMRs.

Much of the nursing research has been conducted in the United States, alongside studies on EMR adoption by physicians (DesRoches et al., 2008; Jha et al., 2009). In addition, research in this area is aimed at determining how nurses use EMRs (in outpatient settings) and electronic patient records (EPRs) (in hospitals). Earlier studies attempted to (a) determine the proportion of registered nurses who use minimally functional electronic records; (b) examine the relationship between nurses' beliefs about quality of/improvement in care and and electronic records; (c) assess the impact of electronic records on time spent on documentation versus patient care (DesRoches et al., 2008); and (d) document the impact of electronic records on hospital costs, staffing levels, patient mortality rates, and development of complications in patients' conditions (Furukawa, Raghu, & Shao, 2011). There has been less research on NP adoption and use of electronic records; the focus of research involving NPs has been how they use electronic records in the context of the "meaningful use" work instituted by the ONC in the United States (Maxson, Jain, Kendall, Mostashari, & Blumenthal, 2010; ONC, 2011). Meaningful use refers to the use of a certified electronic record and its components in the process of patient care in order to improve the "quality, safety, efficiency of health care," "reduce health disparities," engage patients and their families, and "improve care coordination, and population and public health" while at the same time "maintaining the privacy and security of patient health information." For the most part, this work takes the form of anecdotal reports (ONC, 2011).

In Canada, there has been little research, at the national or jurisdictional level, on NP adoption of EMRs. Even less research has been conducted to determine the nature and quality of meaningful EMR use among NPs or the clinical value associated with EMR use. Little is known about the current rate of adoption or how the technology is being used in patient care and practice management. Further, there has been little research on the requirements and needs of NPs who use

EMRs; the focus of nursing informatics survey research in Canada has been the current state of nursing informatics education and competency integration in college and university schools of nursing across the country (see Nagle & Clarke, 2004).

Methods

Participants

NPs in the province of British Columbia who (a) were registered, and (b) had previously consented to be contacted about taking part in research were invited to participate in the Nurse Practitioner Practice Patterns Survey (NPPPS) in the fall of 2011. As the researchers were interested in learning more about the adoption rate and use of EMRs among NPs, they included questions relating to the features and functions of the EMR.

Setting

The survey took place in one Canadian jurisdiction — British Columbia, the third-largest province in Canada.

Survey and Pilot Testing

The NPPPS was used to collect data for this portion of the research. Originally developed by Martin-Misener et al. (2010), the NPPPS has been used in the provinces of Nova Scotia and Ontario to collect data on NP practice. It has been used to collect data on NP characteristics, practice models, practice settings, practice populations, services provided, and barriers to/facilitators of implementing the NP role. Before the tool was used in British Columbia (and with the permission of the author), it was reviewed by three researchers to ensure that the questions were appropriate. For example, modifications were made to collect information on which health authority the NP was employed by, a section was added on reporting of codes and electronic data, and the five most common diagnoses and diseases in British Columbia were added. To investigate EMR adoption and use, questions developed by Jha et al. (2009) were added. The survey was then pilot-tested with two NPs working in the province and found to be appropriate, though long.

EMR Questions

In selecting the EMR questions to be added, the researchers reviewed several survey tools that had been used in North America (see DesRoches, Campbell, et al., 2008; Jha et al., 2009) to assess the level of EMR use among NPs and other health professionals.

Questions used to assess NP adoption and use of EMRs were drawn from a survey developed by Jha et al. in 2009 to determine the level of EMR adoption in hospitals across the United States. The focus of Jha et al.'s (2009) work was determining the degree to which base functionalities of electronic records were used; they developed their survey by "examining and synthesizing prior hospital-based surveys of electronic-records systems or related functionalities (e.g., computerized provider-order entry) that have been administered in the past 5 years" (p. 1629). The researchers shared a draft of the survey with other researchers working in the area, chief information officers, hospital leaders, and survey experts. Lastly, a consensus panel of health informatics, health services research, survey research, and health-policy experts reviewed the survey, leading to further modifications.

The researchers reviewed Jha et al.'s (2009) survey and extracted key questions that would allow for the measurement of NP adoption and use of key functions of the technology and added them to the NPPPS survey. The full survey (NPPPS, including the EMR components) was then pilot-tested with two experienced NPs for clarity, appropriateness, and usability. Permission was obtained from Jha et al. (2009) to use parts of the EMR survey tool that was developed. Ethics approval for the larger study and use of the survey was obtained from the Human Research Ethics Board at the University of Victoria.

Data Collection

Several recruitment methods were used to maximize the response rate for the online survey. Eysenbach (2005) and Jackson (2003) note that several methods of recruitment may be needed to improve online survey response rates.

The full, revised NPPPS was built into Fluid Surveys®, an online application. NPs were invited to complete the online survey in one of three ways, to maximize the response rate. NPs who had indicated their willingness to participate in research were sent a letter from the College of Registered Nurses of BC by post; the letter included a link to the online survey that could be entered as a URL in a Web browser and would direct the participant to the survey Web site. The invitation, including the survey URL, was also posted on the BC Nurse Practitioner Web site, where participants could click on the link to be automatically directed to the online survey. Finally, an e-mail with an invitation to participate and a link to the survey was sent to the University of Victoria NP alumni listserv; NPs wishing to participate were asked to click on the survey link in their e-mail to be connected to the online survey.

Findings

Responses were received from 37 of the 226 NPs registered in British Columbia. Data collected from six of these were excluded from the analyses (three did not complete the survey and three were practising outside the province). The data discussed here are based on responses from 31 NPs, or approximately 14% of NPs practising in the province. According to Eysenbach (2005), the response rate for online surveys ranges from 9% to 98%. Thus, our response rate is consistent with that reported in the literature on online surveys and similar to that reported by the 2011 National Physician Survey (18%), the primary source of data on physician EMR adoption and use in Canada (National Physician Survey, 2012b). Therefore, our response rate is within the expected range. NP demographic data and EMR use data were analyzed using descriptive statistics appropriate for use in analyzing survey data (Backstrom & Hursh-César, 1981).

Demographic Data

The respondents ranged in age from 28 to 60 years (mean = 45). Most were female (*n* = 27; 87%) and all were prepared at the master's level (*n* = 31; 100%), the standard in British Columbia. The mean number of practice years was 19 as an RN and 3.6 as an NP. They were registered as either family NPs (*n* = 27; 87%) or adult/pediatric NPs (*n* = 4; 13%). At the time of survey completion, most respondents (*n* = 21; 68%) held permanent full-time positions, while some (*n* = 6; 19%) held part-time positions.

The majority of respondents were employed by a regional health authority. Most practised in community/primary health care settings, ambulatory clinics, outpatient settings, physician offices, long-term/residential care, or hospital settings (Table 1). Only nine respondents (29%) worked in an inpatient setting and seven of these (*n* = 7; 78%) also worked in an outpatient setting.

NPs were, for the most part, co-located with other members of the health-care team. Most were co-located with physicians (*n* = 27; 87%), registered nurses (*n* = 24; 77%), and/or medical office assistants (*n* = 24; 77%).

EMR Use

Respondents were initially asked to indicate their method of record keeping — that is, whether they were using a full EMR or a hybrid EMR, whereby part of the patient record is electronic and part of it is paper-based (Borycki, Lemieux-Charles, Nagle, & Eysenbach, 2009; Urowitz et al., 2008). A total of 27 NPs responded to this question, of

Table 1 *Practice Settings*		
	n = 31	%
Community/primary health care centre	15	48
Ambulatory clinic/outpatient department	9	29
Other (e.g., mental health centre, addictions centre, homeless shelter, hospice)	7	23
Physician office	7	23
Long-term-care/residential-care facility	5	16
Hospital (inpatients)	3	10
Home care	2	6
Aboriginal health centre	2	6
Outpost nursing health centre	1	3
Public health	1	3
Note: Multiple responses were allowed.		

whom 19% (*n* = 5) were using paper charts, 63% (*n* = 17) were using hybrid records, and 19% (*n* = 5) were using fully electronic records. In other words, 82% of NPs (*n* = 22) who responded to the question were using either hybrid or full EMRs. These data are consistent with those found in prior North American research suggesting that most health professionals use a hybrid electronic record and that 50% of Canadians have at least one component of an electronic record, the remainder being paper-based (Canada Health Infoway, 2011; DesRoches, Donelan, et al., 2008; Jha et al., 2009).

Our results indicate that NPs are using a wide range of electronic records. Only 22% of respondents (*n* = 6) were using PITO-qualified EMRs. Financial and implementation support is provided for PITO electronic record products used by physicians and NPs in British Columbia. The PITO-qualified EMRs being used were Intrahealth (*n* = 1; 4%), MedAccess (*n* = 1; 4%), Osler Systems (*n* = 2; 7%), and Wolf (*n* = 2; 7%). The remaining NPs were using other electronic products. A few were using EPRs such as Cerner (*n* = 1; 4%) or Meditech (*n* = 2; 7%). The type of electronic record used may have varied by type of organization or care setting (e.g., hospital, community, clinic, physician office). For example, EMRs are used by NPs working in physician offices and EPRs by NPs working in hospital settings.

Of the respondents, 25 (80%) rated their degree of satisfaction with the EMR system used. Of these, 60% (*n* = 15) were either very satisfied

or somewhat satisfied. However, 20% (*n* = 5) were very dissatisfied and 16% (*n* = 4) somewhat dissatisfied. Further study is needed to determine the underlying reasons for 36% of NPs being dissatisfied with the EMR system used.

Respondents were asked to identify the features and functions available within their EMR. Not all NPs responded to this question; therefore, the value of *n* changes. The features reported as most available were patient demographics (22/22; 100%), clinical notes (21/23; 91%), electronic lists of patients' medications (19/21; 91%), laboratory results (18/24; 75%), radiology results (16/21; 76%), and patient problem lists (16/20; 80%). A summary of the availability of features and functions is presented in Figure 1.

In addition to identifying the features and functions available within their EMR, respondents were asked if they used these features and functions. They reported using the following features and functions most of the time or some of the time: patient demographics (16/22; 73%), clinical notes (14/21; 67%), electronic lists of patients' medications (13/21; 62%), laboratory results (13/18; 72%), and patient problem lists (13/16; 81%). These results are summarized in Figure 2.

Finally, most NPs rated their electronic records as having a positive impact on the quality and efficiency of their work. In particular, 67% (16/24) felt that they had a positive effect on their communication with other health-care providers and on their timely access to medical records and 54% (13/24) believed that they improved their practice patterns.

Respondents indicated that EMRs improved the consistency of communication between practitioners, legibility of patient information, remote access or access from another health-care site, follow-up and reminders, and ease of refilling prescriptions. Challenges included slow computers, technical failures, lost or difficult-to-access data when hybrid electronic records were used, and missing or suboptimal EMR features that served to hinder NP practice.

Discussion

We have reported on the findings of the NPPPS related to the current state of adoption and use of EMRs by NPs in British Columbia. Over the past several years, there have been significant financial investments and policy changes at the national and jurisdictional levels in Canada aimed at fostering EMR adoption by health professionals, specifically physicians. These initiatives have been undertaken by national organizations such as Canada Health Infoway and local or regional jurisdictional organizations such as PITO and OntarioMD. Much of the investment and policy work has been aimed at helping physicians to select and implement EMRs in
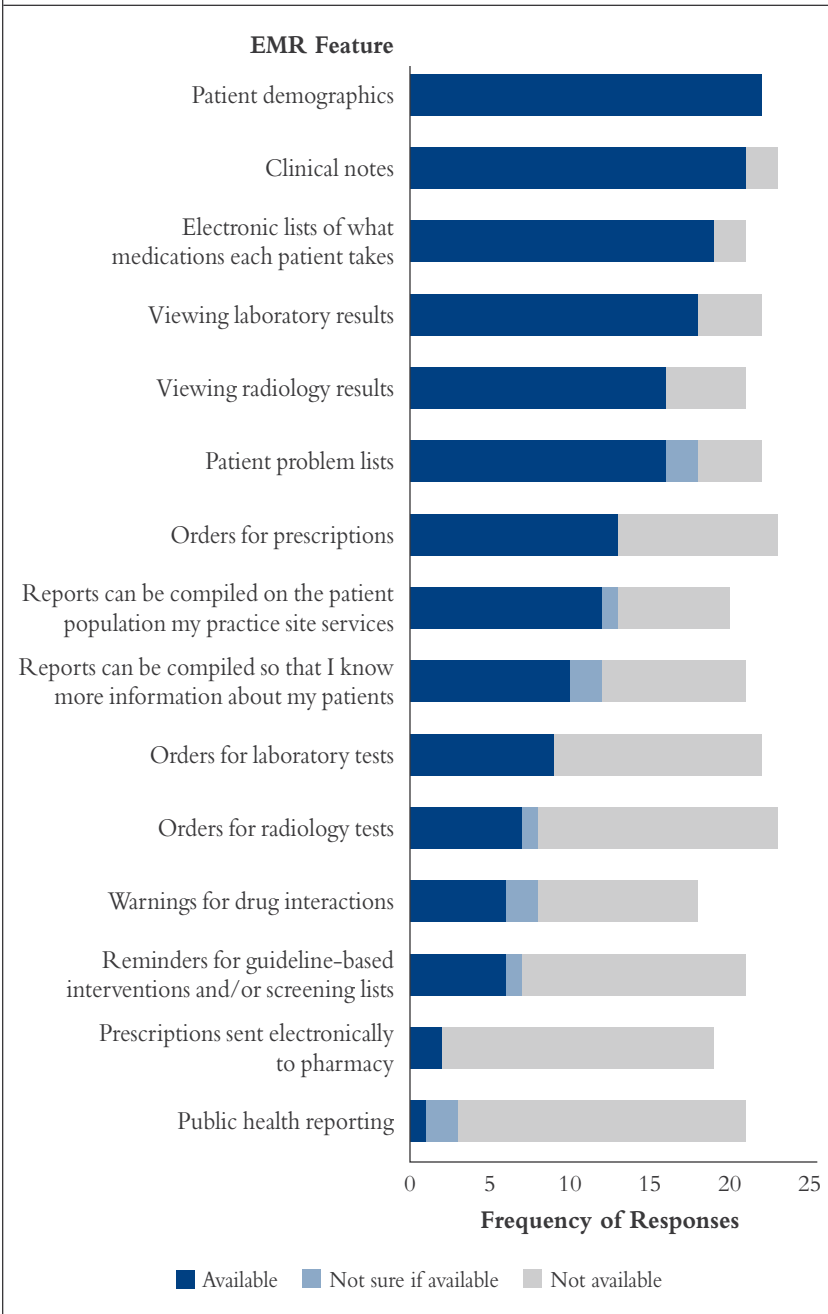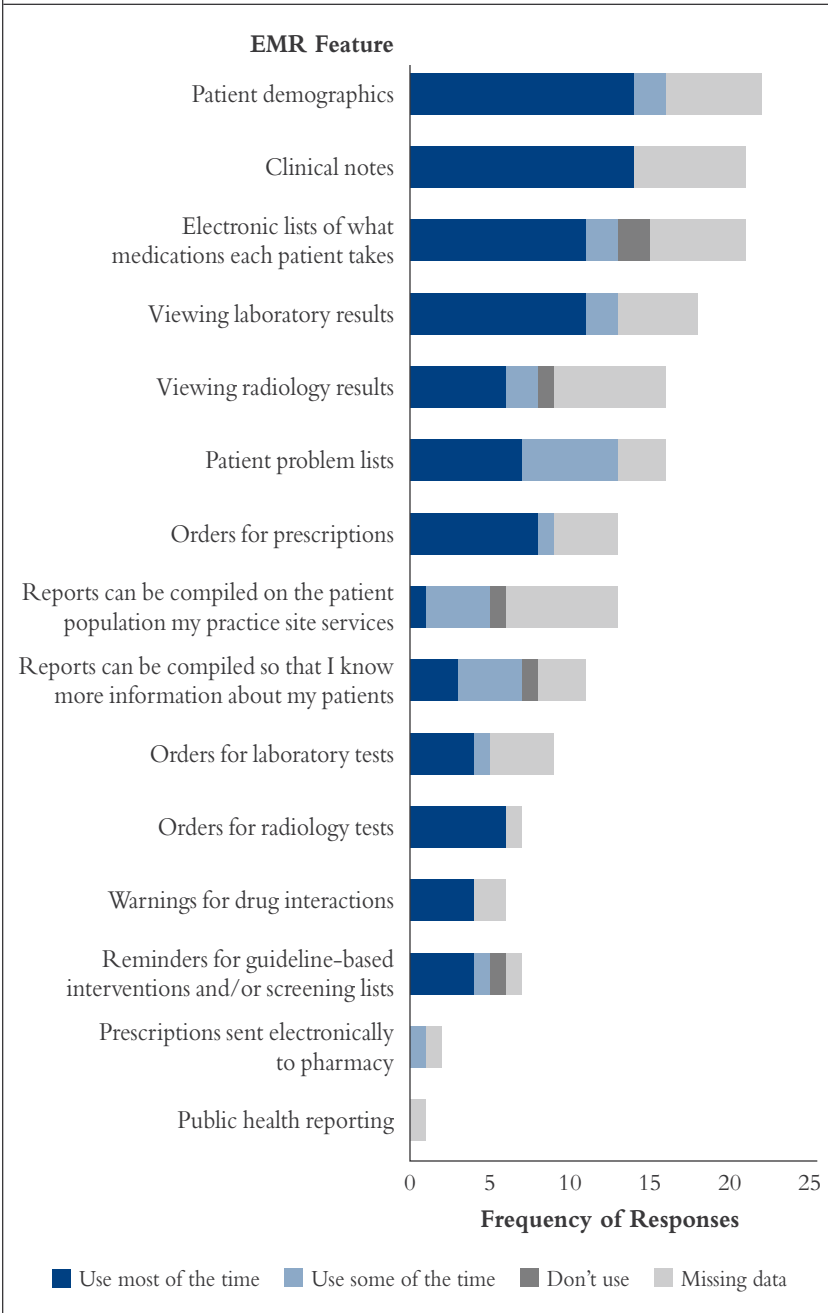
Figure 1   *Availability of EMR Functions and Features*

Figure 2 *Nurse Practitioner Use of Functions and Features*

EMR Feature

- Patient demographics
- Clinical notes
- Electronic lists of what medications each patient takes
- Viewing laboratory results
- Viewing radiology results
- Patient problem lists
- Orders for prescriptions
- Reports can be compiled on the patient population my practice site services
- Reports can be compiled so that I know more information about my patients
- Orders for laboratory tests
- Orders for radiology tests
- Warnings for drug interactions
- Reminders for guideline-based interventions and/or screening lists
- Prescriptions sent electronically to pharmacy
- Public health reporting

Frequency of Responses

■ Use most of the time ■ Use some of the time ■ Don't use ■ Missing data

their office settings in an effort to accelerate physician adoption of EMRs. The expected outcome of this work is improvements in the quality and safety of health care. There have been several publications comparing physician adoption rates across countries (e.g., Canada, Denmark, Germany, United Kingdom, United States) and provinces (e.g., Alberta, British Columbia, Saskatchewan) in terms of progress towards 100% adoption. This work has involved physician surveys with questions added specific to EMR adoption and use (e.g., National Physician Survey in Canada). The surveys conducted allow for comparison of adoption rates and eHealth strategies across countries and jurisdictions; to date, however, the work has focused on physicians.

This study represents the first attempt to examine EMR adoption by NPs and has produced a number of new and interesting findings. NP adoption of electronic records is impressive, with 82% of respondents indicating that they were using the technology: 19% of NPs were using full electronic records and an additional 63% were using hybrid records, with not all components of the electronic record being available. These data are consistent with published reports suggesting that most North American health professionals use some form of hybrid electronic records (Borycki et al., 2009; Urowitz et al., 2008). They are also consistent with the work of DesRoches, Campbell, et al. (2008) involving physicians and nurses; these authors found that 4% of physicians were using full electronic records, 13% were using components of the EMR (part of the electronic record is electronic and part is paper-based), and 83% continued to use paper charts. This finding is consistent with that of a study conducted by DesRoches, Donelan, et al. (2008) focused on nurses. In our study, only 25% of NPs were using full electronic records, relying on both electronic and paper-based sources of information.

NPs appear to be in the very late part of the late majority stage — that is, on the verge of entering the laggard stage of the diffusion of innovation as outlined in Rogers's (1962) theory (see Table 2). According to Rogers's (2003) theory, there would still be some NPs sceptical of the innovation but most average members of the group would have adopted the technology. While NPs are on the very cusp of sinking to the laggard stage, it appears that only a small percentage have not adopted the technology — that is, those who are averse to change (Rogers, 2003). These results differ significantly from those for physician EMR use. The 2010 National Physician Survey found that only 33.6% of physicians in British Columbia used EMRs (National Physician Survey, 2010). In 2009, the data placed physician use in the early majority phase of Rogers's theory, with members of the physician community adopting EMRs only after some time had passed. There may be a number of explanations for this,

Table 2	*Rogers's Adopter Categories*	
Adopter Category	**Description**	**% of Respondents at This Stage**
Innovators	Those who are among the first to adopt an innovation; likely to be younger, take risks, be of a higher social class, and have contact with the innovators.	2.5
Early adopters	Opinion leaders; may adopt an innovation if it helps them to maintain a central position in a communication network.	13.5
Early majority	Those who take longer to adopt an innovation; are slower to adapt; have contact with early adopters.	34
Late majority	Those who adopt an innovation only after an average member of society does so; are often highly sceptical about the innovation; have lower social status.	34
Laggards	Those who are among the last to adopt an innovation; are traditional and averse to change; may also be older.	16

Source: Adapted from Rogers (1962).

including (a) physicians are slow to adopt EMRs, and (b) the organizations where physicians practise are slow to adopt EMRs.

There may be several reasons for the difference in the percentage of NP and MD adopters of EMRs, a difference of approximately 48%. According to Smith, adoption rates among physicians vary according to practice size. In a recent report, Smith (2010) reveals that physicians in British Columbia who work in full-service practices have an EMR adoption rate of 90%, compared to 33% of those in small to medium-sized practices and 5% to 10% of those in solo practices. Our NP respondents worked in many settings, with the majority in primary care, clinic, and ambulatory outpatient settings. These settings often provide a number of services. As employees rather than private practitioners, NPs are unable to make choices about EMR use. It may be that the EMR rate for NPs is high because NPs are more likely to work in organizations that have implemented the EMR. As well, physician EMR adoption rates may have increased since 2009. Ideally, the NP data would be

compared to physician EMR adoption data collected in 2012. However, the National Physician Survey was not administered in 2012. More research is needed to understand NPs' use of EMRs and whether working in full-service practice settings is a reason for high adoption rates.

Among our respondents, 60% who used EMRs were somewhat to very satisfied with the technology while 36% were somewhat to very dissatisfied. There could be a number of reasons for the high rate of dissatisfaction. Respondents noted a number of challenges with EMRs, including (a) slow and inconsistent computer or Internet access, (b) time-intensiveness of EMR use, (c) incomplete EMRs, (d) the system dictates clinical practice, and (e) the system lacks features and functions that support NP work activities such as ordering lab tests and producing requisitions. Other factors include poor interface design, inability of the technology to fully support NP practice requirements or practice-based workflows (Kushniruk, Borycki, Kuwata, & Kannry, 2006), lack of a terminology interface that represents all aspects of NP practice, and poor implementation services. This last factor includes lack of customization of the interface design/workflows emerging from the technology, as well as inadequate training (Walker, Bieber, & Richards, 2005). Further research is needed to refine and customize existing EMR terminology, interface designs, workflows imposed by the technology, and implementation services. Researchers may wish to explore the similarities and differences in NP and physician workflows to inform future EMR design and implementation.

Our findings are congruent with those of previous research: several researchers have identified poor electronic record design as a concern. Health professionals are increasingly cognizant of the impact of poor system usability on workflow (Kushniruk et al., 2006) and on practice. In some cases this has resulted in lack of improvement in patient outcomes or to technology-induced errors (Borycki & Kushniruk, 2008; Kushniruk et al., 2006; Kushniruk, Triola, Borycki, Stein, & Kannry, 2005). Furthermore, electronic records that do not support NP workflow can lead to inefficiencies and can impact the quality of care provided (Kushniruk et al., 2006), because many EMRs have been developed for use by physicians rather than by NPs. Less attention has been given to identifying the user requirements, workflow processes, and terminologies employed by NPs. Inadequate attention to NP-specific aspects of work during the requirements-gathering, design, and development phases of EMR design, in conjunction with a greater focus on physician aspects of work to be supported by the technology, may have led some NPs to become dissatisfied with EMRs. We need research to determine whether EMR vendors have incorporated NP-specific terminology, workflow, and

practice needs into commercially available EMRs, as the practice patterns of NPs differ from those of physicians and many EMR designs have been modelled on physicians' work. Such information should be posted on public Web sites so that NPs are well informed when procuring, recommending, or selecting EMRs for their practice. This is currently the case for physicians in some Canadian jurisdictions — for example, Ontario. Some provinces, including Ontario, make user ratings of EMR attributes available to the public and encourage physicians to post information about their experiences in implementing and using the technology.

In our study, NPs used differing EMR functions in their day-to-day work. For example, 73% used EMRs most or some of the time to store patient demographic information, 67% used EMRs to record clinical notes, 72% to view laboratory results, 62% to maintain patient medication lists, and 81% to view patient problem lists. In most cases NPs employed the technology to support day-to-day practice activities. Here, participants primarily used the technology to view test results, record information, and enter clinical notes. These basic or minimal EMR functions involve using the EMR as a source of information and as a documentation tool (Jha et al., 2009). Only a limited number of respondents used the EMR as an information reminder, to generate screening lists, and/or to manage large groups of patients at the practice level. Given the high rates of EMR adoption, it is important that policy-makers develop supports for NPs that enable full use of the technology to support their practice. NPs are adept at using the EMR as a source of information and as a documentation tool. The next important step is to provide them with educational opportunities to identify population-based issues in their practice. NPs need to be able to use EMRs to help them identify individuals who have an uncontrolled chronic illness, such as diabetes, or who are at risk for illness, such as those who are not immunized against pertussis. They would then be able to identify at-risk individuals and begin the process of helping them to address their health issues in a proactive manner.

Limitations

Although this work took place in one of the largest health-care jurisdictions in Canada, the study was limited to one region of the country. Research in other Canadian jurisdictions and in other countries is needed, in order to compare policy initiatives and impacts on NP EMR adoption and usage rates. In addition, the effects of setting (e.g., clinic, hospital) and location (e.g., urban vs. rural) on EMR adoption rates and use of EMR features and functions need to be examined. This study included NPs working in multiple roles in inpatient and outpatient set-

tings. Future research could examine differences in inpatient and outpatient settings in terms of EMR use.

The study was limited from a sample-size perspective (*n* = 31), even though all NPs in the jurisdiction were invited to participate (Jackson & Verberg, 2007). Nonetheless, the number of respondents is consistent with that of other surveys attempting to gauge health professionals' use of electronic records, such as the National Physician Survey (2012a). It must be noted that there are a number of possible reasons for the small number of respondents, the main one being the newness of the NP role in British Columbia as compared to other provinces, notably Ontario. Also, the number of NPs practising in British Columbia has been influenced by factors such as the time taken to educate NPs and the time taken for organizations to integrate the new role.

Conclusions

The findings from this research can be applied to other jurisdictions in Canada and to other countries where NPs are currently practising or where governments are about to introduce the NP role. NPs, unlike their physician counterparts, are in the late stages of EMR adoption (Rogers, 2003). There may be a number of reasons for this, including the nature of the settings where NPs work and NPs' co-location with other health professionals in full-service practice settings. It may be that in the large-practice settings where NPs work they are more easily supported by EMR vendors and that the nature of the large-practice setting has a greater need for clear communication and documentation support, for which the EMR is well suited. It may also be a result of NPs' status as employees, whereas most physicians are independent practitioners.

Even so, a significant number of NPs continue to be dissatisfied with their EMRs. There are several possible reasons for this, including cases where the EMRs are designed, developed, and implemented to support physician practice alone, rather than the practices of other health professionals as well, such as NPs. Throughout the health-care literature there is a recognition that physician and NP practices differ. The differences should be echoed in the technology's terminology interfaces, user interfaces, design, and implementation where NPs are concerned. EMR vendors need to begin customizing existing EMR systems and designing systems that support the unique and differing aspects of physician and NP practices. EMRs support specific types of workflow and practice activity; if these workflows and activities are not fully supported, then the efficiencies, productivity levels, and patient outcomes (or clinical value) expected of EMR as a technological support for NP practice will not be achieved (Kushniruk et al., 2006). Lastly, this research represents the first

attempt in Canada and internationally to learn more about NPs' use of EMRs. More research is needed to measure this use in other jurisdictions and countries. British Columbia's high rate of EMR adoption by NPs over a short period, since the introduction of the NP role in 2005, suggests that there is much to be learned from this province about the influence of context and EMR eHealth strategies on EMR adoption by NPs.

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Elizabeth Borycki, RN, PhD, is Associate Professor, School of Health Information Science, University of Victoria, British Columbia, Canada. Esther Sangster-Gormley, RN, PhD, is Associate Professor, School of Nursing, University of Victoria. Rita Schreiber, RN, DNS, is Professor, School of Nursing, University of Victoria. Mindy Swamy, RN, MN, is Research Assistant, School of Nursing, University of Victoria. April Feddema, BA, is Research Coordinator, School of Nursing, University of Victoria. Janessa Griffith, MSc, is Research Assistant, School of Health Information Science, University of Victoria.