Data discipline in electronic medical records

Improving smoking status documentation with a standardized intake tool and process

David Barber MD Tyler Williamson PhD Suzanne Biro MPH Karen Hall Barber MSc(HQ) MD
Danyal Martin MA MSc(HQ) Lorne Kinsella Rachael Morkem MSc

Abstract

Objective To evaluate the transformation in smoking status documentation after implementing a standardized intake tool as part of a primary care smoking cessation program.

Design A before-and-after evaluation of smoking status documentation was conducted following implementation of a smoking assessment tool. To evaluate the effect of the intervention, the Canadian Primary Care Sentinel Surveillance Network was used to extract aggregate smoking data on the study cohort.

Setting Academic primary care clinic in Kingston, Ont.

Participants A total of 7312 primary care patients.

Interventions As the first phase in a primary care smoking cessation program, a standardized intake tool was developed as part of a vital signs screening process.

Main outcome measures Documented smoking status of patients before implementation of the intake tool and documented smoking status of patients in the 6 months after its implementation.

Results Following the implementation of the standardized intake tool, there was a 55% ($P<.001$; 95% CI 0.53 to 0.56) increase in the proportion of patients with a completed smoking status; more than 1100 former smokers were identified and the documented smoking rate in this cohort increased from 4.4% to 16.2%.

Conclusion This study shows that the implementation of an intake tool, integrated into existing clinical operational structures, is an effective way to standardize clinical documentation and promotes the optimization of electronic medical records.

EDITOR'S KEY POINTS

- Electronic medical records (EMRs) are integral to a primary care team's communication. Unfortunately there is often wide variability in data content and a high level of missing data. To improve the quality of data entered into an EMR, an efficient process is essential.
- High-quality data are essential to managing important risk factors such as smoking at the patient and population levels. This study evaluated the transformation in smoking status documentation after implementing a standardized intake tool that was designed to improve data quality.
- This study found that including a smoking intake tool as part of the vital signs check during a primary care encounter led to a statistically significant increase in the proportion of patients with a documented smoking status. Intake tools to assess other lifestyle habits should be pilot-tested to determine their feasibility and effectiveness in enriching current EMR data.

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Mieux enregistrer les données dans le dossier médical électronique

Un processus et un outil standardisé pour améliorer l'enregistrement des données sur la condition de fumeur

David Barber MD **Tyler Williamson** PhD **Suzanne Biro** MPH **Karen Hall Barber** MSc(HQ) MD
Danyal Martin MA MSc(HQ) **Lorne Kinsella** **Rachael Morkem** MSc

Résumé

Objectif Vérifier l'effet d'un outil d'enregistrement standardisé sur la qualité de la documentation sur les habitudes de tabagisme, et ce, à l'occasion d'un programme d'abandon du tabac dans un contexte de soins primaires.

Type d'étude On a évalué comment les habitudes de tabagisme étaient enregistrées avant et après la mise en place d'un outil d'enregistrement. Afin d'évaluer l'effet de cette intervention, on a utilisé le Réseau canadien de surveillance sentinelle en soins primaires pour extraire l'ensemble des renseignements sur la cohorte à l'étude.

Contexte Une clinique universitaire de soins primaires à Kingston, Ontario.

Participants Un total de 7312 patients des soins primaires.

Interventions Comme première phase d'un programme des soins primaires visant l'arrêt du tabac, on a développé un outil d'enregistrement standardisé s'inscrivant dans le processus de prise des signes vitaux.

Principaux paramètres à l'étude L'enregistrement des habitudes de tabagisme des patients avant et au cours des 6 mois suivant la mise en place de l'outil d'enregistrement adopté.

Résultats À la suite de la mise en place de l'outil d'enregistrement standardisé, il y a eu une augmentation de 55% ($P \leq ,001$; IC à 95% 0,53 à 0,56) de la proportion de patients dont on connaissait les habitudes de tabagisme; plus de 1100 anciens fumeurs ont aussi été identifiés et la documentation sur le taux de tabagisme dans cette cohorte a augmenté, passant de 4,4% à 16,2%.

Conclusion Cette étude a montré que la mise en place d'un outil d'enregistrement de données intégrée dans le mode de fonctionnement existant d'une clinique est une méthode efficace pour standardiser la documentation clinique et ainsi optimiser l'utilisation du dossier médical électronique.

POINTS DE REPÈRE DU RÉDACTEUR

- Le dossier médical électronique (DME) est un élément essentiel à la communication dans une équipe de soins primaires. Malheureusement, il y a souvent beaucoup de variabilité dans les données qu'il contient et il y manque beaucoup de données. Si on veut améliorer la qualité des données inscrites au DME, il est essentiel d'utiliser une méthode efficace.

- Pour prendre en charge des facteurs de risque aussi importants que le tabagisme, il est nécessaire d'avoir des données de grande qualité, et ce, tant au niveau du patient que de la population. Cette étude a évalué de quelle façon l'enregistrement des données a évolué après la création d'un outil d'enregistrement standardisé pour améliorer la qualité des données.

- Les résultats de l'étude montrent que le fait de faire mention de la consommation de tabac au moment de la prise des signes vitaux lors de la première consultation en soins primaires entraînait une augmentation significative de la proportion de patients pour lesquels on avait des données sur leurs habitudes de tabagisme. Des outils d'enregistrement pour évaluer d'autres habitudes de vie devraient être mis à l'essai afin de déterminer leur faisabilité et leur efficacité pour enrichir et tenir à jour les données du DME.

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Over the past decade there has been a shift toward collaborative patient-centred care, which means health care professionals working together and with their patients.[1] Documentation in the medical record is an important part of providing this comprehensive care because it facilitates the communication of pertinent information among health care providers.[2,3] The increasing use of electronic medical records (EMRs) for both administrative and clinical tasks has considerable implications for patient safety and quality of care.[4] Unfortunately there is often wide variability in data content and a high level of missing data, and this issue can be acute when multisite research and quality improvement activities are dependent on data elements with low reliability. Incorporating an efficient and feasible process to improve the accuracy, consistency, and reliability of data entered into an EMR is essential for ensuring information fields are accurate and up to date.

Evaluating data within an EMR at the clinic or practice levels can be challenging, as many vendors provide a user-friendly interface but are unable to easily capture and evaluate aggregate data. The Canadian Primary Care Sentinel Surveillance Network (CPCSSN) enables a practice or clinic to improve data quality and manage the health of its patients at the population level. It extracts data from EMRs and aggregates them into a national database. Data within CPCSSN can be used to drive strategies to improve electronic record measurement fields that are missing or outdated, particularly risk factor fields such as type of smoker. This field is particularly important because cigarette smoking is recognized as one of the most important risk factors for many chronic diseases, including lung cancer, hypertension, Alzheimer disease, and chronic obstructive pulmonary disease.[5-9] High-quality data are essential to managing this risk factor at the patient and population levels and ultimately to reducing the burden of chronic disease.[10]

Data on risk factors are often recorded in noncoded and free-text fields within an EMR.[11] This limits the usability of these data to estimate risk factor prevalence within a practice or initiate targeted interventions.[12-14] While CPCSSN extracts and transforms any smoking data entered into an EMR, the best way to increase data quality is to improve data collection by developing standardized input procedures and processes.[14] This article reports on a project to standardize data entry procedures for smoking in a structured text field within the EMR. Owing to its expertise in extracting and optimizing aggregate data within an EMR, CPCSSN was used to evaluate this data quality initiative.

The objective was to use CPCSSN to compare smoking status data before and after the implementation of a clinic intake tool designed to improve data consistency and completeness.

METHODS

Study setting

Data were examined from one academic primary care clinic that contributes EMR data to CPCSSN. Comprising family physicians, nurses, nurse practitioners, dietitians, pharmacists, social workers, receptionists, and referral clerks, this academic family health team (FHT) was an ideal setting for evaluating the usefulness of a smoking intake tool for clinicians and researchers because it was in the beginning phase of implementing the Ottawa Model for Smoking Cessation (OMSC) in primary care (**www.ottawamodel.ca**). During the first phase of this model's implementation, a tool was introduced to assess smoking status as part of a vital signs screening process.[15,16] Among other clinical and demographic variables, any structured smoking status data, before and after the implementation of the model, were extracted into CPCSSN and cleansed, and subsequently populated the CPCSSN risk factor table. The data were transformed by CPCSSN into a common database schema to form a rich longitudinal database that facilitated a straightforward evaluation of the aggregate data.

Smoking intake tool

The smoking data elements included in the intake tool were provided by the OMSC program. A team, consisting of a primary care physician and a clinic manager, designed the intake tool to work within the framework of the EMR and minimize the effect on the clinic work flow (**Figure 1**). Although it was not mandatory for clinic personnel to use this tool, it was designed with front-line input to be a convenient and easy way for staff to enter risk factor data. After clinic staff members were trained to use the intake tool, it was integrated into clinic operations on September 30, 2011, and was filled out at the beginning of each patient encounter. The form automatically connects to related fields in the EMR to populate and update EMR data.

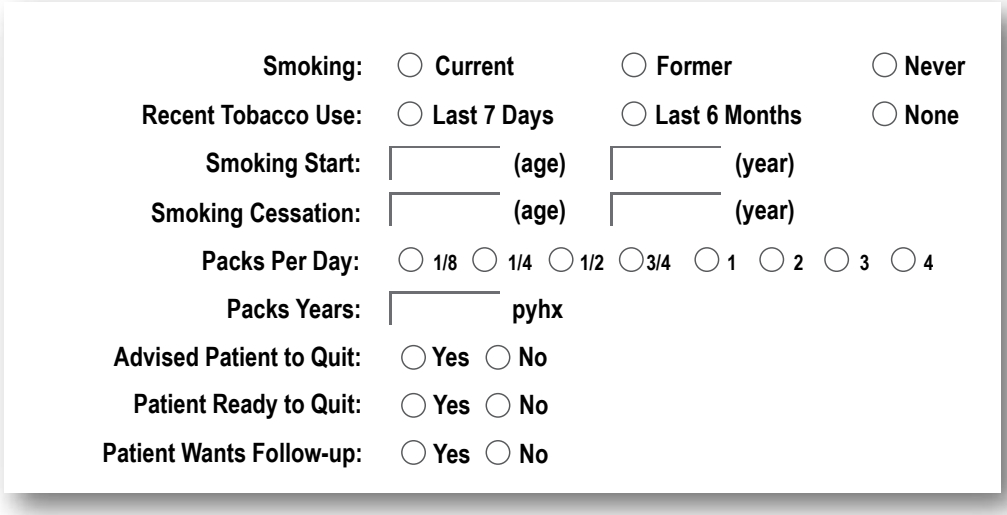
Study design

This study used a within-person comparison to evaluate the effectiveness of modifying intake procedures to include a smoking screening tool. Any patients who had an encounter with the practice between September 30, 2011, and March 31, 2012 (the 6 months immediately following the implementation of the tool) and had also had an encounter with the practice before September 30, 2011, were eligible for inclusion in the study.

Outcome measures and analysis

The primary outcome measure was the proportion of

Figure 1. Portion of the intake tool pertaining to smoking



participants who had an observation within the CPCSSN risk factor table (which is populated by any structured risk factor data entered into the EMR) dated within 6 months after the implementation of the intake tool compared with observations before the implementation of the intake tool. A χ^2 test was undertaken to compare the difference in proportions. The secondary outcome was an evaluation of the quality of the smoking data. This was measured by comparing the type of smoking information within the CPCSSN risk factor table before and 6 months after the intake tool was implemented. The use of a standardized intake tool is intended to harmonize the semantic distinctions of smoking data (eg, yes or no vs former, present, or never). In this way, the final outcome was an evaluation of the semantic harmonization of smoking information within the EMR across the FHT. This was measured by comparing the number of different ways that a participant's smoking status was recorded before and after the intake tool was implemented. This outcome was measured by finding any smoking data entered into a participant's EMR using a search algorithm that flagged any text that included words containing *smok, cig,* or *toba*.

Ethics approval was obtained from the research ethics boards of all the universities that host the practice-based research networks and from the Health Canada Research Ethics Board. All physicians that contributed their data to CPCSSN provided written informed consent for the collection and analysis of their EMR data.

RESULTS

There were 7312 patients with encounters during the 6 months after the implementation of the smoking intake tool who had also had encounters before implementation. Comparison of the before and after periods shows a significant 55.0% increase in the proportion of patients with a documented smoking status ($P<.001$; 95% CI 0.53 to 0.56). Before the implementation of the intake tool, 18.4% (n=1342) of the cohort had a smoking status entered into a structured field in the EMR (**Table 1**); after implementation of the intake tool, 73.2% (n=5351) of the cohort had a structured smoking status entry (**Table 2** and **Figure 2**).

After integrating the smoking tool into clinic procedures, the number of identified smokers increased by 11.9% and 1136 former smokers were identified (**Table 2**). For patients with only free-text smoking data, the number of different ways that smoking was recorded in the unstructured data entry field dropped from 1418 to 347 after implementation of the intake tool.

DISCUSSION

Before the implementation of the intake tool there was no protocol for the routine collection of smoking status

Table 1. Number of completed smoking status fields before implementation of the intake tool: *N = 7312.*

DATA TYPE	RISK FACTOR SMOKING STATUS	N (%)
Structured data	Yes	320 (4.4)
	No	1022 (14.0)
Unstructured data	Free text (unknown status)	2283 (31.2)
No data	Missing	3687 (50.4)

Table 2. Number of completed smoking status fields after implementation of the intake tool: *N = 7312.*

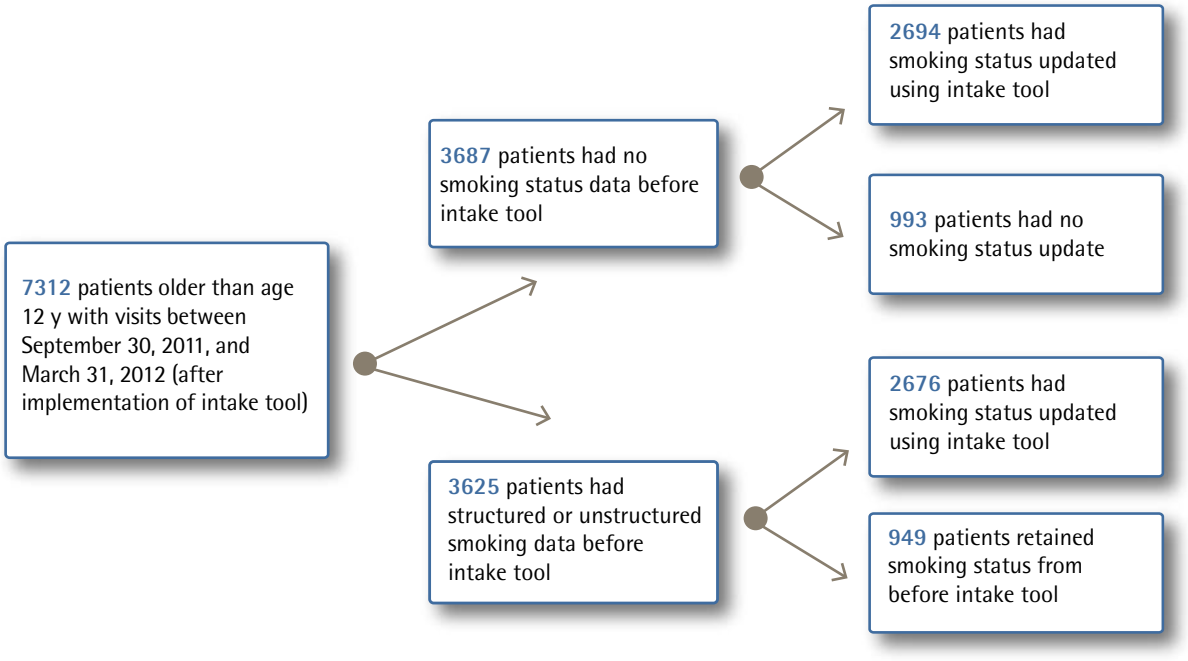
DATA TYPE	RISK FACTOR SMOKING STATUS	N (%)
Structured data	Current	1187 (16.2)
	Former	1136 (15.5)
	Never	2638 (36.1)
	Yes	76 (1.0)
	No	314 (4.3)
Unstructured data	Free text (unknown status)	968 (13.2)
No data	Missing	993 (13.6)

data. A patient's smoking status was recorded in various ways, in as many as 4 different places within the EMR, in noncoded or free-text fields, and by various health professionals. In a fast-paced practice environment, this inconsistent and unreliable documentation of an individual's smoking status makes it difficult to estimate smoking prevalence or easily identify smokers for targeted cessation advice. Additionally, in an academic environment, medical residents read patient charts and rarely have time to review the free-text fields for important information like lifestyle habits, even though this is a considerable contributor to chronic disease.

Not surprisingly, this study found that including a smoking intake tool as part of the vital signs check during a primary care encounter led to a statistically significant increase in the proportion of patients with smoking information within the EMR. A large proportion (73.1%) of the participants who had no smoking information before implementation of the intake tool (n = 3687) had smoking documentation following implementation (n = 2694). This supports previous reports on the effectiveness of using education and information technology tools to increase data discipline. Juxtaposing the different risk factor smoking statuses in **Table 1** with those in **Table 2** shows how a screening tool for smoking can help a primary care provider ask for and document more meaningful information about this risk factor. Electronic medical record documentation that states a patient is not a smoker gives no indication whether the patient is a former smoker or has never smoked. This distinction is important for clinicians and researchers, as this difference has important implications for a patient's risk status. Furthermore, the critical value of having a standardized method for documenting smoking status is evident in the 11.9% (867 of 7312) of participants who were newly identified as current smokers. This tool has considerable ramifications on the planning of clinical interventions and is useful to primary care researchers.

Previous studies have found rates of smoking documentation improvement ranging from 10% to 60%.[2,13,14] This variability might be due to patient or physician characteristics, preintervention rates, and the effectiveness of specific interventions at a particular clinic. It is likely that this study did not see smoking status documentation reach 100% owing to varying degrees of uptake by the different clinicians within the FHT. In

Figure 2. Number of patients in each smoking status group following the implementation of the smoking intake tool



addition, even after the implementation of the intake tool there were still 350 different (unique) ways that smoking status was entered into the EMR. This is likely owing to the 968 participants whose smoking information was not updated and their free-text documentation persisted even after the intake tool was implemented.

This study shows that the implementation of an intake tool, integrated into existing clinical operational structures, is an effective way to standardize clinical documentation and promotes the optimization of EMRs.

To offer the best possible care to patients, primary care providers should be fully informed about their patients' lifestyle habits and how they affect their health. Incorporating an intake tool that can capture smoking status into the daily routine of a primary care practice can have an important clinical significance. The number of known smokers in the cohort more than tripled after the intake tool was implemented. Having this knowledge can help a primary care team manage its patient population and reduce the number of acute and chronic conditions related to smoking.

The effectiveness of adding smoking to a patient's vital signs check is one example of how an intake tool can be leveraged to standardize the collection and documentation of important clinical information. It is essential that certain details regarding patient information have a standardized EMR data entry strategy so that important clinical data on a patient are easily accessible to any member of a primary care team. As a growing number of patients are receiving care from a team of health care professionals, data entry standardization is becoming essential to the provision of comprehensive care.[17] In a primary care practice where health professionals from many disciplines are working together, high-quality, timely, and patient-oriented documentation is necessary for high-quality patient care. Investing time and resources for training and communication on how to use health information technology quality improvement features, such as standardized intake forms, is vital to realizing the benefits of an EMR and ultimately improving patient care.[18]

A clinical data repository like CPCSSN is an ideal way to evaluate health information quality improvement initiatives. The complex algorithm developed by CPCSSN for cleaning and classifying various risk factor fields from multiple EMR systems allows a clinical practice to monitor and measure changes to data collection and input procedures and processes[14]; CPCSSN can provide a baseline measure of a practice's data quality and indicate where quality improvements might be necessary. Following the implementation of a health information technology quality improvement initiative, CPCSSN can provide the evidence for the continued support of that initiative or indicate where further changes need to be implemented.

Limitations

This intake tool is an efficient and effective mechanism to improve the quality of smoking status documentation, which has potential health benefits for patients. However, there are several limitations that should be considered. First, the tool was only implemented at one clinic, so the results could be affected by local clinic idiosyncrasies. Second, this study used a simple before-and-after evaluation design, which might be vulnerable to internal validity threats. The observed results could be valid in the short term (6 months after intervention) but might not persist over the long term as other circumstances arise (work flow changes, staff turnover, decline in motivation to use intake tool, etc). Also, the secondary outcome was measured using a search algorithm rather than a manual chart audit. This could have caused some underestimation of the number of ways smoking was recorded before and after implementation of the intake tool. However, the search terms used were extensive and it is unlikely that many records were missed. Finally, this study did not evaluate if using an intake tool to document smoking status for patients resulted in a reduction in smoking rates. However, extensive research on the OMSC has shown that improving documentation is a key component of a successful smoking cessation program. By itself a smoking intake tool will not reduce smoking rates, but it is a key component of an effective, simple, and systematic program for helping patients quit smoking.[15,16] Future research in additional clinical settings is needed to support these findings. Also, evaluating the correlations between patient and physician characteristics and EMR documentation could indicate areas for further documentation improvement.[2] In addition, intake tools to assess other lifestyle habits should be pilot-tested to determine their feasibility and effectiveness in enriching current data and improving patient health outcomes.

Conclusion

This study found that incorporating a smoking intake tool into the daily routine of a primary care practice can have an important clinical significance. The number of known smokers in the cohort more than tripled after the intake tool was implemented. Having this knowledge can help a primary care team manage its patient population and reduce the number of acute and chronic conditions related to smoking. The effectiveness of adding smoking to a patient's vital signs check is one example of how an intake tool can be leveraged to standardize the collection and documentation of important clinical information. With a standardized EMR data entry strategy, a patient's clinical data are accessible to all members of a primary care team, which is essential to providing comprehensive care.

Dr Barber is Assistant Professor in the Department of Family Medicine at Queen's University in Kingston, Ont. **Dr Williamson** is Assistant Professor in

the Department of Community Health Sciences at the University of Calgary in Alberta. **Ms Biro** is Foundational Standard Specialist at Kingston, Frontenac, Lennox and Addington Public Health Unit in Kingston. **Dr Hall Barber** is Assistant Professor in the Department of Family Medicine at Queen's University. **Ms Martin** is Manager of Quality Improvement Strategies and Quality Improvement Plans at Health Quality Ontario. **Mr Kinsella** is Data Manager for the Canadian Primary Care Sentinel Surveillance Network project at Queen's University. **Ms Morkem** is Research Associate and Privacy Officer for the Canadian Primary Care Sentinel Surveillance Network project.

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Contributors

All authors contributed to the concept and design of the study; data gathering, analysis, and interpretation; and preparing the manuscript for submission.

Competing interests

None declared

Correspondence

Ms Rachael Morkem; e-mail **rachael.morkem@dfm.queensu.ca**

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