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Policy and practice

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Abstract

Background: Electronic medical records (EMRs) have become highly customizable. Although customization allows changes for workflow optimization, such changes can result in a less standardized system and create barriers due to individual preferences.

Aim: This was a documentation of the efforts of a greenfield academic medical centre in Qatar to improve patient safety, physician operational efficiency and revenue capture by standardizing the design of the non-medication orders and associated revenue of the EMR .

Methods: A multi-disciplinary group reviewed and revamped the design and workflow for non-medication orders, including redistributing orders into order catalogues, standardizing their naming, assigning them billing codes, and reviewing other order details. Measurement of project performance followed cross-sectional and prospective cohort designs.

Results: The redesign improved clinicians' satisfaction with the EMR and reduced patient safety incidents and other technical issues. Improvements in the organization's operations and staff performance were noticeable across multiple areas. The proportion of clinicians finding it difficult to navigate and select orders reduced from 31% to 21%. The proportion of clinicians who believed the orders to be clear and accurate increased from about 16% to 31%. The estimated percentage of clinicians reporting a technical issue with an order during the last month reduced from 52% to 41.94%, and physicians' dissatisfaction with the overall

organization of non-medication orders in the EMR reduced from about 32% to 23%. The average number of technical issues and change requests sent monthly to the technology team for non-medication orders reduced from 30 to 1.4 technical issues and 3.2 change requests.

Conclusion: EMR performance improvement projects that consider and address staff input, patient safety and performance metrics can uplift an organization's clinical and financial performance.

Keywords: medical informatics, clinical decision-making, electronic health records, health information systems, medical order entry system, Qatar

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Background

Although the concept and initial designs of electronic medical records (EMRs) have been in use for 5 decades, it only had a noticeable and significant impact on healthcare services and patient outcomes when the United States of America (USA) healthcare system gained interest in and a motive for its adoption. This was most probably associated with a stimulus bill that promised billions of dollars as incentive to the developers and 'end-users' of EMRs (1-4). Backed by this financial input, the bill was successful in increasing the use of EMRs (5). This is exactly what the financial factor in the uptake of technology is responsible for – ensuring the first step of purchasing and training on the use of any new technology is accomplished; however, the extent of adoption and impact of a complex technology ultimately rests with end-users (employees)

(6-7).

Financial stimulus is not always enough to guarantee readiness by staff for a technology uptake Extensive research has shown that ‘technical’ issues can hinder a physician’s adoption of an EMR, which can be fuelled by either the complexity of EMRs or physicians’ insufficient acquaintance with computers. More specifically, a higher number of screens and data entry fields for physicians to access can contribute to a decline in a system’s uptake. This may be directly correlated to the time needed for data input, which further adds to the vicious cycle that increases the challenge of EMR adoption.

System unreliability is another reason physicians reject EMRs. Research safely concludes that this can contribute to the loss of a patient’s medical information (8). Unfortunately, the impact on patients surpasses irretrievable medical information. Sub-optimal EMR design is directly associated with patient harm, and this problem increases when incomplete EMR design breeds physician burnout, thus further contributing to patient harm (5,9-11).

A cross-sectional survey among residents and teaching physicians in primary care settings across Virginia, North and South Carolina, and Florida in the USA found that 75% of subjects who showed symptoms of burnout attributed it to EMRs (9). Eighty-five percent of the respondents reported that EMRs impacted their work-life balance. These findings were significant among physicians who had to spend more than 6 hours of overtime every week to complete their EMR requirements.

At a larger scale, the cumulative impact of these findings may result in public health and healthcare inefficiency. An Annals of Family Medicine 2017 publication found that EMR consumed the lion share of a physician’s shift: 5.9 hours out of 11.4 hours (5). The opportunity cost for this is the ever-important patient whose time became second place with only 5.1 hours, and this may translate into thousands of ‘computer clicks’ during a day’s work. The impact of improper design on hospital operations and patient outcomes may also negatively impact clinical nursing operations (12), thus compounding the problem.

Research and findings on badly designed EMR are clear, but rectifying the problem is not to go back to a paper-based system or to replace the system or vendor with another. We need customized, multi-stakeholder approved programmes that will fix only what is broken and increase clinicians’ confidence in the system. More specifically, in the Gulf Cooperation Council (GCC) countries, healthcare providers need to be especially watchful of the interactions

between their staff and EMRs. Despite the newly developed healthcare systems and the acquisition of state-of-the-art solutions and equipment, these countries have their challenges, including readily assimilating a predominantly expatriate healthcare workforce to operate in a uniform manner.

The State of Qatar is one of the smaller countries and healthcare systems among the GCC countries. It however has invested heavily in developing its healthcare system, including establishing Sidra Medicine, an academic medical centre that hosts Cerner Millennium as its EMR. It employs clinicians and administrators of over 50 nationalities. With such a diverse cadre of healthcare professionals and a customizable EMR, different standards based on the input of multiple academic and professional backgrounds were used for non-medication orders. This lack of standardization was evident in the nomenclature, collateral details (specific information related to each order, such as procedure time, cleanup time, etc.) and even the system design of the orders and their integration with other transactions within the EMR. The design caused revenue capture problems as billing codes were not assigned to orders and consumed a substantial proportion of the time of information technology support personnel (about 60 issues to resolve monthly). This in turn caused losses worth millions of dollars and impacted patient outcomes.

Intervention objectives

In recognition of the challenges with the EMR and their impact on the financial and operational performance, but more importantly, staff satisfaction and experience, as well as patient safety, the Department of Medical Informatics (DMI) launched an organization-wide project to review all non-medication orders. The project had 3 main objectives:

Develop an order checklist to review and evaluate each non-medication order;

Develop and introduce data collection workbooks (DCWs) for categorizing and managing all non-medication orders; and

Design the structure, methods and governance system for an order council that would ensure sustainability of the outcomes of the project and continue to manage all non-medication orders in accordance to a specific set of standards.

The expected outcomes of these were:

1. Enhanced quality of care provided, with more efficient use of clinicians' time in reviewing, selecting and processing orders, thus allowing more time for patient care and professional development;
2. Improved process efficiency;
3. Improved patient safety, with each patient receiving the correct order and in time;
4. Improved patient charge capture and increased revenue generation;
5. Accuracy of patient medical records, which would help improve analysis and interpretation of patient and hospital data for organizational planning, public reporting and insurance coverage.

Methods

DMI started by assembling a core working group of experts from the revenue cycle, clinical operations, nursing and clinical informatics education teams, supply chain, the Sterile Processing Department, and information technology. This was to ensure that any changes made integrated the inputs and addressed the needs of all relevant units holistically.

The orders were divided into priorities, and determination of priorities was based on the expected impact on patient charge capture and patient safety. A core requirement was to ensure that clinicians were involved in all review meetings relevant to non-medication orders because their buy-in and how they perceived the accuracy of the EMR data was crucial to its successful adoption (13).

The chief medical informatics officer (CMIO) and the chief medical officer (CMO) were responsible for adherence to timeline and strategic system approvals, while the core working group was responsible for reviewing all order details, order sentences, order entry formats, and for educating users on changes made to the EMR. The working group was also tasked with attributing patient charges to orders and developing workflows to ensure correct charge capture.

For each order, the working group assigned an order category, which enabled proper tracking and statistical analysis of orders. They reviewed the primary legal name that uniquely identified the order and the more medically common names (known as synonyms), enabling the project to align with international naming standards. The group linked a billing code that would ensure proper and efficient billing, enhance clinical coding and, consequently, health information analysis for the organization, and conducted an overall quality check to eliminate any confusing order duplicates in the system. In this way, they were able to eliminate system rules that could

put patients at risk, such as rules that cancel orders upon a patient's discharge. They also developed order forms and sentences (for certain orders). Order forms enable clinicians to add certain details and instructions to each order, while order sentences serve as shortcuts to help automatically fill certain parts of the order forms.

Once approved, all order designs were developed and tested in a CERT domain (a mirroring platform of the live EMR), and once cleared of any interference with existing EMR formats, they were transferred to the live EMR domain for use by clinicians.

One dedicated programme manager organized the entire project with planning and guidance from a health information systems (HIS) subject matter expert (SME) who had working experience in Cerner's backend build and data mining and representation. This helped to ensure an accurate and standardized order design, but more importantly, helped in communicating the reasons, details and implications of the project to clinicians. The SME's Cerner experience helped in quality control by validating if the input of information technology staff to EMR functions could or could not be implemented. The SME also generated data reports to inform decisions about orders that needed to be removed, and led the adoption of international standards, including the American Medical Association (AMA) current procedural terminology (CPT) 4 codes for procedures and charges and the Association of periOperative Registered Nurses (AORN) surgical procedure list.

All actions were guided by thorough planning that helped in establishing the governance structure and an orders checklist, which was used as a guide for reviewing orders. All reviewed orders were organized in Microsoft Excel files commonly referred to as DCWs, which would serve as the organization's reference for all future changes to orders. Most importantly, the plan included an order council to govern and maintain the achievements of the project.

To measure project success, with tangible organizational outcomes that could be presented to clinicians and the leadership of the centre, the project manager and SME identified and collected data on some indicators presented (Table 1). These indicators played an important role in encouraging leadership to mobilize resources for the project and in helping staff to better understand its significance.

Results

This project held 137 working group meetings and 10 executive meetings (meetings between the programme management team and executives) and published 36 progress reports.

Collectively, it guided the review of 2355 surgery, 4000 ambulatory (all outpatient and bedside procedures, such as foreign body removals, audiometry, etc.), about 300 evaluation and management (professional service fees for healthcare providers, such as outpatient consultations and inpatient rounds, etc.), 1570 radiology, and 1884 laboratory orders.

The project helped in the adoption of DCWs as the mode of change management for the order catalogue and the surgery picklists (surgery supplies), automation of patient charge tickets for ordering patient supplies through EMR orders, reduction of the inactive orders count, and automation of EMR order testing and validation.

Improvements to the centres' operations and staff performance due to the improvements to the EMR were noticeable across multiple areas. There was a significant reduction in patient safety events directly associated with physician orders placed in the EMR from an average of 11 per month to less than one per month. Investigation and resolution of issues, such as radiology encounters requiring anaesthesia, became possible and easier. Prior to implementation of this project, one imaging study was missed because a clinician placed an anaesthesia order that remained stagnant because it was not linked to the diagnostic imaging order. By reviewing the complete order set, the required links and triggers were built between and among related and dependent orders.

A post-intervention survey showed that the proportion of clinicians finding it difficult to navigate and select orders decreased from 31% to 21% and the proportion of clinicians who acknowledged that the orders became clearer and more accurate increased from about 16% to 31%. The estimated proportion of clinicians who reported a technical issue with an order during the last month decreased from 52% to 41.94% and the proportion of physicians who were dissatisfied with the overall organization of non-medication orders in the EMR decreased from about 32% to 23% (Figure 1). A chi-square test for independence however did not show statistical significance for these changes (Tables 2).

Before the intervention, an average of 30 technical issues and 30 change requests were officially sent to information technology staff for non-medication orders, but this reduced to an average of 1.4 technical issues and 3.2 change requests per month after the intervention (Figure 2).

Table 3 Distribution of survey respondents by department and profession

Discussion

The improvements to the EMR and staff satisfaction with the navigation and selection of non-medication orders were encouraging, in line with one of the key goals of advancing clinicians' use of the EMR. Analyses from Cerner Lights on the network showed that the average time spent by physicians navigating basic non-medication orders decreased from 51.66 to 45.95 seconds per order. When we consider the average number of orders placed monthly, this amounts to 334 physician hours, which can be redistributed to patient care and/or other functions. These savings are more impactful for physicians who have many orders per patient or encounter.

At the time of this analysis, the centre was placing a monthly average of 211 000 orders (non-medication) and employed about 250 full-time attending physicians (excluding hospitalists, trainees and locums, etc.). The number of hospitalists was fewer (

The project helped improve the centre's financial performance by accounting for approximately US$ 46 million more in patient charge capture annually. This figure is not exaggerated considering that a key component of the project was to attribute CPT 4 charge codes to each of the revised orders, thus allowing the centre to log and charge for its services. This was a critical component and a significant contribution to the centre's transformation from relying heavily on public funds to self-funding. The substantial increase in patient charge capture may also be attributed to the involvement of the centre's medical chiefs, as this improved their awareness and appreciation of the accurate charge attribution.

Apart from the increase in internally generated revenue, operationally and from a patient safety perspective, projects of this kind are essential to ensure that a healthcare technology investment is not underused, replaced or wrongfully modified due to low adoption by users. This is good business practice. If this happens an unexpected challenge of over-investing in a sub-optimal solution and not realizing the best return on investment despite sufficient financial resources and heavy government support may occur. The ease of data entry and the overall user-friendliness of a system are key determinants of satisfaction in EMR use. Health informatics projects that did not consider the input of primary EMR users and correcting key issues have deterred EMR adoption in the past (14-17). In 2018, a Kaiser Health News article reported that about 18 000 EMR patient safety incidents were registered in just 11 years (5). Without interventions from clinical informaticists (persons who understand the language of computers and physicians) these numbers may continue to increase.

These challenges are not limited to Sidra Medicine alone. Other centres, such as the Hamad Medical Corporation (largest provider of secondary and tertiary care in the country) (18) and the Primary Health Care Corporation (with 31 health centres) (19) also use Cerner system for EMR and employ diverse staff from multiple countries (20). Depending on the level of informatics governance at these and other institutions, the extent of EMR customization may vary, however, informatics projects that continuously consider and respond to the concerns of clinicians are recommended. This is especially important for healthcare institutions that need to

exchange health information. The systems should be standardized enough to be able to communicate with each another. Sidra Medicine currently exchanges health information with HMC and this calls for periodic EMR improvements.

Conclusion

Heavy capital investments in EMRs are not sufficient to ensure optimal interaction between the system and users. Additional design reviews that consider the input of clinicians are required to increase efficiency of the system. The involvement of clinicians in this project, including during the technical reviews and the system launch, was perhaps the most critical contributor to the success. EMRs can help improve patient care, patient safety and process efficiency, while simultaneously developing an institution's financial capacity. However, a prerequisite for an efficient system is bolstering physicians' confidence in EMRs, and consequently their support for the system. We recommend a series of national studies that target primary, secondary and tertiary care settings across the private and public sectors in Qatar to understand how to improve efficiency and satisfaction with EMRs. Lessons learned and best practices shoul

d then be shared with EMR vendors so they can develop smarter solutions.

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Restructuration des dossiers médicaux électroniques afin d'améliorer la sécurité des patients et le recours aux prescriptions non médicamenteuses par les cliniciens

Résumé

Contexte : Les dossiers médicaux électroniques (DME) sont devenus hautement personnalisables. Bien que ce processus permette des changements qui optimisent le flux de travail, il en résulte un système moins normalisé susceptible de causer des obstacles du fait des préférences individuelles.

Objectif : Documenter les efforts déployés par un nouveau centre médical universitaire basé au Qatar dans le but d'améliorer la sécurité des patients, l'efficacité opérationnelle des médecins et la récupération des recettes en normalisant la dénomination et la conception des prescriptions non médicamenteuses et leurs recettes associées dans les DME.

Méthodes : Un groupe multidisciplinaire a passé en revue et remanié la conception et le flux de travail pour les prescriptions non médicamenteuses, notamment en réorganisant ces dernières dans des catalogues d'ordonnances, en normalisant leurs conventions de dénomination, en leur attribuant des codes de facturation et en examinant d'autres détails associés. La mesure de la performance du projet a suivi les modèles de cohortes transversales et prospectives.

Résultats : La restructuration des DME a permis d'améliorer la satisfaction des cliniciens quant à leur utilisation et de réduire le nombre d'incidents liés à la sécurité des patients ainsi que les problèmes techniques. Des progrès ont été constatés en ce qui concerne le fonctionnement de l'organisation et la performance des personnels dans de multiples domaines. Le pourcentage de cliniciens éprouvant des difficultés à parcourir et à sélectionner des ordonnances a baissé, passant de 31 % à 21 %. Le nombre d'entre eux estimant que les ordonnances étaient claires et précises a augmenté, passant de près de 16 % à 31 %. Le pourcentage estimé de cliniciens ayant signalé un problème technique au cours du mois précédant a diminué, passant de 52 % à 41,94 %, et l'insatisfaction des médecins concernant l'organisation globale a également diminué, passant de près de 32 % à 23 %. Le nombre moyen de problèmes techniques et de demandes de modification envoyés mensuellement à l'équipe technique a diminué, passant de 30 à 1,4 et à 3,2 respectivement.

Conclusion : Les projets d'amélioration de la performance des dossiers médicaux électroniques qui tiennent compte des contributions des personnels, de la sécurité des patients et des mesures de la performance peuvent accroître le rendement clinique et financier d'une organisation.

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رامي يعسوب، نادر الشهابي، خالد اليافعي

الخلاصة

: أصبحت السجلات الطبية الإلكترونية قابلة للتكييف بدرجة كبيرة . وعلى الرغم منالخلفية
أن التكييف يسمح بإدخال تغييرات لتحسين تدفُّق العمل، فإنه يخلق نظامًا أقل اتصافًا
بالطابع الموحد، وهو ما قد يسبب عقبات بسبب التفضيلات الفردية .

: هدفت هذه الدراسة إلى توصيف الجهود التي يبذلها مركز طبي أكاديمي جديد في قطرالهدف
لتحسين سلامة المرضى، والكفاءة التشغيلية للأطباء، وتسجيل الإيرادات من خلال توحيد
تسمية وتصميم الأوامر غير الدوائية والإيرادات المتصلة بها في السجلات الطبية
الإلكترونية .

: تولَّت مجموعة متعددة التخصصات استعراض وتحديث تصميم الطلبات غير الدوائيةطرق البحث
وتدفق المهام المتعلقة بها، وشمل ذلك إعادة توزيع ا الطلبات في فهارس الطلبات ، وتوحيد
اصطلاحات تسمية تلك الطلبات ، وتعيين رموز إعداد فواتيرها، واستعراض التفاصيل الأخرى
لها . وكان التصميم المتبع فيما يتعلق بالبيانات التي تقيس أداء المشروع يجمع بين النهج
المقطعي والنهج الأترابي الاستباقي .

: أدت إعادة التصميم إلى تحسين رضا الأطباء السريريين عن السجلات الطبيةالنتائ ج
الإلكترونية، والحد من الحوادث المتعلقة بسلامة المرضى والمشاكل التقنية . وكانت أوجه
التقدم في عمليات المنظمة وأداء الموظفين ملحوظة في مجالات متعددة . وانخفضت النسبة
المئوية للأطباء السريريين الذين يجدون صعوبة في التصفح واختيار الطلبات من 31% إلى
21%. وارتفع عدد الأطباء السريريين الذين يعتقدون أن الطلبات واضحة ودقيقة من نحو 16%
إلى 31%. وانخفضت النسبة المقدرة للأطباء السريريين الذين يبلغون عن مشاكل تقنية
بخصوص الطلبات خلال الشهر الماضي من 52% إلى 41.94% ، وانخفض أيضًا عدم رضا الأطباء عن
التنظيم الإجمالي للطلبات غير الدوائية في السجلات الطبية الإلكترونية من نحو 32%
إلى 23%. وانخفض متوسط عدد المشاكل التقنية والتماسات التغيير التي تُرسَل شهريًّا
إلى فريق التكنولوجيا بشأن الأوامر غير الدوائية من 30 إلى 1.4 مشكلة تقنية و 3.2 التماس
تغيير .

: قد تؤدي مشاريع تحسين أداء السجلات الطبية الإلكترونية التي تتناولالاستنتاجات
مدخلات الموظفين وسلامة المرضى ومقاييس الأداء إلى تحسين الأداء السريري والمالي
للمنظمة .

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