The Clinical Nursing and Midwifery Dashboard (CNMD): A State-Wide Implementation

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Abstract. The clinical nursing and midwifery dashboard (CNMD) was built to provide a near real-time information and data visualisations for nurse unit managers (NUMs) and maternity unit managers (MUMs) within only a 5-15 minutes delay from when they enter data to the integrated electronic medical records (ieMR) system. The dashboard displays metrics and information about current adult inpatients in overnight wards. The aim is to support NUMs and MUMs to manage their daily workload and have continuous visibility of patients nursing risk and safety assessment documentation. A quantitative evaluation approach was conducted to measure the impact of the dashboard on key performance indicators. Statistical analysis was completed to compare risk assessment average completion times prior to and post CNMD implementation. The results of the evaluation were positive, and the statistical analysis shows significant reduction in the average time to complete different risk assessments with p-value<0.01.

Keywords. Dashboard, data analysis, visualisation, risk assessments, nursing unit manager, maternity unit managers, Waterlow, falls, skin assessment, malnutrition

1. Introduction

The introduction of the integrated electronic medical records (ieMR) at hospitals within Queensland provided an opportunity for improved utilisation of clinical data to help enhance health care delivery for our patients. The availability and accessibility of patients' data in a semi real-time setting provided an opportunity to develop this influential and interactive dashboard. Dashboards aim to provide data analytics and visualisations for clinicians to support delivery of improved healthcare for patients [1].

The nurse unit managers (NUMs) and midwifery unit managers (MUMs) play a pivotal role in the provision of safe, high quality patient care. They also have a leading role influencing patient and staff satisfaction by creating a positive culture within their work areas. NUMs are responsible for identifying deficiencies in clinical practices and workflows within their work area. Having access to real-time information is crucial for them to carry out this process and achieve optimal patient outcomes [2].

To support NUMs/MUMs manage their workloads and provide visibility of incomplete tasks for current inpatients, we introduced the clinical nursing and midwifery dashboard (CNMD). The CNMD was developed in Metro South Health (MSH) under a

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wider QLD statewide project. It provides NUMs/MUMs with the ability to see what is happening to their patients in their units in semi-real time. The dashboard also can be used to develop and promote workflows that utilise the data to drive support and decision making in the clinical environment. It provides data on Nurse Sensitive Indicators (NSIs) and other key indicators that affect patient care and outcomes.

2. Methods

In this section we will describe the CNMD development process and the evaluation method used to measure the impact of CNMD use on clinical key performance metrics. CNMD development was a collaborative process that utilised the principles of co-design during the end to end project life cycle. The project officer, (an experienced NUM), worked closely with data analytics team members and NUM's participating in the pilot. This collaboration was critical to the success of the project. A critical role of the project officer was translating clinical language into technical language and back again, ensuring greater understanding of requirements between the two groups. Over the period of 8 months, May 2017- Jan 2018, the project went through 4 concentrated stages; requirements collection and stakeholder's engagement, data collection and dashboard build, clinical validation, and finally, dashboard pilot and feedback collection.

The initial phase of the project consisted of focus groups of clinical nursing stakeholders. They were engaged to determine the content, scope, and use of the CNMD. The clinicians determined that the dashboard should display ward level data, inclusive of patient demographic and location information. High value metrics which were linked to evidence-based improvements in safety and quality for patient care were also included, i.e. patient risk assessments, malnutrition score, high-risk medications, deterioration alerts and intravenous cannula dwell time.

The CNMD was built using QlikView with data derived from the ieMR with a refresh every 15 minutes. A deidentified screenshot of the actual dashboard is in Figure 1. Using human design principles, the dashboard consolidates large volumes of patient information and visualizes key summary information in an easily consumable format for action by front line clinical staff. Examples of summary metrics include; deteriorating alerts within the last 12/24 hours, cannulas insitu >72 hours, and Waterlow scores greater than or equal to 10 and 15. The dashboard also contains gauges showing assessment compliance, such as the number of patients with incomplete Waterlow scores.

The dashboard went through a rigorous validation process to ensure the displayed information was complete and accurate. The CNMD was piloted in 3 acute adult inpatient wards for 4 weeks. Operational feedback from NUMs was collected and minor optimizations were completed to further enhance the usability and informativeness of the dashboard. For example, using shaded cells to view missing risk assessments, and using colors within the gauges to motivate clinicians complete the pending tasks.

In order to evaluate the influence of using the dashboard on clinical key performance indicators (KPIs), we decided to compare the periods before and after implementation of the dashboard (go-live) in the hospital. Evaluation has been done at a single hospital at this stage, which has enough data before and after go-live to build evidence using statistical methods. The data is collected from ieMR for the periods between December 2015 and August 2019. The period between October 2017 – January 2018 has been excluded from the analysis as it was the pilot and go-live implementation of the dashboard. The reason for excluding this period is because the dashboard was piloted in

3 wards and then a staged rollout to the rest of the inpatient wards occurred therefore a transition period which can't be classified as before or after implementation.

We decided to look at measurable metrics which are directly related to patients' risk of harm. Assessment completion within 8 hours of admission to the ward is one of the KPIs to be fulfilled by NUMs/MUMs. We evaluated the average time required for the nursing staff to complete a risk assessment for a patient. The three risk assessments studied were falls assessment, skin assessment, and Waterlow assessment. Hospital procedure manuals state that assessments must be completed for every patient within 8 hours of their admission to any ward. The assumption is that after using the dashboard, the average time to complete the risk assessments would be reduced, due to visibility and ease of access to the incomplete assessments provided by the dashboard in a semi-real time presentation.
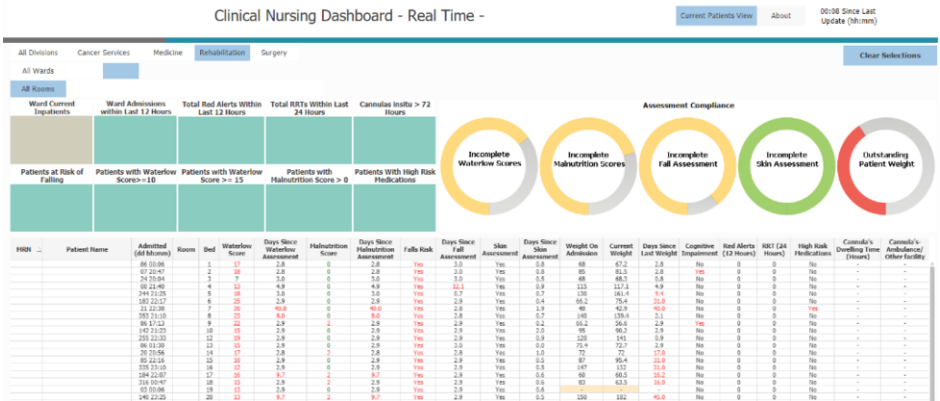

Figure 1. Clinical Nursing and Midwifery Dashboard (CNMD).

3. Results

We used the risk assessments data between December 2015 – October 2017 for "before go-live" calculations, while the period between January 2018 – August 2019 (data collection date) as the "After go-live" period. The number of assessments completed are balanced between the two periods as appear in Table 1. For example, we had 66,508 skin assessments completed prior to the CNMD implementation and 58,354 skin assessments post CNMD. The pre-CNMD numbers are slightly higher because the period included for the before go-live is 23 months, while the period after go-live is 19 months.

The results in Table 1 show that the average assessment completion time improved after the use of the dashboard, in addition to other metrics, such as the percentage of patients with assessment completed within 8 hours of admission, and the percentage of patients which have their assessment completed before discharge. In more details, the percentage of patients with skin assessments completed increased from 81.6% before dashboard implementation to 87.6% post implementation. Similarly, fall assessments completed increased from 69.6% to 76.7%, and Waterlow assessments completed increased from 58.5% to 68.8%. Similar trends also happened with the percentage compliance risk assessments, i.e. skin assessments compliance percentage increased

from 60.4% to 69.1%. Similar increases occurred on this metric for both fall assessments and Waterlow assessments from 54.3% to 60.8% and from 39.4% to 49.7%, respectively.

The average completion time for skin assessment dropped from 9.1 hours before the CNMD implementation to 6.5 hours post implementation. Similarly, fall assessment average completion time went down to 10 hours from 11.6, and for Waterlow assessment it went down to 14.5 hours from 20.8 hours. We conducted a 2-sample t-test which shows statistically significant decrease in the average assessment completion time after implementing the CNMD at MSH for all the three assessments; skin, falls, and Waterlow, see Table 1.

Table 1. Skin, all, and Waterlow assessments completion metrics for inpatients prior and post CNMD implementation.

Metric	Skin Assessments			Fall Assessments			Waterlow Assessments		
	Before Go-Live	After Go-Live	All	Before Go-Live	After Go-Live	All	Before Go-Live	After Go-Live	All
Number of patients with a completed assessment	66,508	58,354	131,519	56,935	51,213	113,875	47,642	45,815	99,083
Percentage of patients with completed assessment	81.6%	**87.6%**	84.5%	69.6%	**76.7%**	72.9%	58.5%	**68.8%**	63.7%
Percentage of patients with assessment completed within 8 hours of admission	60.4%	**69.1%**	64.5%	54.3%	**60.8%**	57.3%	39.4%	**49.7%**	44.6%
Average assessment completion time (Hours)	9.1	**6.5**	7.8	11.6	**10**	10.8	20.8	**14.5**	17.4
T-Test for the average assessment completion time (Hours)	Mean difference: 2.6 95% Confidence Interval (CI) (2.3609, 2.8391) P-Value = < .00001			Mean difference: 1.6 95% CI (1.1927, 2.0073) P-Value = < .00001			Mean difference: 6.3 95% CI (5.5642, 7.0358) P-Value = < .00001		

4. Discussion

The CNMD was designed to support NUMs/MUMs manage their workload and achieve several direct and indirect outcomes. The direct outcomes are intended consequences of nursing staff having access to the real-time clinical information presented in the dashboard. Indirect outcomes are expected as a result of changes to direct outcomes.

There are many ways to measure if the CNMD has achieved its goals, in this work, we decided to focus on evaluating some of the direct outcomes. We choose three metrics displayed on the dashboard and studied the metric trends before and after the CNMD implementations. The three metrics are average time to complete; skin, fall and Waterlow assessments. The three metrics are presented on the dashboard using gauges to show completion rate at ward level. Different colors are used for the gauges depending on the percentage of completed assessments, red for less than 50%, yellow for 50%-90%, and

green for larger than 90% completion rate. The gauges can be used to filter the list of patients to show patients with incomplete assessments. A key purpose of this was to reduce the need for nurses to search individual ieMR records, and hence, save time spent searching patients' records.

By presenting patient risk assessment information clearly and concisely on the dashboard, CNMD was expected to improve the time required to complete risk assessments for inpatients. From the evaluation conducted, we can see the evidence of significant reduction of average completion time for the three-risk assessment studied. The justification for this is easy access to information, visibility of incomplete tasks with color coding, ability to filter patients list for a specific risk assessment to see all incomplete, and visibility of completion rates for all wards within the facility Heading First paragraph.

5. Conclusion

In this project we implemented a state-wide clinical nursing and midwifery dashboard. The dashboard aimed to support NUMs/MUMs to manage their workloads and provide visibility on incomplete tasks for current inpatients. The dashboard also provides visibility on other indicators such as deteriorating patient alerts, IV cannulas, heparin and insulin infusions, and rapid response team requests.

The CNMD has been implemented in six Hospital and Health Services in 12 health facilities and has over 4600 clinical users overseeing over 3000 adult inpatients. When integrated into clinician workflows the evaluation of the dashboard metrics demonstrates significant improvement in the average time of completion for all the risk assessment required to be completed for inpatients after admission to wards. In future work, we plan to do an analysis of dashboard usage impact on a selection of patient outcomes.

Acknowledgement

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