EHR-integrated dashboards for deteriorating patients and oxygen therapy.

Daniel Melley[1], Baneen Alhmoud[1,2], Nadeem Khan[1]

Barts Health Trust, London, UK[1]
University College London, London, UK[2]

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I. Background:

Health care systems globally have been striving to provide the quality of care that has been drastically affected by the Covid pandemic. The escalating pressure has significantly raised the surge in deteriorating patients and ICU admissions. Nurses and physicians' assessment was affected; non-adherence to routine monitoring and recording in EHRs was apparent. As a result, misclassification of patients and poor allocation to critical occur, weakening the plan of care. Another significant dilemma is the continuous soaring demand for medical oxygen in many countries. Accordingly, WHO has established a COVID-19 Oxygen Emergency Plan for oxygen supply.
Nonetheless, less attention has been given to monitoring oxygen demand on the institutional scale. In Barts health trust, the demand was significantly evident by the shifts within the hospital structure, acceleration of the needs for staff, and the challenge of managing oxygen therapy. Recently, there has been a significant development in digitalising the healthcare system in the trust that led to profitable real-time dashboards. The Oxygen Therapy Dashboard is an EHR data-driven tool presenting the level and method of Oxygen Therapy administered. At the same time, a Deteriorating Patient's dashboard is created as an auditing tool for the completion and accuracy of assessment and escalation of deteriorating patients.

II. Objective:

To evaluate the performance of managing oxygen therapy and deteriorating patients by creating a real-time tracking dashboard; in a live and a historical performance tracking view; in Barts Health Trust.

III. Methodology

Design: Quality performance project evaluated using a before and after design.
The clinical informatics and quality improvement teams leads have developed the idea of the dashboard. The clinical informatics lead has created the design with a data analyst who identified the necessary metrics and data sources.
Data collection: Data was chosen based on the standard clinical practice and patients' needs in managing deterioration and oxygen therapy. For the development, data of around 1.2 million recordings of 110.000 admissions from August to October 2020 was extracted from the Datawarehouse of Barts trust hospitals, where information is pulled from electronic health records (Cerner). The metrics are indicators of the status of patients who needed escalation of care, like vital signs and sepsis scoring, and status of oxygen therapy, like the method of O2 administered, and time of entry and by whom. Post-development, data is pulled continuously until the present time.
Method: Dashboards were created using SQL by creating patients' tables and events' tables. Then, inpatients' stays were linked with the events table. Final views were developed using a QVD table in the Qlik Server. The performance for the deterioration dashboard is measured by the completion of the assessment, escalation of care, and sepsis treatment, and for the Oxygen dashboard by oxygen flow rate, FIO2 and oxygen therapy administered before and after implementation.
Analysis: Descriptive analysis was done for the dashboard. Data are presented in line and bar charts and tables. Validation of the views is conducted independently by a data analyst and an informatics specialist from the back and front ends for data validity. Measurement of performance is done before and after implementation.

IV. Results

Oxygen therapy and deteriorating patients' dashboards were implemented in May 2021 for Barts hospitals: St Bartholomew's, Royal London, Mile End, Whips Cross, and Newham hospitals. The Oxygen Dashboard provides an estimate and actual usage of O2 therapy (Figure1), while the

Deteriorating Patients' Dashboard shows the completion of vitals, NEWS2, sepsis assessment and treatment. The dashboards show the hospital, ward, and patients' levels with live and retrospective views for performance tracking. A significant improvement was observed in escalation and sepsis assessment completion from 79 and 21 assessments - per day on average - in April to 3.3k and 250 in September, respectively. Vital signs steadily improved from 66% in September 2019 to 84 -90% from June to October 2021. Doctors' sepsis assessment and treatment showed a significant increase then dropped (April:11 and 16, June: 60 and 45, and October: 5 and 7/day on average) respectively.

V. Discussion and conclusions.

This significant initiative was developed from EHRs, giving an excellent opportunity to use data for improvement. A notable improvement was detected, e.g. sepsis assessment, yet a deterioration was observed in doctors prescribing in EHR, concurrent with the implementation of EPMA. Regular surveillance using data is a substantial gain for healthcare quality - the quality of the data and the care provided. Further evaluation includes assessing the project outcomes in changing practice and patient outcomes using quantitative and qualitative methods.

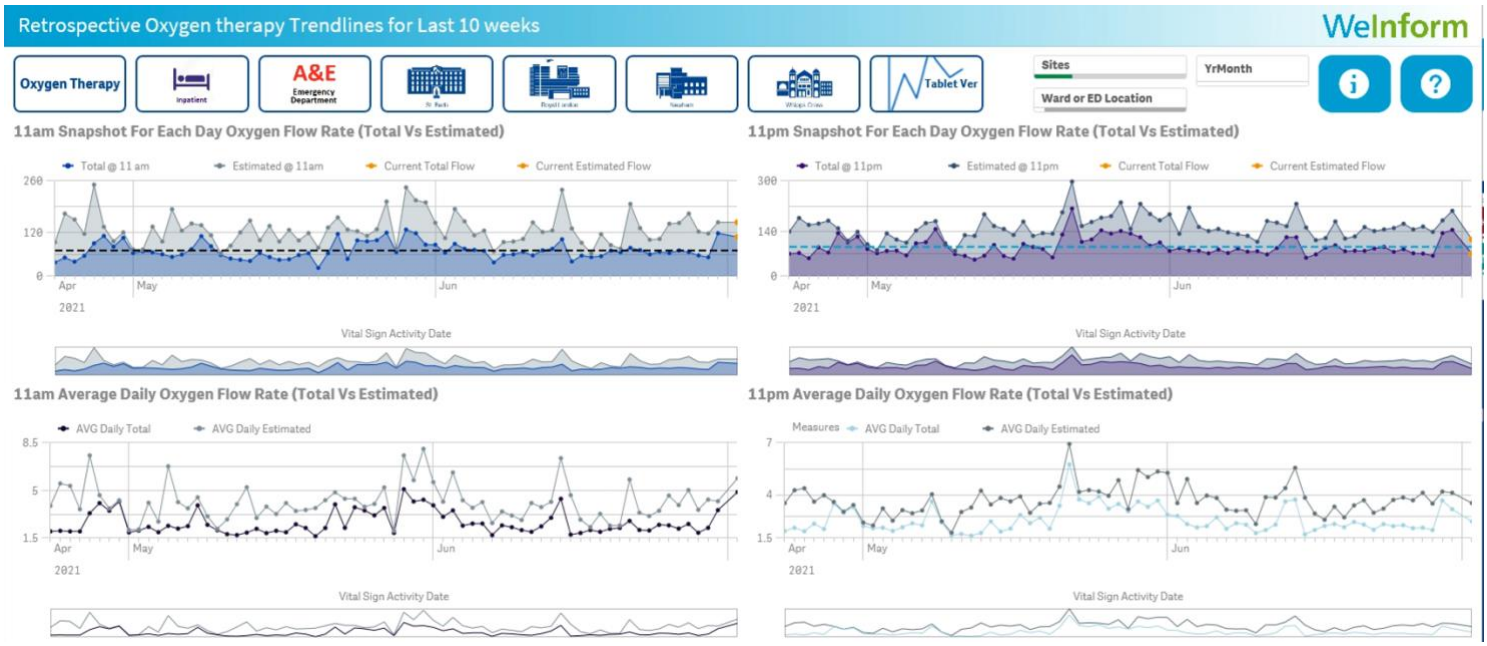

Figure 1: Retrospective oxygen therapy trendline view