8. Evaluating Predictive Analytics to Support Suicide-Risk Surveillance of CAMH Inpatients

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Background:
Suicide ranks among the most serious patient-safety concerns in mental-health care. At CAMH, the Suicide Prevention Expert Group (SPEG) sought to determine whether routinely collected inpatient data could support earlier recognition of patients whose suicide risk may be changing and inform future safety-surveillance tools.

Aim:
To evaluate whether routinely collected clinical and administrative data can identify patients at elevated short-term risk of suicidality-related incidents and to identify indicators suitable for operational monitoring and decision support.

Measures:
Model discrimination (AUROC), precision-recall performance, feature importance, and subgroup performance across demographic groups.

Equity:
Race, gender, sexual orientation/gender identity (SOGI), income, and homelessness were incorporated into the modelling framework, and model performance was examined across demographic subgroups.

Innovation:
We integrated data from multiple operational sources, including hospitalization attributes, diagnoses, suicide-risk assessments, Mental Status Examination (MSE), Dynamic Appraisal of Situational Aggression (DASA), sleep assessments, medication activity, and demographics. More than 50 candidate indicators were engineered, including measures capturing recent changes in patient status. Machine-learning methods were used to predict suicidality-related events within the subsequent 24 hours.

Results:
The model achieved an AUROC exceeding 0.80. However, because suicidality-related incidents were rare events, precision-recall performance remained insufficient to justify deployment as an automated alerting system. Dynamic MSE & DASA measures were among the strongest predictors, particularly indicators related to distress, impulsivity, reactive aggression, negative attitudes, and recent deterioration. Interactions involving personality-disorder diagnoses and antidepressant-related variables also contributed meaningfully. Many incidents occurred within the first 36 hours following admission (see Figure), underscoring transitions in care as a potentially important focus for future monitoring efforts.

Lessons Learned:
While routinely collected inpatient data contain clinically meaningful signals associated with imminent suicidality-related incidents, strong discrimination alone does not ensure operational usefulness in a low-prevalence setting as we see at CAMH. Secondly, dynamic clinical indicators were substantially more informative than demographic characteristics, suggesting that future surveillance efforts should focus on clinically actionable changes in patient status; and fortunately, recall remained relatively consistent across race and gender groups. Thirdly, our findings supported SPEG's ongoing explorations of dashboard-based surveillance and decision-support approaches designed to enhance situational awareness and strengthen patient-safety processes.