Psychosocial and medical predictors of psychiatric crisis: assessing relative risk of imminent emergency and inpatient care

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PURPOSE

Create a real-time predictive tool to help identify, triage, and connect with high-risk individuals before they enter acute care, increasing system capacity, improving client care, and saving money.

INFORMATION GATHERING

Examined risk modeling work conducted elsewhere | Spoke with staff stakeholders to gather feedback on what they saw as likely predictors | Reviewed existing literature | Reviewed what data was available to us

SIGNIFICANT VARIABLES

Multiple SPMI-level diagnoses

No recent mental health outpatient history

History of substance use

Week with 2+ crisis line calls

History of homelessness/housing instability

Receiving SSI for disability

Healthcare encounters with pain or respiratory issues as primary diagnosis

Focused on determining reliable indicators, not just causal factors--e.g., we don't expect calling the crisis line to prompt hospitalizations (hopefully), we theorize it as a tangible expression of the underlying issue that is putting someone at risk.

BUILDING THE ORIGINAL MODEL

Sample: Clients with SPMI and 1+ years of Medicaid coverage, all data between January 1, 2015 and June 30, 2017 → 13,158 clients, 11,222 acute care events

Data sources: Medicaid enrollment file; Medicaid claims; crisis line calls

Models: multiple-failure Cox survival analysis and logistic regression, both with demographic controls (sidebar).

Cox--fit data structure best (multiple events by large panel of people at different time intervals, including people that may not experience an event in the time studied but could in the future).

Logit--clustered by Medicaid ID, and compared to Cox. Due to similarity of output and ability to use post-estimation tests like LROC, chose to move forward with these results.

8 significantly predictive variables identified, with LROC of 0.85 (sidebar).

REVALIDATING WITH ALTERNATE SAMPLE

New sample: Clients with SPMI eligible for <1 year but more than 30 days; same time period → 3,380 members, 2,481 acute care events

Realistic scenario for "real life" application; frequently work with clients on whom we don't have much data. Used same logistic model with new data; results supported initial model (LROC of 0.86, highly similar coefficients and score/event distributions).

DEVELOPING THE SCORE

Used odds ratios from original model as formula to calculate risk score, scaled to range of 0 to 10. OR * 1 or 0 (presence/absence of covariate).

$$4.334528*\text{(multiple dx.)} + 2.928598*\text{(substance use hx.)} + 1.6967373*\text{(SSI)} + 1.687269*\text{(housing instability)} + 2.892232*\text{(2+ crisis line calls)} + 1.5464711*\text{(primary pain dx.)} + 1.606196*\text{(primary respiratory dx.)} + 4.518399*\text{(no recent outpatient hx.)} + 0.0372867 \text{ constant} = \text{raw risk score; raw score/2.124772} → \text{final risk score}$$

Reviewed results and potential applications with involved staff; gathered feedback for UX phase

AUTOMATION, VISUALIZATION, AND USER EXPERIENCE

Automated data linking and application of scoring mechanism to create a single dataset of all members and their current risk score, updated daily (SQL stored proc). Linked with other data sources and pushed to Tableau for an interactive dashboard of clients, risk scores, any open behavioral health treatment authorizations, demographics, and contact information.

REVALIDATION IN PRESENT DAY

Sample: Entire Medicaid population, regardless of behavioral health history; point-in-time as of May 15, 2018 → 175,194 members

Saved scores, tracked acute care over next 14, 30 days--similar results (LROC 0.84, 0.83). After removing kids, dropped (score not intended for children, and tend to low scores and have few events), but still within an acceptable range (LROC 0.76, 0.77).

IMPLEMENTATION

Current phase. Determining parameters for implementation study; presenting to management and staff in MHASD. Potential for additional variables to be added in the future.
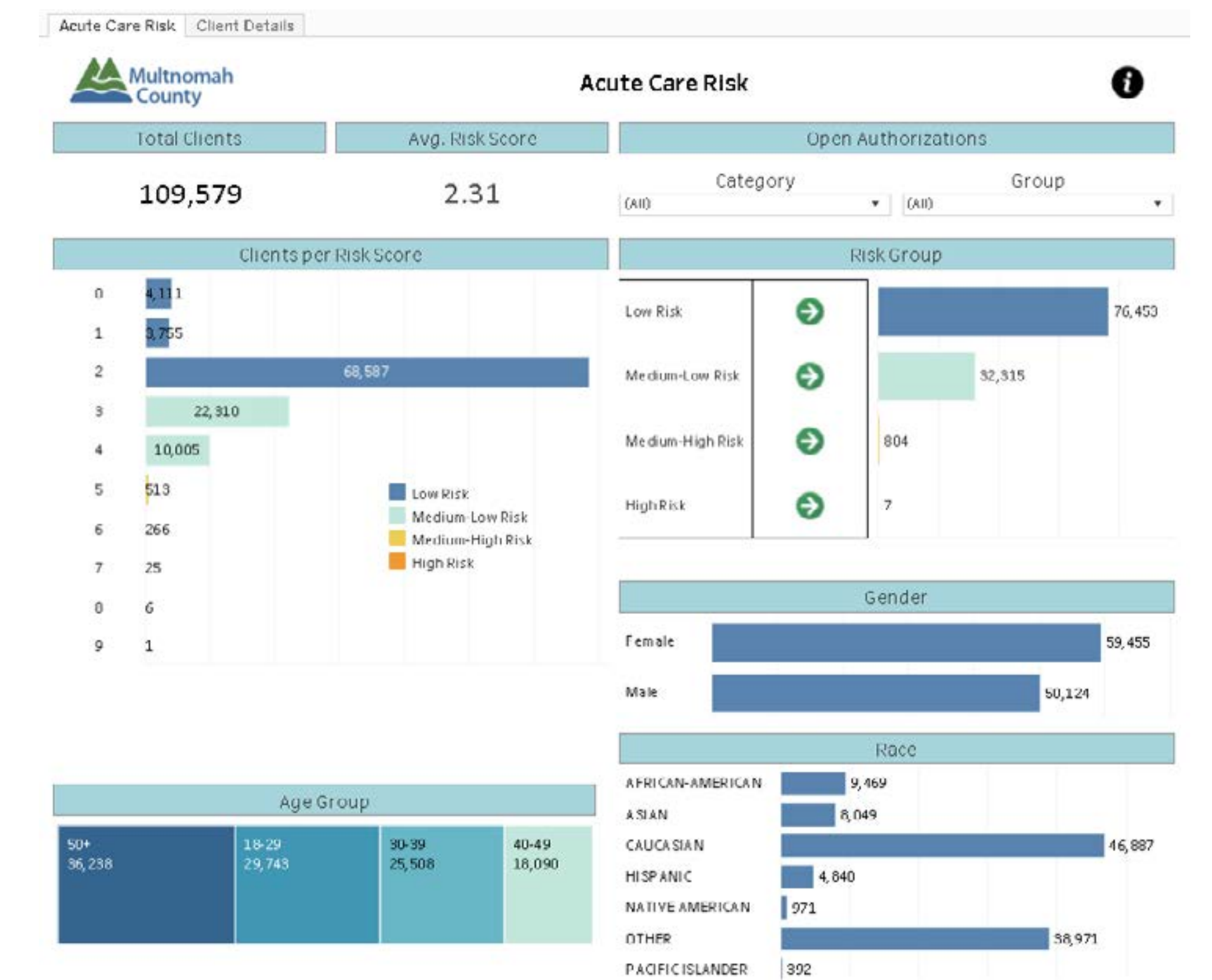
How did we define acute care?

PES (psychiatric emergency services; e.g. Unity), psychiatric hospitalizations, and ED visits attributed to mental health and/or substance use.

APPLYING AN EQUITY LENS

Controlled for race, age, sex, and primary language in original model, to minimize any disparities. Demographic results were not included in the score construction, however, to ensure that we were not privileging or disadvantaging one group over another.

Different demographic groups were tested to ensure that predicitve power held across demographics, both singly and in combination (e.g., Asians, 60+, non-English speakers, females...Asian females age 60+ who do not speak English). Predictive power held across all tested groups, with little variance.

"Jack" is a 30 year old white man who has a diagnosis of schizophrenia. He has visited the ED multiple times with complaints of pain, and has been known to heavily drink. He is involved in outpatient care, and has only called the crisis line once. He is on SSI, and lives in permanent supportive housing. His final risk score is 3, placing Jack in the medium-low risk category. 29.2% of those in the original SPMI-only sample with a score of 3 had an acute care event occur (median time to event: 132 days).

"Jill" is a 60 year old African-American woman with major depression and panic disorder, as noted by her primary care doctor. She has COPD and chronic pain, as noted in primary care visit claims. She does not use any substances. She has not been in outpatient care before, and called the crisis line three times this week. She is on SSI, and is temporarily staying at Bradley Angle. Her final risk score is 9, placing Jill in the high risk category. 93.9% of those in the original SPMI-only sample with a score of 9 had an acute care event occur (median time to event: 3 days).

Tableau dashboard

View list of clients and personal details, by filter criteria