Psychiatric hospitalization readmission risk:
Analysis of Multnomah Mental Health hospitalizations, 2012-2016
rev. March 2017

Executive summary

Using Medicaid claims data, 4,220 hospitalizations were examined for 2,549 patients over a four-plus year period. The goal was to examine the risk of patients readmitting within 30 days, and what statistically significant differences might exist between different hospitals, different diagnoses, and other relevant factors when considered together. The raw admission rate across all hospitalizations within 30 days of discharge was 11.1%, and 16.4% for readmissions within 60 days. The average hospital stay was 8.5 days, and the most common diagnostic category was depressive disorders. This updated version of the report includes analysis of specific types of outpatient services, stepping beyond a simple yes/no as to post-hospitalization outpatient engagement.

Using a Cox multiple-failure proportional hazards model, the relative impact of length of stay, outpatient services after discharge, diagnosis, hospital facility, and age was considered for 30 day readmission. While length of stay had a significant impact on reducing readmission risk, the level of that impact was very small. By comparison, a much larger impact was predicted for outpatient services—receiving at least one billable outpatient service after discharge reduced the likelihood of readmission in 30 days by 55.2% for those who had not been in services prior to their hospitalization, and by 31% for those who had been receiving services before their hospitalization. Of specific types of services, skills training, therapy/counseling, and basic assessments and office visits all predicted significant reductions in readmission risk when considering all other factors (including other services received), as did having greater numbers of encounters with outpatient services within that 30 days and receiving a more diverse array of service types. Bipolar and manic disorders was the highest diagnosis risk group for rehospitalization when accounting for all other variables; anxiety was the lowest risk group. OHSU had a significantly higher likelihood of readmission among local hospitals; Legacy Good Samaritan had a significantly lower likelihood. Finally, there was no significant difference between adult and child hospitalizations.

Full results

The following results were based on 4,220 unique psychiatric hospitalizations by 2,549 patients from February 1, 2012 to May 31, 2016.[1]

The core question: what impacts the risk of a patient readmitting within 30 days of discharge? (While raw counts are given for 60 day readmissions, the core focus of the following is on 30 day readmissions.)

Readmission into *any* hospital, not just the discharging hospital, was counted; e.g., a patient who left Legacy Emanuel and went to OHSU within 30 days would count as a readmission for Legacy. Thus, these numbers may differ from what hospitals track internally for readmissions.

Six major factors that could impact readmission were considered[2]:

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[1] Additional hospitalizations were considered for up to 60 days after May 31st, 2016, but only to ascertain whether hospitalizations ending previous to that had a readmission within the chosen timeframe. They were not included as "original" hospitalizations in this dataset, due to current inability to know whether readmissions occurred. The timely filing rule for claims allows 120 days for providers to submit; as of the initial time of this analysis, we were only guaranteed completed claims through early August 2016.

[2] The advantage of what's called a multivariate approach—looking at multiple variables' effect on an outcome at the same time—is that you can control for how the combination of variables may impact an outcome. For example, if one were to look just at hospital rates of readmission, one may conclude that a certain hospital has a much higher rate of readmission than the others. But if that hospital takes the most patients with a high-risk diagnosis, it may actually be more about the diagnosis than about the

- Length of stay in the hospital prior to discharge,
- Which hospital the patient was staying in,
- The patient's primary diagnosis,
- Whether any outpatient services occurred after discharge,
- What type of outpatient services were rendered and how frequently,
- Whether the patient was an adult or a child.

Results:
- Length of stay had a significant but small impact on the risk of readmission—each additional day spent in the hospital slightly reduced the likelihood of readmission.
- Patients coming out of OHSU were significantly more likely to readmit. Legacy Good Samaritan patients had a lower-than-average likelihood of readmission. Other hospitals were not significantly different from the overall average risk.
- Patients with bipolar/mania disorders were significantly more likely to readmit, whereas those with anxiety disorders were significantly less likely to readmit. Other diagnoses were not significantly different from the overall average risk.
- Participating in some type of outpatient service immediately after discharge had a strong impact on reducing risk, especially for those who had not been previously engaged.
- Of those outpatient services, skills training, therapy/counseling, and general assessments and office visits all significantly reduced risk.
- Receiving a more diverse array of services and receiving services more frequently both significantly reduced risk.
- There was no significant difference between adults and children.

The following tables show the specific impact of each factor. (If the result is listed as N/A, it means it was insignificant at the 90% confidence level—this characteristic didn't impact clients significantly differently than the overall average risk of readmission within this analysis. This doesn't mean that the variable in question had no impact—only that we cannot dismiss the possibility of it having occurred by chance.) The first table is the core model with which we began—length of stay, hospital, diagnosis, age, and a simple yes/no on whether outpatient services were received afterward.

RISK OF READMISSION WITHIN 30 DAYS

prob > chi2 = 0.0000

VARIABLE	IMPACT
Length of stay	Each additional day reduces risk by 2.1%

Hospital
    • Legacy Emanuel
    • Legacy Good Samaritan
    • OHSU
    • Portland Adventist
    • Providence Portland
    • Other hospitals (omitted)
	
	    • N/A
	    • 19.5% less likely to readmit
	    • 34.5% more likely to readmit
	    • N/A
	    • N/A

Diagnosis
    • Anxiety disorders
    • Bipolar/mania disorders
    • Depressive disorders
	
	    • 66.4% less likely to readmit
	    • 25.2% more likely to readmit
	    • N/A

hospital's care. Looking at both simultaneously allows us to control for both at the same time, "evening out" those types of differences to better understand what factors may truly have the greatest impact.

• Other mood disorders • Schizophrenia • Schizoaffective disorders • Other psychoses/psychotic disorders • Other disorders (omitted)	• N/A • N/A • N/A • N/A
New outpatient services within 30 days of discharge or prior to readmission	55.2% less likely to readmit
Renewed outpatient services within 30 days of discharge or prior to readmission	31% less likely to readmit
Adult vs. child	N/A

While this is very promising for the use of outpatient services to reduce the risk of readmission, there is much more information we can and should consider. Do any specific services help more than others? What about the combination or frequency of services?

We thus ran three additional versions of the model, looking specifically at:
1) Specific outpatient services received,
2) The number of types of services received (did they receive services from just one category, such as therapy, or more categories, such as therapy plus case management plus skills training?),
3) How often services were received (measured as unique days that clients had outpatient encounters; e.g., July 1 and July 5).

(For brevity's sake, the following tables omit the rest of the variables—hospital, diagnosis, etc.—but they were still included as control variables while each of the models were run, with very little variation in their effects from what was seen above.)

VARIABLE	IMPACT
Specific services (clients receiving at least 1 unit of X): • Case management • Medication support and training • Skills training • Therapy/counseling • Assessments, testing, and office visits for evaluation/management • Other services (all service types representing <5% of total outpatient services) (omitted) *We also stratified by returning clients vs. new clients. The effects remained very similar for each type of service, except that skills training for new clients became insignificant.*	• N/A • N/A • 39% less likely to readmit • 31.2% less likely to readmit • 46.7% less likely to readmit

Skills training, therapy/counseling, and even basic office visits for evaluation/management had significant impacts on reducing the risk of readmission, while controlling for all other factors (including the other types of services). The combination and duration of services should also be considered, however. For example, when testing medication support and training by itself, without other services, it showed a reduction in risk of readmission by 29.8%. But once the other services were included, that effect vanished, suggesting it was a proxy for the effects of those other services. (Only 2.3% of patients had medication support/training without any other type of service, lending validity to that argument.)

VARIABLE	IMPACT
Counts of service types received (e.g. just skills training, skills training plus therapy, skills training plus therapy plus case management, etc.)[3] • For returning clients • For new clients	 • Each additional service type received reduces risk by 18.2% • Each additional service type received reduces risk by 34%
Or, a more simple comparison of service types: • One or more service types in 30 days (baseline of receiving at least one service, for clients old and new) • Five or more service types in 30 days	 • 40.2% less likely to readmit • 71.6% less likely to readmit
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Total number of unique days clients received services • For returning clients • For new clients	 • Each day reduces risk by 10.8% • Each day reduces risk by 19.7%

Receiving a more diverse array of services appears to have substantial benefit in reducing risk of readmission, as does the more times a client can be seen during that 30 day period. New clients tended to not reach as high a count of service types received as returning clients—this could likely be attributed to the processes involved with initiating a new episode of care (e.g. assessment, deciding what services are appropriate, etc.), as well as potential access issues that can delay initial appointments. By comparison, returning clients may already be established with a number of different types of services. Regardless, receiving more types of services, at greater frequency, both have a positive impact on reducing readmissions.

Implications for practice

Paying extra attention to the highest risk diagnosis groups among current clients may help with targeting interventions—in these scenarios, clients with bipolar or manic disorders. While adding additional days in the hospital may reduce risk, the impact is consistently relatively small, at around 2% per day. A much higher return on investment appears to lie with outpatient services—someone who had not previously been in outpatient services for at least 30 days prior to hospitalization, who then had at least one assessment or therapeutic encounter within 30 days after discharge, was 55.2% less likely to readmit within 30 days. Even a patient who was previously engaged in services had a 31% lower risk of readmission if they were re-engaged. Paying attention to the types and frequency of services may also be key. The more diverse array of services that can be offered (where medically appropriate) and the more unique encounters with a client, the better the outcomes appear to be, with skills training and therapy/counseling being of especial benefit.

Summary data

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[3] *Service categories:*
- *Assessments, testing, and general evaluation/management office visits*
- *Case management*
- *Medication support*
- *Skills training*
- *Therapy/counseling*
- *Other (represents multiple service types, all less than 5% of total cases)*

The aggregate summary data can also be helpful to know. These numbers are *not* adjusted by other variables.

DATA POINT	NUMBER
Average hospitalizations per person	1.7
Average length of stay Median length of stay	8.5 days 5 days
30 day readmission rate	11.1%
60 day readmission rate	16.4%
Diagnoses among population: • Anxiety • Bipolar/mania disorders • Depressive disorders • Schizophrenia • Schizoaffective disorders • Other psychoses/psychotic disorders • Other mood disorders • Other mental health issues	 • 4.1% • 15.1% • 33.2% • 13.8% • 18.6% • 10.8% • 1.7% • 2.7%
Adult population | Child population	89.1% | 10.9%
Patients receiving new outpatient services after discharge	21.6%
Patients returning to outpatient services after discharge	37.5%
No outpatient services rendered after discharge	40.9%
30-day readmission rate by number of days outpatient services were received • Zero encounters • One encounter • Two to three encounters • Four to five encounters • Six to ten encounters • More than ten encounters	 • 14.1% • 15.1% • 9.8% • 7.1% • 5.9% • 3.7%

HOSPITAL	HOSPITALIZATIONS	READMISSION RATE (30 | 60)	AVERAGE LENGTH OF STAY (DAYS)
Legacy Emanuel	603	9.8% | 14.9%	9.7
Legacy Good Samaritan	733	10.1% | 16.6%	6.1
OHSU	322	14.6% | 19.3%	8.5
Portland Adventist	1387	11.8% | 17.4%	7.9
Providence Portland	780	10.1% | 15.1%	10.7
Other	395	11.1% | 15.2%	8.7

DIAGNOSIS	HOSPITALIZATIONS	READMISSION RATE (30 | 60)	AVERAGE LENGTH OF STAY (DAYS)

Anxiety	173	4% | 8.7%	5.3
Bipolar/mania disorders	639	12.7% | 18%	7.7
Depressive disorders	1403	10.5% | 15.9%	5.2
Other mood disorders	72	9.7% | 11.1%	8
Schizophrenia	581	11.2% | 16.7%	14.4
Schizoaffective disorders	783	11.5% | 18.3%	11.5
Other psychoses/psychotic disorders	455	13.6% | 18%	8.5
Other mental health issues	114	6.1% | 8.8%	7.9

Limitations

If a hospital kept a patient for longer than we authorized payment, we would not have that data. Thus, lengths of stay may be longer than they appear, and follow-up periods would also be impacted.

We cannot know for sure that a patient's first hospitalization in this dataset is truly their first hospitalization. These records only date back to January 2012; similarly, we do not know where a client may have been prior to enrollment in a Multnomah County Mental Health Medicaid plan (previously, Verity; now, Health Share). This could also impact the "look back" period for determining prior outpatient engagement. This is a rather small risk, however, considering that both renewed outpatient and new outpatient services both had positive impacts on reducing readmissions. A greater consideration is that we cannot know with certainty if someone who has their Medicaid enrollment terminated or switches CCOs have had further hospitalizations beyond those we can see. The short time period of analysis (30 to 60 days after) minimizes this risk, and initial matching to eligibility files further estimated that this risk is very small relative to the overall population, but it is a consideration.[4]

Future considerations

Adding in emergency department and non-psychiatric hospital admissions before and after psychiatric hospitalization would give an improved picture of what happens to patients after leaving the hospital and allow us to better assess additional risks.

While we have diagnoses, we lack information on ranges of severity within those diagnoses. Further refinement of the diagnosis code groupings could help with this (breaking down into more subgroups); alternatively, if we were able to match records to actual patient assessment data, we may be able to better define case severity in a meaningful way that will help us better assess this risk of readmission.

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[4] This is noted as "estimated" currently. Due to the complexity of the coverage data and competing eligibility records, a simplified method was employed where all eligibility records were collected and a client's range of eligible dates was computed from the minimum and maximum dates of coverage present in all record sets to determine an estimated impact. This method assumes continuous coverage between the earliest and latest coverage months. This is not uniformly true. Some clients have multiple lapses in coverage over time, from a few days to a few months. An initial rerun of the results, using truncated end dates in the rare cases where coverage appeared to end early after hospitalization, showed only minuscule deviations from the reported results that did not impact any interpretation or practical application. Continued work on improved matching of fully accurate eligibility date ranges to claims will be helpful to further tighten data and results, including the future truncation of time periods of analysis where necessary.

More work with the interactions of specific combinations of services—e.g., skills training plus therapy, or case management plus medication support, and so forth—could be enlightening.

Methods

Hospitalizations were identified using CPT codes for psychiatric hospital bed nights—RV114, RV124, RV134, RV154, RV204—in approved claims.

A Cox multi-failure proportional hazards model was used to analyze the results. This model analyzes the hazard of a specified event occurring within a certain time period—in this case, hospital readmission happening within 30 days. Each variable included in the model gives a hazard ratio, also interpreted as a percent risk, of the event happening.

Primary diagnoses were clustered into categories, and the top 5 most prevalent were selected for analysis while the rest were designated "Other." ("Other" constituted only 2.7% of cases.) If a patient had multiple primary diagnoses in the same visit—an anomaly, but which did occur—they were coded as "other." This represented only a few cases.

The five major hospital psychiatric units in the Multnomah County region were selected for individual analysis, and the rest were clustered into "Other." ("Other" constituted only 9.4% of cases, and included both hospitals from surrounding counties as well as across the Pacific Northwest region.)

Weighted effects coding, otherwise known as deviation coding, was utilized for both diagnoses and hospitals. This is an alternative for categorical data to dummy variables, which specify each variable's results in relation to a baseline group (e.g., every hospital's result would be compared to Legacy Emanuel as a baseline). Effects coding makes each result comparable to the average of *all* factors; e.g., Legacy Good Samaritan's risk is relative to the average risk of all other hospitals combined, OHSU's risk is relative to the average risk of all other hospitals combined, etc. It still dictates that one category must be omitted; for both diagnoses and hospitals, the "Other" categories were omitted, as these were the least likely to be of importance (being both small and very heterogeneous groupings). Using a weighted effects model took into account the different sizes of each category.

A client receiving outpatient services was defined as having an approved outpatient code billed between discharge and either the end of the 30 day period or readmission into another hospital stay, whichever came first. (E.g., if "Joe" readmitted to the hospital within 10 days, whether an outpatient encounter happened in those 10 days; if he did not readmit, if that encounter happened within the full 30 day period of interest.) These outpatient engagements were divided into two variables—outpatient encounters for those who had no recorded outpatient involvement in the 30 days prior to entering the hospital, and those who did have outpatient sessions recorded in the 30 days prior to their readmission (deemed more a resuming of care than initiation of care). For this expanded version, crisis intervention services were omitted as an outpatient service, given their high correlation with clients already at increased likelihood of readmission. All other outpatient services were considered, including programs like wraparound, ACT, and intensive outpatient or day treatment, as well as traditional outpatient office visits and therapy.