

Characterizing Oregon's Medicaid Super-Utilizers: Descriptive Analysis

OHSU CENTER FOR HEALTH SYSTEMS EFFECTIVENESS

FINAL REPORT

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Executive Summary

This work identifies a population of Oregon Medicaid patients with high needs (or “super-utilizers”) and compares their characteristics to the rest of the Medicaid population. The results of this descriptive analysis are then evaluated in order to inform subsequent statistical analyses.

Super-utilizer definitions

We identify nine groups of super-utilizers based on emergency department (ED) utilization, as described in the table below.

ED VISIT PATTERN	Traditional Medicaid Population		Medicaid Expansion Population (2014 only)
	Temporary (2013 only)	Persistent (2013 & 2014)	
4+ ED visits of any kind per year	Group 1	Group 4	Group 7
4+ avoidable ED visits per year	Group 2	Group 5	Group 8
4+ ED visits for mental health conditions per year	Group 3	Group 6	Group 9

Differences between super-utilizers and non-super-utilizers

- Super-utilizers defined by four or more ED visits of any kind, avoidable ED visits, and mental health ED visits had some common characteristics. For example, super-utilizers in general were younger, had worse physical and mental health status, and had higher baseline health service use compared to the rest of the Medicaid population.
- However, each group also had several distinguishing features. In particular, super-utilizers defined by mental health ED visits were a distinct group: they were more likely to be male, dual-eligible, and live in urban areas compared to the rest of the Medicaid population. As compared to other super-utilizer groups, they had slightly better physical health status.
- These patterns held for temporary, persistent, and expansion super-utilizers. However, they were more pronounced for those with persistent super-utilization.

Conclusions

We conclude that future statistical models that include persistent super-utilizers (group 4-6) may be the most informative. The pronounced differences between persistent super-utilizers and non-super-utilizers will likely yield stronger and more detectable associations. In addition, targeting patients with persistently high use offers the greatest opportunity to conserve resources and improve care.

Purpose

The goals of this report are to:

- 1 Define a population of patients with high needs (or “super-utilizers”) among Oregon Medicaid members for whom there are opportunities to improve care
- 2 Compare member characteristics of super-utilizers to those of non-super-utilizers, and
- 3 Guide future statistical modeling work.

Definitions of Super-Utilizers

No standard definition of super-utilization currently exists. Therefore, we draw on published literature and discussions with the Oregon Health Authority to define super-utilizers. Based on this background work, we opt to focus on super-utilization in the emergency department (ED) setting. High rates of ED use by Medicaid members have been a longstanding concern among policymakers. During 2011-2013, 9.6% of Oregon Medicaid members had four or more ED visits per year, compared to only 0.3% of privately insured enrollees.

When developing definitions of ED super-utilization, we consider the following four factors:

- 1 **The distinction between avoidable and unavoidable visits:** Patients with many avoidable ED visits are a clear target for interventions. We identify avoidable ED visits using an algorithm developed by Billings, Parikh and Mijanovich at New York University.² More details are provided in the Appendix.
- 2 **The role of mental health conditions on ED visits:** Medicaid members with mental health conditions incur higher health care costs than those without mental health conditions.^{3,4} In addition, Oregon Health Authority staff suggested that mental health issues may be an important factor in super-utilization. We therefore use the Billings algorithm to identify ED visits for mental health conditions.
- 3 **Sustained high utilization over time:** Members might frequently visit the ED only for a short period due to an unpredictable, temporary illness that subsequently improves over time. Therefore, interventions for patients who have persistently high ED utilization can differ from those with temporary episodes of high ED utilization.⁵ To address this concern, we separately examine members with temporarily versus persistently high ED use.
- 4 **The Medicaid expansion population:** ED utilization among the newly insured is a topic of interest for the Oregon Health Authority. The overwhelming majority of expansion members gained Medicaid coverage in 2014 due to changes in income eligibility under the Affordable Care Act. We analyze the Medicaid expansion population separately because Medicaid expansion members may have different characteristics from traditional Medicaid members and less historical data are available for expansion members than for traditional Medicaid members.

Based on these four factors, we identify nine groups of super-utilizers in Oregon. Table 1 shows the nine groups. We use four ED visits as a cutoff for super-utilizers because it was the most commonly used threshold to define frequent ED use in the literature.⁶ We define temporary super-utilizers as those who had a high number of ED visits in 2013, but not in 2014. We define persistent super-utilizers as patients who visited the ED frequently in both 2013 and 2014. A limitation of the temporary super-utilizers definition is that we do not consider ED visit patterns prior to 2013.

Note that columns are mutually exclusive; temporary, persistent, and expansion super-utilizers are completely distinct groups. However, not all rows are mutually exclusive; for example, members with 4+ avoidable ED visits per year and members with 4+ ED visits for mental health conditions per year are subgroups of members with 4+ ED visits of any kind per year.

TABLE 1. NINE DEFINITIONS OF SUPER-UTILIZERS

ED VISIT PATTERN	Traditional Medicaid Population		Medicaid Expansion Population (2014 only)
	Temporary (2013 only)	Persistent (2013 & 2014)	
4+ ED visits of any kind per year	Group 1	Group 4	Group 7
4+ avoidable ED visits per year	Group 2	Group 5	Group 8
4+ ED visits for mental health conditions per year	Group 3	Group 6	Group 9

Study Population and Data

We use 2012-2014 health care claims from the Oregon All Payers All Claims database and the Division of Medical Assistance Programs Medicaid database. We include all members enrolled in Oregon Medicaid, or Oregon Medicaid + Medicare (dual-eligibles). We exclude:

- Members younger than 18 years, because pediatric ED utilization is likely to be highly correlated with parent ED visit behaviors.
- Traditional Medicaid members who were enrolled for less than nine out of 12 months in each calendar year between 2012 to 2014. Therefore, our results might not be generalizable to Medicaid members who were temporarily enrolled in Medicaid. However, this restriction ensures that enough information is available to accurately assess super-utilization and baseline patient characteristics for each person in the study.
- Medicaid expansion members who were enrolled in coverage for less than six months during 2014. Because Medicaid enrollment for the expansion population occurred throughout 2014, the Medicaid expansion population was likely enrolled for a shorter period of time. For this reason, we require the expansion population to be enrolled in Medicaid for at least six out of 12 months, instead of nine out of 12 months, to be included in our analyses. Consequently, results are not directly comparable between the two groups and caution should be used in comparing results for Medicaid expansion and traditional Medicaid members. For example, Medicaid expansion members may appear relatively healthier than traditional members because less data is available for assessing the presence of health conditions.

Characterizing Super-Utilizer Populations

For the traditional Medicaid population, we first identify super-utilizer and non-super-utilizer members, based on 2013 and 2014 claims. We then describe baseline characteristics for these members in 2012. This approach allows us to describe the relationship between member characteristics during the baseline year and their future ED use. For the Medicaid expansion population, we assess both patient characteristics and ED use patterns during the same year (2014) because we do not have access to data for the expansion population prior to 2014.

We examine the following baseline member characteristics:

- Demographics: age, gender, race, and ethnicity
- Eligibility for Medicare (i.e., ‘dual’ eligibility).
- Neighborhood characteristics: rural or urban, proportion of residents living below the federal poverty level and proportion of residents with a college degree.
- Distance to the nearest ED.
- Health conditions: 16 physical health conditions, five mental health conditions, and Charlson Comorbidity Index, which estimates overall physical health.
- Health care utilization: inpatient admissions, primary care visits, mental health visits, ED visits, and long-term services and supports.

Additional details are provided in the Appendix. Because claims related to substance abuse have been censored from the All Payers All Claims database, our results underestimate the prevalence of mental health conditions.⁷

Results

We make two types of comparisons. First, we compare characteristics of each super-utilizer group to characteristics of members outside that group. Second, we also compare characteristics of the different super-utilizer groups to each other.

TEMPORARY SUPER-UTILIZERS IN TRADITIONAL MEDICAID (GROUPS 1-3)

Table 2 displays characteristics of temporary super-utilizers in traditional Medicaid (Groups 1-3). We found the following:

Comparison of super-utilizers to non-super-utilizers

- **Super-utilizers defined by any type of ED visit (Group 1)** were more likely to be female, and had worse physical and mental health status compared to non-super-utilizers. For example:
 - » Prevalence of chronic pulmonary disease was almost double among Group 1 super-utilizers compared to other Medicaid members (30.9% vs 16.5%).
 - » Prevalence of diabetes mellitus without chronic complications was higher among Group 1 super-utilizers compared to other Medicaid members (21.5% vs 14.1%)
 - » Prevalence of bipolar and depression disorders was higher among Group 1 super-utilizers compared to other Medicaid members (40.8% vs 23.9%)
 - » Prevalence of anxiety disorders was higher among Group 1 super-utilizers compared to other Medicaid members (34.4% vs 18.9%)

Group 1 super-utilizers also had higher baseline health service utilization (ED visits, inpatient admissions for both non-mental health and mental health conditions, primary care visits, outpatient mental health visits, and use of long-term services and supports).

- **Super-utilizers defined by avoidable ED visits (Group 2)** were also more likely to be female, and had worse physical and mental health status compared to non-super-utilizers. For example:
 - » Prevalence of chronic pulmonary disease was more than double among Group 2 super-utilizers compared to other Medicaid members (35.0% vs 16.8%).
 - » Prevalence of diabetes mellitus without chronic complications was higher among Group 2 super-utilizers compared to other Medicaid members (19.3% vs 14.3%)
 - » Prevalence of bipolar and depression disorders was higher among Group 2 super-utilizers compared to other Medicaid members (44.5% vs 24.3%)
 - » Prevalence of anxiety disorders was higher among Group 2 super-utilizers compared to other Medicaid members (42.9% vs 19.2%)

Group 2 super-utilizers also had higher baseline health service utilization compared to other Medicaid members.

- **Super-utilizers defined by mental health ED visits (Group 3)** were younger and substantially more likely to have mental health conditions compared to non-super-utilizers. For example:
 - » Prevalence of bipolar and depression disorders was more than double among Group 3 super-utilizers compared to other Medicaid members (67.5% vs 24.4%)
 - » Prevalence of anxiety disorder was tripled among Group 3 super-utilizers, compared to other Medicaid members (61.6% vs 19.3%).
 - » Prevalence of schizophrenia and other non-mood disorders was almost ten times greater among Group 3 super-utilizers compared to other Medicaid members (57.6% vs 5.8%)

Prevalence of chronic pulmonary disease was higher among Group 3 super-utilizers compared to other Medicaid members (26.2% vs 17.0%). Group 3 super-utilizers also had higher baseline use of health services compared to other Medicaid members.

Comparison of super-utilizer Groups 1, 2 and 3

- In contrast to Group 1 super-utilizers, Group 2 super-utilizers were younger and did not have higher use of long-term services and supports during the baseline year.
 - In contrast to Groups 1 and 2, Group 3 super-utilizers had slightly better overall physical health. However, some conditions were slightly more prevalent among Group 3 super-utilizers. For example:
 - » Mild liver disease was more prevalent among Group 3 super-utilizers (9.6%) than among Group 2 (8.1%) or Group 1 (7.7%) super-utilizers.
 - » Myocardial infarction was more prevalent among Group 3 super-utilizers (4.6%) than among Group 2 (3.9%) or Group 1 (3.3%) super-utilizers.
- Group 3 also had substantially higher rates of mental health conditions and was more likely to be male, dually eligible for Medicare, and live in an urban neighborhood.

PERSISTENT SUPER-UTILIZERS IN TRADITIONAL MEDICAID (GROUPS 4-6)

Table 3 displays characteristics of persistent super-utilizers in traditional Medicaid (Groups 4-6). We found the following:

Comparison of super-utilizers to non-super-utilizers

Differences between persistent super-utilizers and non-super-utilizers were similar to patterns observed for temporary super-utilizers. However, these patterns were more pronounced for persistent super-utilizers than they were for temporary super-utilizers.

SUPER-UTILIZERS IN THE MEDICAID EXPANSION POPULATION (GROUPS 7-9)

Table 4 includes results of a separate descriptive analysis for the Medicaid expansion population. We first restrict the sample to the Medicaid expansion population. We then compare member characteristics of each super-utilizer group (Groups 7-9) to members outside each group. We found the following:

Comparison of super-utilizers to non-super-utilizers

Table 4 includes results of a separate descriptive analysis for the Medicaid expansion population. We first restrict the sample to the Medicaid expansion population and then compare member characteristics of each super-utilizer group (Groups 7-9) to expansion members outside each group. We found the following differences between super-utilizers and non-super-utilizers:

In general, differences between super-utilizers and non-super-utilizers in the Medicaid expansion population followed similar patterns to differences found between super-utilizers and non-super-utilizers in the traditional Medicaid population.

Comparison of super-utilizer Groups 7, 8 and 9

Prevalence of mental health conditions was markedly higher among expansion super-utilizers defined by mental health ED visits (Group 9), compared to expansion super-utilizers defined by any type of ED visit or avoidable ED visits (Group 7 and 8). More than 90 percent of Group 9 super-utilizers had bipolar disorder/depression, anxiety disorder, and other psychiatric disorders.

Conclusions

Super-utilizers defined by four or more ED visits of any kind, avoidable ED visits, and mental health ED visits had some common characteristics. For example, super-utilizers in general were younger, had worse physical and mental health status, and had higher baseline health service use compared to the rest of the Medicaid population.

However, each group also had several distinguishing features. In particular, super-utilizers defined by mental health ED visits were a distinct group: they were more likely to be male, dual-eligible, and live in urban areas compared to the rest of the Medicaid population. In contrast to other super-utilizer groups, they had slightly better physical health status than others in Medicaid.

All of these patterns held for temporary, persistent, and expansion super-utilizers. However, differences between super-utilizers and other Medicaid members were generally more pronounced when

we examined persistent super-utilization rather than temporary super-utilization.

We recommend that super-utilizers, defined by any, avoidable, and mental health ED visits, be included in the next phase of this work, since each of these groups has unique characteristics that may be of interest to policymakers. We also recommend that the next phase of this work focus on persistent super-utilizers (Groups 4-6). The pronounced differences between persistent super-utilizers and the rest of the Medicaid population will likely lead to improved statistical models. In addition, persistent super-utilizers may be of more interest to policymakers since they have sustained high needs, and therefore provide a clear target for intervention.

TABLE 2: CHARACTERISTICS OF TEMPORARY SUPER-UTILIZERS IN TRADITIONAL MEDICAID POPULATION

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-Super-Utilizer	Super-Utilizer (Group1)	Non-super-Utilizer	Super-Utilizer (Group 2)	Non-super-Utilizer	Super-Utilizer (Group 3)
Age %						
18-49	62.9	64.4	62.8	74.8	62.9	70.2
50-64	23.6	22.6	23.6	18.1	23.6	26.5
65-74	7.2	6.2	7.2	3.4	7.1	2.6
75-84	4.2	4.6	4.2	2.4	4.2	0.7
85+	2.2	2.2	2.2	1.4	2.2	0.0
Female %	63.2	70.6	63.3	77.6	63.4	58.9
Race %						
White	76.3	78.9	76.3	78.6	76.4	78.8
Black	4.2	5.8	4.2	6.3	4.2	7.0
Asian	1.5	0.7	1.5	0.5	1.5	0.0
American Indian/Alaska Native	2.0	2.0	2.0	2.4	2.0	2.3
Native Hawaiian/Other Pacific Islander	0.8	0.7	0.8	0.3	0.8	0.7
Others	1.8	1.7	1.8	1.4	1.8	4.0
Unknown	13.5	10.2	13.4	10.5	13.4	7.3
Hispanic %	0.6	0.5	0.6	0.3	0.6	0.3
Eligible for Medicare %	24.2	26.6	24.3	20.5	24.3	37.1
Neighborhood Characteristics (by ZIP code)						
Urban Residence %	58.9	59.2	58.9	60.7	58.9	74.5
% of population below poverty, mean (SD)	12.0(5.5)	12.1(5.5)	12.0(5.5)	12.2(5.6)	12.0(5.5)	12.4(6.5)
% of population with college degree, mean (SD)	6.5(7.3)	6.6(7.9)	6.5(7.3)	6.5(7.9)	6.5(7.3)	9.7(11.4)
Distance to the nearest ED (miles), mean (SD)	11.3(10.4)	11.1(10.3)	11.3(10.4)	10.8(10.1)	11.3(10.4)	8.6(10.1)

TABLE 2: CHARACTERISTICS OF TEMPORARY SUPER-UTILIZERS IN TRADITIONAL MEDICAID POPULATION (CONTINUED)

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 1)	Non-super-Utilizer	Super-Utilizer (Group 2)	Non-super-Utilizer	Super-Utilizer (Group 3)
Charlson comorbidity index, mean (SD) (1-19)	0.8(1.5)	1.4(2.0)	0.8(1.5)	1.3(1.9)	0.8(1.5)	1.1(1.6)
Charlson comorbidities						
Myocardial infarction	1.2	3.3	1.3	3.9	1.3	4.6
Congestive heart failure	3.4	8.4	3.6	6.3	3.6	3.6
Peripheral vascular disease	2.9	5.7	3.0	4.5	3.0	1.7
Cerebrovascular disease	3.8	8.1	3.9	6.8	4.0	5.3
Dementia	0.9	1.1	0.9	0.5	0.9	0.7
Rheumatic disease	1.7	3.2	1.7	3.1	1.7	1.7
Peptic ulcer disease	0.7	1.5	0.7	1.6	0.7	2.0
Mild liver disease	4.6	7.7	4.7	8.1	4.7	9.6
Moderate or severe liver disease	0.4	0.8	0.4	0.6	0.4	0.7
Diabetes mellitus without chronic complications	14.1	21.5	14.3	19.3	14.4	16.2
Diabetes mellitus with chronic complications	4.5	8.9	4.6	7.2	4.7	7.6
Chronic pulmonary disease	16.5	30.9	16.8	35.0	17.0	26.2
Hemiplegia or paraplegia	2.3	3.8	2.4	3.6	2.4	1.3
Renal disease	3.3	6.6	3.4	5.8	3.4	5.3
Any malignant tumor	2.9	3.7	2.9	2.7	2.9	2.3
Metastatic solid tumor	0.4	0.5	0.4	0.5	0.4	0.3
Ettner behavioral health conditions						
Bipolar disorder/depression	23.9	40.8	24.3	44.5	24.4	67.5
Adjustment disorder	2.0	3.3	2.0	4.7	2.0	6.3
Anxiety disorder	18.9	34.4	19.2	42.9	19.3	61.6
Schizophrenia and other nonmood disorders	5.7	10.5	5.9	9.8	5.8	57.6
Other psychiatric disorders	20.5	33.7	20.8	36.4	20.9	63.2

TABLE 2: CHARACTERISTICS OF TEMPORARY SUPER-UTILIZERS IN TRADITIONAL MEDICAID POPULATION (CONTINUED)

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 1)	Non-super-Utilizer	Super-Utilizer (Group 2)	Non-super-Utilizer	Super-Utilizer (Group 3)
Baseline health care utilization						
Any ED visits %	37.3	79.3	38.3	90.8	38.7	78.5
# ED visits, if any, mean(SD)	2.4(3.0)	3.9(3.6)	2.4(2.9)	6.2(6.0)	2.5(2.9)	8.2(10.4)
Any hospitalizations %	14.7	29.4	15.0	33.6	15.2	29.8
# Hospitalizations, if any, mean(SD)	1.4(1.0)	1.7(1.4)	1.4(1.0)	2.0(1.8)	1.4(1.0)	2.3(2.9)
Any PCP visits %	52.9	64.8	53.1	67.5	53.3	67.5
# PCP visits, if any, mean(SD)	3.8(3.7)	5.3(5.0)	3.9(3.7)	5.9(5.5)	3.9(3.8)	5.2(5.6)
Any outpatient mental health visits %	25.7	40.2	26.1	44.4	26.2	82.5
# Outpatient mental health visits, if any, mean(SD)	9.2(18.4)	10.5(21.5)	9.3(18.5)	9.5(21.6)	9.2(18.3)	28.3(42.0)
Any hospitalizations for mental health condition %	1.1	4.1	1.2	3.8	1.2	30.5
# Hospitalizations for mental health condition, if any, mean(SD)	1.4(1.1)	1.5(1.1)	1.5(1.1)	1.5(1.3)	1.4(1.0)	1.9(1.5)
Any long-term care use %	11.7	18.2	11.9	13.2	11.9	11.6
Number of Observations	172,326	6,411	177,010	1,727	178,435	302
%	96.4	3.6	99.0	1.0	99.8	0.2

TABLE 3: CHARACTERISTICS OF PERSISTENT SUPER-UTILIZERS IN TRADITIONAL MEDICAID POPULATION

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 4)	Non-super-Utilizer	Super-Utilizer (Group 5)	Non-super-Utilizer	Super-Utilizer (Group 6)
Age %						
18-49	62.8	67.7	62.8	80.5	62.9	73.7
50-64	23.6	22.6	23.6	15.6	23.6	22.6
65-74	7.2	5.9	7.1	2.4	7.1	2.9
75-84	4.2	2.7	4.2	1.3	4.2	0.7
85+	2.2	1.1	2.2	0.2	2.2	0.0
Female %	63.1	72.5	63.3	81.3	63.4	56.2
Race %						
White	76.3	79.4	76.4	76.0	76.4	78.8
Black	4.2	6.4	4.2	7.4	4.2	9.5
Asian	1.5	0.3	1.5	0.1	1.5	0.0
American Indian/Alaska Native	2.0	2.1	2.0	2.6	2.0	2.2
Native Hawaiian/Other Pacific Islander	0.8	0.6	0.8	0.5	0.8	0.0
Others	1.8	1.9	1.8	1.6	1.8	3.6
Unknown	13.5	9.3	13.4	11.8	13.4	5.8
Hispanic %	0.6	0.3	0.6	0.4	0.6	0.7
Neighborhood Characteristics (by ZIP code)						
Urban residence %	58.9	61.2	58.9	61.8	58.9	79.6
% of population below poverty, mean (SD)	12.0(5.5)	12.1(5.4)	12.0(5.5)	11.9(5.2)	12.0(5.5)	11.8(6.8)
% of college graduate, mean (SD)	6.5(7.2)	7.4(9.1)	6.5(7.3)	7.3(9.0)	6.5(7.3)	12.3(13.8)
Eligible for Medicare (%)	24.2	27.4	24.3	20.3	24.3	40.1
Distance to the nearest ED (miles), mean (SD)	11.3(10.3)	10.8(10.5)	11.3(10.3)	10.8(11.6)	11.3(10.4)	7.4(9.5)

TABLE 3: CHARACTERISTICS OF PERSISTENT SUPER-UTILIZERS IN TRADITIONAL MEDICAID POPULATION (CONTINUED)

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 4)	Non-super-Utilizer	Super-Utilizer (Group 5)	Non-super-Utilizer	Super-Utilizer (Group 6)
Charlson comorbidity index, mean (SD) (1-19)	0.8(1.5)	1.8(2.2)	0.8(1.5)	1.6(2.0)	0.8(1.5)	1.0(1.5)
Charlson comorbidities						
Myocardial infarction	1.2	5.1	1.3	4.9	1.3	2.9
Congestive heart failure	3.4	10.9	3.6	5.4	3.6	3.6
Peripheral vascular disease	2.9	5.9	3.0	4.2	3.0	0.7
Cerebrovascular disease	3.8	8.4	4.0	6.1	4.0	5.8
Dementia	0.9	0.8	0.9	0.1	0.9	0.0
Rheumatic disease	1.7	3.4	1.7	3.3	1.7	0.7
Peptic ulcer disease	0.7	2.3	0.7	3.0	0.7	2.2
Mild liver disease	4.4	12.1	4.6	13.8	4.7	12.4
Moderate or severe liver disease	0.3	1.5	0.4	1.3	0.4	1.5
Diabetes mellitus without chronic complications	13.9	27.2	14.3	24.6	14.4	17.5
Diabetes mellitus with chronic complications	4.4	11.9	4.6	8.8	4.7	2.9
Moderate or severe liver disease	0.3	1.5	0.4	1.3	0.4	1.5
Hemiplegia or paraplegia	2.3	3.8	2.4	2.6	2.4	0.7
Renal disease	3.2	8.7	3.4	6.0	3.4	4.4
Any malignant tumor	2.9	4.3	2.9	3.7	2.9	2.2
Metastatic solid tumor	0.4	0.5	0.4	0.5	0.4	0.7
Ettner behavioral health conditions						
Bipolar disorder/depression	23.6	49.7	24.3	57.5	24.5	73.0
Adjustment disorder	2.0	4.6	2.0	5.8	2.0	8.8
Anxiety disorder	18.5	45.5	19.2	53.3	19.4	72.3
Schizophrenia and other nonmood disorders	5.6	14.1	5.9	14.6	5.9	67.2
Other psychiatric disorders	20.3	42.0	20.9	44.4	20.9	71.5

TABLE 3: CHARACTERISTICS OF PERSISTENT SUPER-UTILIZERS IN TRADITIONAL MEDICAID POPULATION (CONTINUED)

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 4)	Non-super-Utilizer	Super-Utilizer (Group 5)	Non-super-Utilizer	Super-Utilizer (Group 6)
Baseline health care utilization						
Any ED visits %	37.0	91.9	38.5	96.3	38.7	88.3
# ED visits, if any, mean(SD)	2.2(2.0)	6.8(7.1)	2.4(2.5)	11.6(11.4)	2.5(3.0)	11.6(12.7)
Any hospitalizations %	14.3	40.7	15.1	39.5	15.2	33.6
# Hospitalizations, if any, mean(SD)	1.4(0.9)	2.2(2.0)	1.4(1.0)	2.3(2.4)	1.4(1.1)	1.9(1.6)
Any PCP visits %	52.7	70.5	53.2	75.1	53.3	73.0
# PCP visits, if any, mean(SD)	3.8(3.6)	6.4(6.0)	3.9(3.7)	7.4(7.0)	3.9(3.8)	6.2(5.5)
Any outpatient mental health visits %	25.5	46.9	26.1	51.5	26.2	87.6
# Outpatient mental health visits, if any, mean(SD)	9.1(18.1)	12.8(24.5)	9.3(18.5)	12.3(20.3)	9.3(18.4)	34.3(50.1)
Any hospitalizations for mental health condition %	1.1	6.8	1.2	7.4	1.2	46.0
# Hospitalizations for mental health condition, if any, mean(SD)	1.4(0.9)	1.8(1.5)	1.4(1.0)	1.9(1.8)	1.4(1.0)	3.0(2.4)
Any long-term care use %	11.7	19.1	11.9	11.6	11.9	11.7
Number of Observations	172,828	5,909	177,803	934	178,600	137
%	96.7	3.3	99.5	0.5	99.9	0.1

TABLE 4: CHARACTERISTICS OF SUPER-UTILIZERS IN MEDICAID EXPANSION POPULATION

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 7)	Non-super-Utilizer	Super-Utilizer (Group 8)	Non-super-Utilizer	Super-Utilizer (Group 9)
Age %						
18-49	72.5	81.0	72.7	87.1	72.8	86.0
50-64	26.8	18.6	26.5	12.7	26.4	13.6
65-74	0.7	0.4	0.7	0.1	0.7	0.4
75-84	0.0	0.0	0.0	0.0	0.0	0.0
85+	0.0	0.0	0.0	0.0	0.0	0.0
Female %	52.6	57.4	52.6	67.2	52.8	44.8
Race %						
White	68.8	76.8	69	76	69.1	79.6
Black	2.8	4.2	2.8	4.6	2.8	5.1
Asian	0.3	0.1	0.3	0.0	0.3	0.0
American Indian/Alaska Native	1.1	1.9	1.2	2.1	1.2	1.1
Native Hawaiian/Other Pacific Islander	0.3	0.2	0.3	0.2	0.3	0.4
Others	1.5	1	1.5	0.9	1.5	1.3
Unknown	25.2	15.8	24.9	16.3	24.8	12.5
Hispanic %	0.7	0.4	0.7	0.2	0.7	1.3
Neighborhood Characteristics (by ZIP code)						
Urban %	60.6	60.6	60.6	59.6	60.5	80.5
% of population below poverty, mean (SD)	11.4(5.3)	11.8(5.3)	11.4(5.3)	11.6(5.1)	11.4(5.3)	11.4(5.8)
% of college graduate, mean (SD)	7.1(7.7)	7.4(9.3)	7.1(7.8)	6.9(8.5)	7.1(7.8)	12.6(14.0)
Eligible for Medicare (%)	1.4	2.2	1.5	1.5	1.5	4.5
Distance to the nearest ED (miles), mean (SD)	11.0(10.0)	10.8(10.3)	11.0(10.0)	11.0(10.9)	11.0(10.0)	7.0(7.9)

TABLE 4: CHARACTERISTICS OF SUPER-UTILIZERS IN MEDICAID EXPANSION POPULATION (CONTINUED)

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 7)	Non-super-Utilizer	Super-Utilizer (Group 8)	Non-super-Utilizer	Super-Utilizer (Group 9)
Charlson comorbidity index, mean (SD) (1-19)	0.3(0.9)	1.2(1.8)	0.3(1.0)	1.1(1.6)	0.4(1.0)	0.8(1.4)
Charlson comorbidities						
Myocardial infarction	0.6	3.5	0.7	2.6	0.7	2.1
Congestive heart failure	0.8	4.3	0.9	2.7	0.9	2.8
Peripheral vascular disease	0.7	2.5	0.8	1.9	0.8	1.1
Cerebrovascular disease	0.9	4.6	1.0	5.5	1.1	4.7
Dementia	0.0	0.1	0.0	0.1	0.0	0.4
Rheumatic disease	0.7	1.9	0.7	2.4	0.7	1.3
Peptic ulcer disease	0.3	2.4	0.4	2.3	0.4	0.8
Mild liver disease	2.8	14	3.2	12.0	3.3	13.2
Moderate or severe liver disease	0.2	1.9	0.3	0.6	0.3	0.8
Diabetes mellitus without chronic complications	6.3	13.5	6.6	13.2	6.6	8.1
Diabetes mellitus with chronic complications	1.4	4.5	1.5	4.2	1.5	3.2
Chronic pulmonary disease	9.4	34.5	10.2	40.7	10.5	30.4
Hemiplegia or paraplegia	0.2	1	0.2	1.1	0.2	0.4
Renal disease	0.7	3.5	0.8	2.5	0.8	1.5
Any malignant tumor	1.4	3.4	1.4	2.9	1.5	2.5
Metastatic solid tumor	0.2	1.1	0.3	0.6	0.3	0.2
Ettner behavioral health conditions						
Bipolar disorder/depression	15.7	47.4	16.8	50.3	17.0	94.1
Adjustment disorder	1.6	4.8	1.7	5.6	1.7	16.8
Anxiety disorder	13.7	49.4	14.8	53.7	15.1	91.5
Schizophrenia and other nonmood disorders	1.0	10.0	1.3	8.5	1.3	65.8
Other psychiatric disorders	18.5	54.6	19.7	57.5	20.0	95.8

TABLE 4: CHARACTERISTICS OF SUPER-UTILIZERS IN MEDICAID EXPANSION POPULATION (CONTINUED)

	All ED visits		Avoidable ED visits		Mental Health ED visits	
	Non-super-Utilizer	Super-Utilizer (Group 7)	Non-super-Utilizer	Super-Utilizer (Group 8)	Non-super-Utilizer	Super-Utilizer (Group 9)
Health Service Utilization in 2014						
Any hospitalizations %	6.1	35.1	7.2	28.9	7.3	43.9
# Hospitalizations, if any, mean(SD)	1.2(0.5)	1.9(1.5)	1.3(0.8)	2.0(1.8)	1.3(0.9)	1.9(1.4)
Any PCP visits %	41.2	65	42	70.3	42.2	66.5
# PCP visits, if any, mean(SD)	2.9(2.6)	4.9(4.5)	3.0(2.8)	5.5(5.2)	3.1(2.8)	4.8(4.4)
Any outpatient mental health visits %	18.8	48.9	19.8	50.6	20.0	94.1
# Outpatient mental health visits, if any, mean(SD)	6.1(8.7)	8.4(12.0)	6.3(9.1)	8.5(12.3)	6.2(8.9)	21.1(24.1)
Any hospitalizations for mental health condition %	0.6	10.4	1.0	6.8	0.9	74.3
# Hospitalizations for mental health condition, if any, mean(SD)	1.1(0.4)	1.6(1.1)	1.3(0.8)	1.8(1.3)	1.2(0.7)	2.3(1.6)
Any long-term care use %	0.3	2.2	0.3	1.3	0.3	1.1
Number of Observations	364,992	16,290	377,792	3,490	380,811	471
%	95.7	4.3	99.1	0.9	99.9	0.1

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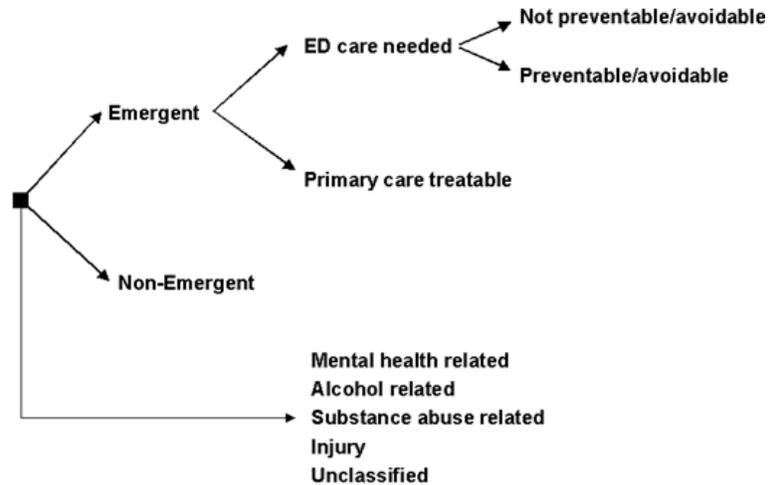
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Appendix

BILLINGS ALGORITHM

As seen in Figure 1, the algorithm calculates probabilities for four types of ED visits based on the documented types of primary diagnosis: non-emergent; emergent yet primary care treatable; emergent and ED care needed yet preventable; and emergent and ED care needed and not preventable. We define a visit as avoidable if the sum of the probabilities of the last two categories (emergent and ED care needed yet preventable; emergent and ED care needed and not preventable) is less than 0.25, which is an approach validated in other studies.⁸⁻¹¹ In addition to four types of ED visits, the algorithm of Billings et al. also classifies ED visits related to mental health conditions.

FIGURE 1. BILLINGS EMERGENCY DEPARTMENT VISIT CLASSIFICATION



MEMBER CHARACTERISTICS

We compare patient characteristics between super-utilizers and non-super-utilizers. In particular, we examine patients' demographics, neighborhood characteristics, health conditions, insurance coverage status, health service utilization, and distance to the nearest ED.

- Patient demographics include age (18-49, 50-64, 65-74, 75-84, and 85+), gender, race (White, Black, Asian, Hawaiian & Pacific Islanders, American Indian/Alaska Natives, and others), and ethnicity (Hispanic or non-Hispanic).
- Neighborhood characteristics include rurality (as assigned by the Oregon Office of Rural Health), percentage of the population living below the poverty level, and percentage of the population who are college graduates (extracted from the 2007-2011 American Community Survey), all based on ZIP code of residence.
- Health conditions include a modified version of the Charlson comorbidity index. The modified comorbidity index excludes human immunodeficiency virus and AIDS because the APAC database does not include those conditions.¹³ We also include each member's mental health conditions, as defined by the Ettner classification system. Mental health condition categories include: bipolar disorder, major depression, or dysthymia or other depression; adjustment disorder; anxiety disorder; schizophrenia or other non-mood disorder; and other (including disorders originating in childhood, personality disorder, and other miscellaneous mental health conditions).
- Insurance coverage status includes each member's eligibility for Medicare.
- Health service utilization include frequency of ED visits, inpatient admission, primary care visits, mental health visits, and any use of long-term services and supports including personal care, group home care, foster care, and nursing home care.
- Distance of the nearest ED is the distance between residence and the nearest ED in miles, using ZIP codes.