

# Forensic Risk Modeling in the Medicaid Population

**Alice Huber, PhD and David Mancuso, PhD**

DSHS Facilities, Finance and Analytics Administration, Research and Data Analysis Division

**October 18, 2018**

# Overview

- **Proviso language**
- **Overlap between forensic and Medicaid populations**
- **Predictive model development**
- **Modeling results**
- **Data and delivery system implications**
- **Discussion**

# Proviso Language

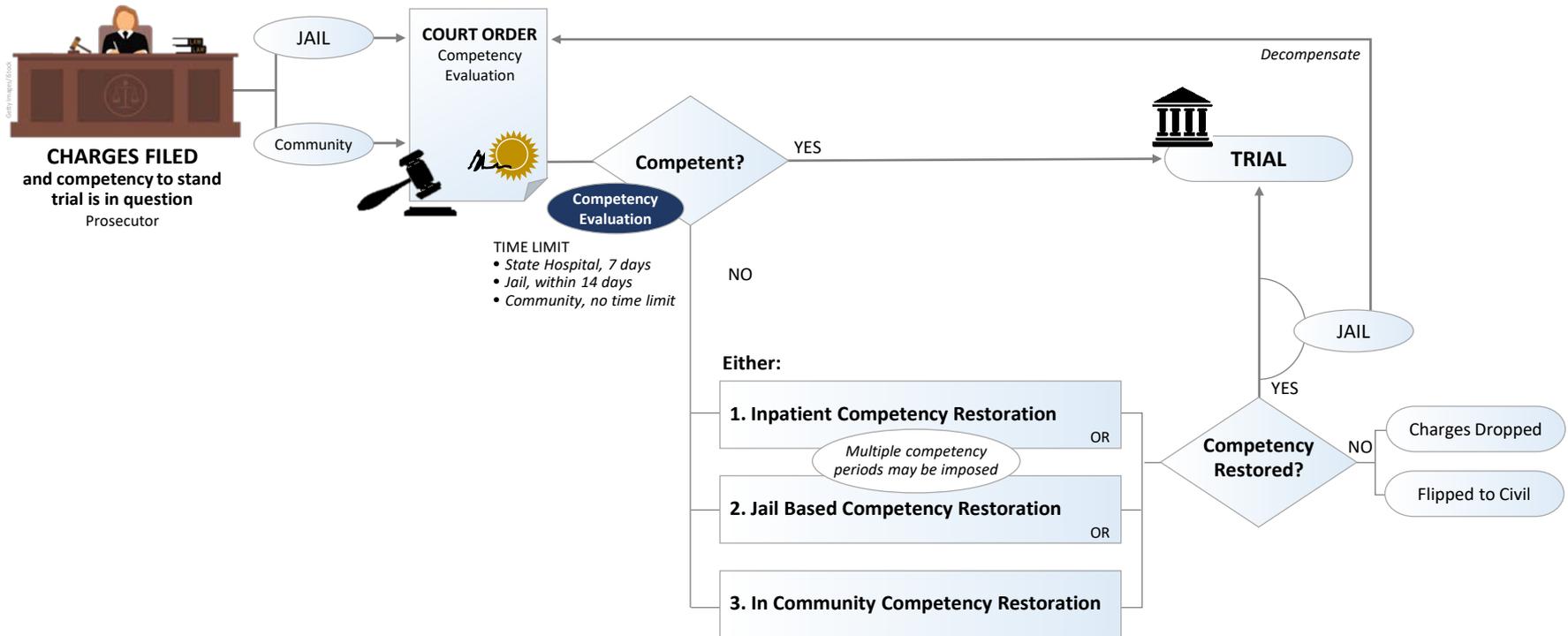
\$250,000 of the general fund—state appropriation for fiscal year 2019 is provided solely for the department, in collaboration with the health care authority, to develop and implement a predictive modeling tool which identifies clients who are at high risk of future involvement with the criminal justice system and for developing a model to estimate demand for civil and forensic state hospital bed needs pursuant to the following requirements.

## Proviso Language *(continued)*

(i) The predictive modeling tool must be developed to leverage data from a variety of sources and identify factors that are strongly associated with future criminal justice involvement. By December 1, 2018, the department must submit a report to the office of financial management and the appropriate committees of the legislature which describes the following:

- (A) The proposed data sources to be used in the predictive model and how privacy issues will be addressed;
- (B) modeling results including a description of measurable factors most strongly predictive of risk of future criminal justice involvement;
- (C) an assessment of the accuracy, timeliness, and potential effectiveness of the tool;
- (D) identification of interventions and strategies that can be effective in reducing future criminal justice involvement of high risk patients; and
- (E) the timeline for implementing processes to provide monthly lists of high-risk client to contracted managed care organizations and behavioral health organizations.

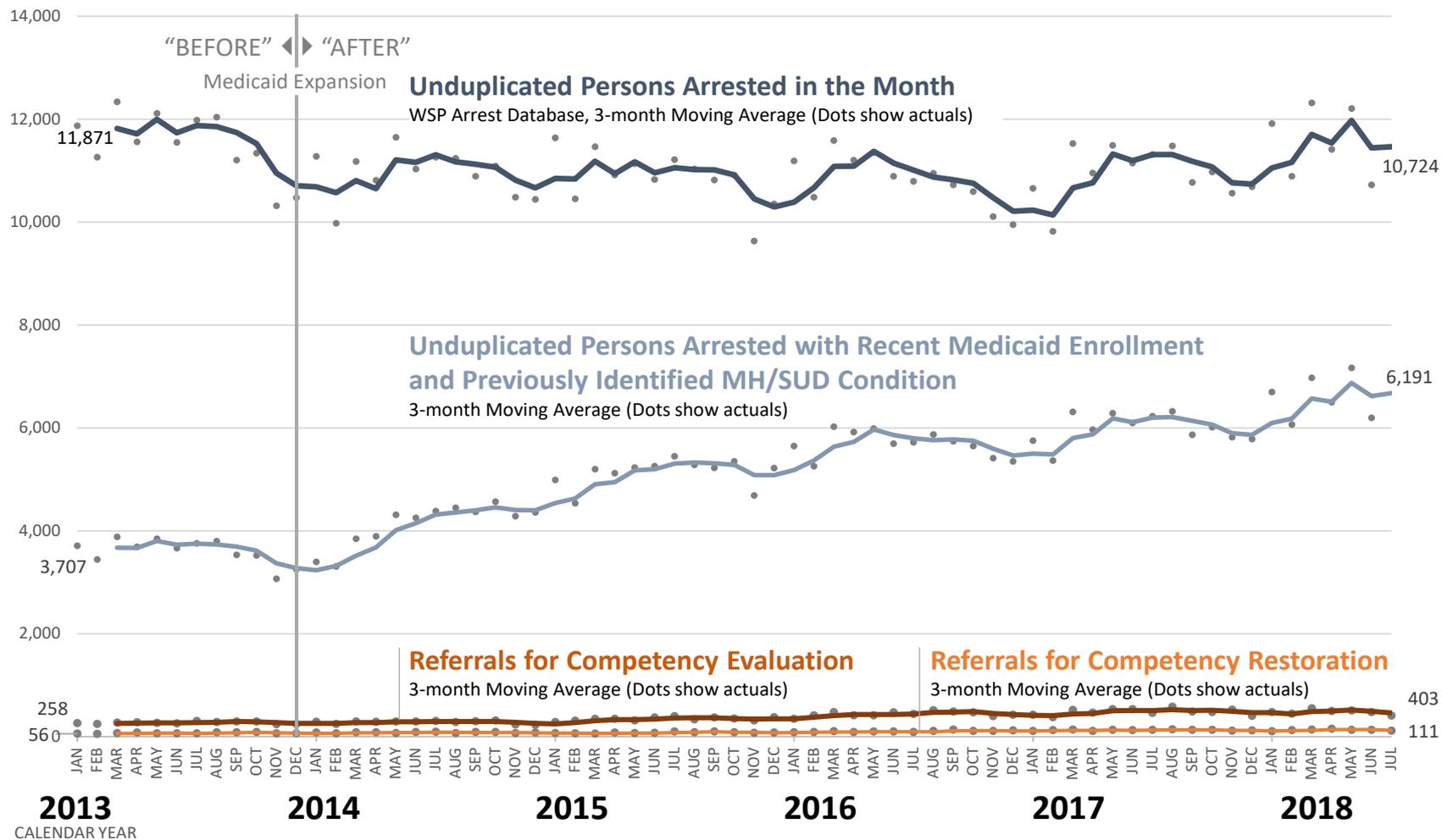
# Competency Evaluation/Restoration Pathway



Legal Authority: Revised Code of Washington 10.77.

# Trend in Arrests and Competency Evaluation/Restoration

Washington State



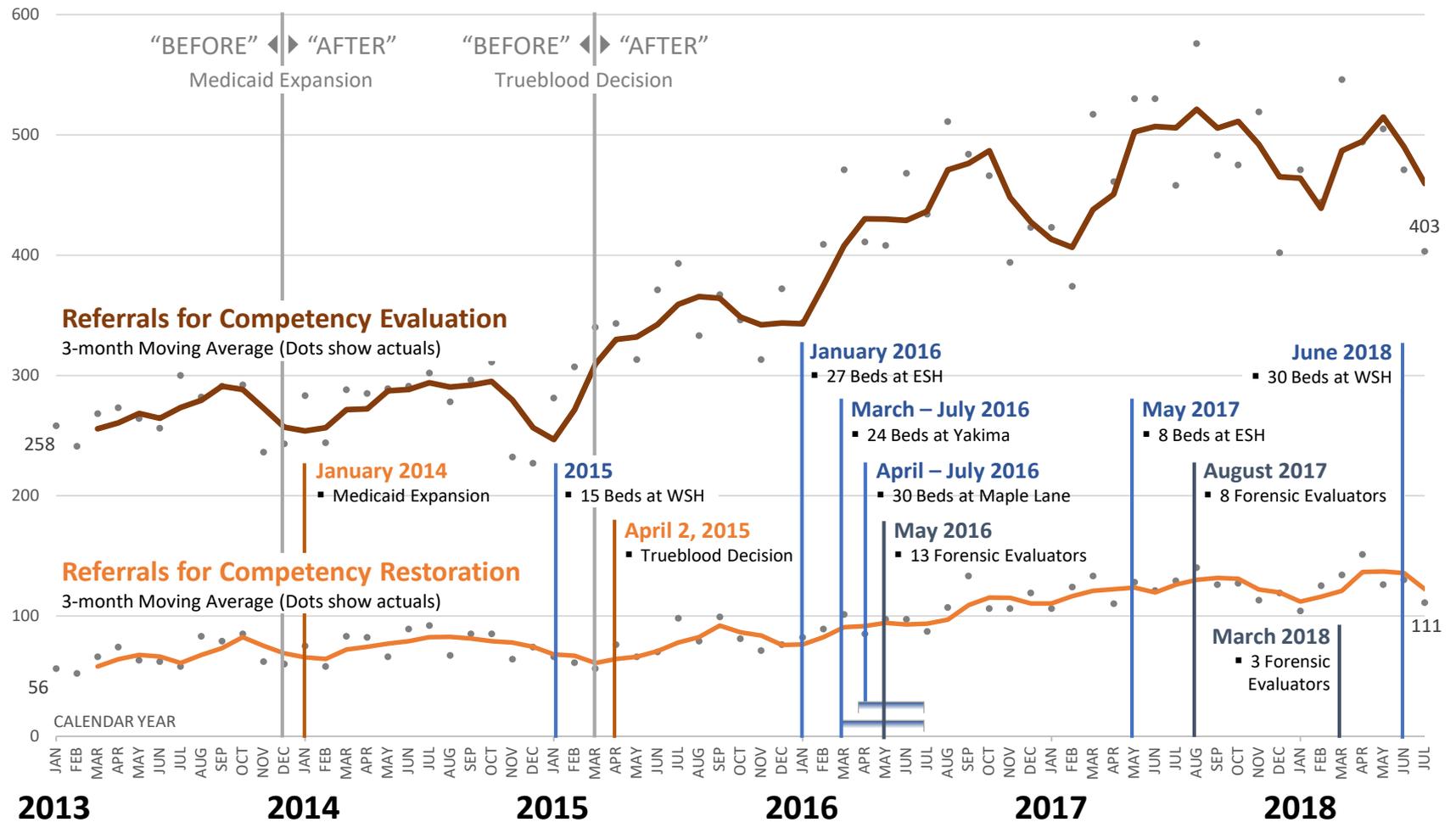
**NOTES:** 1. Total Competency evaluation referrals includes jail, inpatients, and personal recognizance (PR) based competency evaluations. The data also includes Pierce County Evaluation Panel data from January 2016 to July 2018. 2. Total Competency restoration referrals includes inpatient admissions to state hospitals and other competency restorations facilities.

**DATA SOURCES:** DSHS Research and Data Analysis Division, Client Outcomes Database and Washington State Patrol Arrest Database, FES modules in Cache database(WSH), MILO database(ESH), Pierce County, October 2018.



# Competency Evaluation/Restoration Referrals in a Policy Context

Washington State



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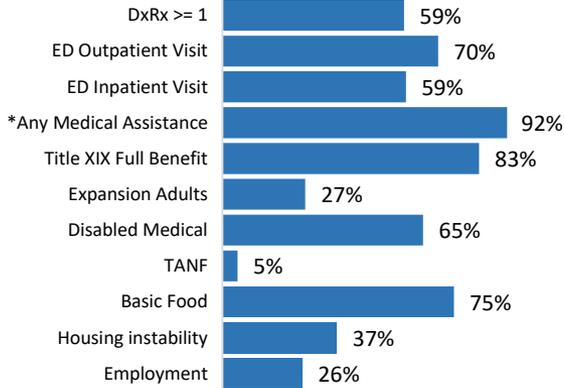
# SH Patients CY 2016: Medical and Social Service Utilization

ADMISSIONS

## CIVIL PATIENTS ONLY

### Baseline (5 Years Pre-Admission)

TOTAL = 694

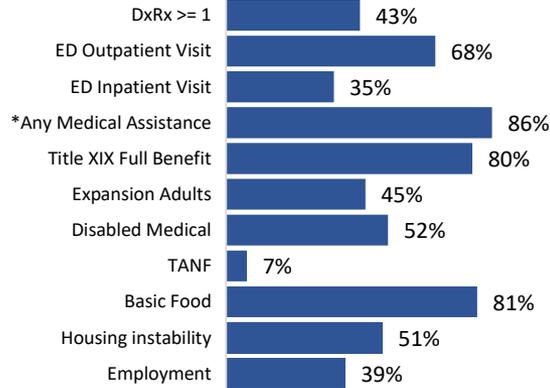


\* Any Medical Assistance means any category.

## FORENSIC PATIENTS, ANY TYPE

### Baseline (5 Years Pre-Admission)

TOTAL = 967

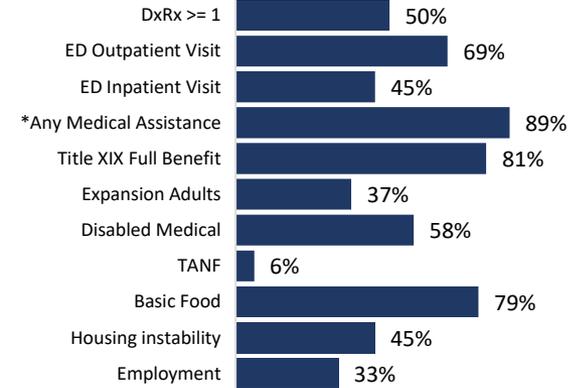


\* Any Medical Assistance means any category.

## ALL STATE HOSPITAL PATIENTS

### Baseline (5 Years Pre-Admission)

TOTAL = 1,661

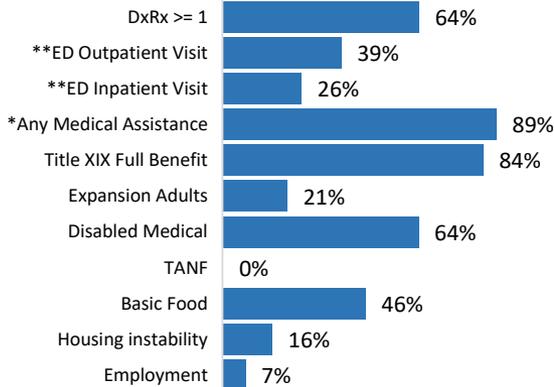


\* Any Medical Assistance means any category.

DISCHARGES

## After (12 Months Post Discharge)

TOTAL = 722

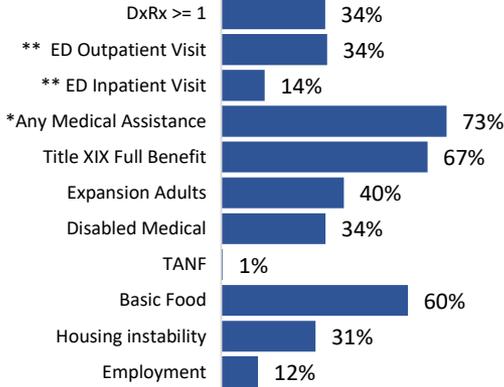


\* Any Medical Assistance means any category.

\*\*ED data is incomplete September – December 2017.

## After (12 Months Post Discharge)

TOTAL = 929

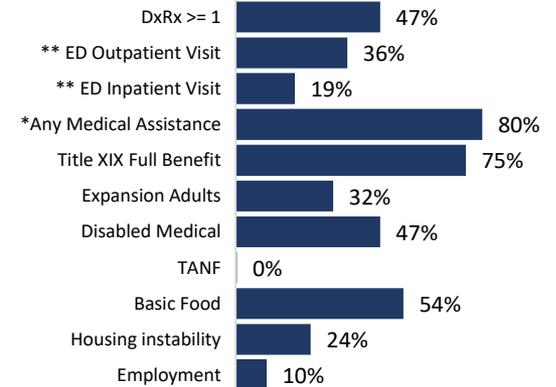


\* Any Medical Assistance means any category.

\*\*ED data is incomplete September – December 2017.

## After (12 Months Post Discharge)

TOTAL = 1,651



\* Any Medical Assistance means any category.

\*\*ED data is incomplete September – December 2017.

# Predictive Model Development

- **Target outcome: person is referred for a competency evaluation in next 6 months**
- **Target population: Medicaid enrollees**
- **Model calibrated using Medicaid coverage months from January 2015 to December 2016**
- **Predictive accuracy assessed using first 10 months of CY 2017**
- **Machine learning used to identify impactful predictors**
- **Model structured for dynamic risk scoring:**
  - Unit of observation: Medicaid coverage month
  - Risk factors structured by recency to the coverage month
  - Outcomes measured over the following 6 months

# Prior Risk Indicators Considered in the Model and Outcomes Over Time

## PRE-PERIOD RISK INDICATORS EXAMINED

60 months with stratification of events based on recency

## POST-PERIOD OUTCOMES

6 month follow-up

  
**INDEX  
MONTH**

- Forensic evaluation referrals
- Arrests
- Convictions
- DOC incarceration
- Psychiatric hospitalizations (community psych, E&T, state hospitals)
- Volume of prior OP mental health services
- Mental illness diagnosis
- Substance use disorder diagnosis
- Homelessness and housing instability
- Receipt of LTSS or DD services
- Use of Basic Food
- Involvement in child welfare system
- Involved with child support services
- Earnings history
- Demographics: age, gender, race/ethnicity

- **Competency evaluation referral**
- Arrest
- Psychiatric hospitalization
- Mental health crisis services
- Homelessness
- Death



# Predictive Accuracy and Outcome Means

Calendar Year 2017 (First 10 months)

## Predictive Accuracy of Testing Sample by Decile

Decile	Observations	% With Forensic Evaluation in next 6 months
1	760,910	0.01%
2	566,565	0.03%
3	1,550,852	0.02%
4	587,933	0.01%
5	679,674	0.05%
6	980,712	0.04%
7	336,197	0.06%
8	1,128,577	0.05%
9	964,303	0.10%
10	827,865	0.85%

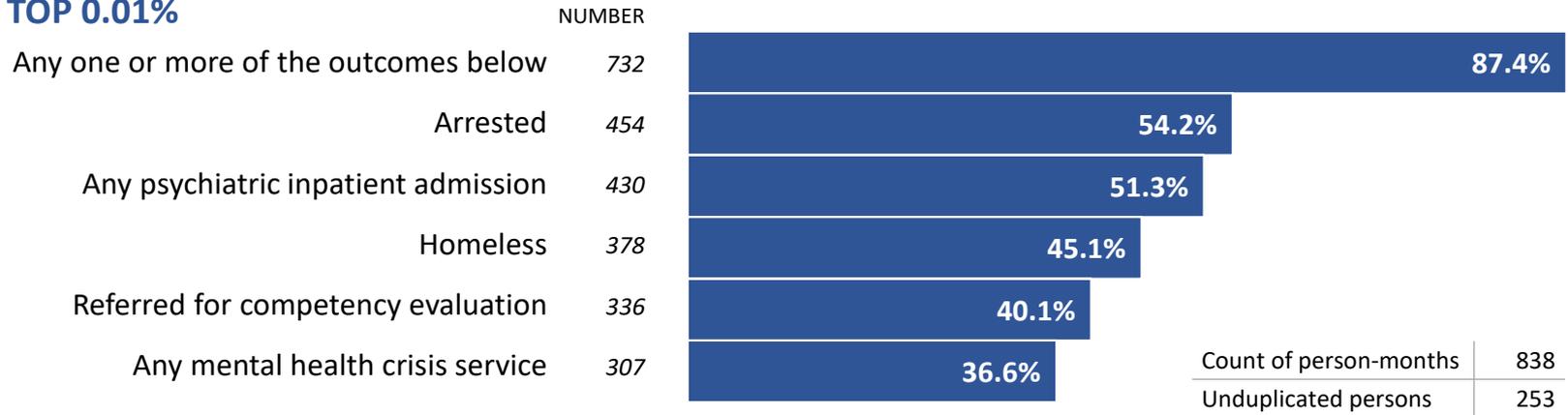
## Outcome Means for Top Percentage Groups

Quantiles	Observations	% With Forensic Evaluation in next 6 months
Top 1%	83,787	5.1%
Top 0.1%	8,383	20.6%
Top 0.01%	838	40.1%

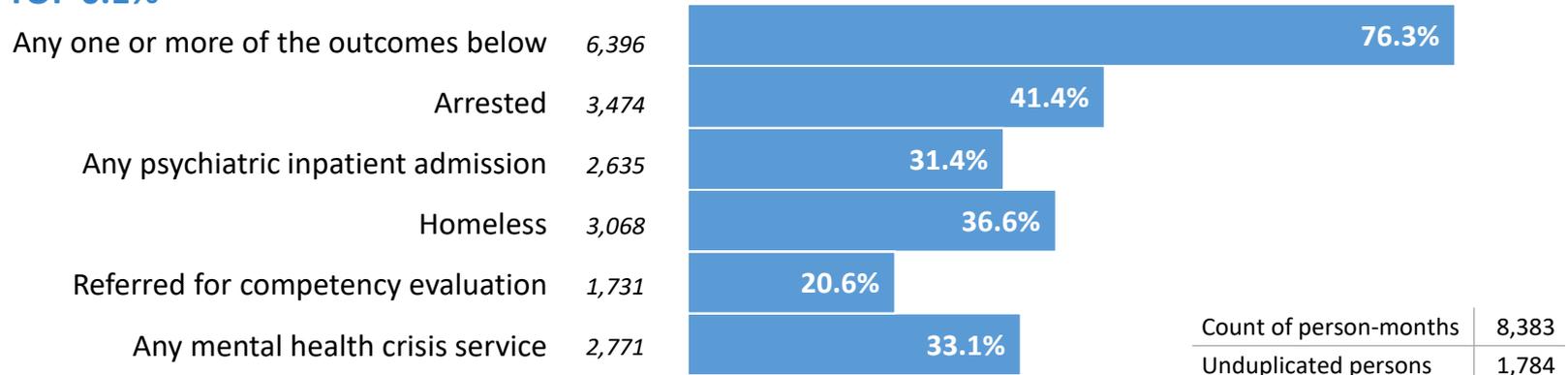
# Outcomes in the Next 6 Months

Forensic Predictive Modeling Results: 10-Month Validation Sample

## TOP 0.01%



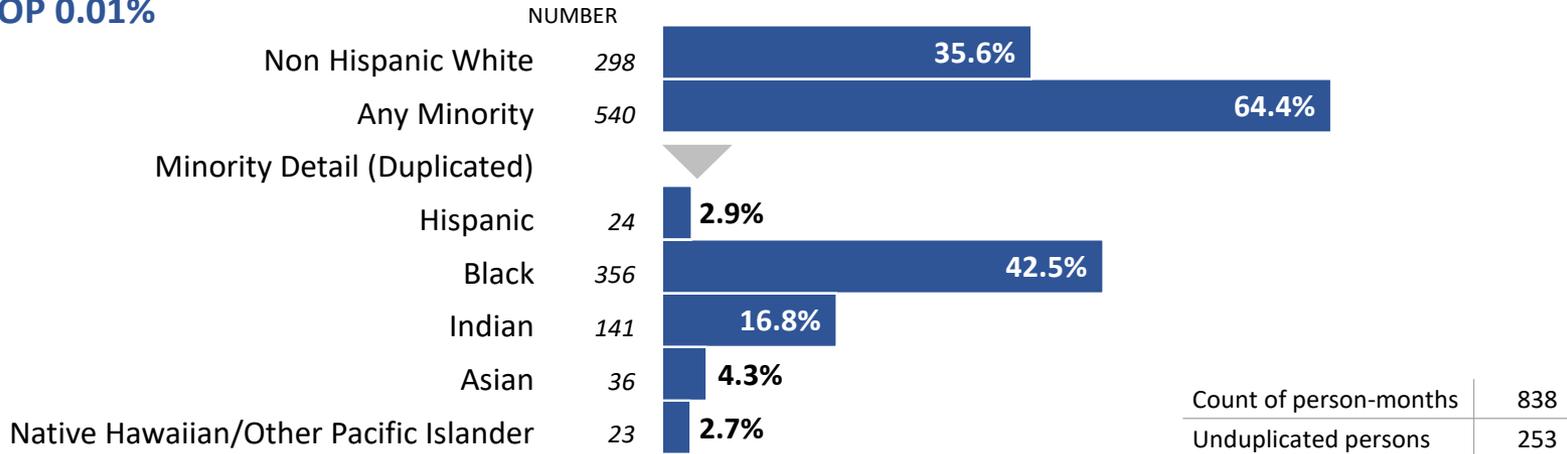
## TOP 0.1%



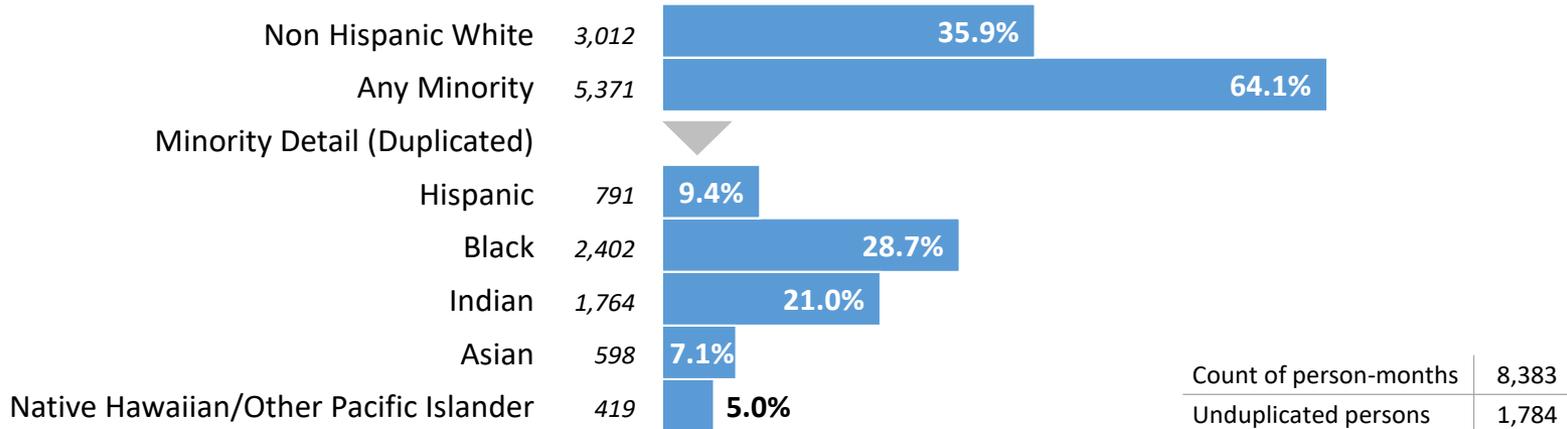
# Race/Ethnicity

## Forensic Predictive Modeling Results

### TOP 0.01%



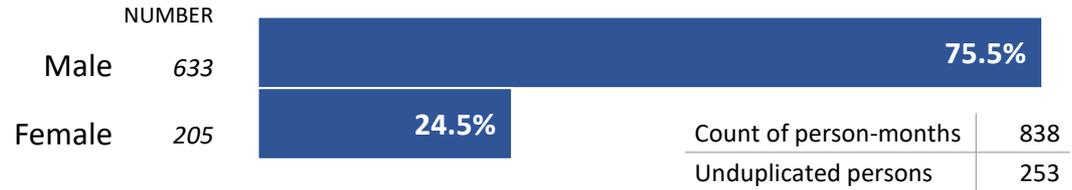
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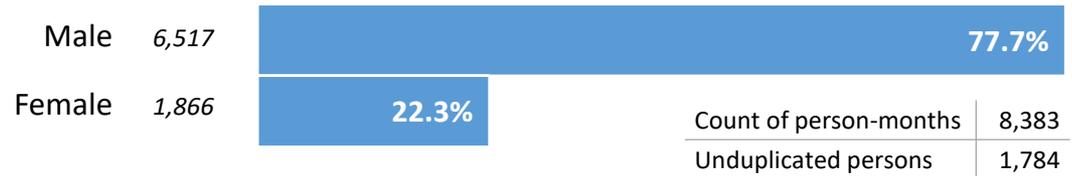
# Gender

## Forensic Predictive Modeling Results

### TOP 0.01%



### TOP 0.1%



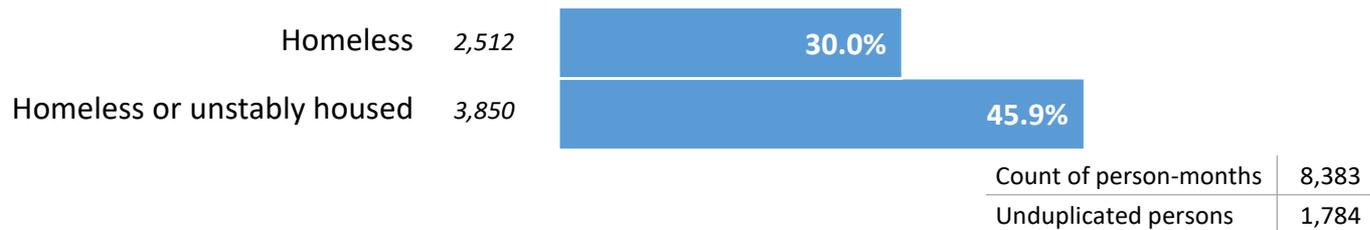
# Housing Status as of Index Month

Forensic Predictive Modeling Results

## TOP 0.01%



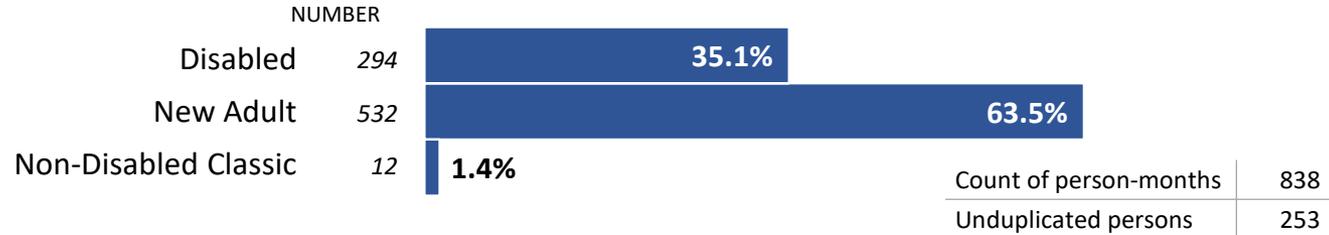
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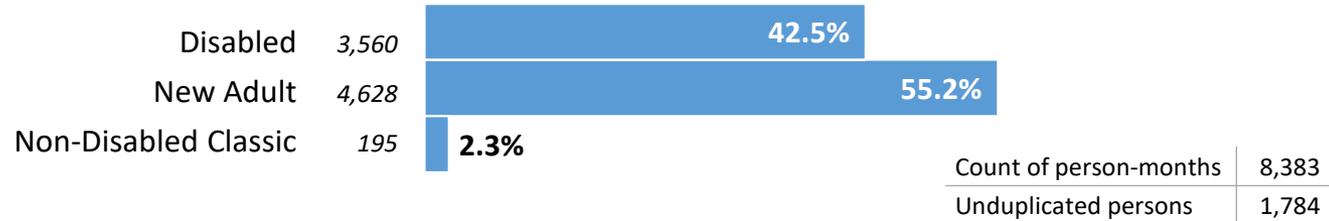
# Medicaid Coverage Group

Forensic Predictive Modeling Results

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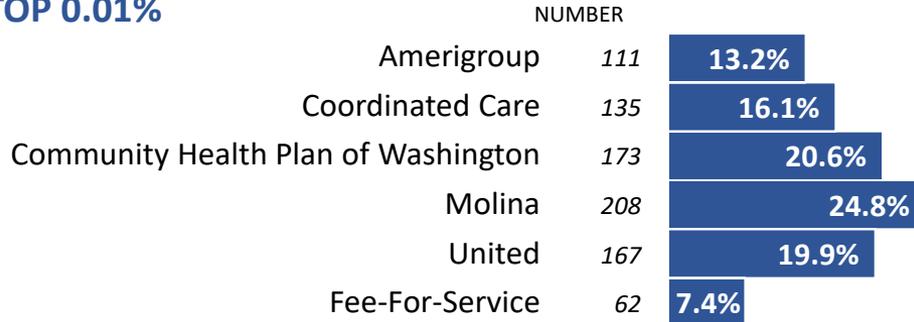
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# Managed Care Plan

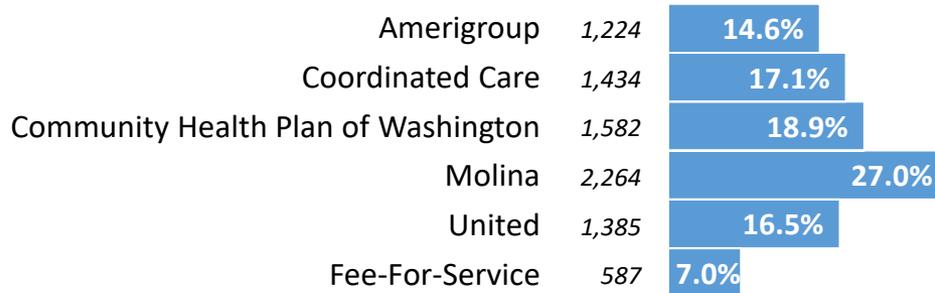
## Forensic Predictive Modeling Results

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Count of person-months	838
Unduplicated persons	253

### TOP 0.1%

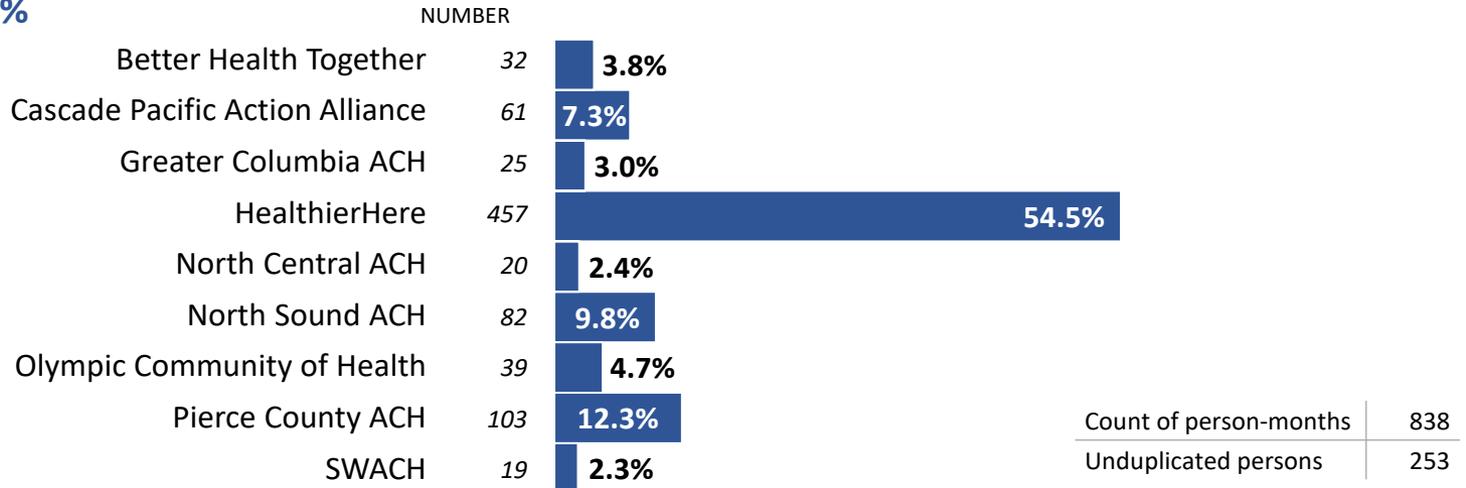


Count of person-months	8,383
Unduplicated persons	1,784

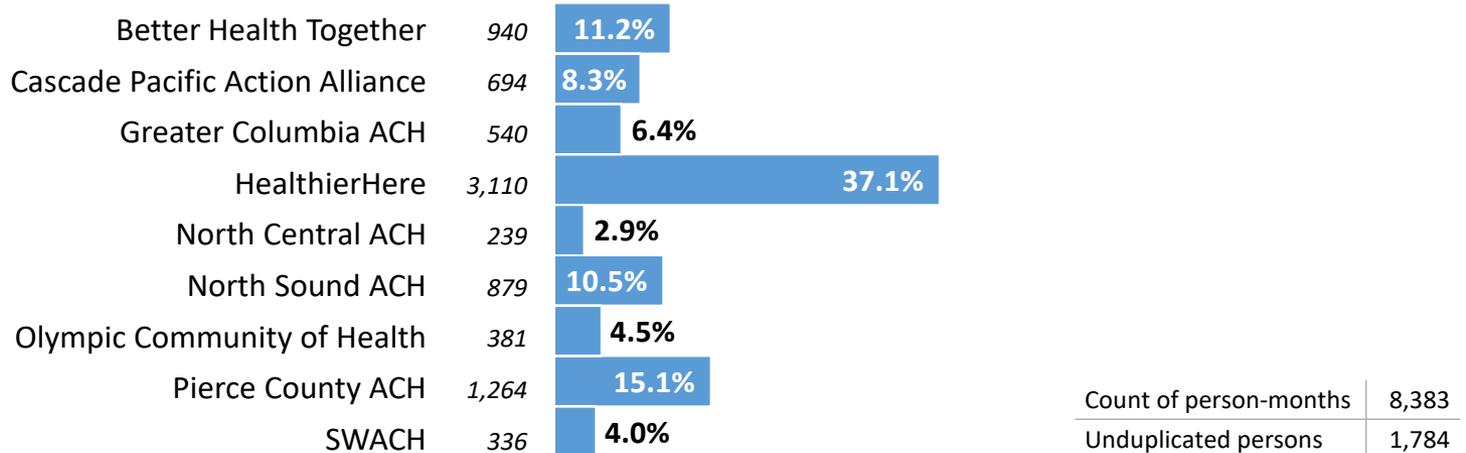
# Accountable Communities of Health (ACH) Region

## Forensic Predictive Modeling Results

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### TOP 0.1%



# Summary of Findings

- **Model is likely sufficiently predictive and timely to be actionable**
- **Prior competency evaluation referral history is by far the most important information for predicting future referrals**
- **Characteristics of the high-risk target population:**
  - High rates of homelessness and co-occurring substance use disorder
  - High proportion are minority consistent with the disproportionality in the criminal justice system
  - Numerical concentration in urban counties
  - High proportion are enrolled in Medicaid Expansion coverage
  - Many identified as high-risk who do not experience near-term forensic involvement will experience other adverse outcomes (arrest, MH crisis, hospitalization, homelessness)
  - Variation in the extent of physical comorbidities

# Data System Implications

- **Potential to regularly interface forensic evaluation referral and related risk information to HCA MCOs/IMCs/BHOs**
- **Dependency on improvements in data quality in recently implemented Forensic Data System**
- **PRISM provides complementary risk information to which MCOs currently have access:**
  - Co-occurring SUD
  - Homelessness
  - Physical comorbidities
  - Treating providers
  - Psychotropic medications

# Some Delivery System Implications

- **Identifying evidence-based or promising intervention strategies**
- **Developing financing and implementation strategy (pilots?)**
  - **Identifying financing and intervention strategies for the portion of the high-risk population that is not Medicaid eligible**
- **MCO/IMC/BHO readiness to receive regular data flows identifying at-risk Medicaid beneficiaries currently enrolled**
  - **Capacity building throughout the delivery system capacity building**
- **Longer term: evaluation of effectiveness of intervention strategies**

APPENDIX

## Parameter and Odds Ratio Estimates, Stepwise Selection

# Parameter and Odds Ratio Estimates, Stepwise Selection

Model Calibration Data: Calendar Year 2015 – Calendar Year 2016

Variable	Label	Estimate	Odds Ratio Estimate
Intercept		-7.0944	.
Age 25 – 29, relative to Age 18 - 24		0.0906	1.095
Age 40 – 44, relative to Age 18 – 24		-0.1193	0.888
Age 45 – 49, relative to Age 18 – 24		-0.1772	0.838
Age 50 – 54, relative to Age 18 – 24		-0.3186	0.727
Age 55 – 59, relative to Age 18 – 24		-0.4478	0.639
Age 60 – 64, relative to Age 18 – 24		-0.6550	0.519
Female, relative to Male		-0.8981	0.407
Black		0.4428	1.557
Indian		0.4905	1.633
In DOC facility, prior 7 to 12 months		0.3323	1.394
In DOC facility, prior 13 to 24 months		0.2292	1.258
In DOC facility, prior 25 to 36 months		0.2673	1.306
In DOC facility, prior 37 to 60 months		0.6374	1.892
Forensic SH admit, prior 4-6 months		0.7290	2.073
Forensic SH admit, prior 7-12 months		0.7076	2.029
Forensic SH admit, prior 25-36 months		0.9061	2.475
Forensic SH admit, prior 37-60 months		0.7904	2.204
Civil SH admit, prior month		-1.1683	0.311

*Continued on next slide*

# Parameter and Odds Ratio Estimates, Stepwise Selection

Model Calibration Data: Calendar Year 2015 – Calendar Year 2016

Variable	Label	Estimate	Odds Ratio Estimate
Com. Psych admit, 1 month prior		0.8756	2.400
Com. Psych admit, 2 months prior		0.7053	2.024
Com. Psych admit, 3 months prior		0.5617	1.754
Com. Psych admit, 4-6 months prior		0.6663	1.947
Com. Psych admit, 7-12 months prior		0.7887	2.201
Com. Psych admit, 13-24 months prior		0.7437	2.104
Com. Psych admit, 25-36 months prior		0.5836	1.793
Com. Psych admit, 37-60 month prior		0.6003	1.823
E&T admit, 1 month prior		0.6797	1.973
E&T admit, 2 months prior		0.6174	1.854
E&T admit, 4-6 months prior		0.5205	1.683
E&T admit, 7-12 months prior		0.9505	2.587
E&T admit, 13-24 months prior		0.6787	1.971
E&T admit, 25-36 month prior		0.8907	2.437
E&T admit, 37-60 month prior		0.3240	1.383
Forensic SH discharge, 13-24 months prior		0.5755	1.778
Forensic SH discharge, prior 25-36 months prior		0.5733	1.774
Civil SH discharge, 1 month prior		0.7664	2.152
Civil SH discharge, 4-6 months prior		0.5704	1.769
Civil SH discharge, 7-12 months prior		0.8159	2.261
Civil SH discharge, 13-24 months prior		0.3260	1.385
Civil SH discharge, 37-60 month prior		0.5662	1.762

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# Parameter and Odds Ratio Estimates, Stepwise Selection

Model Calibration Data: Calendar Year 2015 – Calendar Year 2016

Variable	Label	Estimate	Odds Ratio Estimate
Homeless without housing, 1 month prior		0.5611	1.753
Homeless without housing, 7-12 months prior		0.2494	1.283
Homeless without housing, 25-36 months prior		0.2533	1.288
Homeless with housing, 1 month prior		0.8785	2.407
Homeless with housing, 7-12 months prior		0.1731	1.189
Homeless with housing, 13-24 months prior		0.2973	1.346
Homeless with housing, 37-60 months prior		0.2593	1.296
<b>Competency evaluation referral, 1 month prior</b>		<b>3.2568</b>	<b>25.967</b>
<b>Competency evaluation referral, 2 months prior</b>		<b>1.7282</b>	<b>5.630</b>
<b>Competency evaluation referral, 3 months prior</b>		<b>1.5506</b>	<b>4.714</b>
<b>Competency evaluation referral, 4-6 months prior</b>		<b>1.8563</b>	<b>6.400</b>
<b>Competency evaluation referral, 7-12 months prior</b>		<b>1.6106</b>	<b>5.006</b>
<b>Competency evaluation referral, 13-24 months prior</b>		<b>1.8805</b>	<b>6.557</b>
Found not competent, 1 month prior		-1.1486	0.317
Found not competent, 13-24 months prior dispo_not_comp_pre13to24mo		-0.2655	0.767
Other competency evaluation disposition, 2 months prior		0.9482	2.581
Other competency evaluation disposition, 3 months prior		0.8289	2.291
Other competency evaluation disposition, 7-12 months prior		0.2854	1.330