

# Demographic and clinical factors associated with recurrent psychiatric hospitalizations in adult patients with major depressive disorder (MDD)

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## INTRODUCTION

### CONTEXT:

- MDD accounts for the largest personal and economic burden of all adult mental health disorders in the United States (US)<sup>1</sup>. It has been estimated that each MDD-related hospitalization costs \$15,941<sup>2</sup>.
- Recurrent hospitalizations (RHs) within the 1<sup>st</sup> year occur in 13% of patients with MDD<sup>3</sup>.

### UNMET NEED:

- Factors associated with RH in MDD are important to understand; however, commonly used methods, e.g., Cox proportional hazards model (CoxPH) are designed to assess the risk of first occurrence rather than recurrent events.
- Extensions to CoxPH have been proposed<sup>4</sup>, however, their adoption is still less common than CoxPH or the simpler Poisson-distributed generalized linear model (Poisson-GLM).

### AIM:

- Identify demographic and clinical factors associated with RH using 3 extensions of CoxPH.
- Evaluate performance and goodness-of-fit of models involving recurrent outcomes.

## METHODS

### A non-interventional cohort study

**Neuro Blu**  
Version 23R2

A longitudinal behavioral health real-world database comprising patient-level clinical data

30+ United States mental health systems

1.4+ million patients

20+ years longitudinal data

### Population inclusion criteria

- Recorded diagnosis of MDD across ≥ 2 outpatient visits within 6 months
- Age of ≥18 years at the time of second MDD diagnosis (index date)
- ≥1 record of the Patient Health Questionnaire-9 (PHQ-9)
- ≥1 record of follow-up visit after the index date

### Population exclusion criteria

- Lifetime diagnosis of schizophrenia, schizophrenia spectrum disorder, or bipolar disorder
- Missing variables on sex, race, or PHQ-9 items within 30 days before the index date

### Statistical analysis

- Time to recurrent psychiatric hospitalization within a 1-year period is studied using 3 extensions of CoxPH: (1) Andersen-Gill (AG) model, (2) Prentice-Williams-Peterson gap time (PWP-GT), and (3) Prentice-Williams-Peterson total time (PWP-TT) model.
- Independent variables included in the analysis: age, sex, race, PHQ-9 items, psychiatric comorbidities, antidepressant treatment (ADT) and/or psychotherapy, number of outpatient and/or inpatient visits 6 months before index date. The AG model is also adjusted for the number of previous hospitalization events.
- Akaike Information Criterion (AIC) and concordance were used to evaluate the model quality. Adjusted hazard ratio (aHR) is used to study the associations learned by the model. All models are benchmarked against CoxPH to assess consistency.

## KEY RESULTS

- Statistically significant associations with RH among patients with MDD were observed for suicidal ideation, psychotherapy, and healthcare resource utilization (HCRU) variables (Table 1).
- Number of previous hospitalization events showed the strongest association with the risk of RH in the AG model [aHR (95% CI): 5.03 (3.58-7.07)].
- Overall, the three models demonstrate relative consistency against each other, in terms of aHR estimates.

Table 1. Associations between selected variables and the risk of RH using three different models. Statistically significant ratios (based on P-value of <0.05) are highlighted in blue.

Variable	aHR (95% CI)		
	AG	PWP-TT	PWP-GT
PHQ-9: Suicidal ideation	1.47 (1.32-1.64)	1.48 (1.32-1.65)	1.47 (1.32-1.64)
Treated with ADT	0.85 (0.68-1.07)	0.85 (0.68-1.07)	0.84 (0.68-1.05)
Treated with psychotherapy	0.57 (0.37-0.87)	0.56 (0.37-0.86)	0.54 (0.37-0.80)
Treated with ADT + psychotherapy	0.66 (0.43-1.00)	0.66 (0.43-1.00)	0.68 (0.45-1.03)
No. of baseline OP visits	1.04 (1.01-1.06)	1.04 (1.01-1.06)	1.04 (1.01-1.06)
1 baseline IP visit	1.89 (1.45-2.47)	1.89 (1.45-2.47)	1.80 (1.40-2.30)
≥2 baseline IP visits	2.03 (1.45-2.83)	2.02 (1.45-2.83)	1.86 (1.37-2.52)
No. of previous hospitalization events	5.03 (3.58-7.07)	-	-

RH: Recurrent hospitalization; AG: Andersen-Gill; PWP-TT: Prentice-Williams-Peterson total time; PWP-GT: Prentice-Williams-Peterson gap time; PHQ-9: Patient Health Questionnaire-9; ADT: Antidepressant treatment; OP: Outpatient; IP: Inpatient; aHR: Adjusted Hazard Ratio; CI: Confidence Interval. All models are truncated after 2 hospitalizations due to limited sample counts.

## MODEL QUALITY & SENSITIVITY

- AG model performed the best out of the 3 models in terms of predictive accuracy (i.e., concordance). In terms of model goodness-of-fit (based on AIC), PWP-TT performed the best (Table 2).
- When assessed using a longer follow-up (2 years), suicidal ideation, psychotherapy, and HCRU variables are still statistically significant against the risk of RH, reinforcing the significance of our primary results (Supplementary Table 1; scan QR code to access).

Table 2. Model goodness-of-fit and predictive performance

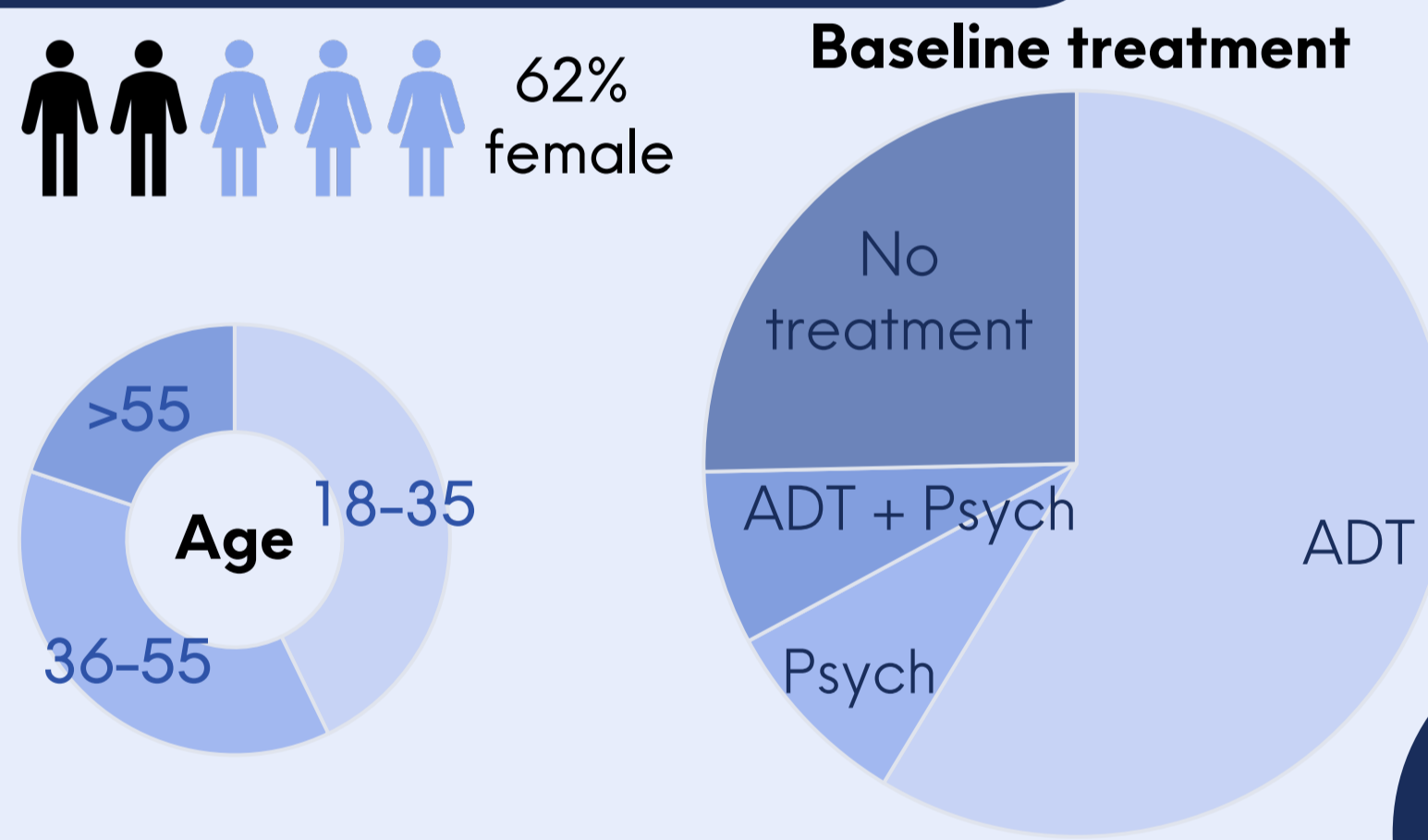
	AG	PWP-TT	PWP-GT
AIC	6539.2	6261.0	6429.8
Concordance	0.73	0.71	0.71

AG: Andersen-Gill; PWP-TT: Prentice-Williams-Peterson total time; PWP-GT: Prentice-Williams-Peterson gap time; AIC: Akaike Information Criterion.

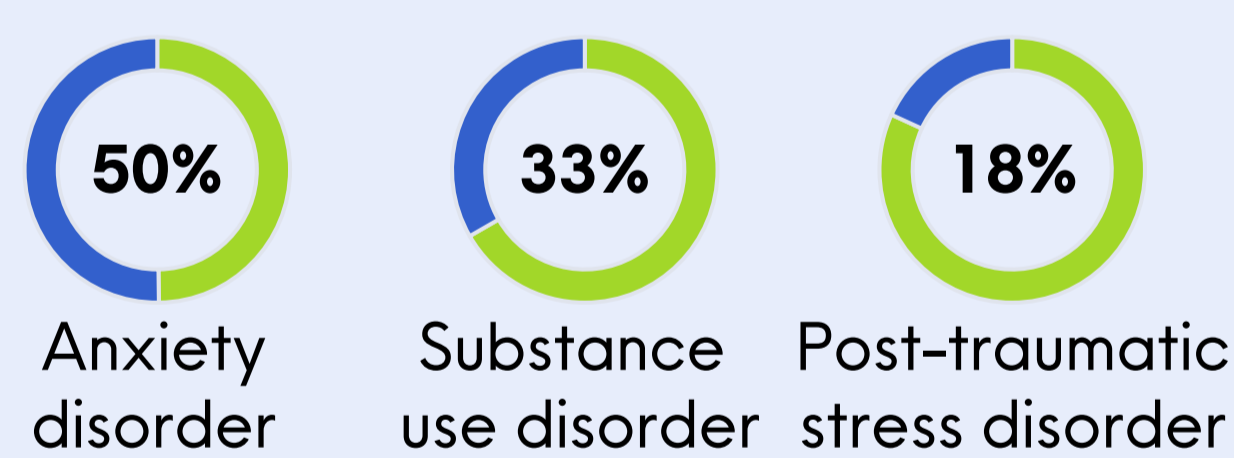
Scan QR code for supplementary materials



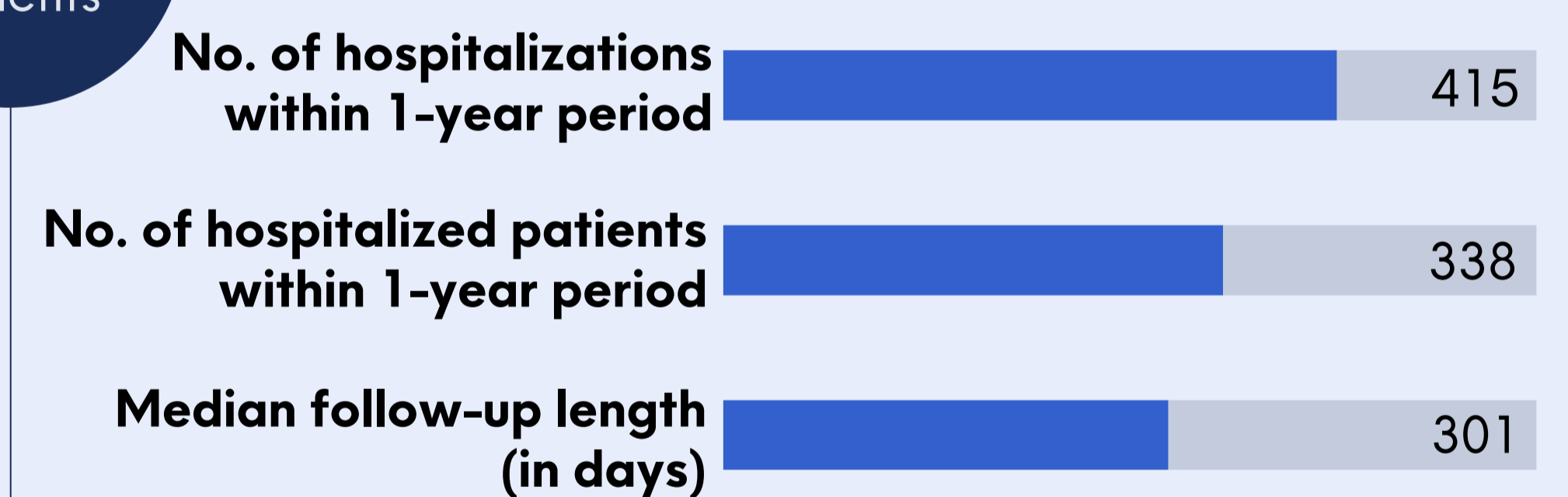
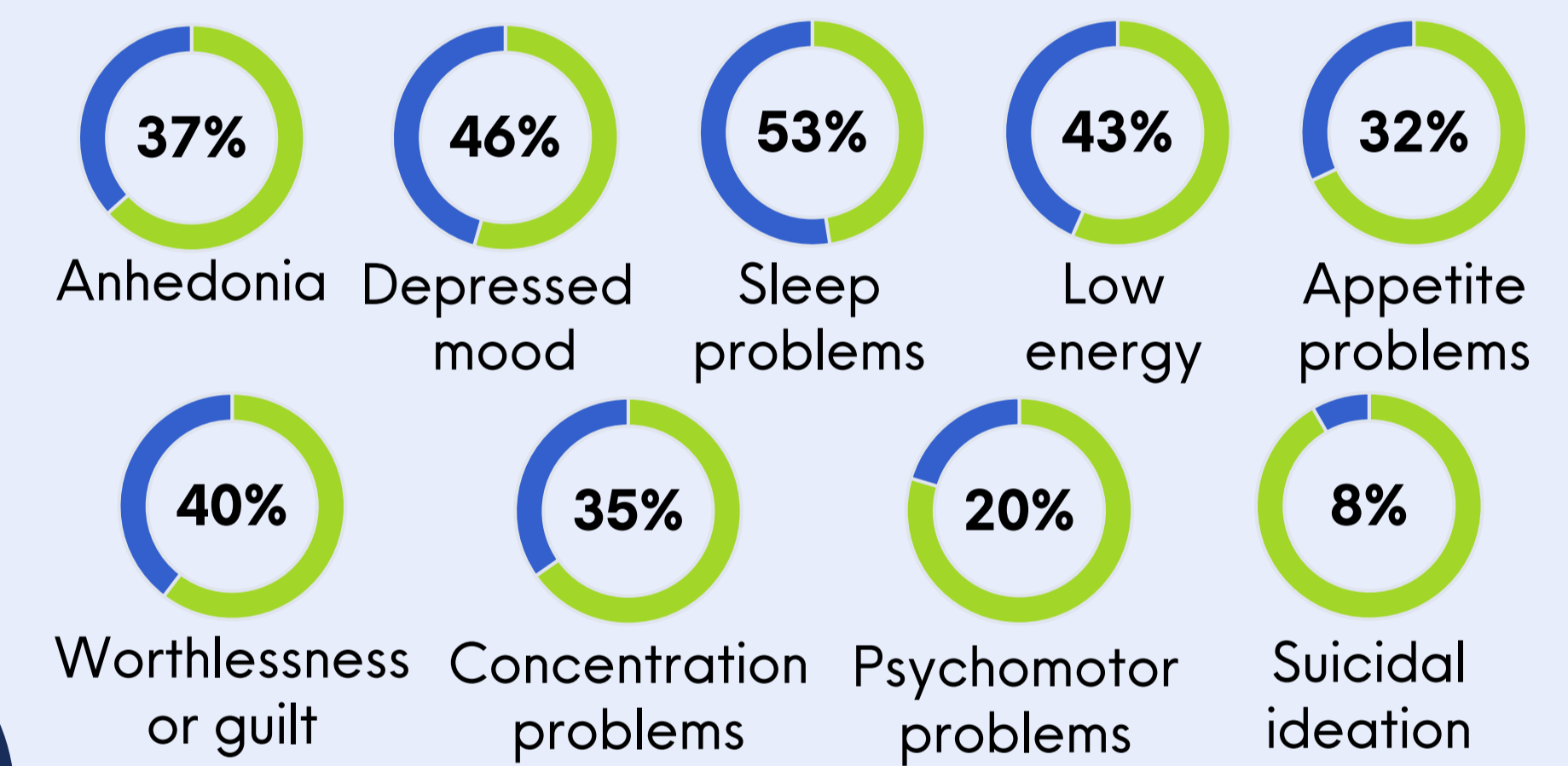
## PATIENT CHARACTERISTICS



### Top psychiatric comorbidities



### Patients with baseline PHQ-9 sub-score of 3



## CONCLUSIONS

- Suicidal ideation, psychotherapy, baseline HCRU, and number of previous hospitalizations are found to be significantly associated with RH in patients in MDD in the NeuroBlu data.
- The three tested methods for assessing risk of RH showed consistent results. The goodness-of-fit was similar across all models, with AG performing slightly better.
- The strongest association with RH was observed with the number of previous hospitalization events, highlighting the importance of accounting for hospitalization events beyond the first occurrence among patients with MDD.

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## DISCLOSURES

CL, JW, SK, and AW report current employment by KKT Technology Pte Ltd (Holmusk). XH and MER report prior employment by KKT Technology Pte Ltd (Holmusk). AJR and MT report personal fees from Holmusk Technologies, Inc.

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