Predictors of treatment and recovery among obese patients in the United States: A retrospective observational study using the PINC AI™ Healthcare Database (PHD)

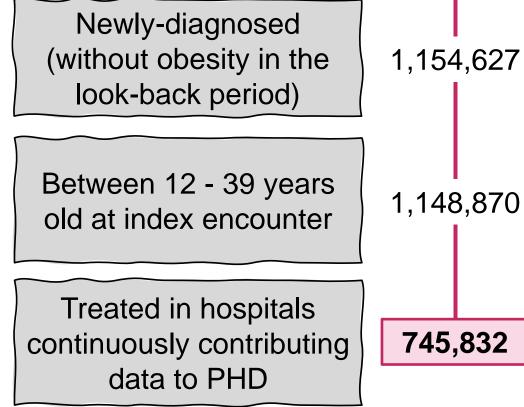**Guilherme Lopes, MS PhD[1], Rachel Mackey, MPH, PhD[1], Craig Lipkin, MS[1], Zhun Cao, PhD[1]**

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PINC AI APPLIED SCIENCES

OBJECTIVES

- Obesity rates increased globally in the last century
- Obesity can lead to serious chronic diseases, such as diabetes and heart disease[1]
- Access to treatment is critical to management and recovery from obesity
- We investigated predictors of treatment and recovery in obese patients in the United States

STUDY POPULATION

Patient selection criteria

Patients admitted with obesity diagnosis during the accrual period	1,287,672
Newly-diagnosed (without obesity in the look-back period)	1,154,627
Between 12 - 39 years old at index encounter	1,148,870
Treated in hospitals continuously contributing data to PHD	**745,832**

Patient characteristics

- Average follow-up of 55 months (SD = 11)
- 32 years old on average (SD = 6.9, 97.5% adults)
- Mostly male (69%)
- White (63%), Black (24%), Asian (1.1%), Other (12%)
- Most patients treated in urban hospitals (88%)

METHODS

Study design: Retrospective observational study

Data source

The PINC AI™ healthcare database (PHD) is one of the largest hospital administrative databases in the US[2]

Study timeline
- **Overall study period**
  01/01/2016 to 12/31/2023 (**8 years**)
- **Accrual period**
  01/01/2017 to 12/31/2020 (**4 years**)
- **Look-back period**
  01/01/2016 to index admission date (≥ 1 year)
- **Follow-up period**
  Index discharge date to 12/31/2023 (≥ 3 years)
- **Index encounter**
  Earliest encounter with obesity during accrual period

PHD

Exposure
- Obesity diagnosis (Yes/No, via ICD-10-CM Z-codes)

Endpoints*
- Time to bariatric surgery
- Time to weight-loss drugs
- Time to normal-weight diagnosis
* from ICD-10, CPT, and CDM codes and terms

Predictors
- **Age** (Pediatric [12-17 years], Adult [18-39])
- **Sex** (Men, Women)
- **Race** (White, Black, Asian, Other)
- **Hospital setting** (Urban, Rural)

Statistical analysis
- Survival analysis (Cox regression and Kaplan-Meyer plots)
- Adjusted for age, sex, race, and hospital setting
- Censoring at end of follow-up (12/31/2023)

RESULTS (adjusted Hazard Ratios [aHR] of predictors for each endpoint)

	Bariatric surgery aHR (95% CI)	Weight-loss drugs aHR (95% CI)	Normal weight aHR (95% CI)
Age			
Adult (18-39) (ref)	1.00 (---)	1.00 (---)	1.00 (---)
Pediatric (12-17)	0.07 (0.05 - 0.08)	0.45 (0.42 - 0.47)	1.77 (1.63 - 1.91)
Sex			
Male (ref)	1.00 (---)	1.00 (---)	1.00 (---)
Female	2.54 (2.48 - 2.60)	1.61 (1.59 - 1.64)	0.86 (0.83 - 0.89)
Race			
White (ref)	1.00 (---)	1.00 (---)	1.00 (---)
Black	0.84 (0.82 - 0.85)	0.77 (0.76 - 0.78)	1.39 (1.34 - 1.44)
Asian	0.50 (0.44 - 0.56)	1.02 (0.97 - 1.07)	0.79 (0.67 - 0.94)
Other/Unknown	1.27 (1.24 - 1.30)	0.99 (0.98 - 1.01)	0.67 (0.63 - 0.71)
Hospital setting			
Urban (ref)	1.00 (---)	1.00 (---)	1.00 (---)
Rural	0.71 (0.69 - 0.73)	0.77 (0.75 - 0.78)	0.68 (0.64 - 0.72)

CONCLUSIONS

- **Adults, women, Whites, and patients treated in urban hospitals were most likely to receive treatment (bariatric surgery or weight-loss drugs)**
- **Our findings also suggested that bariatric surgery and weight-loss drugs alone may not be sufficient to promote obesity recovery**
- **Improving access to treatment and ensuring obesity recovery across populations is urgently warranted**
- **Future research may explore behavioral approaches to obesity (e.g., diet and counseling). It may also explore other predictors of obesity treatment, such as social economic status**

LIMITATIONS

- Z-codes are underutilized, so we may have under-captured "true" obesity in the PHD
- Patients were followed within their index hospital, so visits to other hospitals would not be captured
- Mortality was not captured, so we may have overestimated follow-up time for some patients
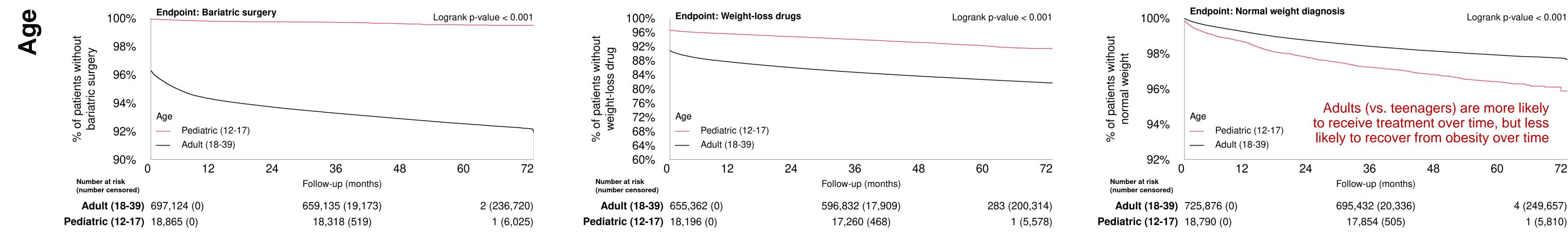
REFERENCES

1. CDC - Childhood Overweight & Obesity. https://www.cdc.gov/obesity/childhood
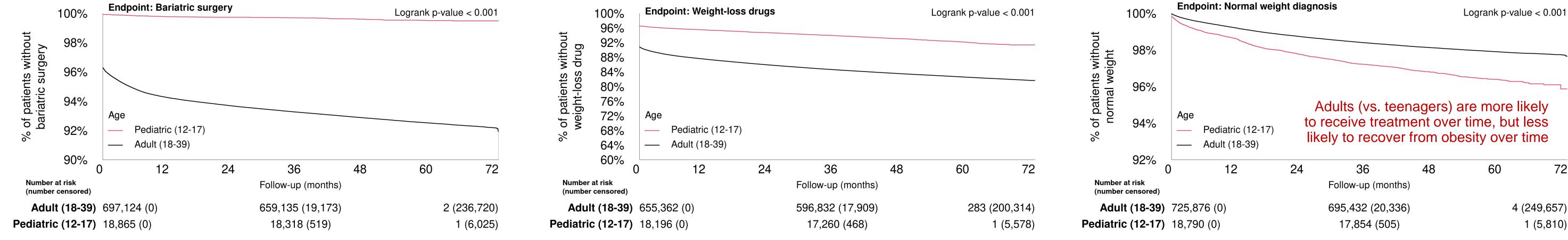2. PHD White Paper September 2024: https://offers.pinc-ai.com/PINC-AI-Healthcare-Database-White-Paper-LP.html

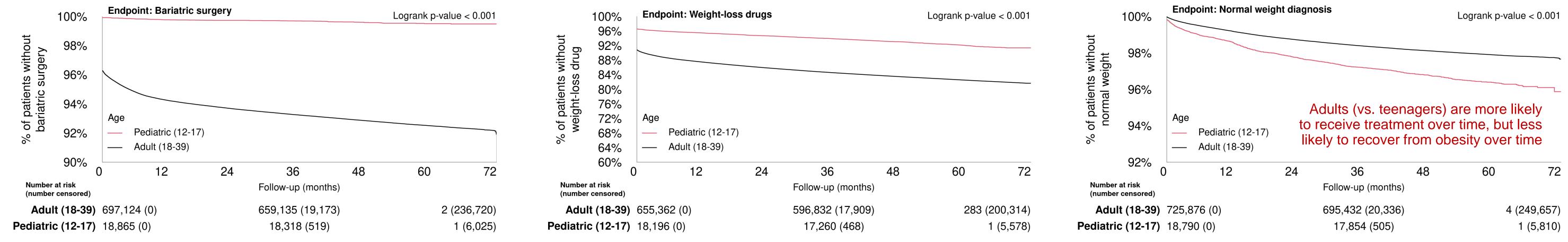## RESULTS (unadjusted Kaplan-Meyer time-to-event curves)
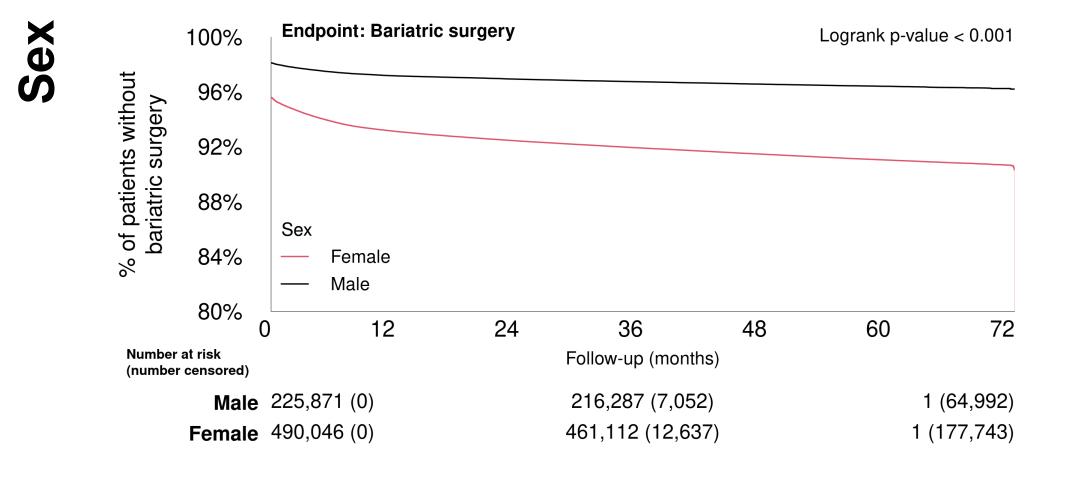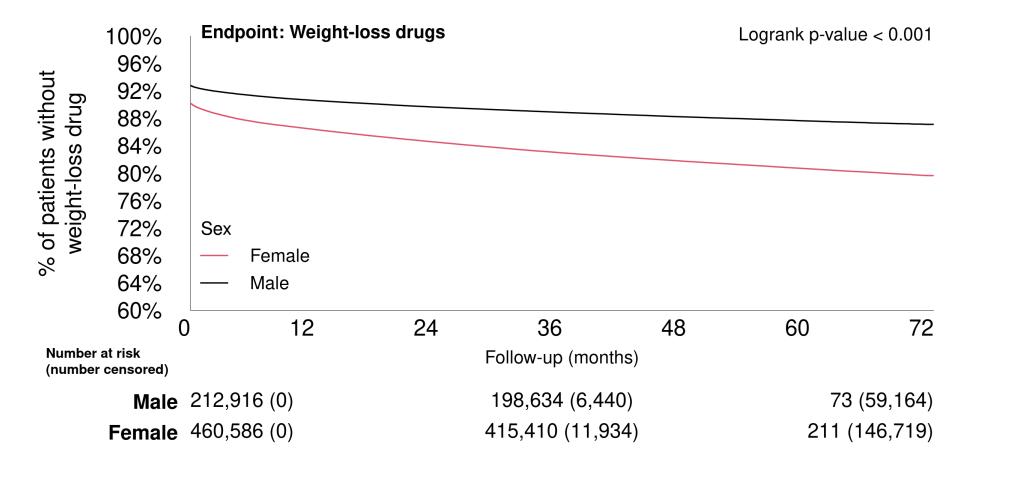
Bariatric surgery

Age

Endpoint: Bariatric surgery — Logrank p-value < 0.001. Age: Pediatric (12-17), Adult (18-39)

Number at risk (number censored)
Adult (18-39) 697,124 (0); 659,135 (19,173); 2 (236,720)
Pediatric (12-17) 18,865 (0); 18,318 (519); 1 (6,025)

Sex

Endpoint: Bariatric surgery — Logrank p-value < 0.001. Sex: Female, Male

Number at risk (number censored)
Male 225,871 (0); 216,287 (7,052); 1 (64,992)
Female 490,046 (0); 461,112 (12,637); 1 (177,743)

Race

Endpoint: Bariatric surgery — Logrank p-value < 0.001. Race: Other/Unknown, Asian, Black, White

Number at risk (number censored)
White 452,212 (0); 427,699 (12,352); 1 (151,018)
Black 170,505 (0); 161,894 (4,734); 93 (58,928)
Asian 8,238 (0); 7,839 (309); 4 (3,061)
Other/Unknown 85,021 (0); 80,021 (2,297); 1 (29,738)

Hospital setting

Endpoint: Bariatric surgery — Logrank p-value < 0.001. Hospital setting: Rural, Urban

Number at risk (number censored)
Urban 630,597 (0); 596,414 (17,182); 2 (215,443)
Rural 85,377 (0); 81,039 (2,510); 43 (27,302)

Weight-loss drugs

Age

Endpoint: Weight-loss drugs — Logrank p-value < 0.001. Age: Pediatric (12-17), Adult (18-39)

Number at risk (number censored)
Adult (18-39) 655,362 (0); 596,832 (17,909); 283 (200,314)
Pediatric (12-17) 18,196 (0); 17,260 (468); 1 (5,578)

Sex

Endpoint: Weight-loss drugs — Logrank p-value < 0.001. Sex: Female, Male

Number at risk (number censored)
Male 212,916 (0); 198,634 (6,440); 73 (59,164)
Female 460,586 (0); 415,410 (11,934); 211 (146,719)

Race

Endpoint: Weight-loss drugs — Logrank p-value < 0.001. Race: Other/Unknown, Asian, Black, White

Number at risk (number censored)
White 422,229 (0); 384,332 (11,440); 170 (126,617)
Black 163,480 (0); 149,690 (4,471); 82 (51,389)
Asian 7,443 (0); 6,789 (273); 1 (2,424)
Other/Unknown 80,403 (0); 73,281 (2,193); 31 (25,462)

Hospital setting

Endpoint: Weight-loss drugs — Logrank p-value < 0.001. Hospital setting: Rural, Urban

Number at risk (number censored)
Urban 592,102 (0); 539,570 (15,983); 245 (181,923)
Rural 81,453 (0); 74,522 (2,394); 39 (23,969)

Normal-weight diagnosis

Age

Endpoint: Normal weight diagnosis — Logrank p-value < 0.001. Age: Pediatric (12-17), Adult (18-39)

Adults (vs. teenagers) are more likely to receive treatment over time, but less likely to recover from obesity over time

Number at risk (number censored)
Adult (18-39) 725,876 (0); 695,432 (20,336); 4 (249,657)
Pediatric (12-17) 18,790 (0); 17,854 (505); 1 (5,810)

Sex

Endpoint: Normal weight diagnosis — Logrank p-value < 0.001. Sex: Female, Male

Women (vs. men) are more likely to receive treatment over time, but less likely to recover from obesity over time

Number at risk (number censored)
Male 230,109 (0); 219,373 (7,144); 82 (66,096)
Female 514,498 (0); 493,857 (13,694); 4 (189,360)

Race

Endpoint: Normal weight diagnosis — Logrank p-value < 0.001. Race: Other/Unknown, Asian, Black, White

Black (vs. White) patients are less likely to receive treatment over time, but more likely to recover from obesity over time

Number at risk (number censored)
White 470,163 (0); 450,874 (13,059); 3 (159,556)
Black 176,563 (0); 168,121 (4,990); 94 (60,870)
Asian 8,409 (0); 8,012 (310); 4 (3,123)
Other/Unknown 89,533 (0); 86,279 (2,482); 2 (31,918)

Hospital setting

Endpoint: Normal weight diagnosis — Logrank p-value < 0.001. Hospital setting: Rural, Urban

Patients treated in rural (vs. urban) hospitals are less likely to receive treatment and to recover from obesity over time

Number at risk (number censored)
Urban 657,149 (0); 629,190 (18,200); 4 (227,067)
Rural 87,517 (0); 84,096 (2,641); 1 (28,400)

Acronyms
aHR = adjusted Hazard Ratio; CI = Confidence Interval; PHD = PINC AI™ healthcare database