2024 ADLM FairLabs Competition - Endeavor Health

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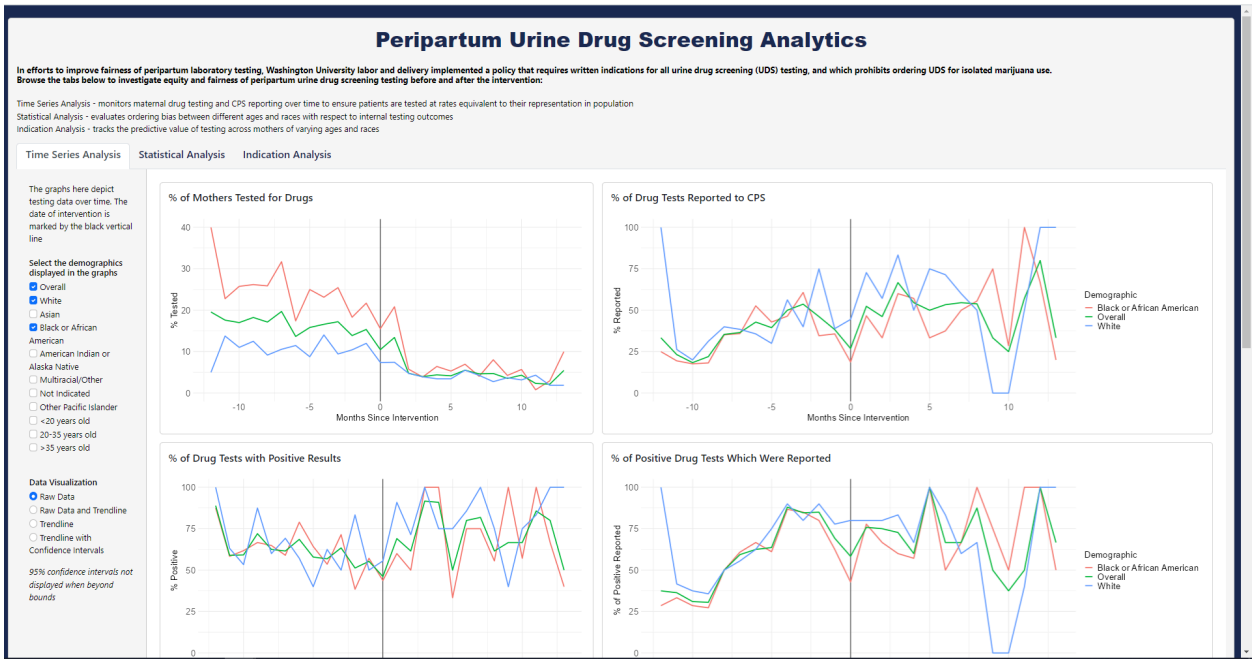
Thank you for the opportunity to submit our dashboard. To run this dashboard, visit: https://erinsproctor.shinyapps.io/ADLM_competition/. The source code can be found in the github repository https://github.com/Samwise327/adlm-fairlabs-competition in the file "app.R". This file also indicates which libraries are required at the top, and can be run with the provided data file.

We divided our Urine Drug Screen (UDS) analysis into 3 panels: time series analysis, statistical analysis, and indication analysis. We divided the data before/after the intervention based on the date of the first order indication provided: 02-27-2028.

1. Time Series Analysis



The goal of this first panel is to investigate UDS trends over time. To examine **demographic parity**, we display meaningful statistics for each demographic group across ages and races.

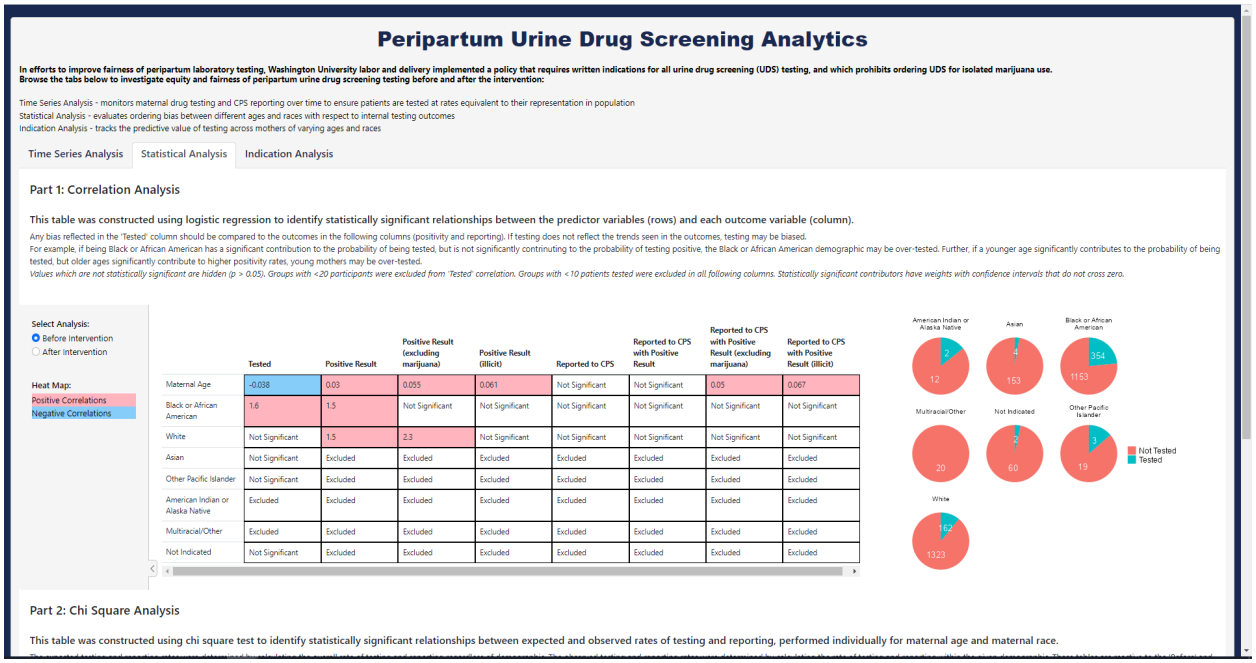
Specifically, we illustrate the rate of testing, the percent positivity, and the CPS reporting rates for each demographic group with respect to their representation in the overall population.

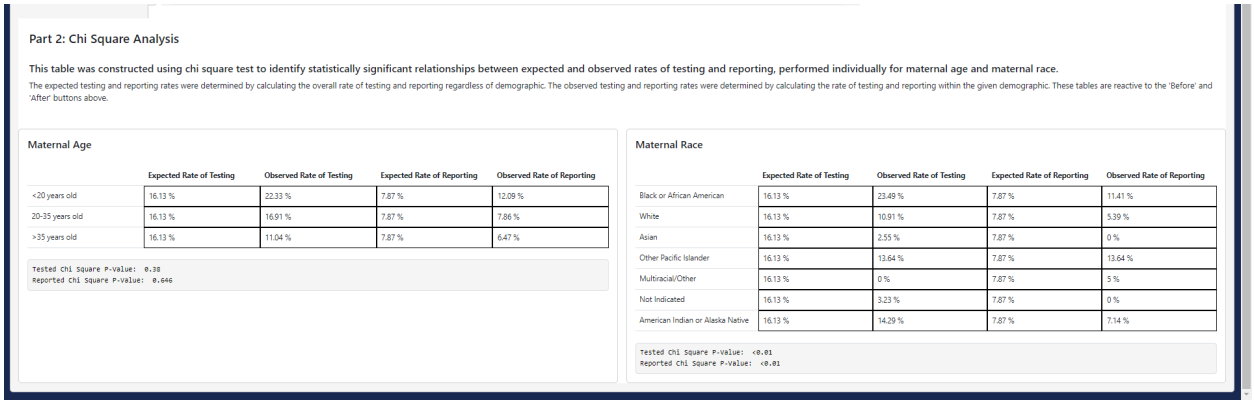
Prior to the intervention, black mothers were tested more frequently than the overall population, while white mothers were tested less frequently. These testing rates converge after the intervention, indicating mothers of these groups are trending towards being tested at rates similar to their representation in the overall population. We see a similar phenomenon in other demographics as well.

Additionally, there is an upward trend in the percentage of drug tests positive for non-marijuana and illicit substances in most demographic groups, suggesting testing may be more efficient post-intervention.

Each trendline can be displayed with 95% **confidence intervals**.

2. Statistical Analysis





Part 2: Chi Square Analysis

This table was constructed using chi square test to identify statistically significant relationships between expected and observed rates of testing and reporting, performed individually for maternal age and maternal race.

The expected testing and reporting rates were determined by calculating the overall rate of testing and reporting regardless of demographic. The observed testing and reporting rates were determined by calculating the rate of testing and reporting within the given demographic. These tables are reactive to the 'Before' and 'After' buttons above.

Maternal Age

	Expected Rate of Testing	Observed Rate of Testing	Expected Rate of Reporting	Observed Rate of Reporting
<20 years old	16.13 %	22.33 %	7.87 %	12.09 %
20-35 years old	16.13 %	16.91 %	7.87 %	7.86 %
>35 years old	16.13 %	11.04 %	7.87 %	6.47 %

Tested Chi Square P-Value: 0.38
Reported Chi Square P-Value: 0.646

Maternal Race

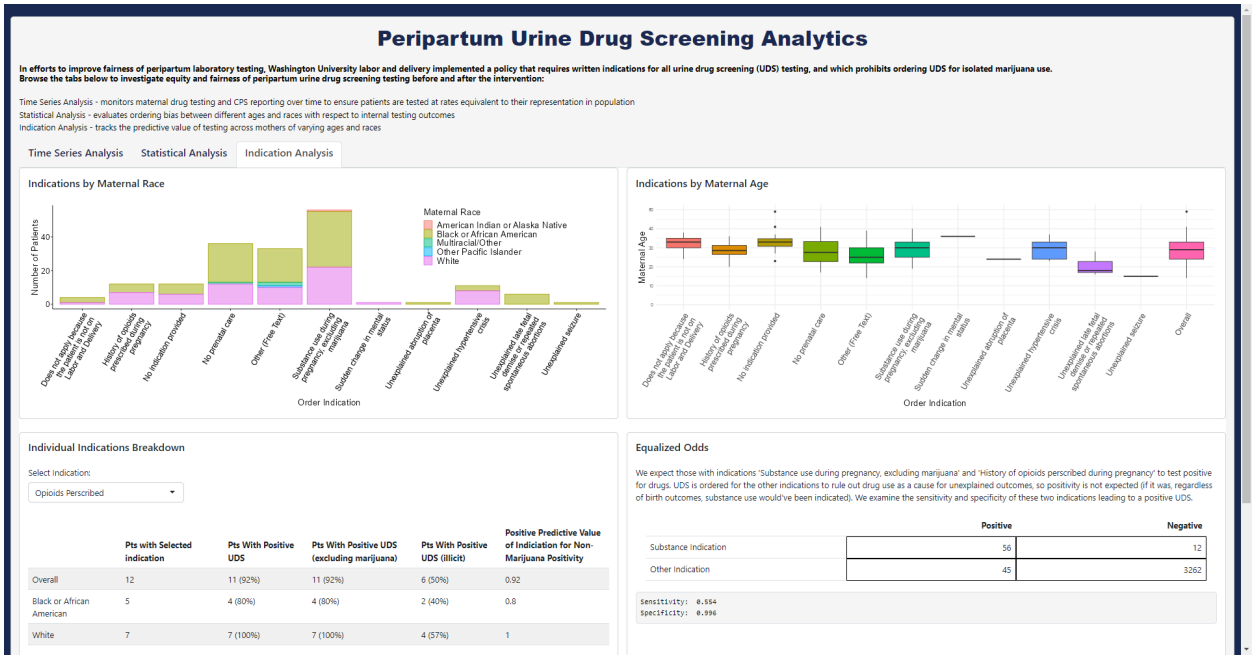
	Expected Rate of Testing	Observed Rate of Testing	Expected Rate of Reporting	Observed Rate of Reporting
Black or African American	16.13 %	23.49 %	7.87 %	11.41 %
White	16.13 %	10.91 %	7.87 %	5.39 %
Asian	16.13 %	2.55 %	7.87 %	0 %
Other Pacific Islander	16.13 %	13.64 %	7.87 %	13.64 %
Multiracial/Other	16.13 %	0 %	7.87 %	5 %
Not Indicated	16.13 %	3.23 %	7.87 %	0 %
American Indian or Alaska Native	16.13 %	14.29 %	7.87 %	7.14 %

Tested Chi Square P-Value: <0.01
Reported Chi Square P-Value: <0.01

The goal of this panel is to identify significant associations between the demographic groups and different **outcomes**, specifically testing and reporting. The first part, the correlation analysis, identifies demographic traits that significantly contribute to the observed outcomes. This can offer insight into testing bias, whether the bias is supported by positive results, and finally, whether there is bias in reporting positivity to CPS.

The second part, the chi square analysis, allows us to test if the outcomes we observe differ significantly from the outcomes we would expect under equal treatment. This **formal hypothesis testing** uses the p-value from the chi square test to determine the significance of these differences.

3. Indication Analysis



Peripartum Urine Drug Screening Analytics

In efforts to improve fairness of peripartum laboratory testing, Washington University labor and delivery implemented a policy that requires written indications for all urine drug screening (UDS) testing, and which prohibits ordering UDS for isolated marijuana use. Browse the tabs below to investigate equity and fairness of peripartum urine drug screening testing before and after the intervention:

Time Series Analysis - monitors maternal drug testing and CPS reporting over time to ensure patients are tested at rates equivalent to their representation in population
Statistical Analysis - evaluates ordering bias between different ages and races with respect to internal testing outcomes
Indication Analysis - tracks the predictive value of testing across mothers of varying ages and races

Time Series Analysis | Statistical Analysis | Indication Analysis

Indications by Maternal Race

Indications by Maternal Age

Individual Indications Breakdown

Select Indication:

Opioids Perscribed

	Pts with Selected indication	Pts With Positive UDS	Pts With Positive UDS (excluding marijuana)	Pts With Positive UDS (illicit)	Positive Predictive Value of Indication for Non-Marijuana Positivity
Overall	12	11 (92%)	11 (92%)	6 (50%)	0.92
Black or African American	5	4 (80%)	4 (80%)	2 (40%)	0.8
White	7	7 (100%)	7 (100%)	4 (57%)	1

Equalized Odds

We expect those with indications 'Substance use during pregnancy, excluding marijuana' and 'History of opioids perscribed during pregnancy' to test positive for drugs. UDS is ordered for the other indications to rule out drug use as a cause for unexplained outcomes, so positivity is not expected (if it was, regardless of birth outcomes, substance use would've been indicated). We examine the sensitivity and specificity of these two indications leading to a positive UDS.

	Positive	Negative
Substance Indication	56	12
Other Indication	45	3262

Sensitivity: 0.554
Specificity: 0.996

The goal of this panel is to investigate how the indications were used within the post-intervention group. The first row of panels illustrates the distribution of indications over maternal race and age. The second row computes the efficiency of these indications. This includes the **positive predictive value** of each indication, and the **sensitivity and specificity** of substance-related indications.

We have also incorporated a section outlining the next steps that can be implemented to enhance the utility and effectiveness of this dashboard in clinical practice.

Rachel Ruderman MD, MPH
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To Whom It May Concern:

I am writing to offer my support of the Endeavor Health team's dashboard in this year's FairLabs Data Analytics Challenge.

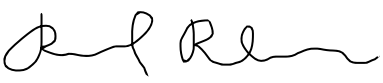
I am the current rising senior Maternal Fetal Medicine fellow at the University of Chicago/Endeavor Health, with a background in public health and a special interest and expertise in implementation science and its impact on health equity efforts. I have seen firsthand the negative impact of targeted or improper urine drug screening on the health of pregnant patients and their families, so I was eager to participate in this effort. The team approached me to provide feedback on the usability and applicability of their dashboard. They have obtained IRB clearance and await de-identified data from the IT department to apply the dashboard to our patient population.

Upon my review, I found the dashboard meticulously crafted to offer comprehensive insights into the provided data. The use of impactful and clear visuals effectively communicates the findings. The dashboard is segmented into three pages to explain the changes before and after the intervention, along with the differential impact on various racial groups. Notably, the decrease in the number of African American females undergoing urine drug screening before and after the intervention underscores the potential for small interventions to promote equity.

I proposed several recommendations to the team, including acquiring prescription data for individual patients to ascertain whether a positive urine drug screen resulted from illicit substances or prescribed medications. Furthermore, I suggested integrating the dashboard into the electronic medical record and developing a distinct dashboard tailored to the needs of physicians to enhance usability. This custom dashboard would have the potential to flag practitioners at elevated risk for biased testing, thereby prompting physicians to ensure fair testing practices.

The potential impact of this dashboard on our patient population is substantial. It has the capability to not only identify disparities in urine drug screening practices among different racial and ethnic groups but also to facilitate the implementation of interventions that can significantly improve the fairness of our clinical practice. I look forward to continuing my partnership with this team and give them my utmost support.

Sincerely,



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