

OPIOID CRISIS

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**'ONCE YOU'RE INTO HEROIN, IT'S ALMOST LIKE A
RELATIONSHIP WITH A PERSON YOU LOVE. AND
LETTING GO OF THAT, THE THOUGHT OF NEVER
SEEING SOMEONE I LOVE AGAIN—I COULDN'T
IMAGINE GIVING IT UP FOREVER.'**

DAN
A HOMELESS USER IN SAN FRANCISCO

OPIOID CRISIS

- Big Pharma
- Fentanyl and Oxycodone
- National Emergency



Two men sharing drugs under a truck in Boston on Jan. 14

HYPOTHESIS

- We hypothesize that a decrease in opioid prescribing rates from 2013 to 2015 leads to a lower rate of drug overdose deaths in counties in 2016.



A woman, who goes by Jen, struggling to inject herself in the freezing cold in Boston on Jan. 14

Source — Time: The Opioid Diaries

DATA SETS

- Medicare Opioid Prescribing Rate Data
- CDC Overdose Death Data

Opioid Overdose Death Rate for Three Prescribing Rate Changes

The GLM Procedure

Dependent Variable: deathrate

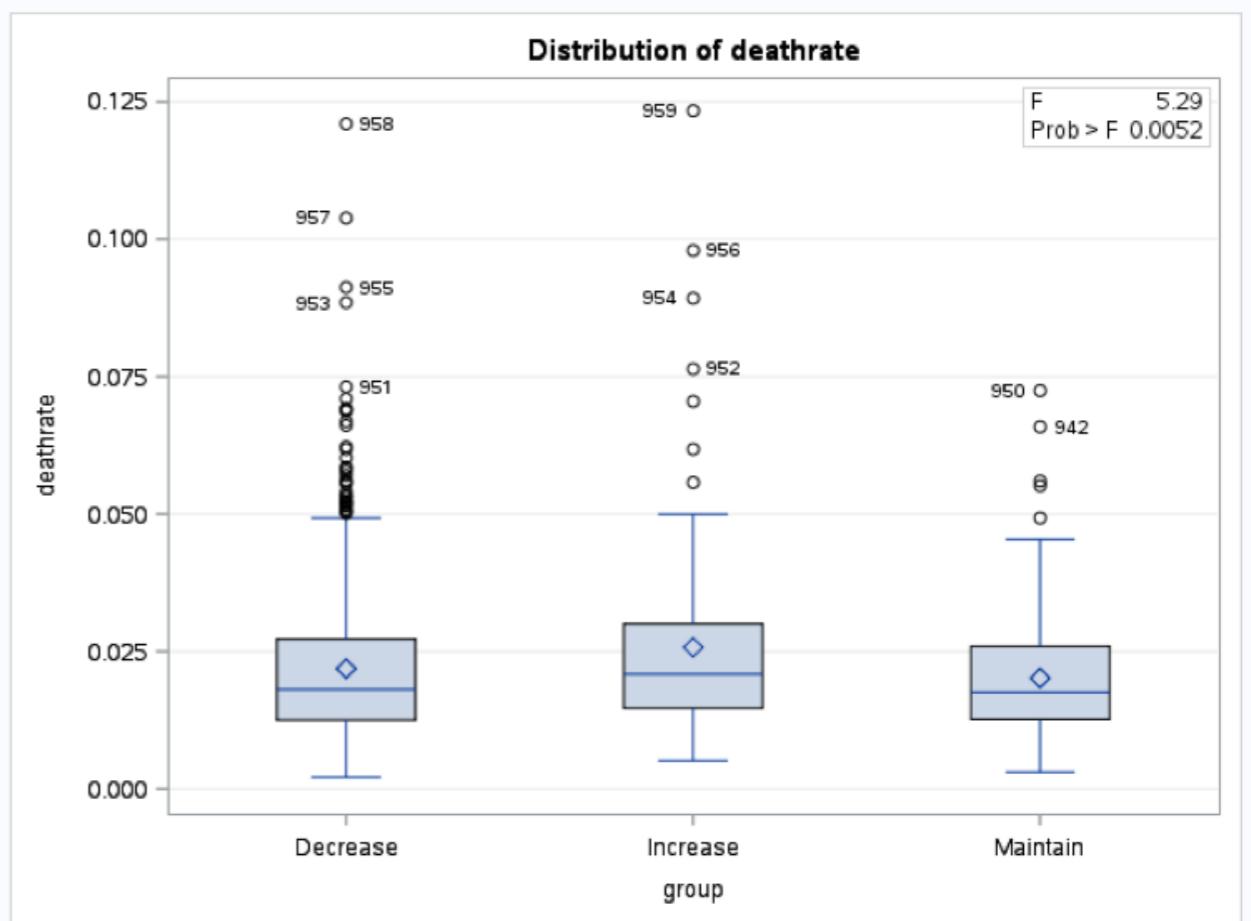
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00208926	0.00104463	5.29	0.0052
Error	956	0.18870524	0.00019739		
Corrected Total	958	0.19079450			

R-Square	Coeff Var	Root MSE	deathrate Mean
0.010950	64.22488	0.014050	0.021876

Source	DF	Type I SS	Mean Square	F Value	Pr > F
group	2	0.00208926	0.00104463	5.29	0.0052

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	0.00208926	0.00104463	5.29	0.0052

ANOVA



ANOVA

Bonferroni (Dunn) t Tests for deathrate

Note: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than Tukey's for all pairwise comparisons.

Alpha	0.05
Error Degrees of Freedom	956
Error Mean Square	0.000197
Critical Value of t	2.39820

Comparisons significant at the 0.05 level are indicated by ***.				
group Comparison	Difference Between Means	Simultaneous 95% Confidence Limits		
Increase - Decrease	0.0038835	0.0002138	0.0075532	***
Increase - Maintain	0.0055786	0.0014663	0.0096910	***
Decrease - Increase	-0.0038835	-0.0075532	-0.0002138	***
Decrease - Maintain	0.0016951	-0.0009451	0.0043353	
Maintain - Increase	-0.0055786	-0.0096910	-0.0014663	***
Maintain - Decrease	-0.0016951	-0.0043353	0.0009451	

CORRELATION



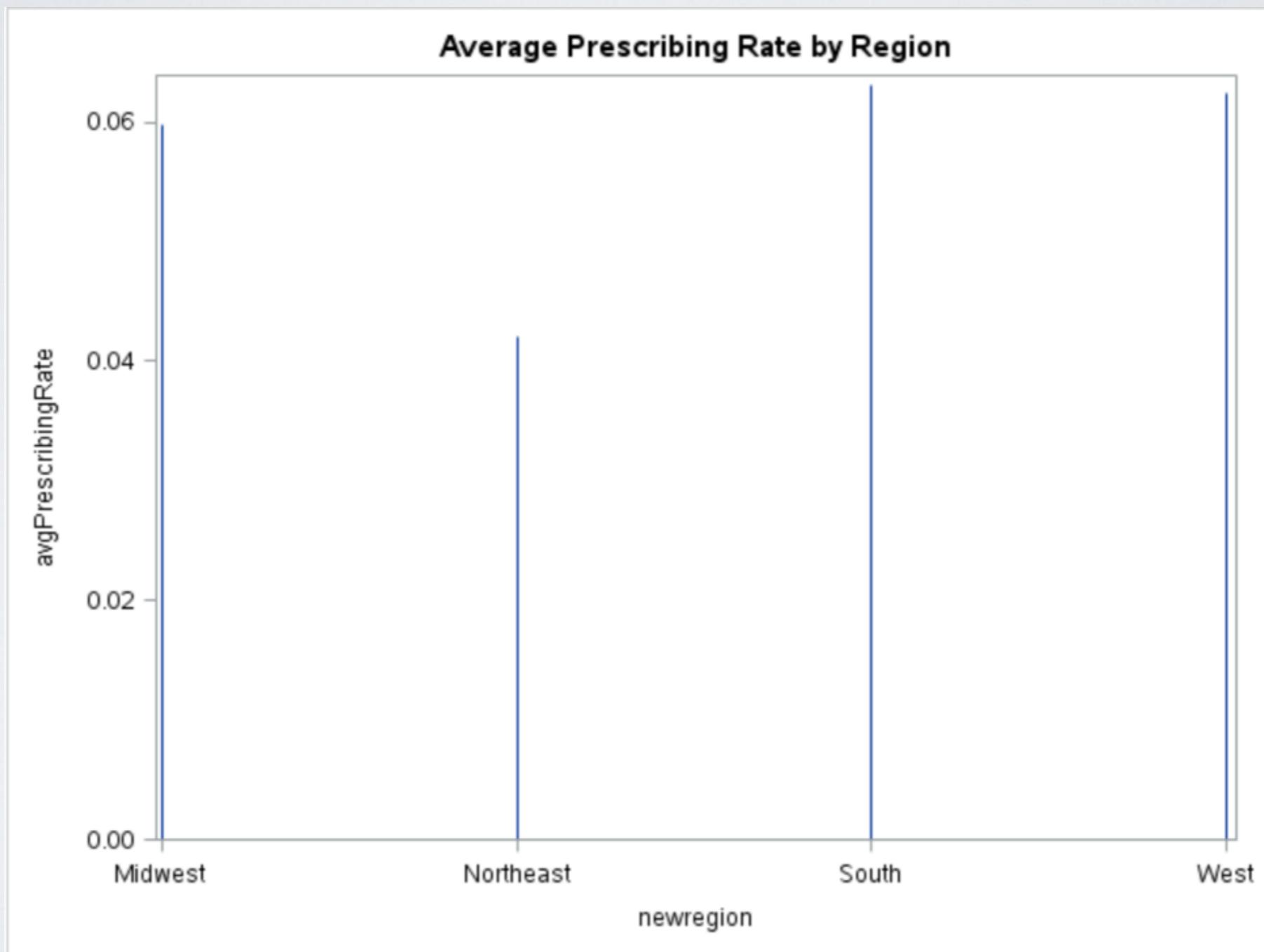
The CORR Procedure

6 Variables:	pop	deaths	deathrate	rate2013	rate2014	rate2015
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Simple Statistics							
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
pop	502	472194	716709	237041536	18646	10137915	
deaths	502	88.79880	110.01505	44577	20.00000	1041	
deathrate	502	0.02420	0.01517	12.14887	0.00247	0.12335	
rate2013	502	6.17004	1.50310	3097	1.68000	11.30000	J
rate2014	502	6.07803	1.48720	3051	1.57000	11.49000	Q
rate2015	502	5.85329	1.48378	2938	1.56000	10.83000	X

Pearson Correlation Coefficients, N = 502						
Prob > r under H0: Rho=0						
	pop	deaths	deathrate	rate2013	rate2014	rate2015
pop	1.00000	0.76610 <.0001	-0.23477 <.0001	-0.19967 <.0001	-0.19255 <.0001	-0.18632 <.0001
deaths	0.76610 <.0001	1.00000	0.08665 0.0523	-0.19788 <.0001	-0.19146 <.0001	-0.18180 <.0001
deathrate	-0.23477 <.0001	0.08665 0.0523	1.00000	-0.06081 0.1738	-0.05753 0.1981	-0.07169 0.1087
rate2013 J	-0.19967 <.0001	-0.19788 <.0001	-0.06081 0.1738	1.00000	0.97661 <.0001	0.94970 <.0001
rate2014 Q	-0.19255 <.0001	-0.19146 <.0001	-0.05753 0.1981	0.97661 <.0001	1.00000	0.97878 <.0001
rate2015 X	-0.18632 <.0001	-0.18180 <.0001	-0.07169 0.1087	0.94970 <.0001	0.97878 <.0001	1.00000

BAR-CHART



TWO-WAY ANOVA

The GLM Procedure

Dependent Variable: deathrate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	11	0.01915500	0.00174136	9.60	<.0001
Error	945	0.17143286	0.00018141		
Corrected Total	956	0.19058786			

R-Square	Coeff Var	Root MSE	deathrate Mean
0.100505	61.59559	0.013469	0.021867

Source	DF	Type I SS	Mean Square	F Value	Pr > F
group	2	0.00212489	0.00106244	5.86	0.0030
region	3	0.01174632	0.00391544	21.58	<.0001
group*region	6	0.00528379	0.00088063	4.85	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	0.00080499	0.00040250	2.22	0.1093
region	3	0.00647396	0.00215799	11.90	<.0001
group*region	6	0.00528379	0.00088063	4.85	<.0001

TWO-WAY ANOVA

deathrate SNK Grouping for Means of region (Alpha = 0.05)

Means covered by the same bar are not significantly different.

region Estimate

North East 0.02530

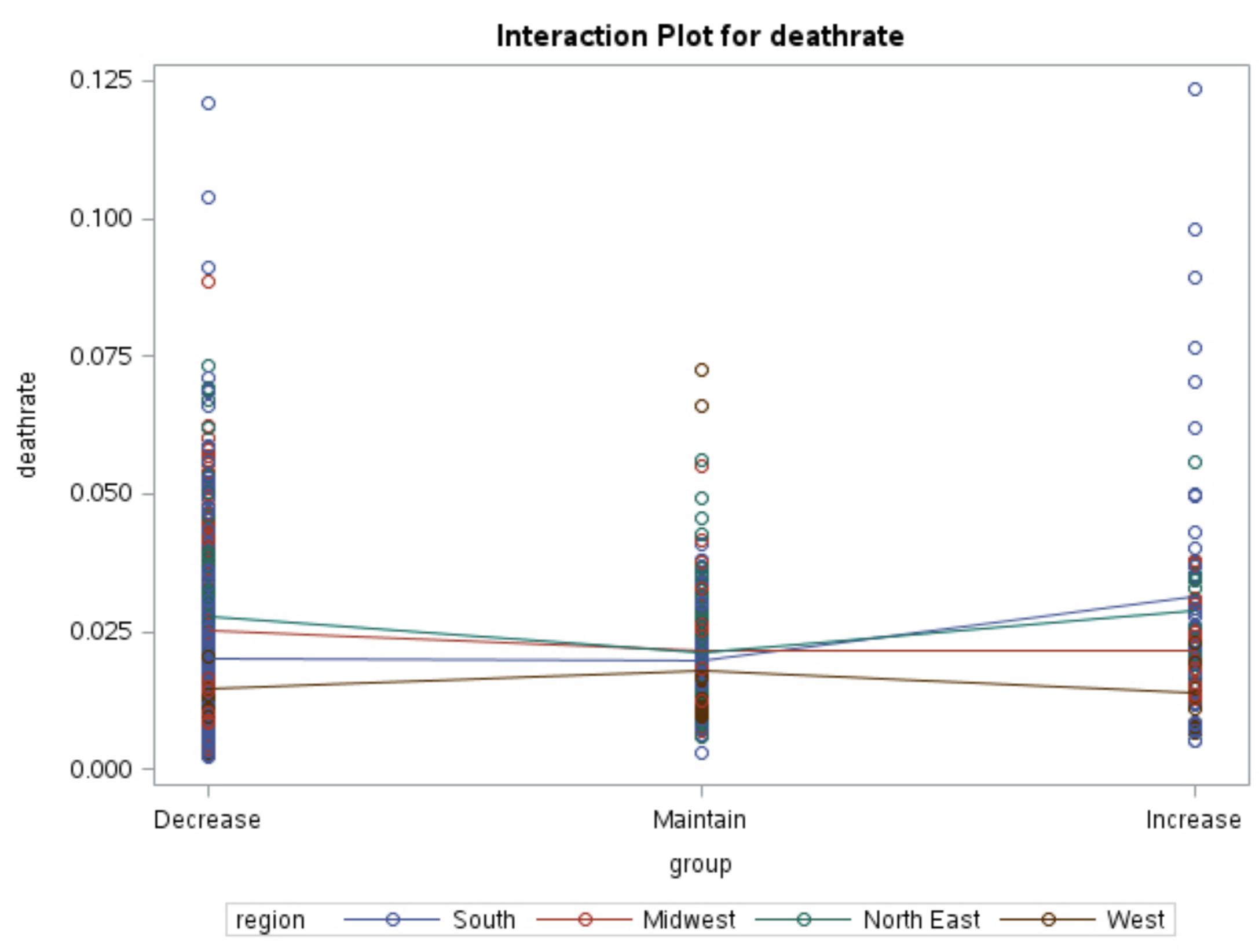
Midwest 0.02441

South 0.02137

West 0.01520



TWO-WAY ANOVA



CONCLUSION



Kayla Rauck, 29, experiencing withdrawal symptoms in a holding cell at the Kenton County Detention Center on Dec. 8 2017, in Covington, Ky.

Source — Time: The Opioid Diaries

ANOVA

Correlation

Two-Way ANOVA

Questions?

WORKS CITED

- Time Magazine: The Opioid Diaries — <http://time.com/james-nachtwey-opioid-addiction-america/>
- CDC — <https://www.drugabuse.gov/drugs-abuse/opioids/opioid-overdose-crisis>