



A POLLUTED MIND

EFFECTS OF CARBON DIOXIDE EMISSIONS ON PANIC ATTACK PREVALENCE

Kylie Jones
University of North Texas
KylieJones@my.unt.edu

RESEARCH QUESTION

- Can pollution contribute to panic attacks?
- Specifier: Carbon Dioxide Emissions



SIGNIFICANCE

- CO₂: 81% of pollutants (EIA, 2019)
- Panic Attacks:
 - Affect 10% of U.S. residents (Hemmings, 2018)
 - Five-fold prevalence over panic disorder (Hemmings, 2018)
 - May be caused by CO₂

CARBON DIOXIDE AND PANIC ATTACKS

Gorman, J.M., Martinez, J., Coplan, J.D., Kent, J., Kleber, M. (2004). The effect of successful treatment on the emotional and physiological response to carbon dioxide inhalation in patients with panic disorder. *Biological Psychiatry*, 56(11), 862-867. doi:10.1016/j.biopsych.2004.08.016.

Relationship: Neurology

Lopes, F.L., Oliviera, M.M., Freire, R.C., Caldirola, D., Perna, G., Bellodi, L... (2010). Carbon dioxide-induced panic attacks and quantitative electroencephalogram in panic disorder patients. *World Journal of Biological Psychiatry*, 11(2), 357-363. doi:10.3109/15622970903144012.

Relationship: Neurology

Roberson-Nay, R., Gorlin, E.I., Beadel, J.R., Cash, T., Vrana, S., Teachman, B.A. (2017). Temporal stability of multiple response systems to 7.5% carbon dioxide challenge. *Biological Psychology*, 124, 111-118.

doi:10.1016/j.biopsycho.2017.01.014.

Relationship: Neurology

CARBON DIOXIDE AND PANIC ATTACKS, CONT.

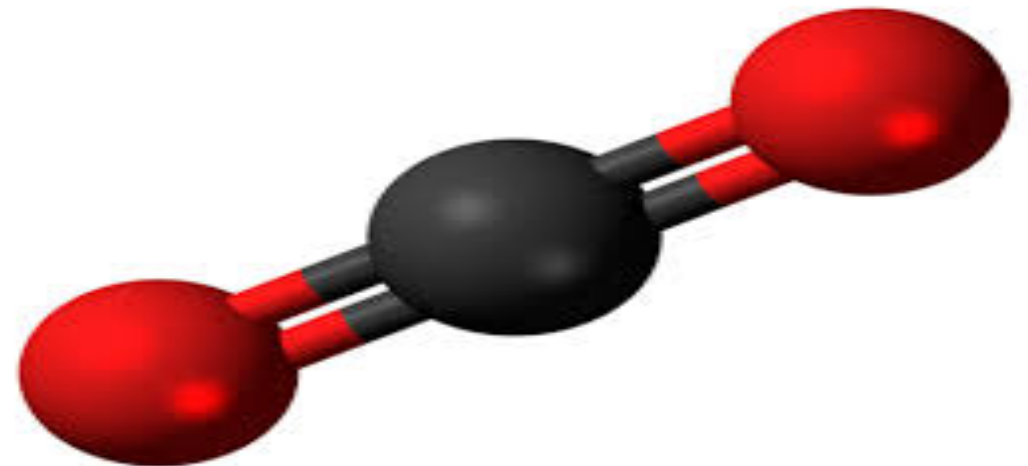
Lehman, C.L., Brown, T.A., Palfai, T., Barlow, D.H. (2002). The effects of alcohol outcome expectancy on a carbon-dioxide challenge in patients with panic disorder. *Behavior Therapy*, 33(3), 447. doi:10.1016/S0005-7894(02)80038-7.
Relationship: Environment

Levitt, J.T., Brown, T.A., Orsillo, S.M., Barlow, D.H. (2004). The effects of acceptance versus suppression of emotion on subjective and psychophysiological response to carbon dioxide challenge in patients with panic disorder. *Behavior Therapy*, 35(4), 747-766. doi:10.1016/S0005-7894(04)80018-2.
Relationship: Environment

van Beek, N., Perna, G., Schruers, K., Verburg, K., Cucchi, M., Bellodi, L.... (2003). Vulnerability to 35% carbon dioxide of panic disorder patients with a history of respiratory disorders. *Psychiatry Research*, 120(2), 125.
doi:10.1016/S0165-1781(03)00164-1.
Relationship: Respiration

INFERENCES FOR POLLUTION

- Physical Symptoms & CO₂:
 - Lopes et al. (2010)
 - Roberson-Nay et al. (2017)
- Chemical Cause Potential:
 - Lehman et al. (2002)



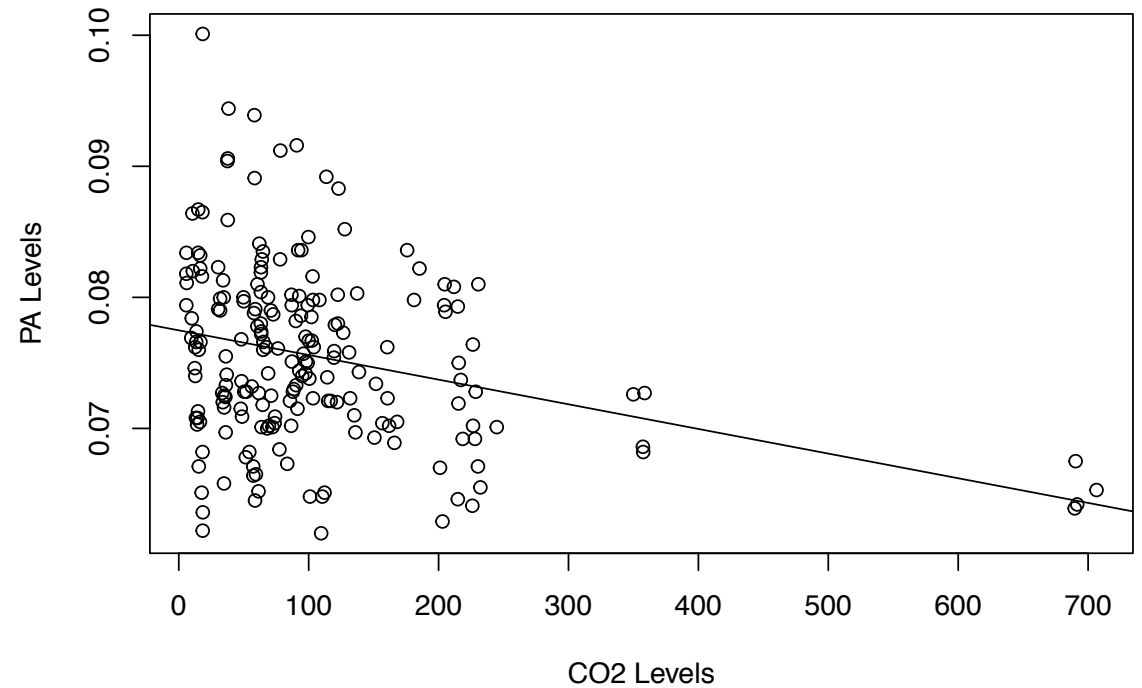
METHODOLOGY

- CO₂/Panic Attack Association Check
 - Across all 50 states
 - 2014-2017
 - Includes linear regression, significance, r^2 , and Cohen's d
 - Excel: Containing Data; R: Association & Graphs

DATA

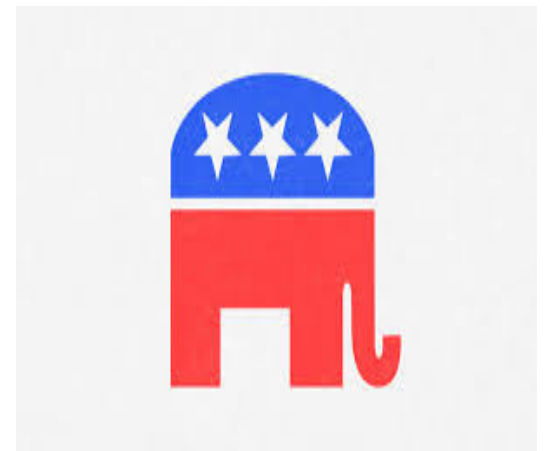
- Significant Correlations, Both Directions
 - 37 states with significant relationships
 - $r_{overall} = -.16; p = .216$
 - $r^2 = .02$
 - Cohen's $d = .24$
- Likely third variable at play

Panic Attack & Carbon Dioxide Associations 2014–2017



DISCUSSION

- Ideas of third variables:
 - Industrial v. Agricultural Economy
 - Democratic v. Republican States
 - Weather by State
 - State-Level Population Density



CONCLUSIONS

- CO₂ and Panic Attacks – Related
 - Possible third variable
 - Future Association Checks

IMAGE CREDITS

- **Slide 2:** Wikipedia. (2014). [Model of carbon dioxide molecule]. Retrieved from <https://phys.org/news/2014-10-oxygen-molecules-carbon-dioxide.html>
- **Slide 6:** Petersen-Clausen, C. (2018). [Carbon dioxide pollution in China]. Retrieved from <https://www.npr.org/2018/12/05/673821051/carbon-dioxide-emissions-are-up-again-what-now-climate>
- **Slide 9:**
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