

# Analysis of US Opioid Mortality and ER Visit Data

[CDC Wonder + AHRQ HCUP-US Databases]

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+ Richard A Lawhern, Ph.D – Data interpretation and conclusions

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# Objectives and Sources

- Assess trends, patterns in opioid prescriptions versus opioid-related mortality by US State
- Assess trends, patterns in Emergency Department admissions for opioid-related causes
- Sources
  - \* CDC Wonder Database
  - \* CDC Prescribing Data
  - \* Agency for Healthcare Research Quality  
HCUP-US Database
- Trends Checked in Organization for Economic Cooperation and Development (OECD = 34 industrialized countries)
- Data Current April 2018

# Take-Away Conclusions

- There is no consistent causal relationship between rates of opioid prescription and rates of opioid-overdose-related deaths by US State.
- Production restrictions on scheduled opioid drugs – either prescribed for patients or diverted – will not reduce opioid-overdose-related deaths or opioid-related hospital admissions.

# Graphical Analysis of Overdose Rates by US State

# About Data Analysis

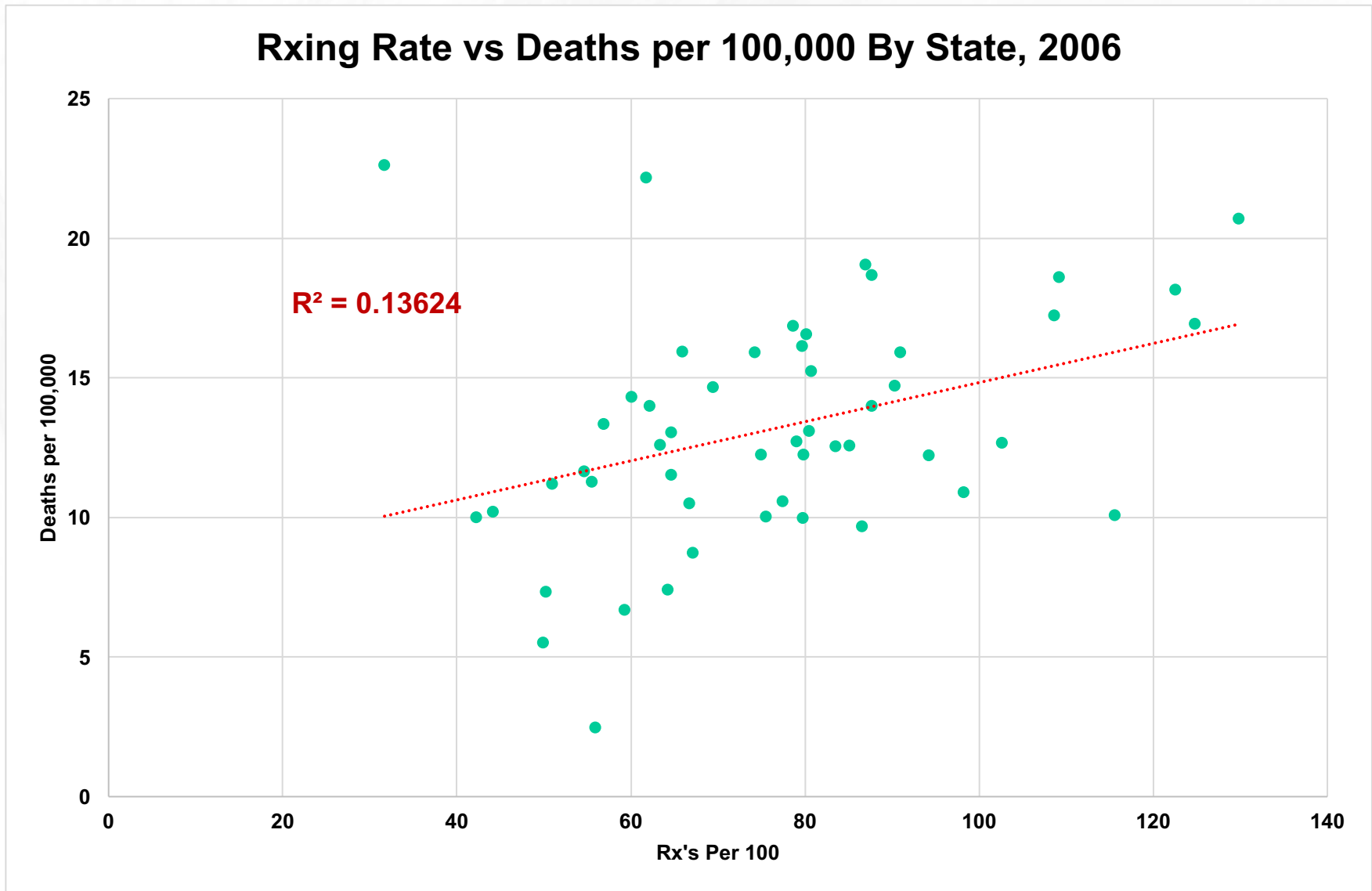
Excel™ spreadsheets offer “regression analysis” capabilities, to examine how strongly one set of data may be related to another. “R-Squared” is a mathematical measure of how well two groups of data “fit” with a model of the relationship between them.

In a strong relationship, R-Squared should be above 0.9. This means that the data “fit” closely around a “moving average” line. The smaller the value of R-Squared, the weaker is the “fit” and the weaker is the relationship.

In charts which follow, data on opioid-related overdoses from all sources (legal and illegal) and data on hospital and ER visits involving opioids of all kinds (legal and illegal) are compared with State-by-State rates of medical opioid prescriptions.

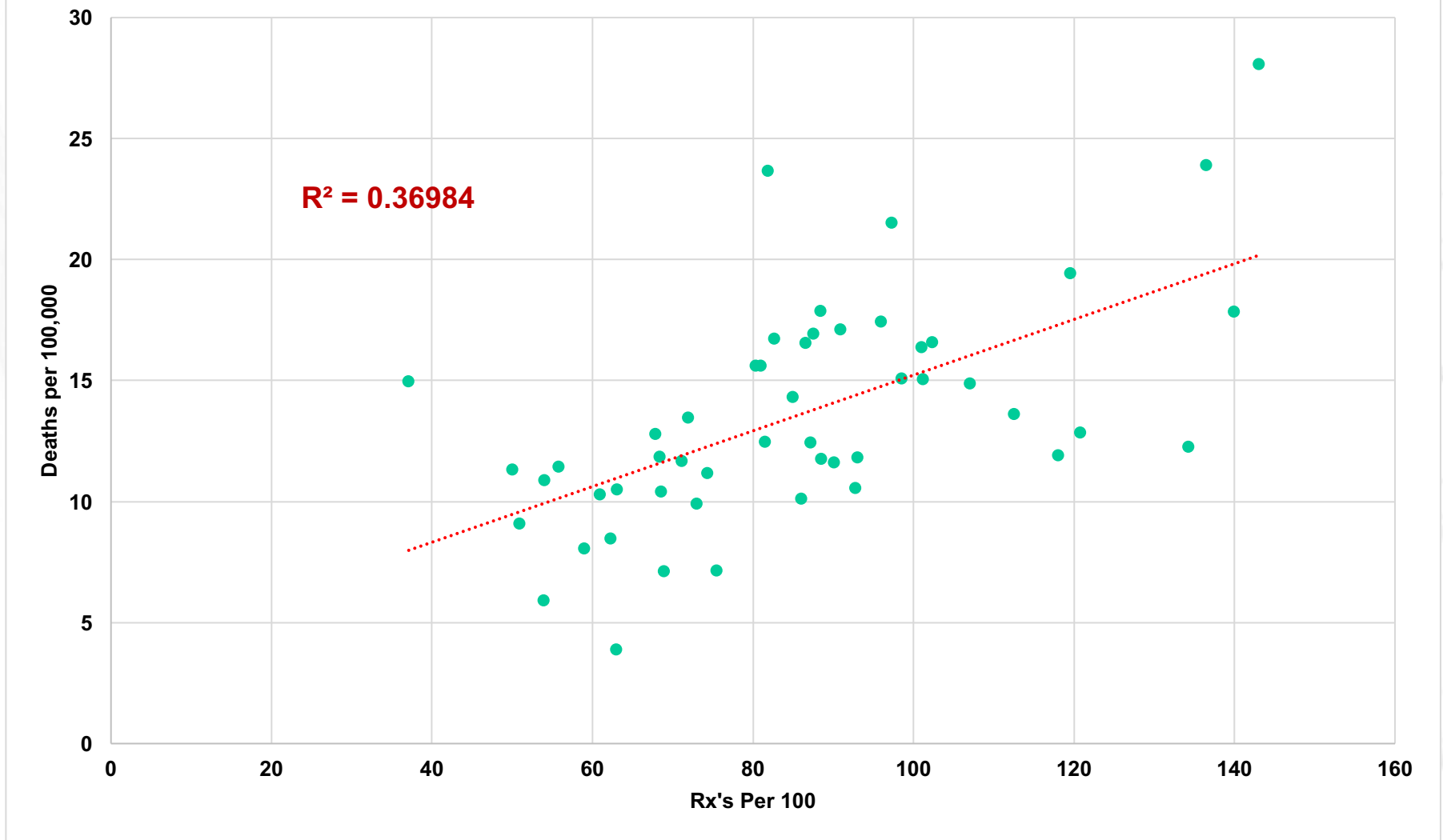
Computed R-squared for all of the data is so low that no consistent relationship can be detected. **Higher rates of prescription are *NOT* “causing” increased drug overdose deaths.** Other factors must be at work.

## Rxing Rate vs Deaths per 100,000 By State, 2006



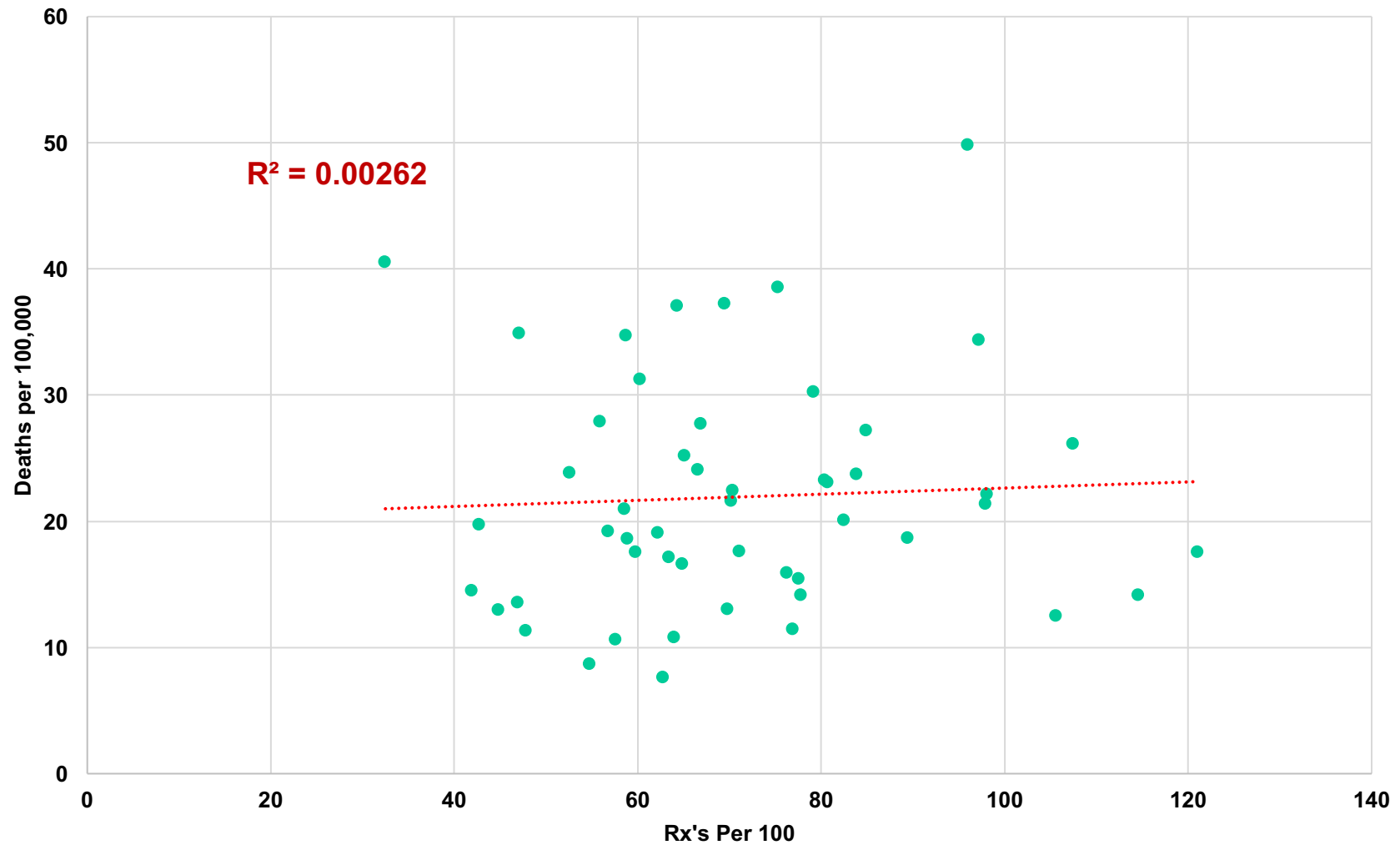
Opioid prescriptions per 100 people by US State vs. opioid-related deaths per 100K. Weak upward trend with prescription rates, wide variation between States

## Rxing Rate vs Deaths per 100,000 By State, 2010



Opioid prescriptions per 100 people by US State vs. opioid-related deaths per 100K. Weak upward trend with prescription rates, wide variation between States

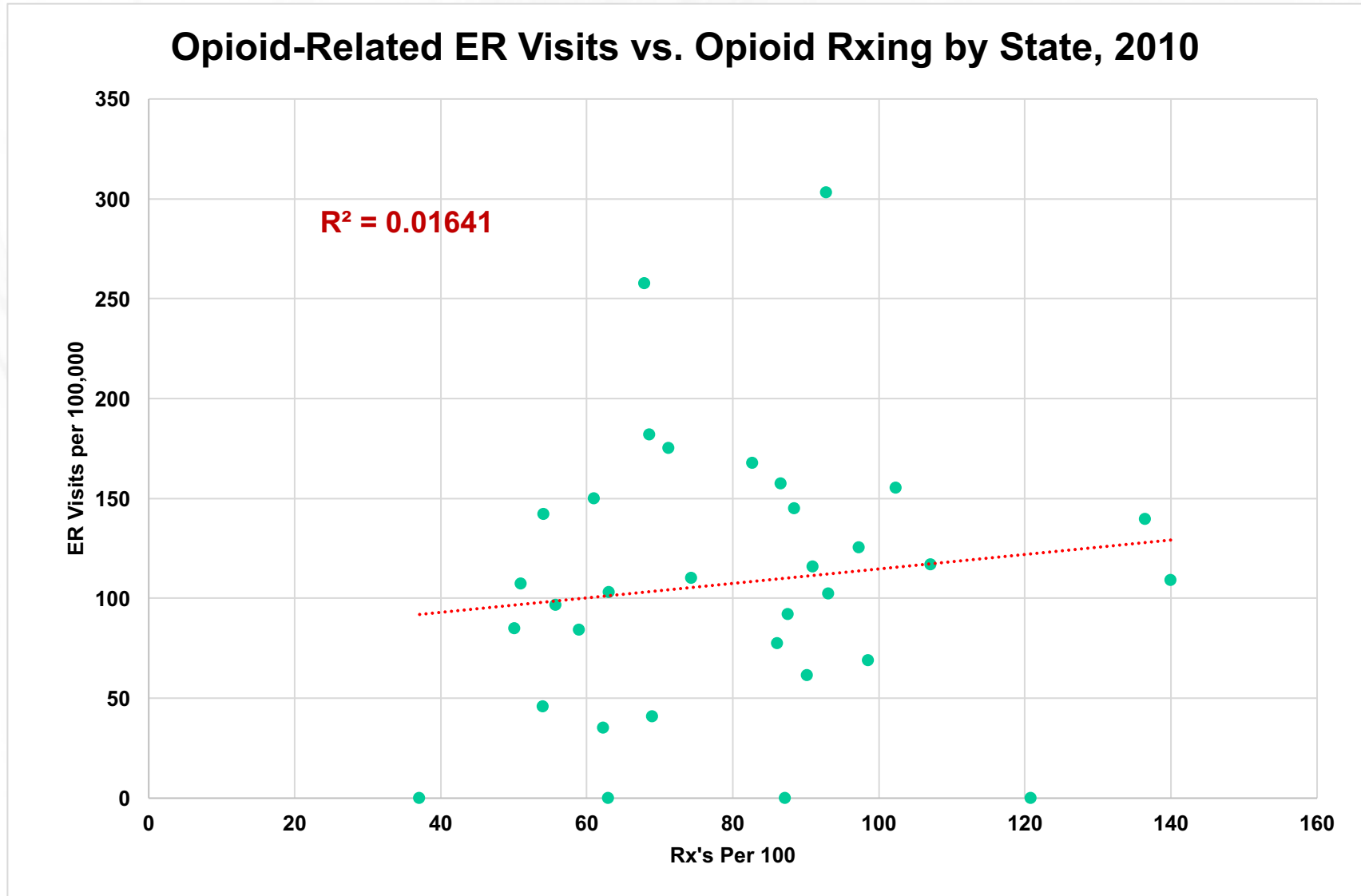
## Rxing Rate vs Deaths per 100,000 By State, 2016



Opioid prescription rates per 100 people by US State versus opioid-related deaths per 100,000. **No consistent trends, wide variations, very poor data fit.**

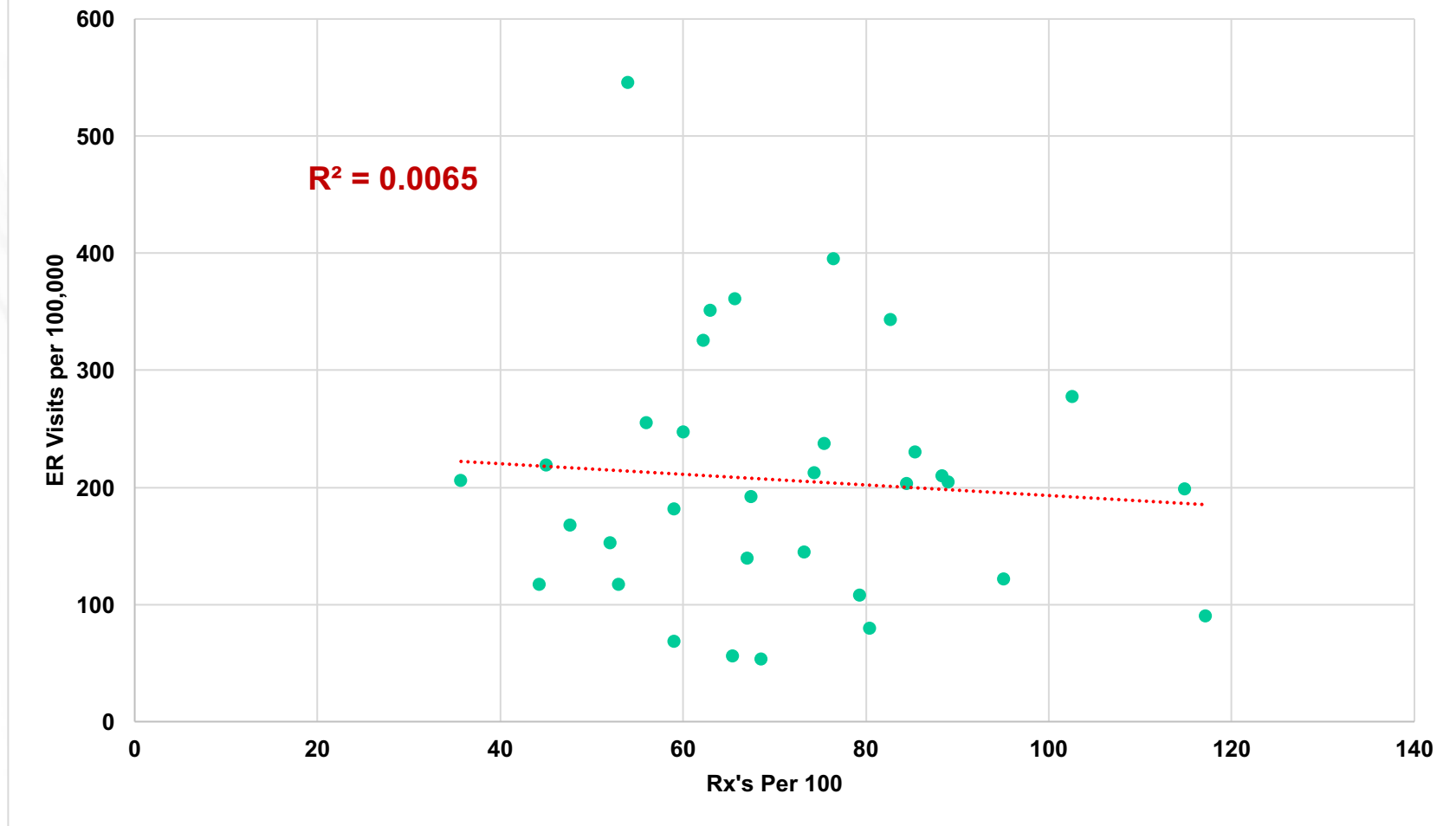


# Graphical Analysis of Hospital Visits vs Opioid Prescribing



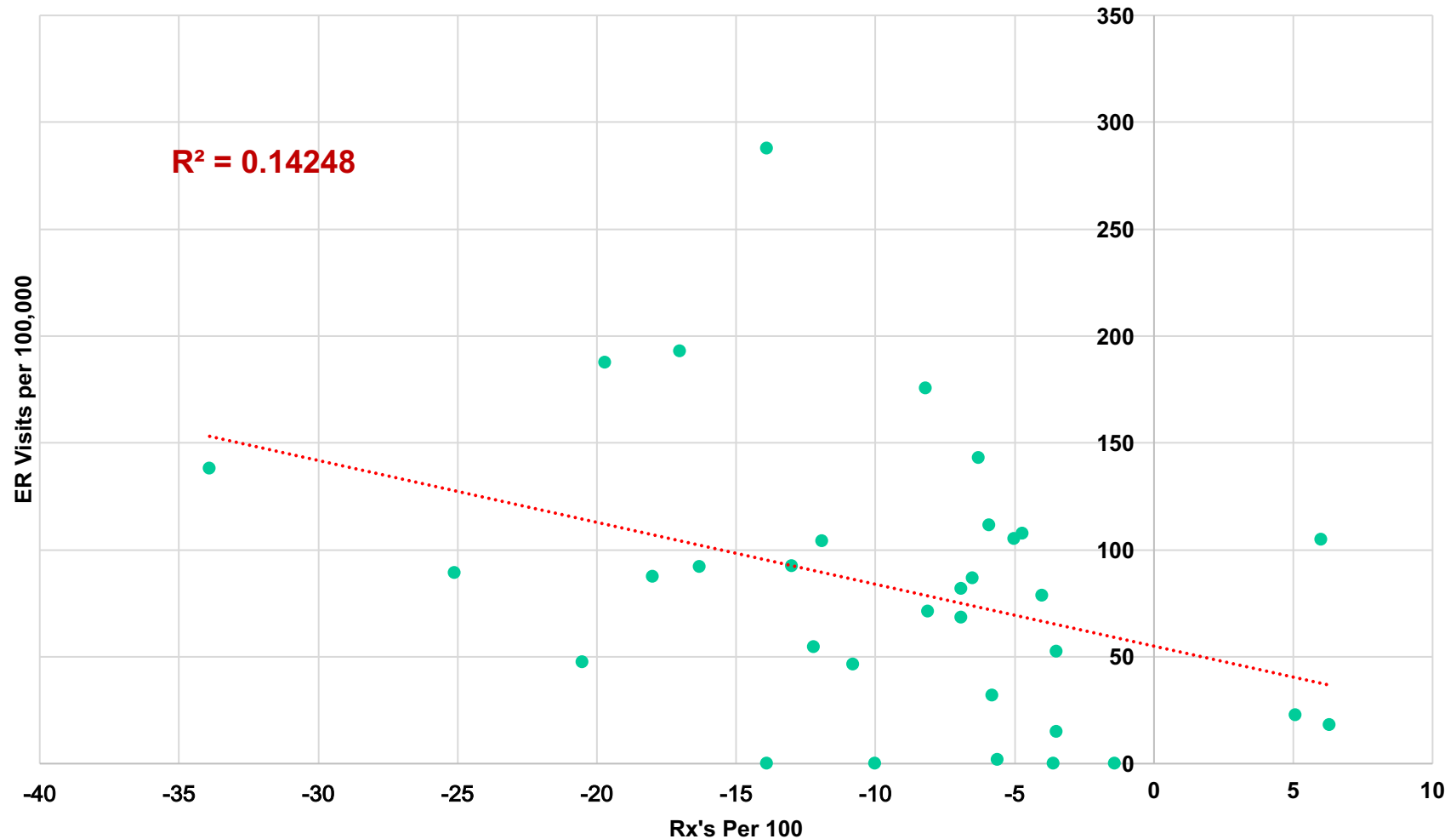
Opioid prescription rates per 100 people by US State vs. ER Visits per 100,000.  
**Wide variations between states, no consistent trends.**

## Opioid-Related ER Visits vs. Opioid Rxing by State, 2015



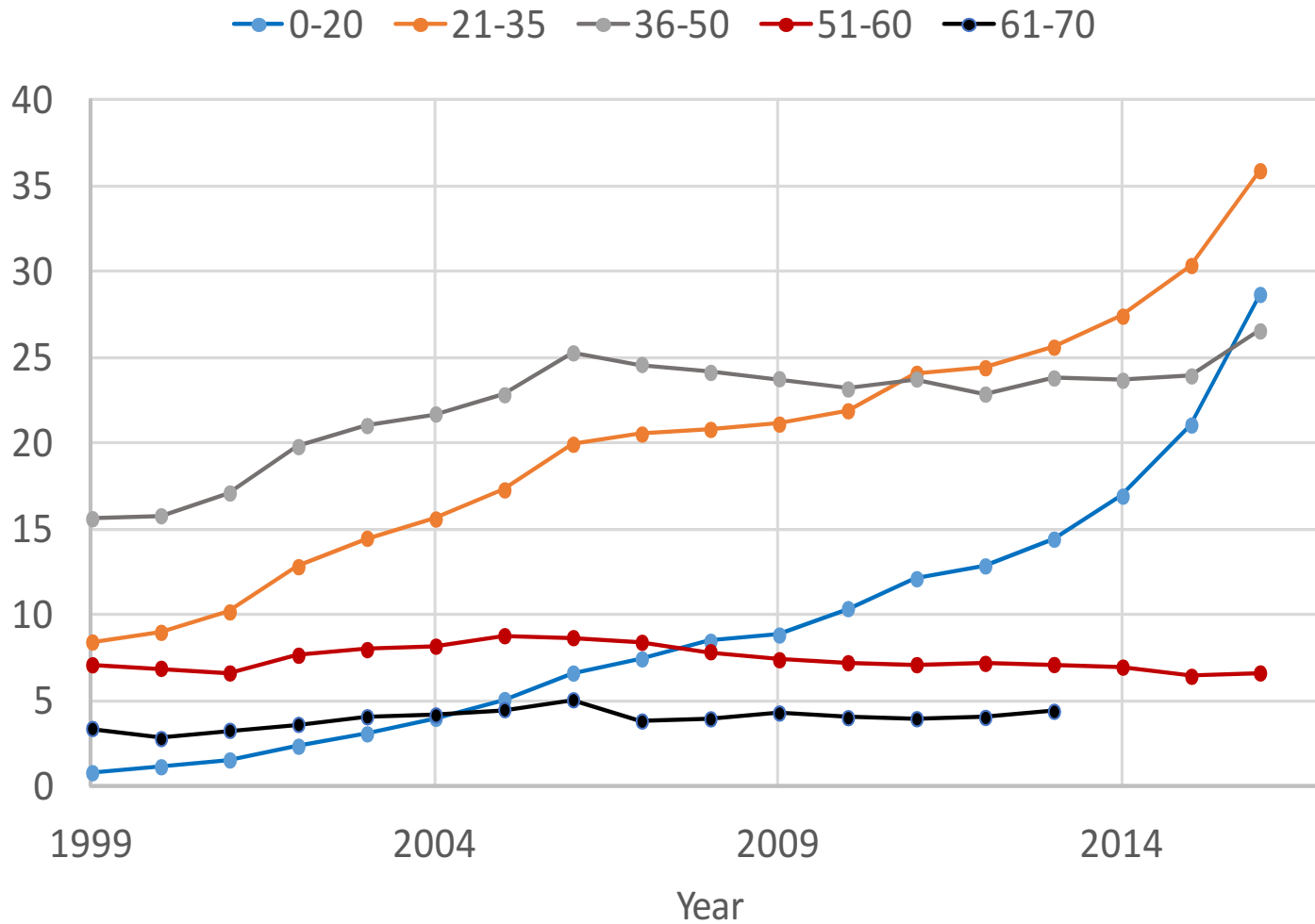
Opioid prescriptions per 100 people by US State versus opioid-related ER visits. **Wide variations between States. No consistent trends.**

## Change in Rxing vs. Change in ER Visits by State 2010 to 2015



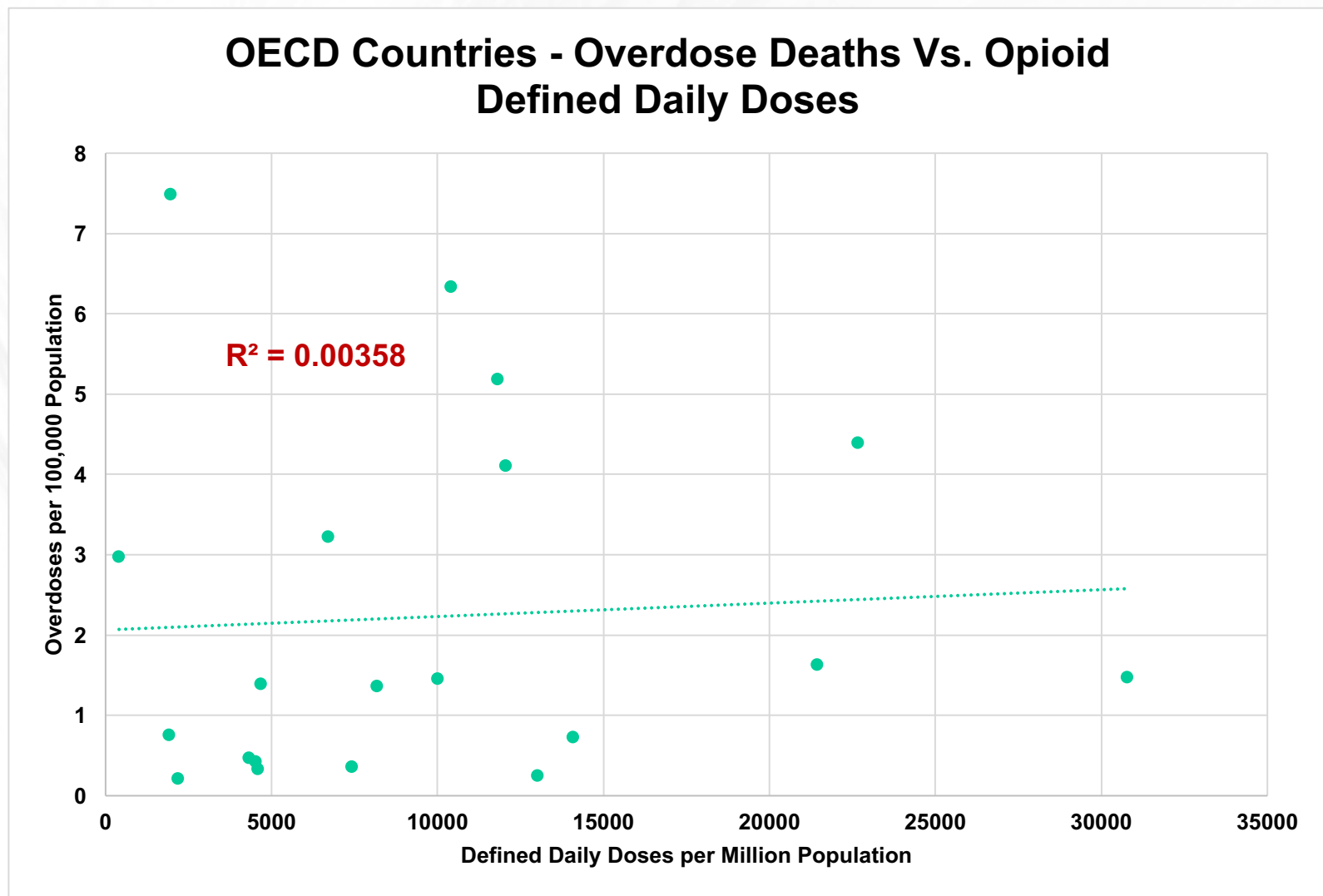
Change in prescribing vs. change in ER Visits by US State. Major variations between States. **Reduced prescribing but increasing admissions.**

## Longitudinal Analysis of Opioid ODs by Age - 1999 to 2016



Who died of opioid-related overdose by age group and year?

## OECD Countries - Overdose Deaths Vs. Opioid Defined Daily Doses



Organization of Economic Cooperation and Development – 34 industrialized countries. Wide “scatter”, **no consistent trends** for overdose deaths vs. average daily doses per million population.

# Observations

- US Opioid-related deaths/100K population doubled from 2006 to 2016
- Deaths/100K increase weakly with prescription rates for 2006-2015 -- but not for 2016.
- Decreasing prescriptions in 2010-2016 were accompanied by *increasing* deaths.
- Major statistical variation between US States, suggests multiple factors and causes are operating.
- Decreasing prescriptions per 100K population from 2010 to 2015 **BUT** opioid-related ER visits doubled. Something besides prescribing is going on – illegal street drugs.

# Observations (2)

- Maximum US mortality rate (2016) attributed to opioid overdose is .06% - Compared to .007% in other developed countries.
- US mortality rate increase 1999-2016 is dominated by adolescents and adults under 35. However, highest rates of opioid prescription are generally among adults over 50.
- US Opioid mortality over age 50 is stable throughout; 35-50 rate initially rises, then stabilizes from 2006 onward.
- In 34 industrialized countries, opioid overdose rates show no trend line versus daily opioid dose per million population.



## Observations (3)

**\* Prescribing rates are not a significant driver in either US overdose deaths or ER admission rates.**

# Source Notes (1)

- Prescribing Data – CDC Prescribing Data Page
- Mortality and Population – CDC Wonder Database
  - Data (deaths / 100,000) obtained by searching deaths by year and State using the limitation "Drug-induced causes" within the UCD - Drug/Alcohol Induced Causes" module of "Underlying Cause of Death". All other search parameters were left at their defaults. Mortality rates are not age-adjusted. Where the death rate was described as "not reliable" due to a low death count, a nominal value was estimated by dividing number of deaths by population.
- Emergency Room Visits – Agency for Healthcare Research Quality
  - Data downloaded as Excel spreadsheet. ER visits per 100K population in 35 states for ER visits and in 46 states for inpatients.
- Correlation of Prescribing With Mortality and ER Visits – Performed with Excel™ Spreadsheet Graphics Tools
- Longitudinal Analysis of Overdose Deaths by Age Cohort
  - Searched CDC wonder by age (1 year intervals) and State, using the Drug/Alcohol Induced Causes selection in underlying cause of death and choosing "drug related." Compiled into a table using Excel™ lookup functions and then grouped each year by 10-15 year age categories. Population data unavailable for the oldest age category beyond 2013.
- Organization for Economic Cooperation and Development (34 Nations)
  - Opioid Consumption data from [https://www.incb.org/incb/en/narcotic-drugs/Technical\\_Reports/2016/narcotic-drugs-technical-report-2016.htm](https://www.incb.org/incb/en/narcotic-drugs/Technical_Reports/2016/narcotic-drugs-technical-report-2016.htm).

# Source Notes (2)

- Opioid-Related Hospital Use Estimated by Diagnostic Codes (CDC Wonder)
  - Hospital inpatient stays and ER visits including opioid-related hospital use are identified by any diagnosis from a range of codes in the International Classification of Diseases, relating to legal and illegal opioids.  
  
ICD-9 prior to October 2015  
ICD-10-CM after October 2015
  - Rx and Admissions data are aggregated by drug type and medical diagnosis code. Adverse outcomes are not reliably tracked to diverted versus therapeutic use.

# Author Notes

- Richard A Lawhern, PhD is a technically trained non-physician healthcare writer and patient advocate, with 21 years experience in peer to peer social media support groups and medical literature analysis.
- John Allan Tucker, PhD is a research chemist and business analyst for Fortune 1000 financial services firms.
- Neither author has a personal financial interest in the findings or data of this presentation.