

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

* John Alan Tucker, Ph.D. - Data extraction, organization and Excel spreadsheet graphics

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 cause and effect relationship between rates of opioid prescription and rates of opioid-overdose-related deaths by US State.
- Deeper 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

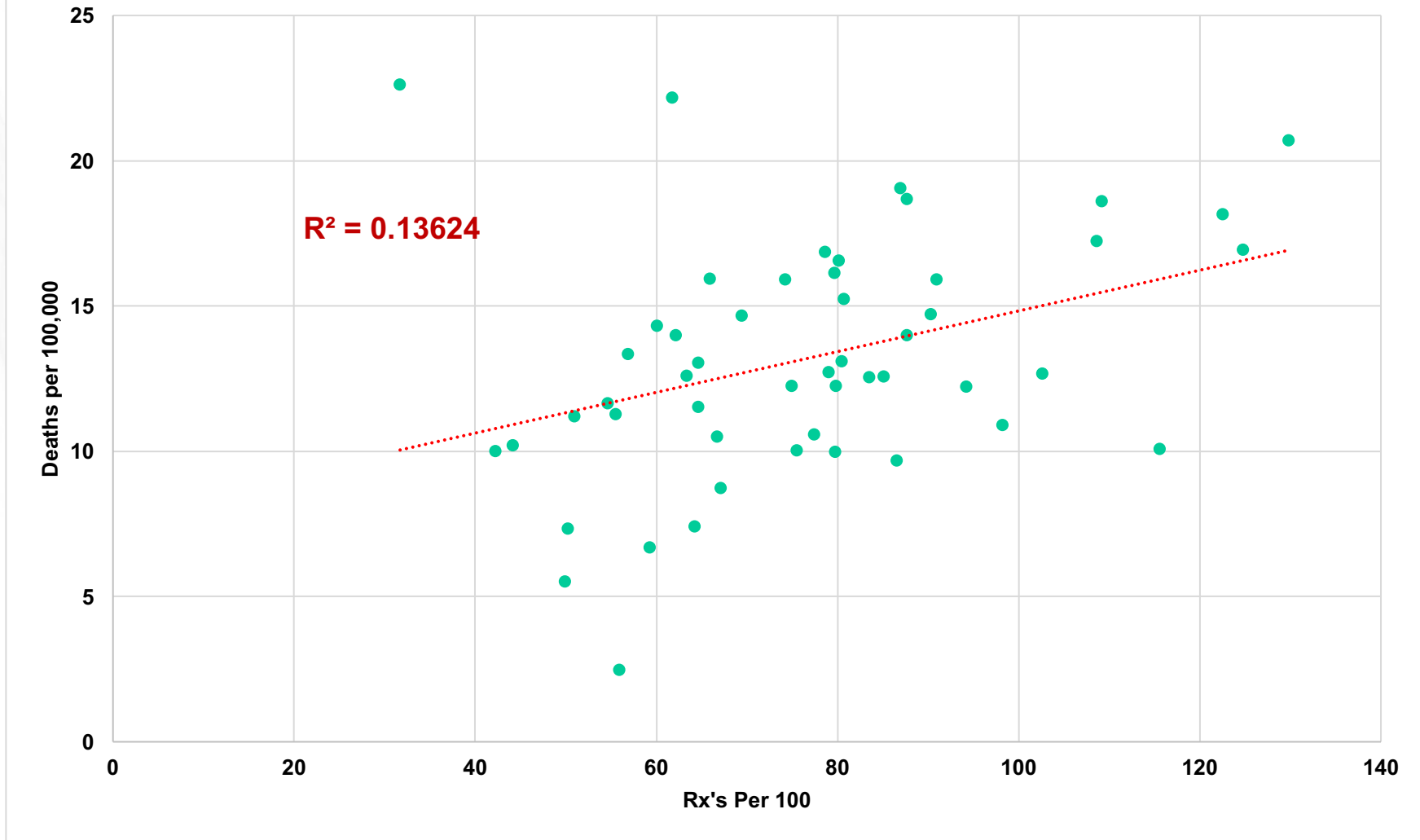
Excel™ spreadsheets offer “regression analysis” capabilities, to examine how strongly one set of data may be related to another. “R-Squared” is a mathematical measure of how well two groups of data “fit” with a model of the relationship between them.

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.

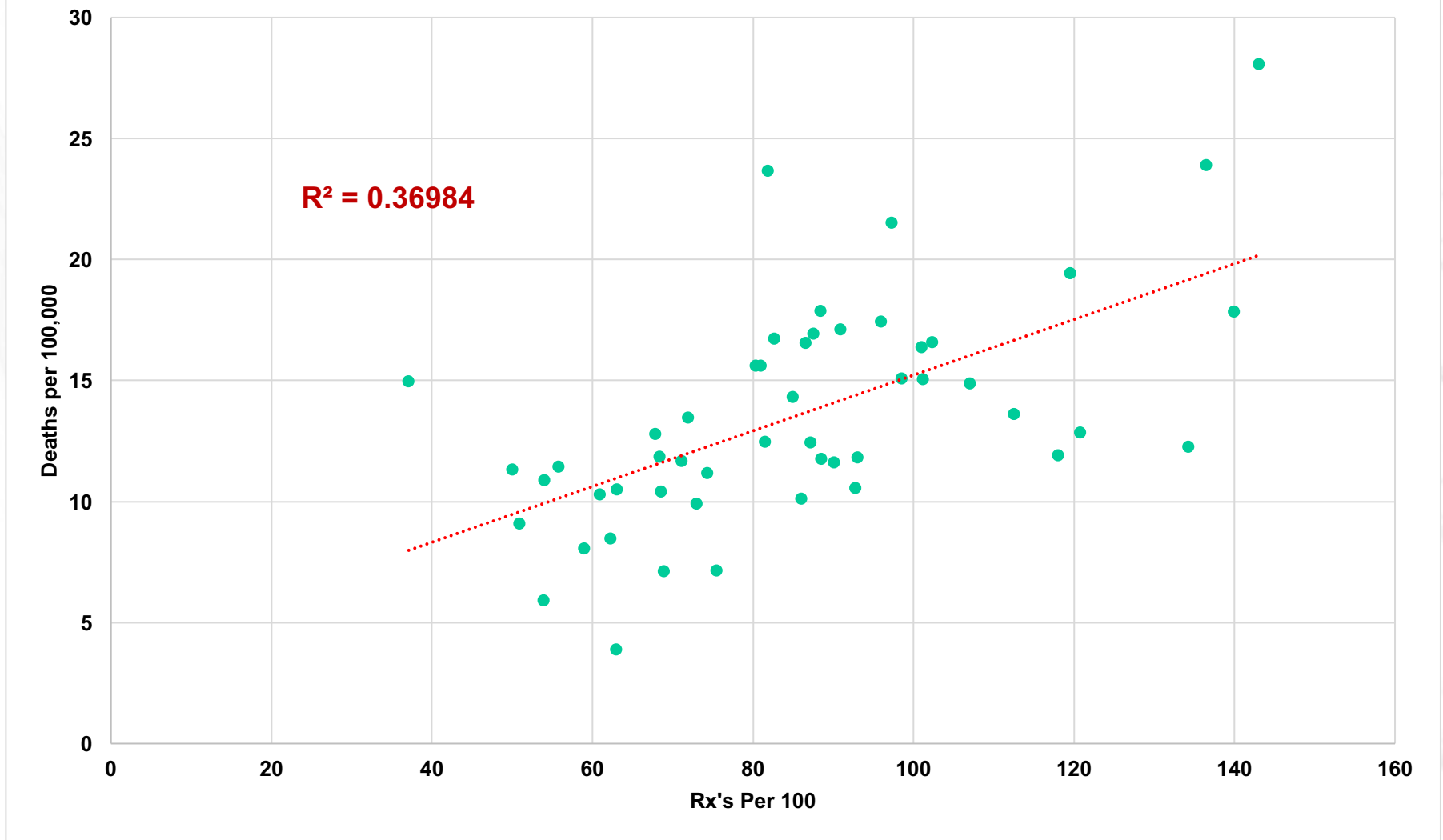
Computed R-squared for all of the data is so low that no consistent relationship can be detected. **Higher rates of prescription are *NOT* “causing” increased drug overdose deaths.** Other factors must be at work.

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



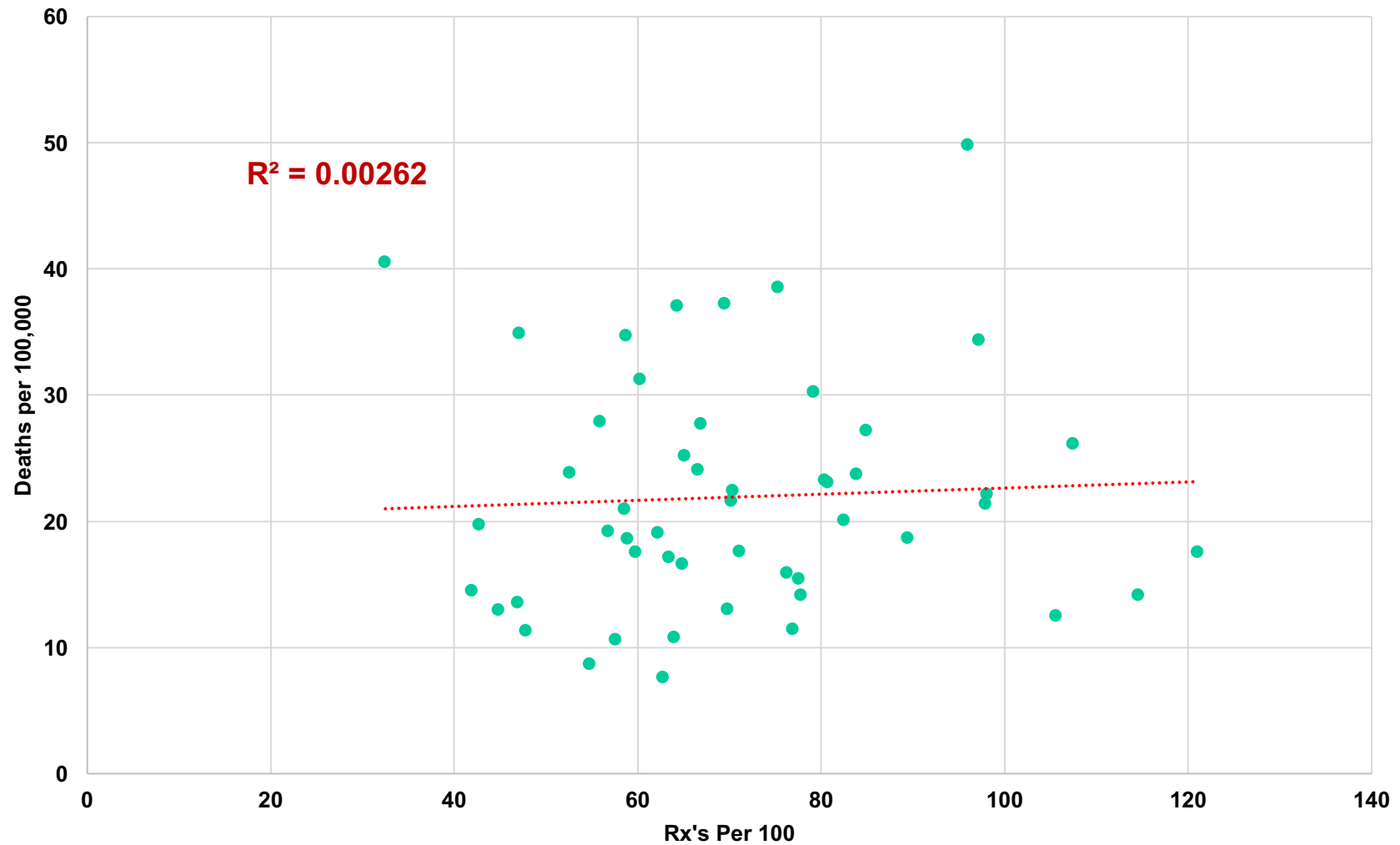
Opioid prescriptions per 100 people by US State vs. opioid-related deaths per 100K. Weak upward trend with prescription rates, wide variation between States

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



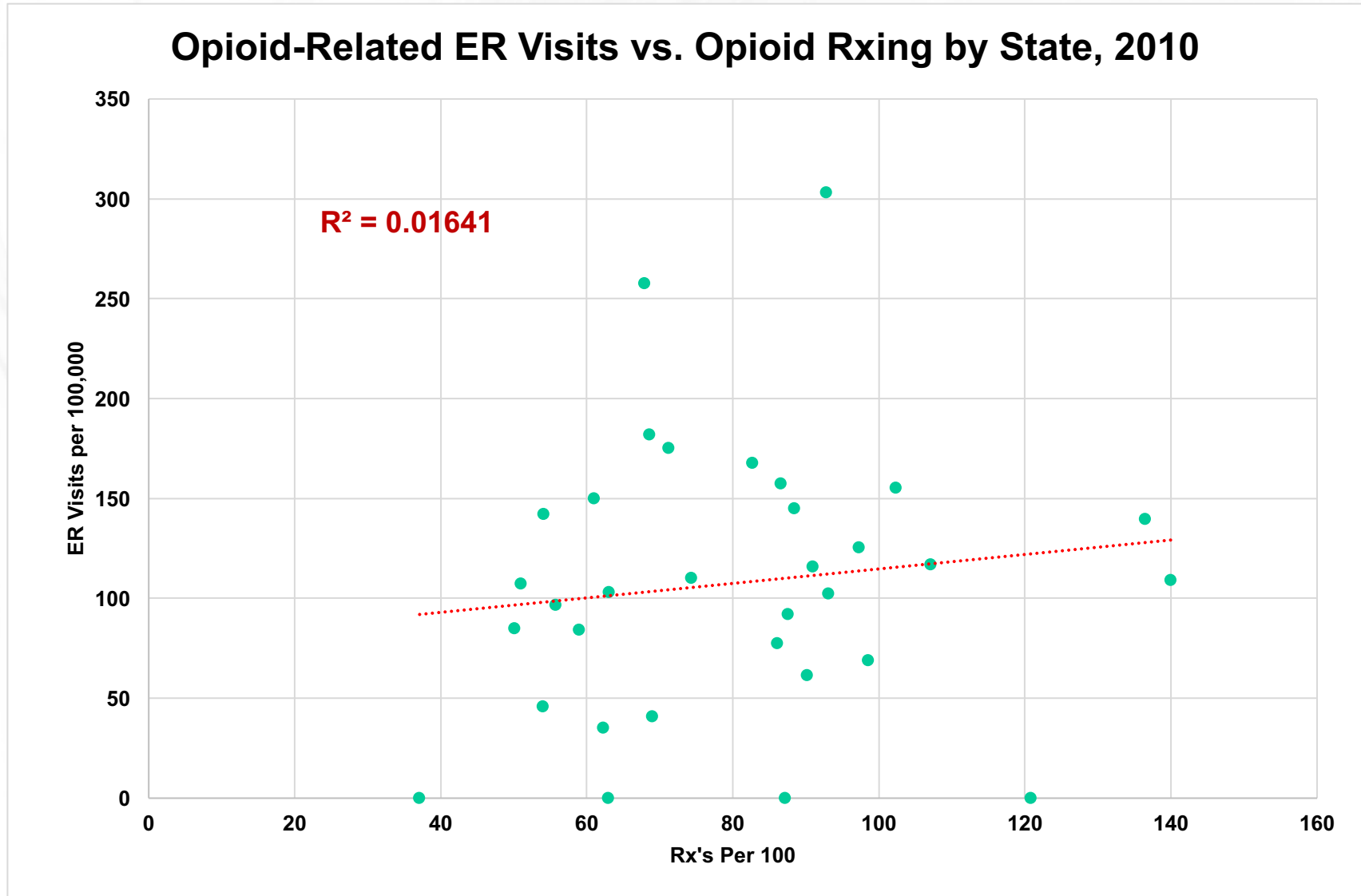
Opioid prescriptions per 100 people by US State vs. opioid-related deaths per 100K. Weak upward trend with prescription rates, wide variation between States

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



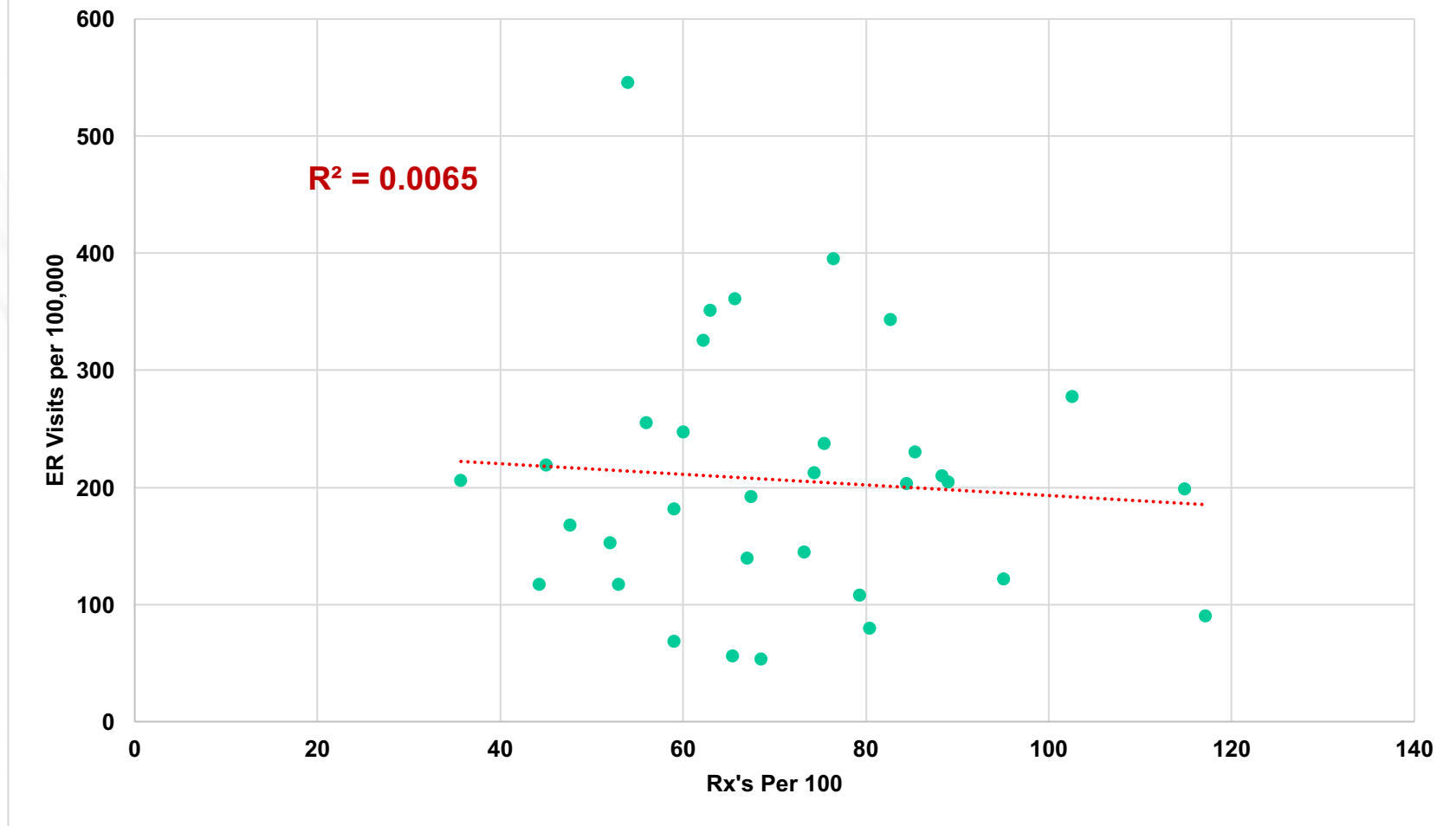
Opioid prescription rates per 100 people by US State versus opioid-related deaths per 100,000. **No consistent trends, wide variations, very poor data fit.**

Graphical Analysis of Hospital Visits vs Opioid Prescribing



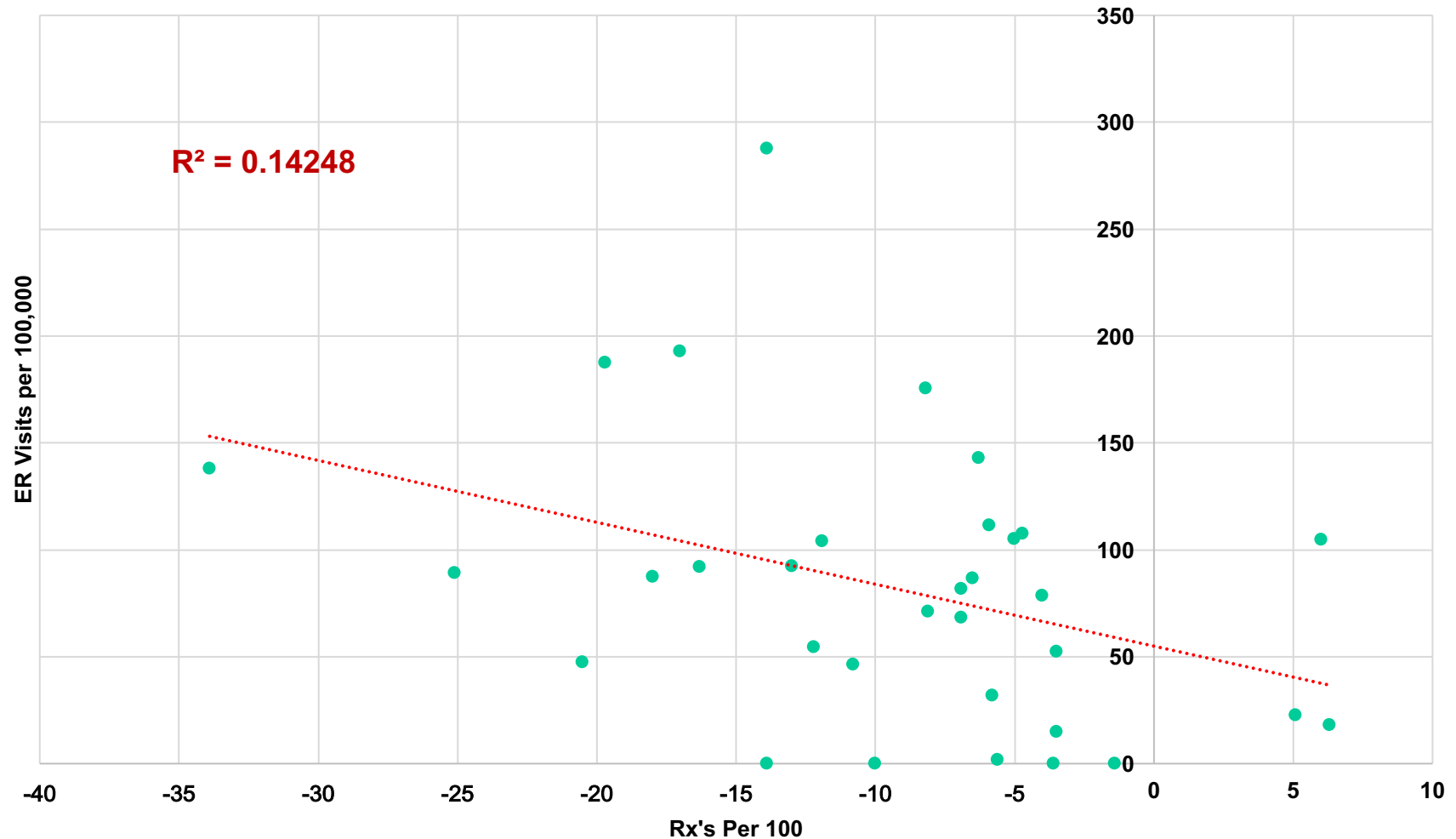
Opioid prescription rates per 100 people by US State vs. ER Visits per 100,000.
Wide variations between states, no consistent trends.

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



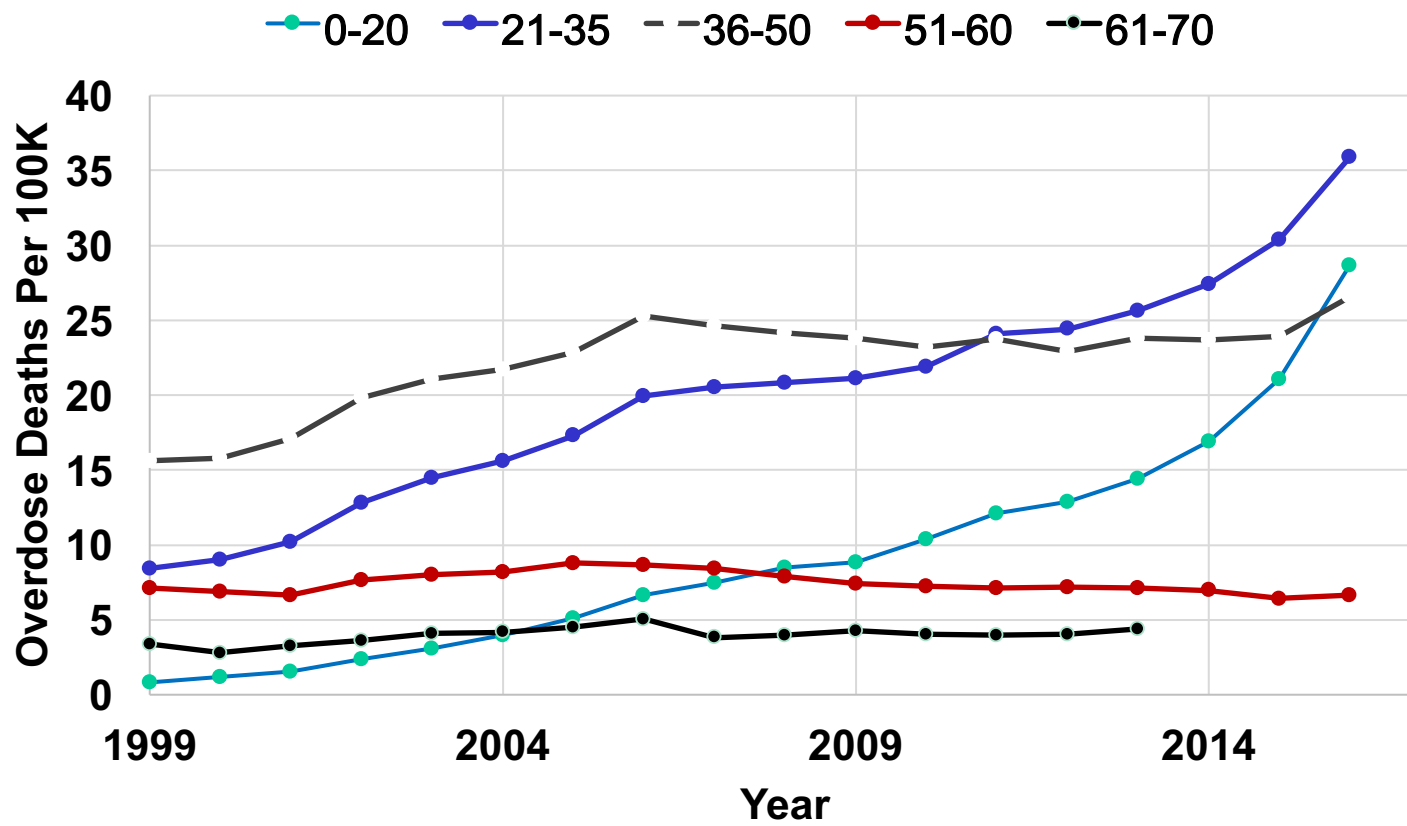
Opioid prescriptions per 100 people by US State versus opioid-related ER visits. **Wide variations between States. No consistent trends.**

Change in Rxing vs. Change in ER Visits by State 2010 to 2016



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

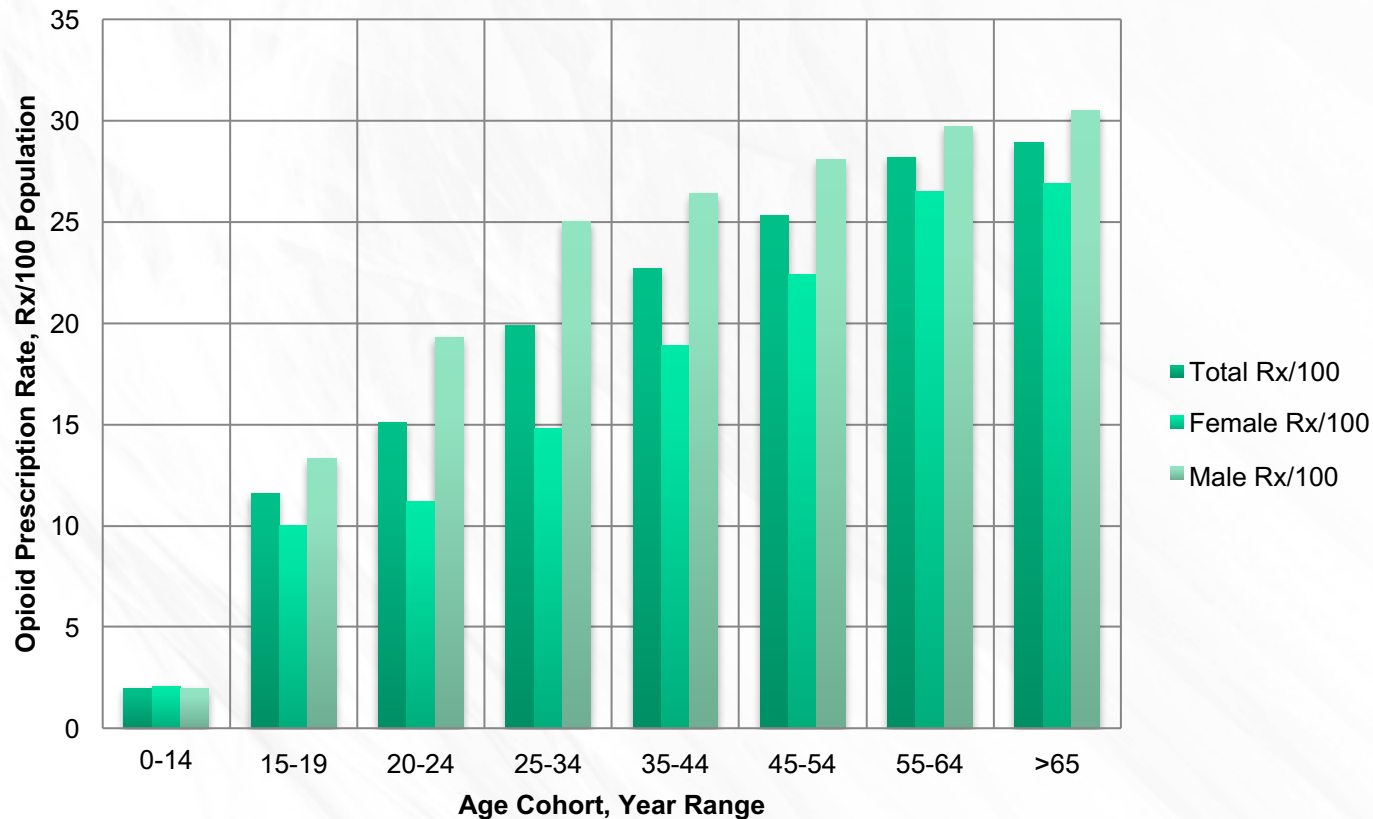
Longitudinal Analysis of Opioid ODs by Age - 1999 to 2016



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

Opioid Prescribing by Age Cohort *

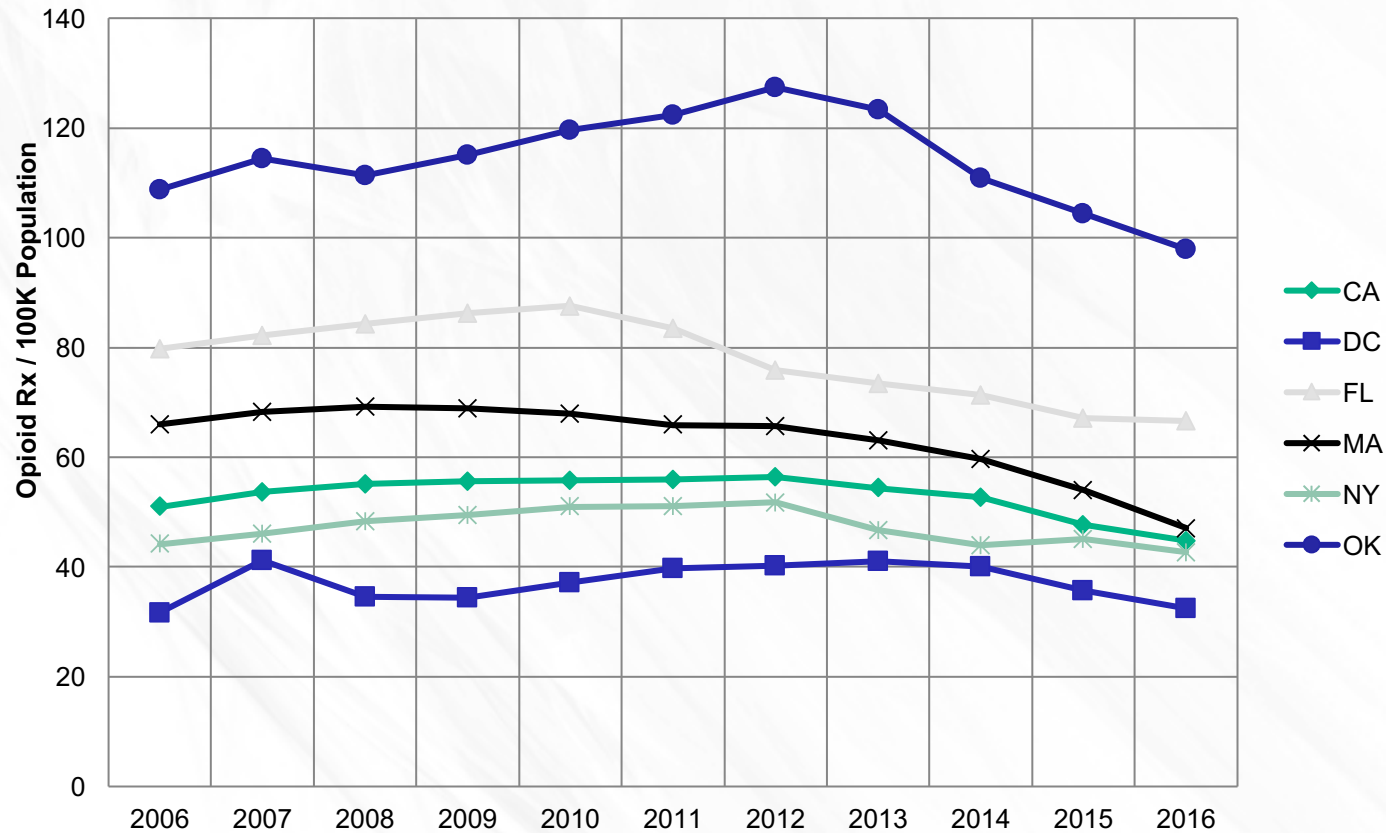
Prescribing Rates per 100 Population by Age Range, 2016



* Prescriptions/100 over age 55 are 200% higher than under age 20. But Opioid OD death rates are 600% higher among youth than among seniors

One Opioid Crisis or Many?

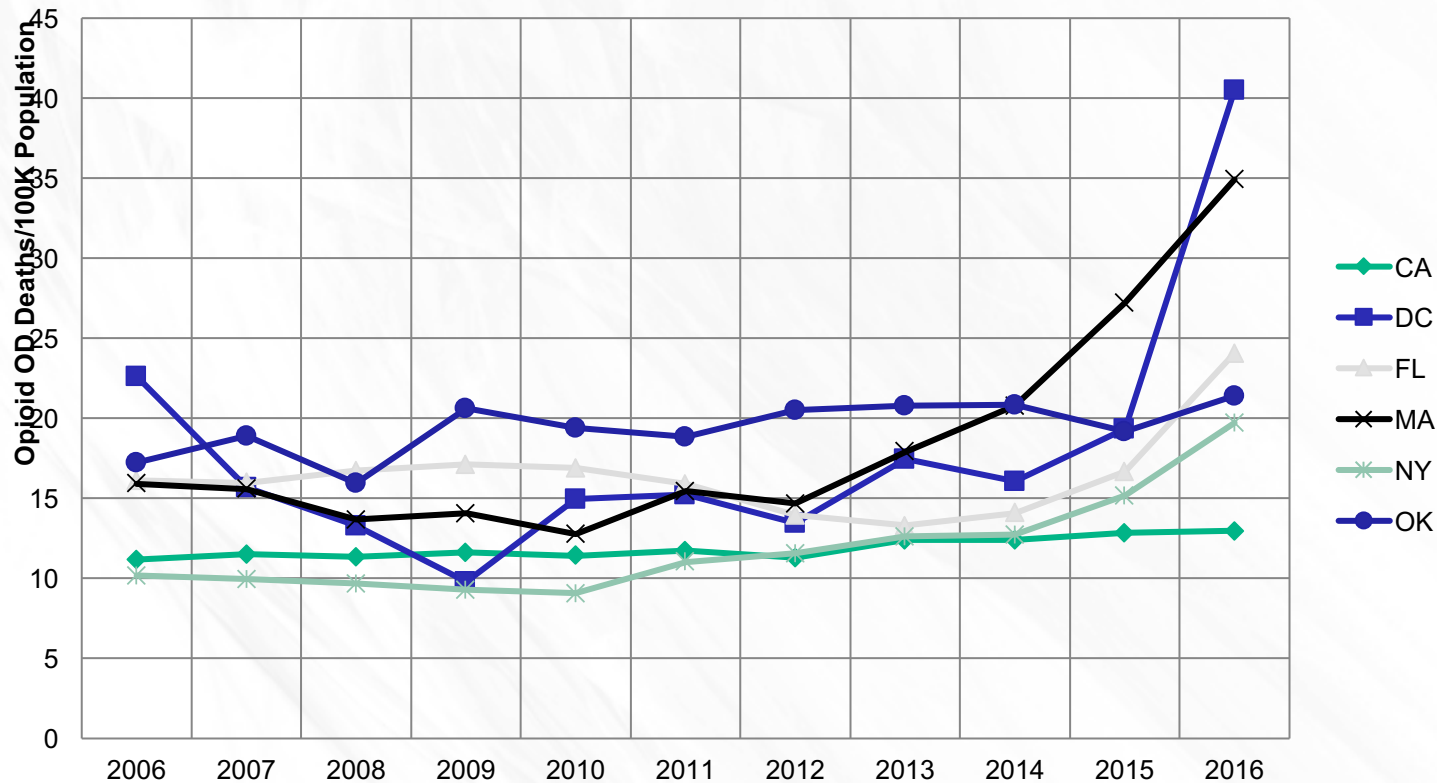
Prescribing Rate per 100 Population
by Year - 6 US States 2006-2016



Prescribing rates vary by 4:1 across States, peak in 2010, fall thereafter.

One Opioid Crisis or Many? (2)

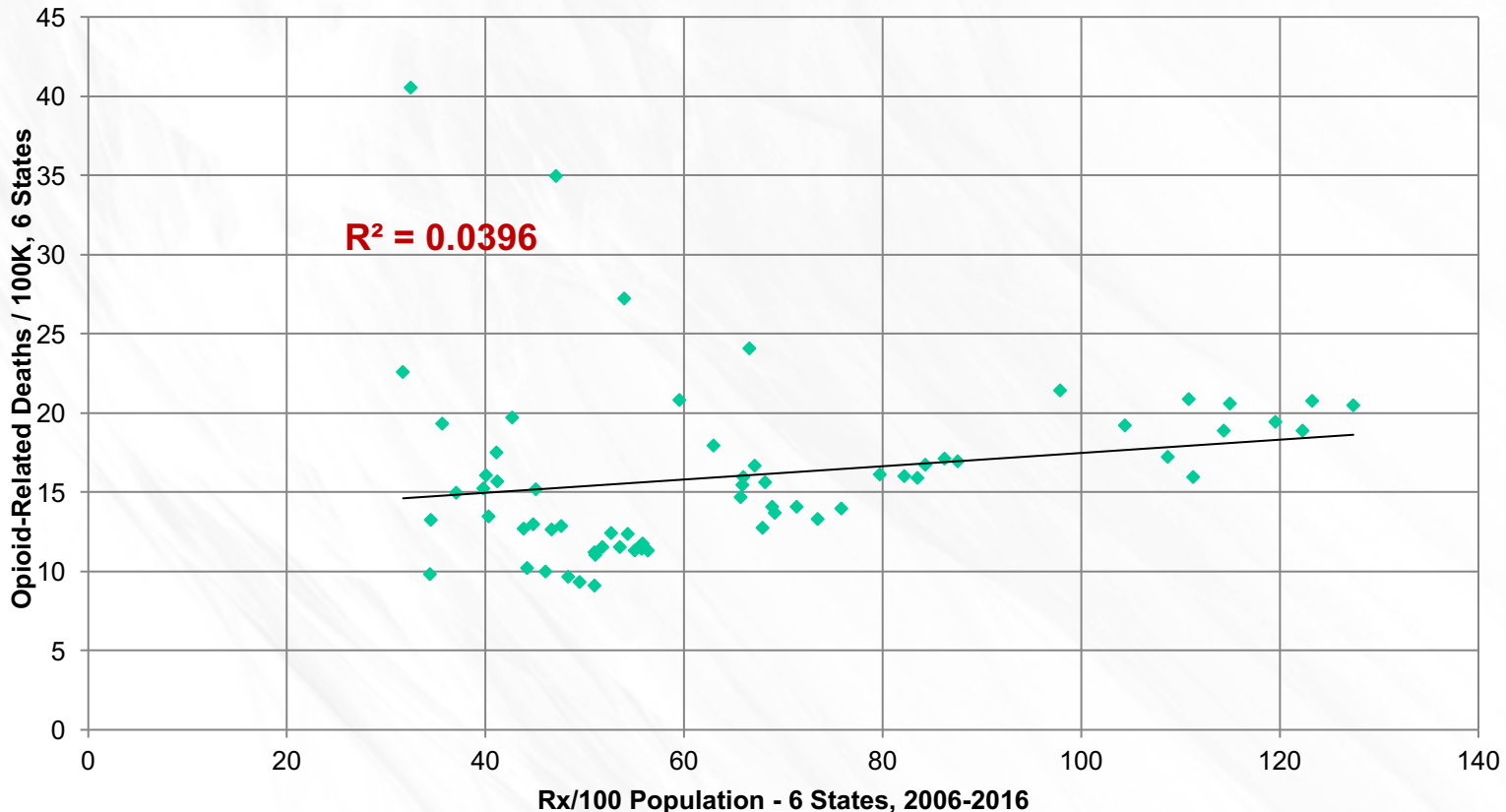
Opioid Mortality per 100K
by Year - Six US States 2006-2016



**2006-2012 opioid mortality relatively stable ~.015%/yr.
Rates vary .01% to .025% between six analyzed States.
2012-2016 mortality rises sharply in some States, not in others.**

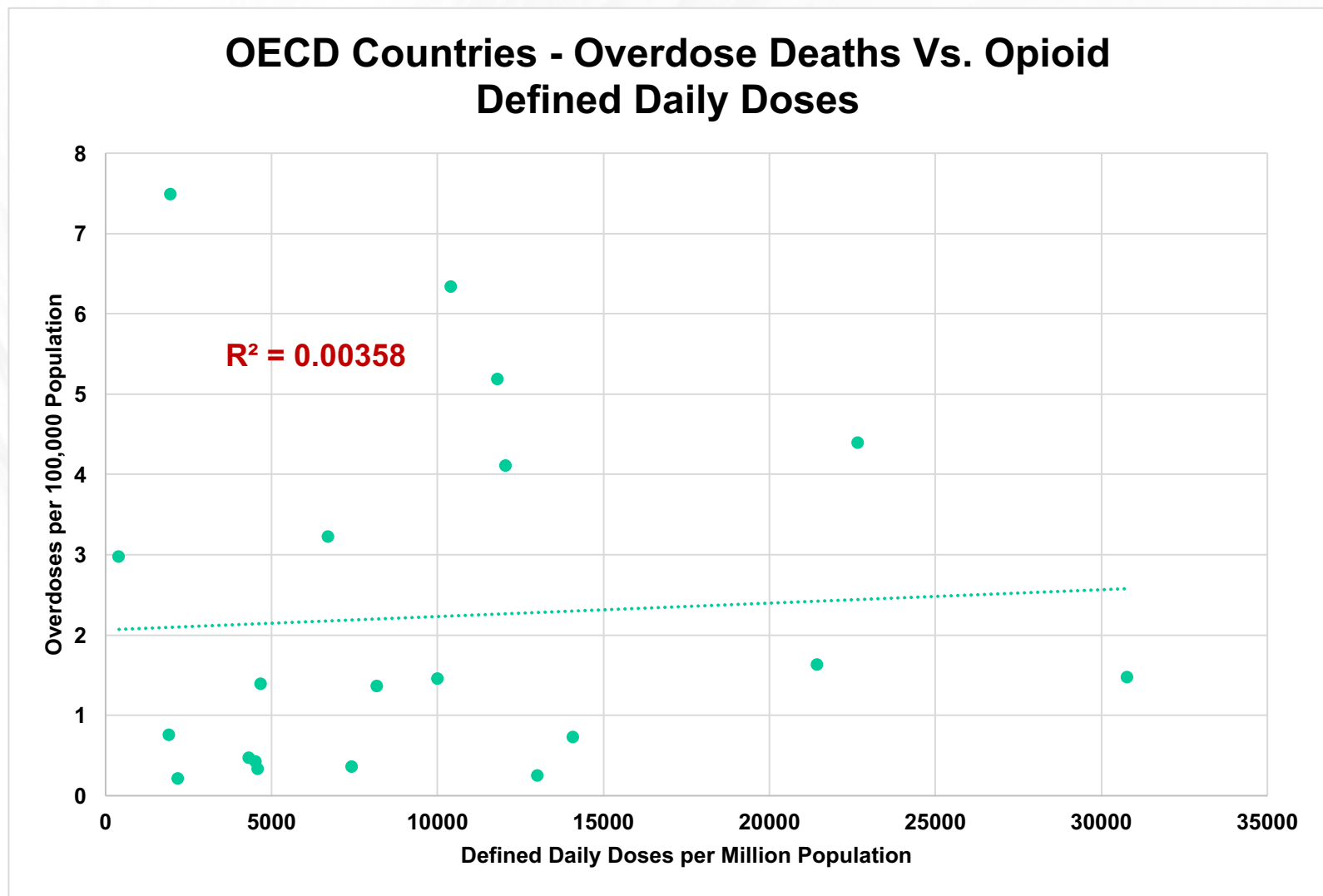
One Opioid Crisis or Many? (3)

**Rx /100 Population vs Opioid-Related OD Deaths/100K
(2006-2016, Six US States)**



**Wide variations in 2006-2016 trends between CA, NY, MA, DC, FL, OK.
Weak relationships in OD Deaths vs. Rx/100 Population.**

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 variations between US States suggest multiple factors and causes are operating.
- Something besides prescribing is going on – illegal street drugs.

Observations (2)

- Maximum US mortality rate (2016) attributed to opioid overdose is .06%/yr - 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 among adults over age 50.
- US Opioid mortality over age 50 is stable throughout; 35-50 rate initially rises, then stabilizes from 2006 onward.
- Among 34 industrialized countries, opioid overdose rates show no trends versus daily opioid doses 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 – from CDC Prescribing Data Page
- Mortality and Population – from 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.

Source Notes (2)

- Opioid-Related ER Visits and Hospital Admissions 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 Alan 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.