
Absolute vs Relative Measures

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Lecture 2

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Goals for Today:

- Distinguish between absolute and relative measures
- Calculate percent change and absolute change

How crowded is a country?

| Country | Total Population (2018) |
|---------------|-------------------------|
| United States | 327,000,000 |
| Singapore | 5,790,000 |
| Mexico | 131,000,000 |
| Mauritius | 1,270,000 |

How crowded is a country?

What should we look at?

| Country | Total Population | Population Density (people per square kilometer of land area) |
|----------------|-------------------------|--|
| United States | 327,000,000 | 35.6 |
| Singapore | 5,790,000 | 7920 |
| Mexico | 131,000,000 | 66.4 |
| Mauritius | 1,270,000 | 623 |

Absolute vs Relative Measures

Absolute Measure: total population

Relative Measure: population density, people per square kilometer of land area

Where is it best to have a baby?

What should we look at?

| Country | Number of Child Deaths (number of children dying before 5 years old) |
|----------------|---|
| Canada | 1820 |
| Nepal | 19,900 |
| United States | 24,900 |
| China | 182,000 |

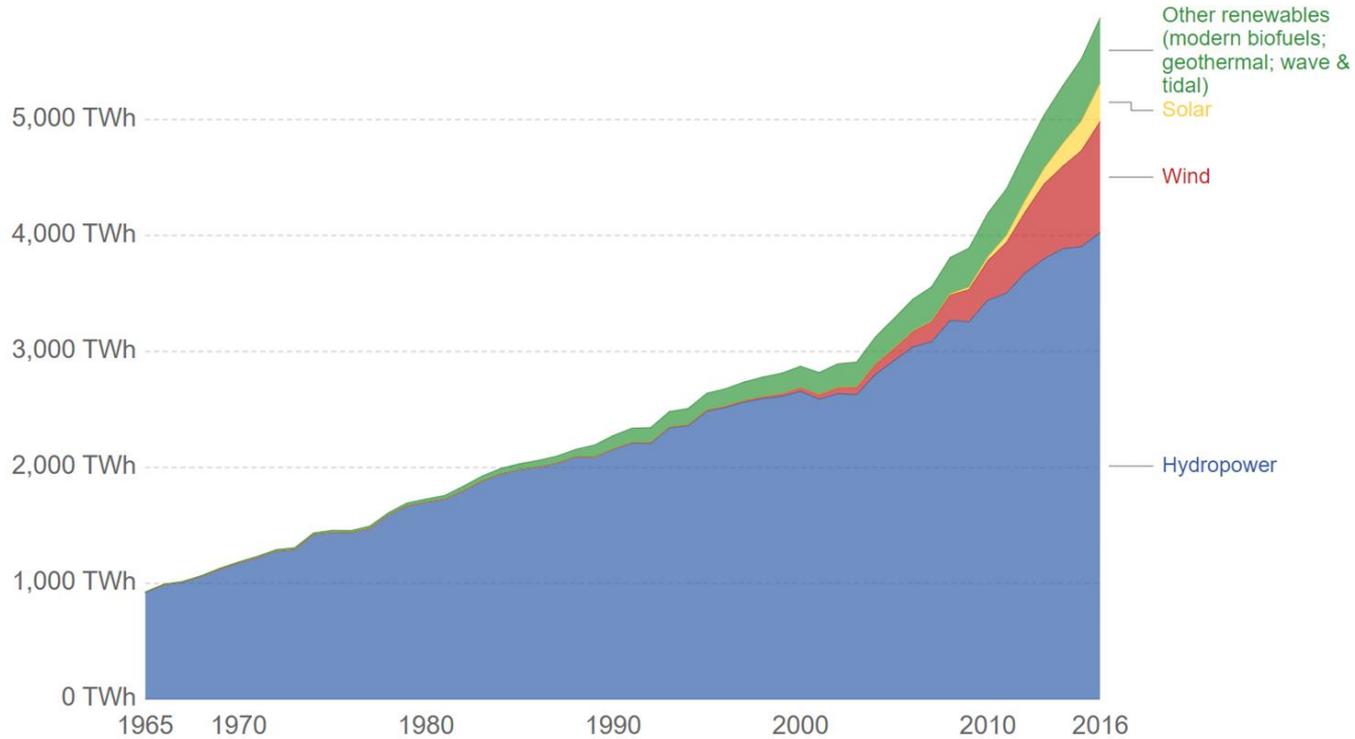
Where is it best to have a baby?

What should we look at?

| Country | Number of Child Deaths (number of children dying before 5 years old) | Child Mortality Rate, 0-5 years old dying per 1000 born |
|----------------|---|--|
| Canada | 1820 | 4.82 |
| Nepal | 19,900 | 31.4 |
| United States | 24,900 | 6.06 |
| China | 182,000 | 9.95 |

Modern renewable energy consumption, World

Total renewable energy consumption, measured in terawatt-hours (TWh) per year. This data includes all renewable energy sources with the exclusion of traditional biomass.



Source: BP Statistical Review of Global Energy

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↔ Change country Relative

CHART

DATA

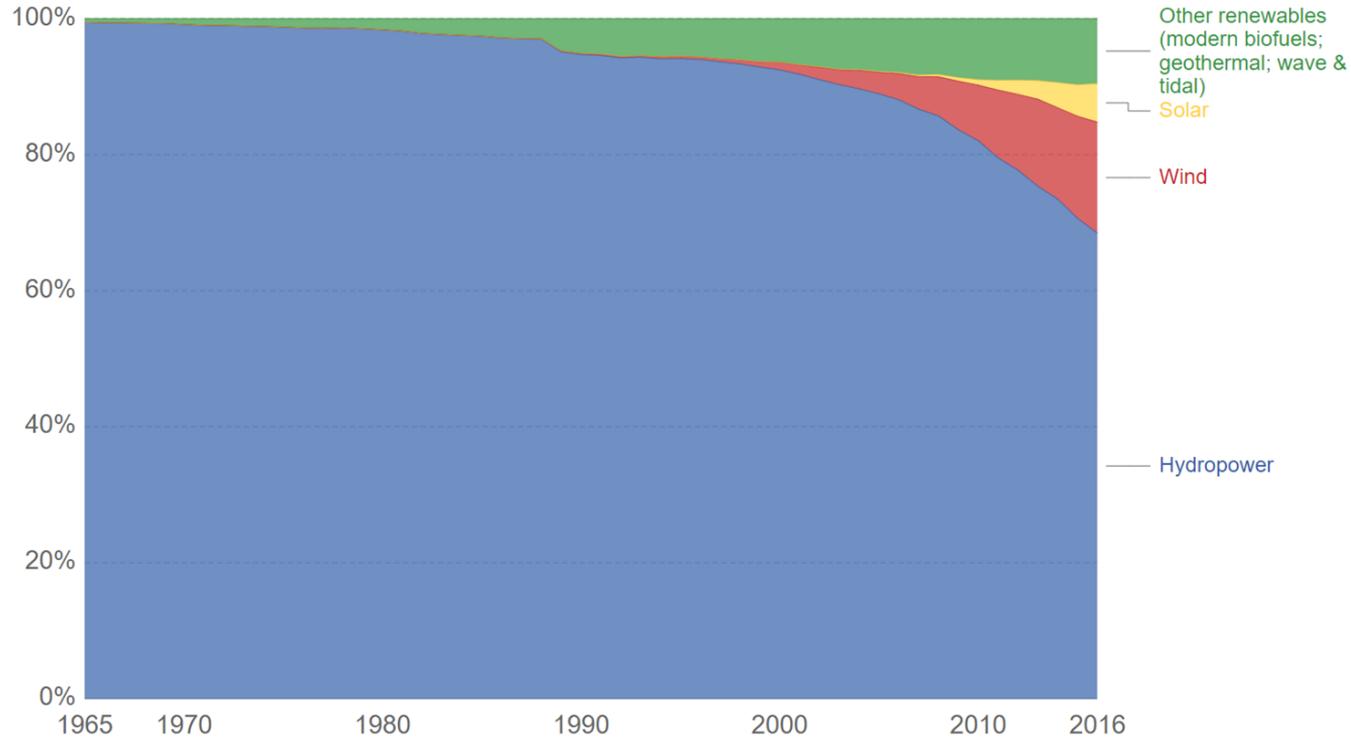
SOURCES



Modern renewable energy consumption, World

Total renewable energy consumption, measured in terawatt-hours (TWh) per year. This data includes all renewable energy sources with the exclusion of traditional biomass.

Our World
in Data



Source: BP Statistical Review of Global Energy

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⇌ Change country Relative

CHART

DATA

SOURCES



Q1

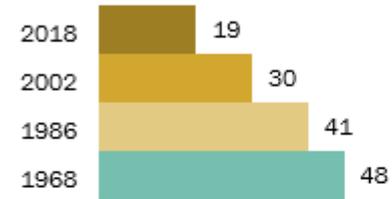
Describe the number 48 in the chart.

- A. Forty-eight civilians aged 15-17 years old were employed in 1968.
- B. Forty-eight percent of civilians aged 15-17 years old were employed in 1968.
- C. Forty-eight percent of civilians were employed in 1968.
- D. Forty-eight percent of millennials were employed in 1968.

Post-Millennials less likely to work than older generations when they were young

% of civilians who were employed during the prior year

15- to 17-year-olds



18- to 21-year-olds



Source: Pew Research Center analysis of 1968, 1986, 2002 and 2018 Current Population Survey Annual Social and Economic Supplement (IPUMS).

"Early Benchmarks Show Post-Millennials on Track to Be Most Diverse, Best-Educated Generation Yet"

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Q2

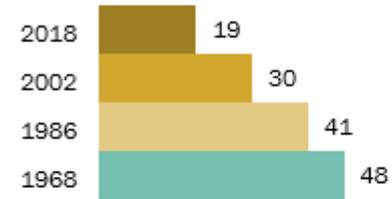
Choose the true statement(s) according to the graph.

- A. The percent of civilians age 18-21 years old employed in 1968 is higher than the percent employed in 2018.
- B. The number of civilians age 18-21 years old employed in 1968 is higher than the number employed in 2018.
- C. More 18-21 year olds are employed in each given year than 15-17 year olds.
- D. The percent of 18-21 year olds employed in each year given is higher than the percent of 15-17 year olds.

Post-Millennials less likely to work than older generations when they were young

% of civilians who were employed during the prior year

15- to 17-year-olds



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Source: Pew Research Center analysis of 1968, 1986, 2002 and 2018 Current Population Survey Annual Social and Economic Supplement (IPUMS).

"Early Benchmarks Show Post-Millennials on Track to Be Most Diverse, Best-Educated Generation Yet"

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Important Note

We cannot say that 58% in 2018 is more total 18-21 year olds than 80% in 1968.

The percent of civilians 18-21 years old is higher in 1968 than in 2018, but we can't compare **number** civilians. We don't know the total population in either year of 18-21 year olds.

Types of Change

Absolute Change: describes the actual increase or decrease from a reference value to the new value

Relative Change: the size of the absolute change in comparison to the reference value (and can be expressed as a percentage)

Relative change = $(\text{new value} - \text{reference value}) / \text{reference value} \times 100\%$

Relative can also mean amount PER #

WHY THE NUMBERS MATTER

RELATIVE RISK

**"New wonder drug
reduces heart
attack risk 50%"**

ABSOLUTE RISK

**"New wonder drug
reduced heart attacks
from from 2 per 100
to 1 per 100"**

The **absolute risk** is more useful at conveying the true impact of an intervention, yet is often under-reported in the research and the news.



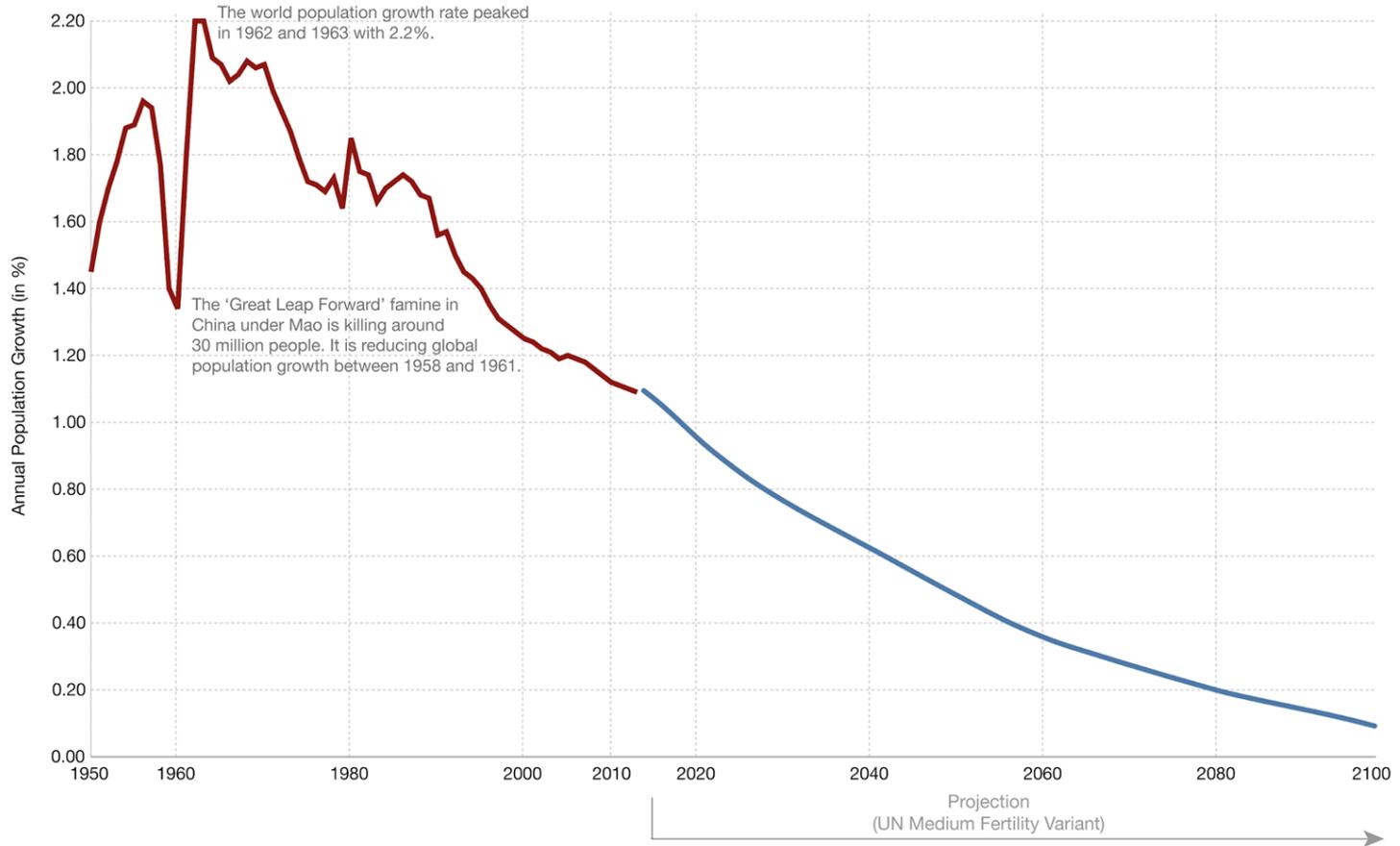
HEALTHNEWSREVIEW
YOUR HEALTH NEWS WATCHDOG

Q3

A store has a big sale - all items are 50% off. A week later the store has additional 50% off on the already reduced prices. Which of the following statements are true?

- A. All items in the store are free.
- B. We cannot determine the discount rate of a given item, as we need to know the original price of the item.
- C. We cannot determine the sale price of a given item, unless we know the original price of the item.
- D. All items are 75% off.
- E. All items are 25% of their original price.

Annual world population growth rate (1950-2100)



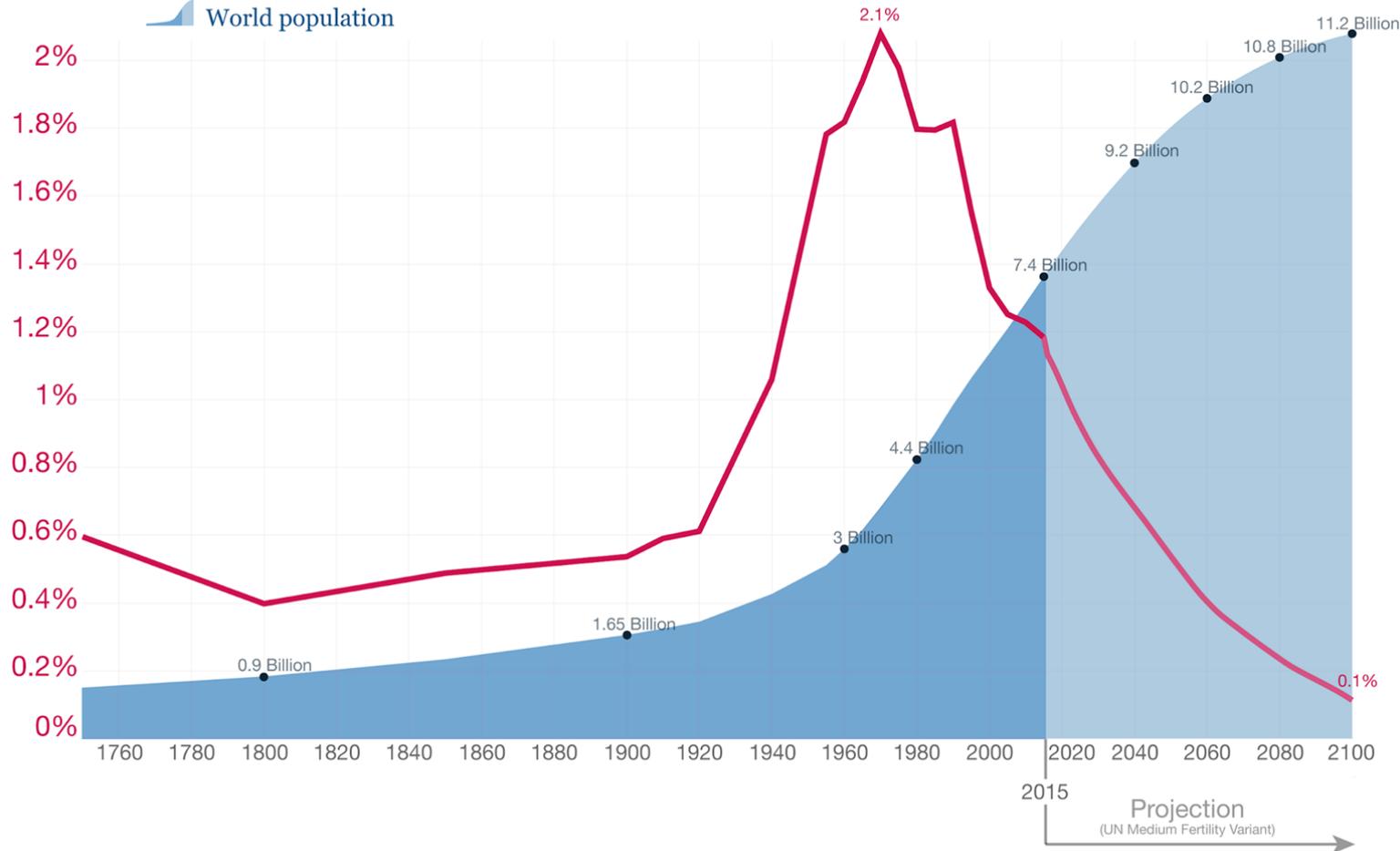
Q4

What can we say about the world population in 2010?

- A. The world population is decreasing in 2010.
- B. The world population is increasing 2010, but at a slower rate than in previous years.
- C. The graph does not give enough information to determine if the world population increasing or decreasing in 2010.

World population growth, 1750-2100

Annual growth rate of the world population
World population



Data sources: Up to 2015 OurWorldInData series based on UN and HYDE. Projections for 2015 to 2100: UN Population Division (2015) – Medium Variant. The data visualization is taken from [OurWorldInData.org](https://ourworldindata.org). There you find the raw data and more visualizations on this topic.

$$\text{Percent Change} = \frac{\text{New} - \text{Old}}{\text{Old}} * 100\%$$

Example 1

Terry makes \$40,000 and gets a promotion, which includes a \$5,000 raise. What is the percent increase in her salary?

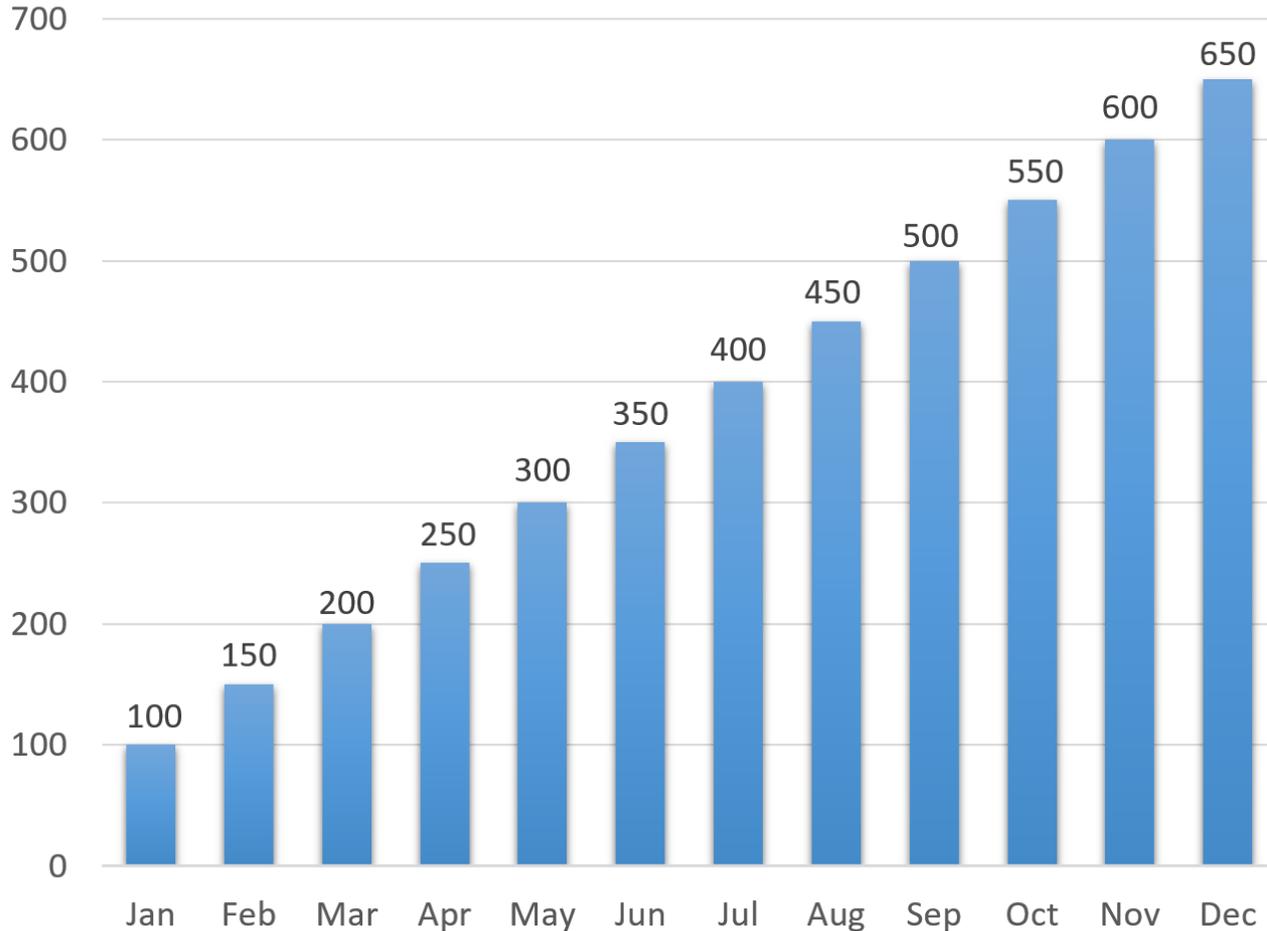
Example 2

A backpack usually costs \$70, but is on sale for \$30. What is the percent change in the price?

Example 3

Ana makes \$45,000 and gets a 2.5% raise. What is her new salary?

Constant Change



| Month | Savings |
|-------|---------|
| Jan | 100 |
| Feb | 150 |
| Mar | 200 |
| Apr | 250 |
| May | 300 |
| Jun | 350 |
| Jul | 400 |
| Aug | 450 |
| Sep | 500 |
| Oct | 550 |
| Nov | 600 |
| Dec | 650 |

Example 4

Calculate the percent change in the total amount in Neri's savings account, based on the chart, from January to February.

Example 5

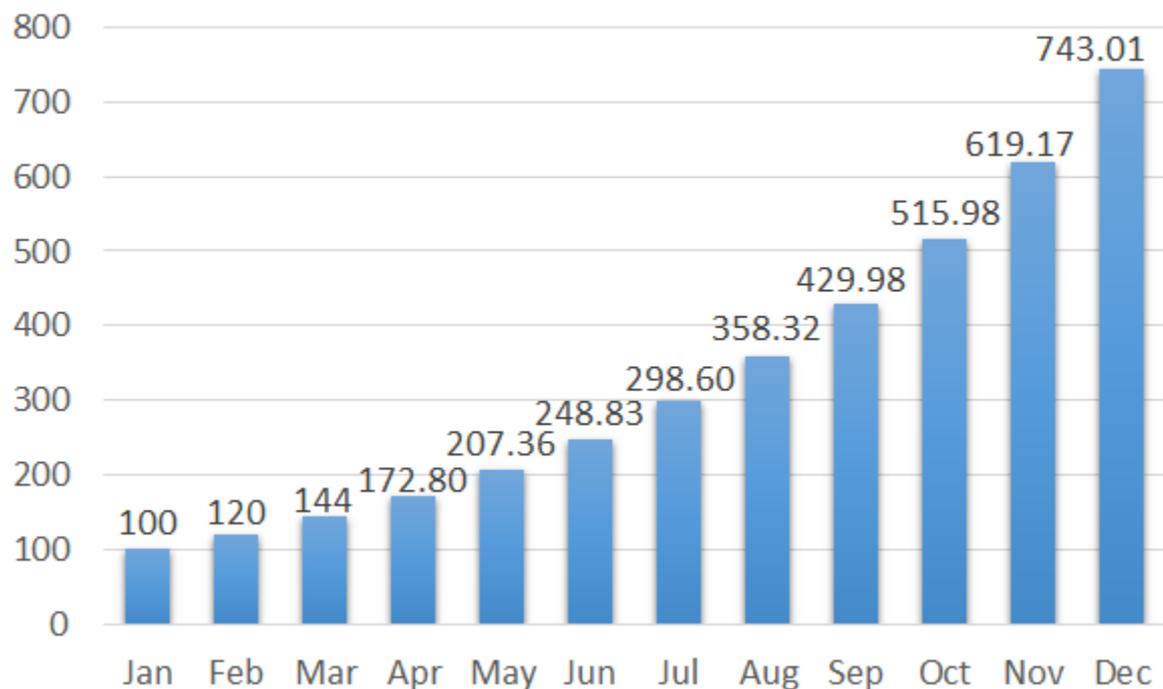
Calculate the percent change in the total amount in Neri's savings account, based on the chart, from November to December.

Q5

Based on the graph above, which of the following statements are true?

- A. Each month her savings increases by a constant amount.
- B. Each month her savings increases by a constant percentage.
- C. The contribution to her savings increases each month.
- D. The percent change of her savings decreases each month.

Constant Percent Change



| Month | Investment amount |
|-------|-------------------|
| Jan | 100 |
| Feb | 120 |
| Mar | 144 |
| Apr | 172.80 |
| May | 207.36 |
| Jun | 248.83 |
| Jul | 298.60 |
| Aug | 358.32 |
| Sep | 429.98 |
| Oct | 515.98 |
| Nov | 619.17 |
| Dec | 743.01 |

Example 6

Calculate the percent change in the total amount in Xander's investment account, based on the chart, from February to March.

Example 7

Calculate the percent change in the total amount in Xander's investment account, based on the chart, from June to July.

Q6

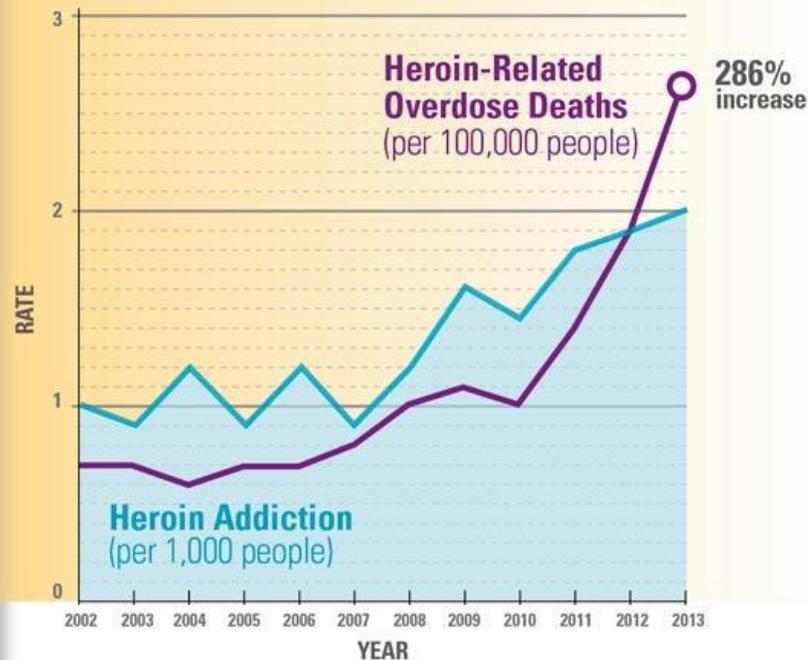
Which of the following statements are true?

- A. Each month his savings increases by a constant amount.
- B. Each month his savings increases by a constant percentage.
- C. The contribution to his savings increases each month.
- D. The percent change of his savings increases each month.

Heroin Use Has INCREASED Among Most Demographic Groups

| | 2002-2004* | 2011-2013* | % CHANGE |
|----------------------------------|------------|------------|----------|
| SEX | | | |
| Male | 2.4 | 3.6 | 50% |
| Female | 0.8 | 1.6 | 100% |
| AGE, YEARS | | | |
| 12-17 | 1.8 | 1.6 | -- |
| 18-25 | 3.5 | 7.3 | 109% |
| 26 or older | 1.2 | 1.9 | 58% |
| RACE/ETHNICITY | | | |
| Non-Hispanic white | 1.4 | 3 | 114% |
| Other | 2 | 1.7 | -- |
| ANNUAL HOUSEHOLD INCOME | | | |
| Less than \$20,000 | 3.4 | 5.5 | 62% |
| \$20,000-\$49,999 | 1.3 | 2.3 | 77% |
| \$50,000 or more | 1 | 1.6 | 60% |
| HEALTH INSURANCE COVERAGE | | | |
| None | 4.2 | 6.7 | 60% |
| Medicaid | 4.3 | 4.7 | -- |
| Private or other | 0.8 | 1.3 | 63% |

Heroin Addiction and Overdose Deaths are Climbing

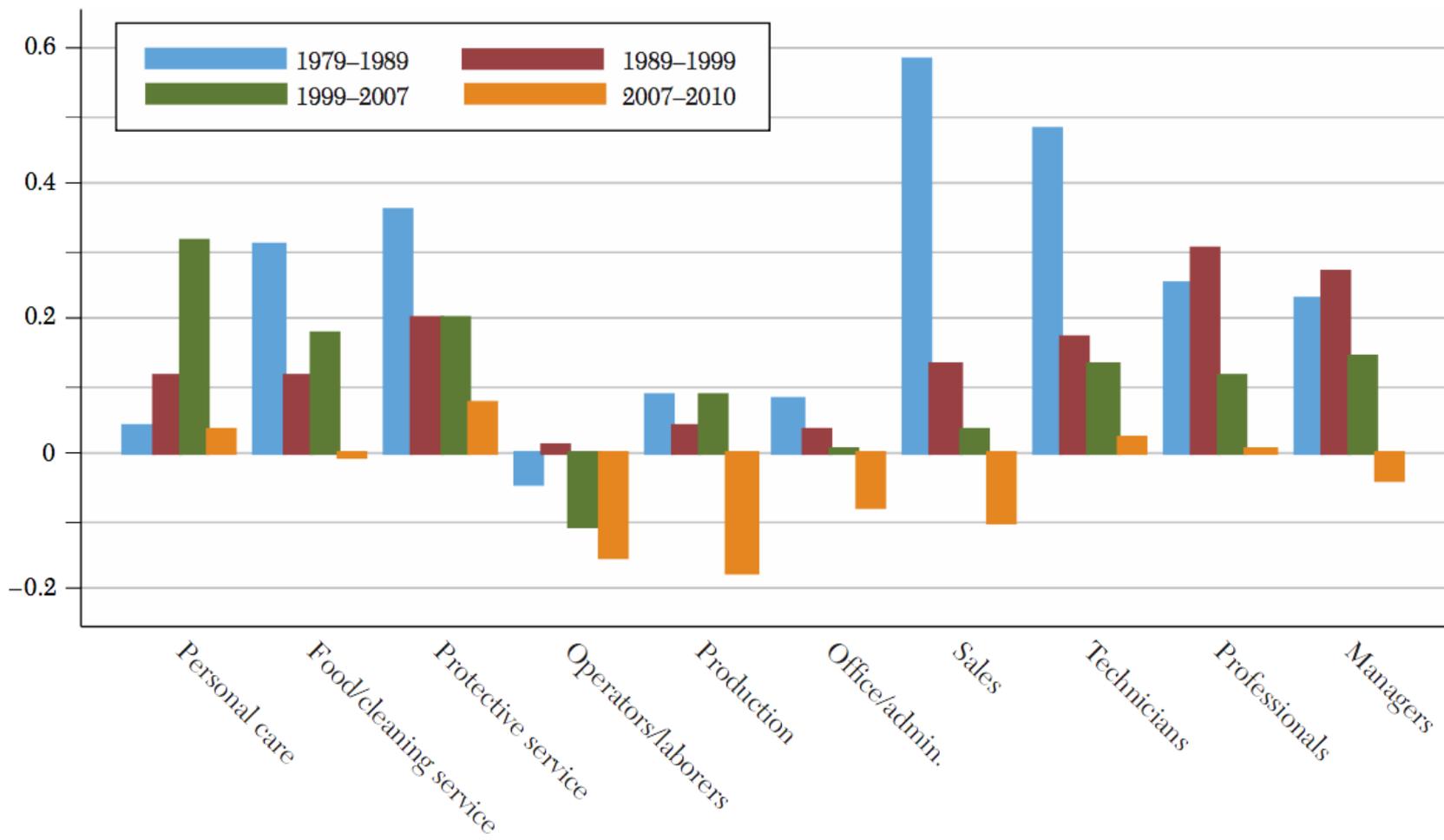


SOURCES: National Survey on Drug Use and Health (NSDUH), 2002-2013.
National Vital Statistics System, 2002-2013.

Heroin Use Has INCREASED Among Most Demographic Groups

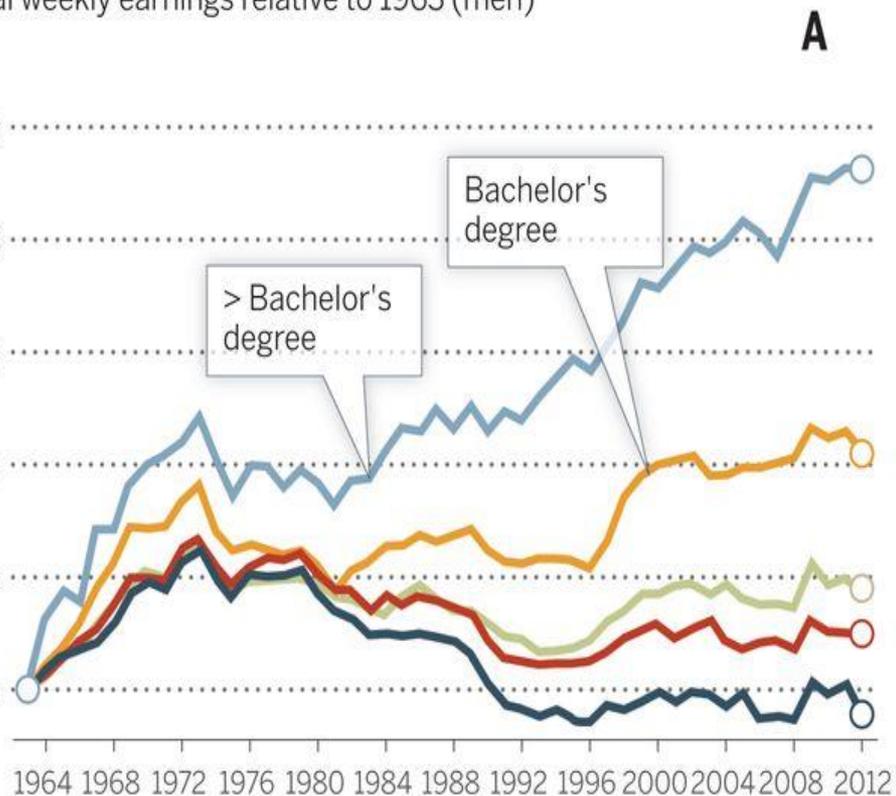
| | 2002–2004* | 2011–2013* | Percent Change |
|-------------------|------------|------------|----------------|
| Sex | | | |
| Male | 2.4 | 3.6 | 50% |
| Female | 0.8 | 1.6 | 100% |
| Age, Years | | | |
| 12–17 | 1.8 | 1.6 | -11% |
| 18–25 | 3.5 | 7.3 | 109% |
| 26 or older | 1.2 | 1.9 | 58% |

Percent Change in Employment by Occupation, 1979–2010 - Acemoglu and Autor

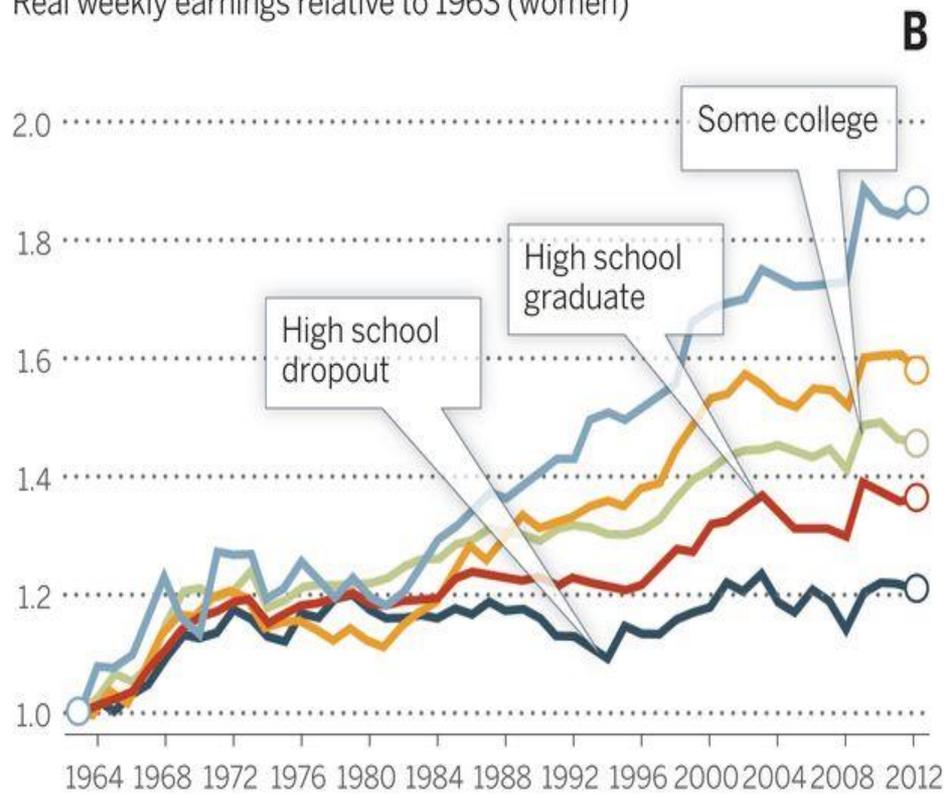


Changes in real wage levels of full-time U.S. workers by sex and education, 1963–2012

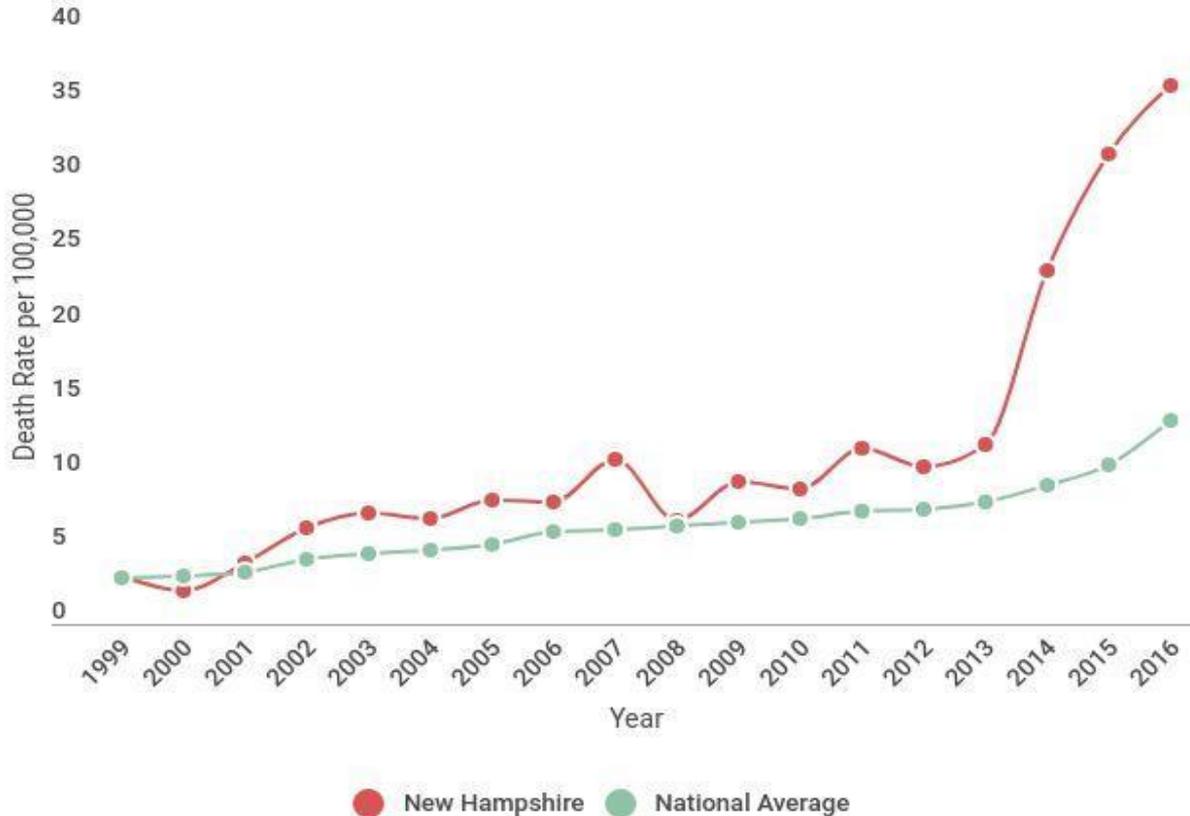
Real weekly earnings relative to 1963 (men)



Real weekly earnings relative to 1963 (women)

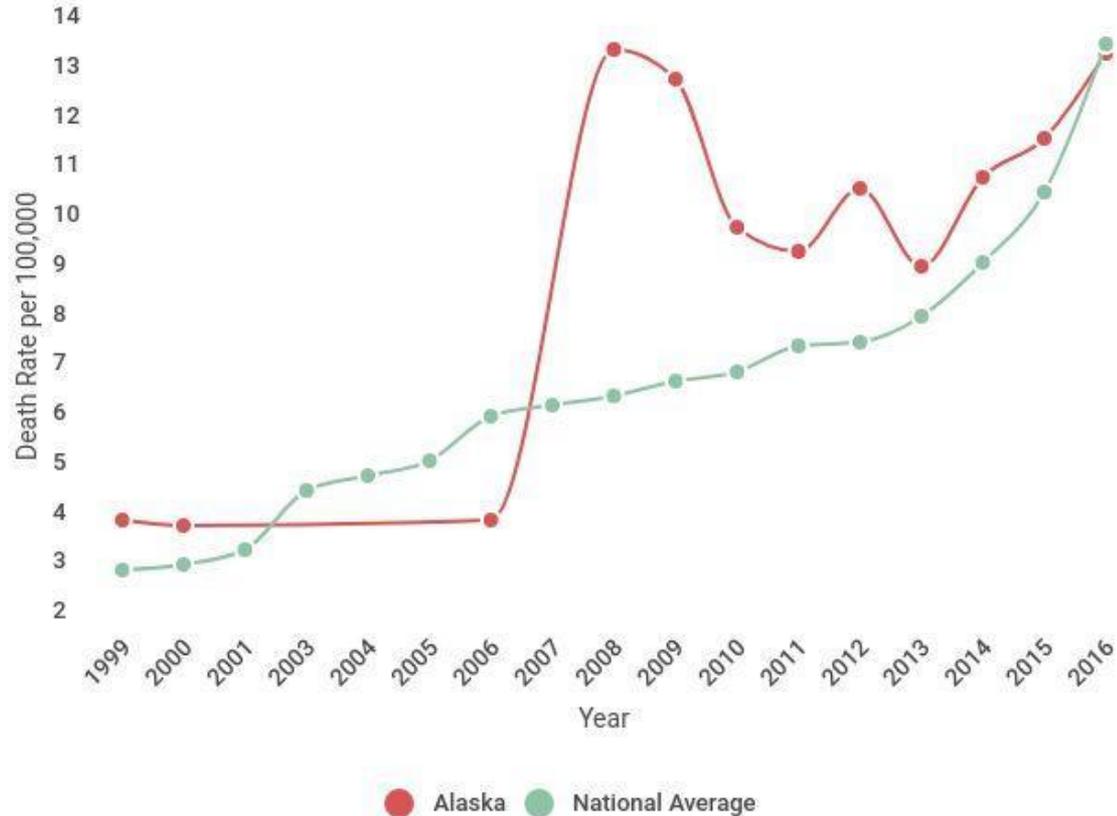


Opioid Overdose Deaths



- **Opioid overdose death rate (age-adjusted):** 36.3 per 100,000
- **10-year percent change:** 343% increase
- **Most impacted age group:** 35-44 years
- **Most impacted county:** Rockingham County

Opioid Overdose Deaths



- **Opioid overdose death rate (age-adjusted):** 13.5 per 100,000
- **10-year percent change:** 229% increase
- **Most impacted age group:** Unknown
- **Most impacted county:** Unknown