How do people lie with charts?

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Background

People have long wrestled with the problem of lying with charts. Visualization researchers and enthusiasts alike have developed **rules and guidelines** for making charts intuitive and easy to understand. Consequently, visualizations that do not conform to agreed upon guidelines are colloquially termed to be deceptive or misleading:

Truncated axis
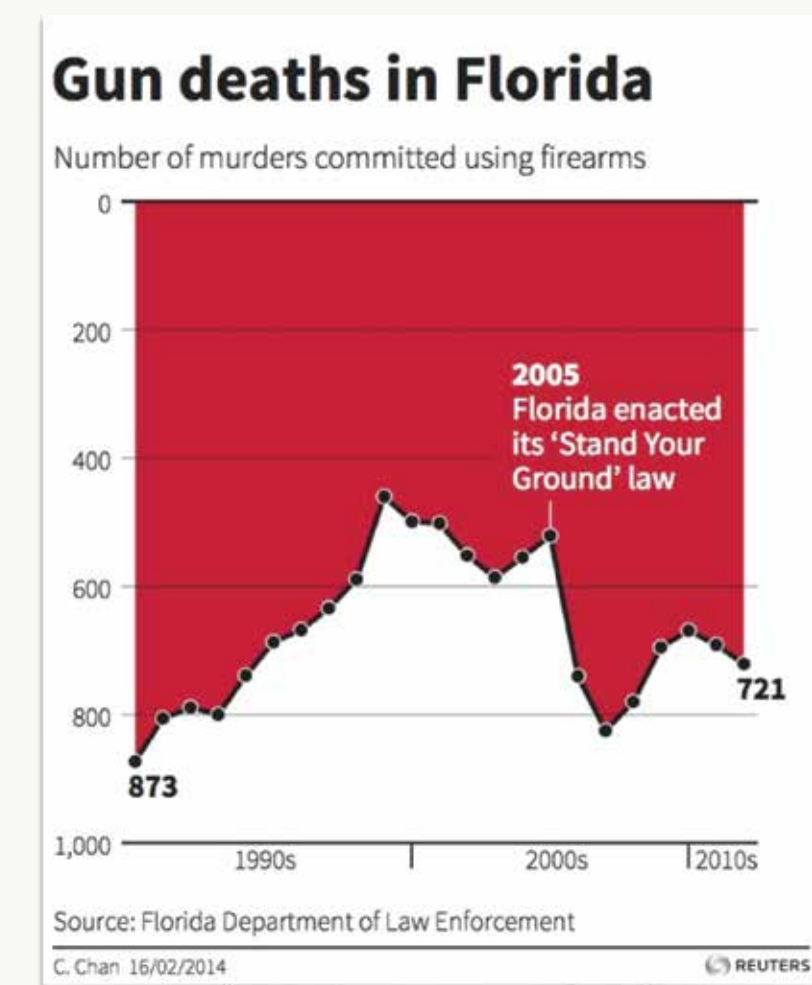
Inverted axis
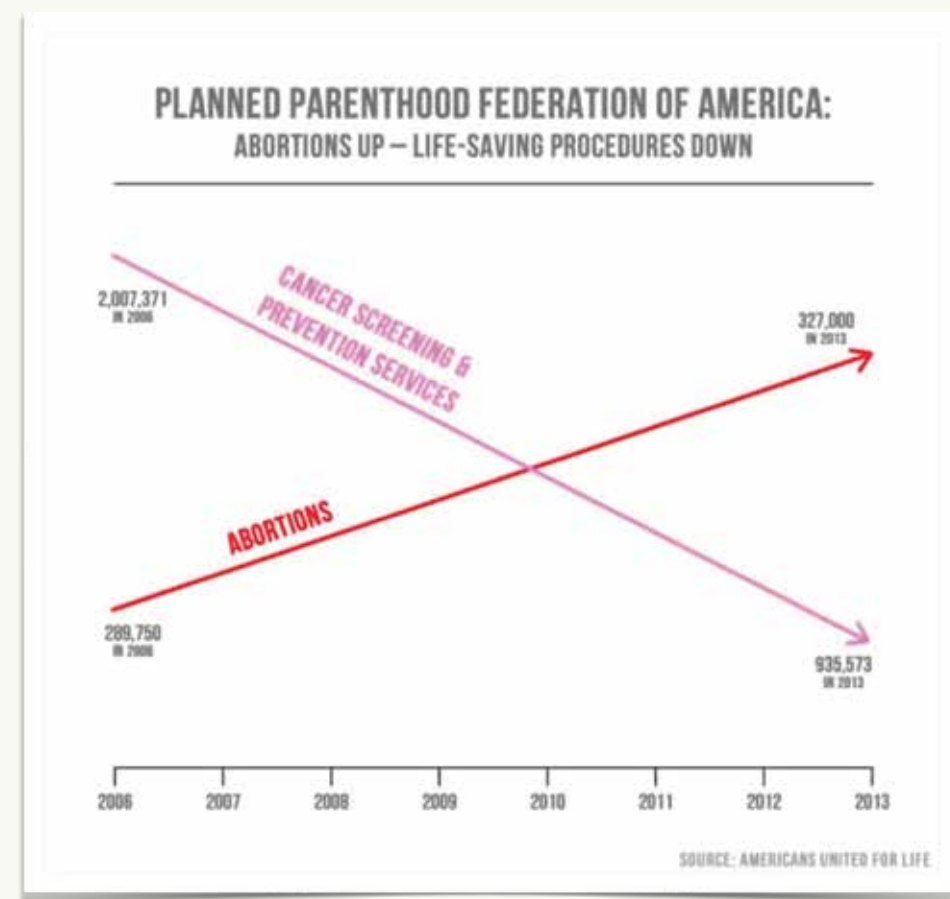
Dual axis

But is this how people **actually** lie with charts?

Are visualizations violating common design guidelines used to support misinformation?

Methods

We analyzed 10,000 COVID-19 data visualization posts from Twitter. Many of them supported commonly-shared misleading and harmful information about the pandemic, promoting vaccine hesitancy, skepticism about mask effectiveness, or origins of the virus.

We performed a qualitative analysis of these posts to identify **how common violations of visualization guidelines are** and what **strategies people use to mislead with charts**.

Despite being widely termed misleading, visualizations that violate design guidelines are rare and are not disproportionately used to promote misinformation:

We find that **less than 13% of all charts** violate any of the common visualization design guidelines. This proportion is **consistent across all types of arguments**: posts that promote misinformation, posts that uphold the severity of the pandemic, or neutral posts.

Misinformation charts do not only conform to guidelines, they are most often screenshots of reputable visualizations:

Visualization from Mexico government's official COVID dashboard. Does not violate any common visualization guidelines.

The author points to a salient feature (**sharp drop in cases**) to suggest that ivermectin—an alternative medication proven to not be helpful against COVID—is the cause of the drop.

This post is an example of **incorrect causal inference** and **cherry-picking**.

Visualization from a CDC report about a COVID-19 outbreak. Does not violate any common visualization guidelines.

The author of the post again to a salient feature (**difference in proportion of cases by vaccination status**) to suggest that the vaccine is harmful. The author fails to account for the fact that 97% of the underlying population had been vaccinated at the time.

This post is an example of **incorrect causal inference** and **misunderstanding of statistical nuance**.
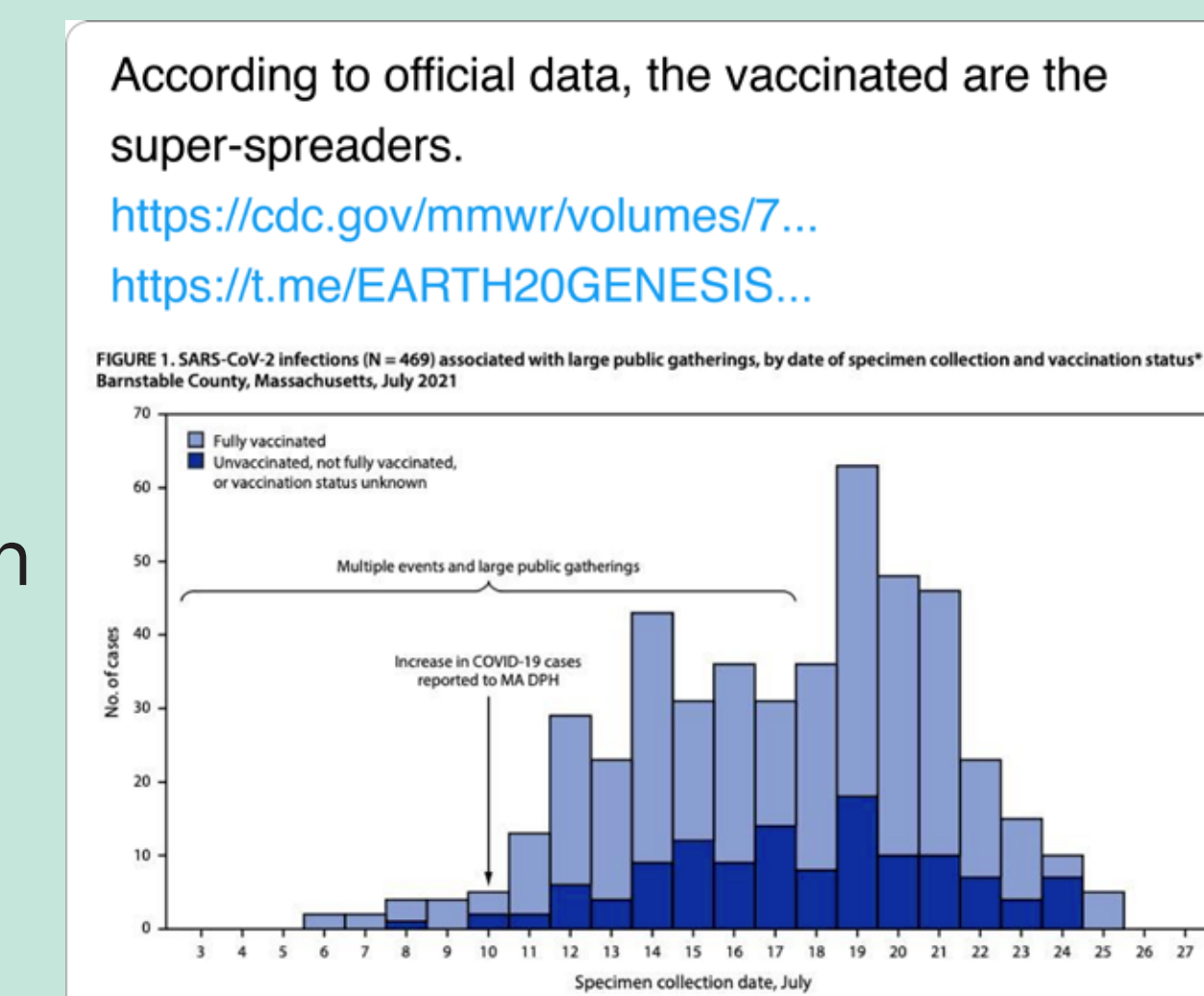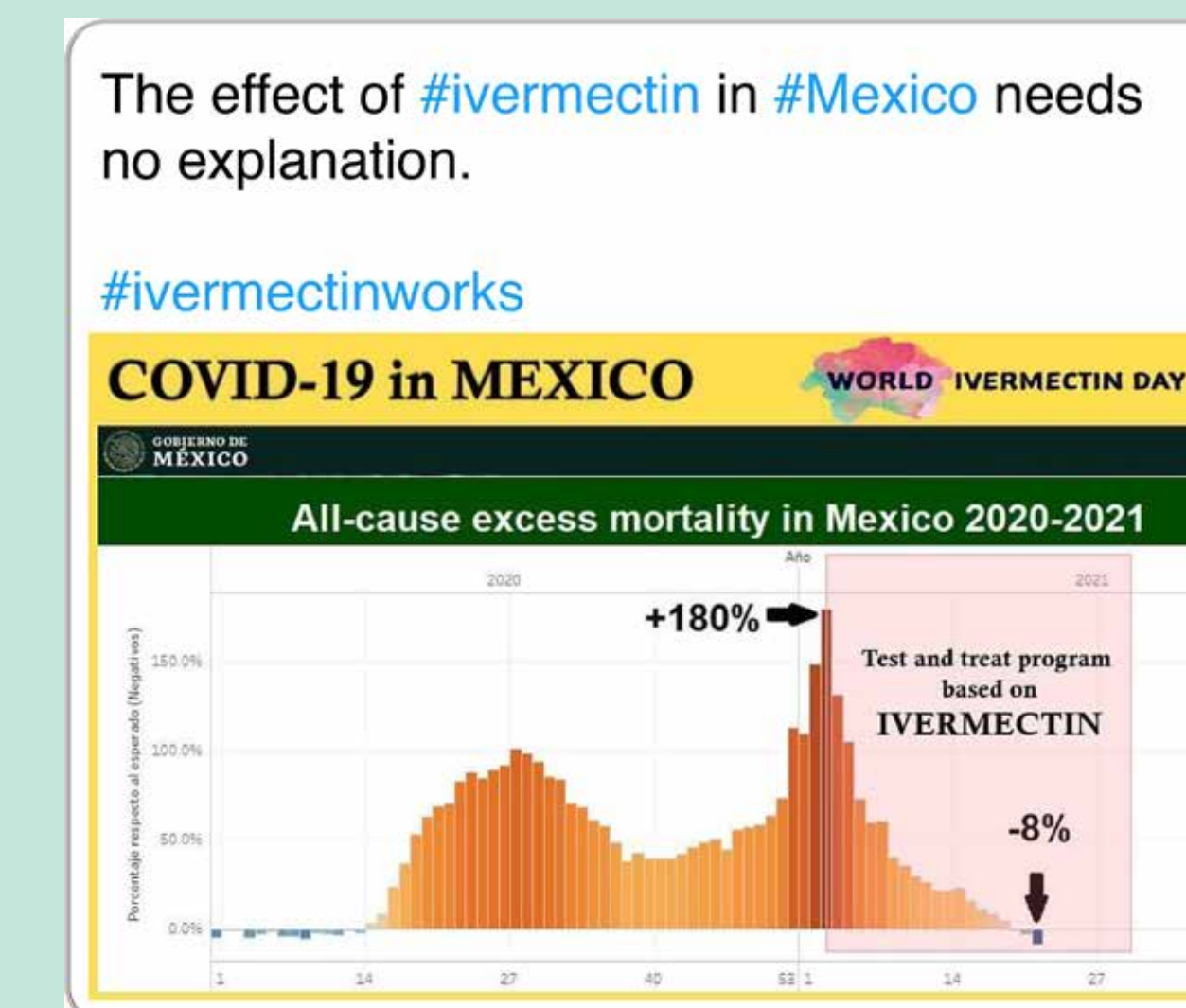
Reasoning errors

In 55% of posts, charts are **screenshots of existing visualizations** from reputable sources that are erroneously **reinterpreted**.

95% of all COVID-skeptic visualization posts exhibit one of **7 types of reasoning errors** in their interpretations:

- Incorrect causal inference
- Cherry-picking
- Setting an arbitrary threshold
- Issues with data validity
- Misunderstanding of statistical nuance
- Misrepresentation of scientific findings
- Incorrect reading of chart

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