

# Evaluating different methods for calculating IIS-based immunization rates

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Denver, Colorado, USA

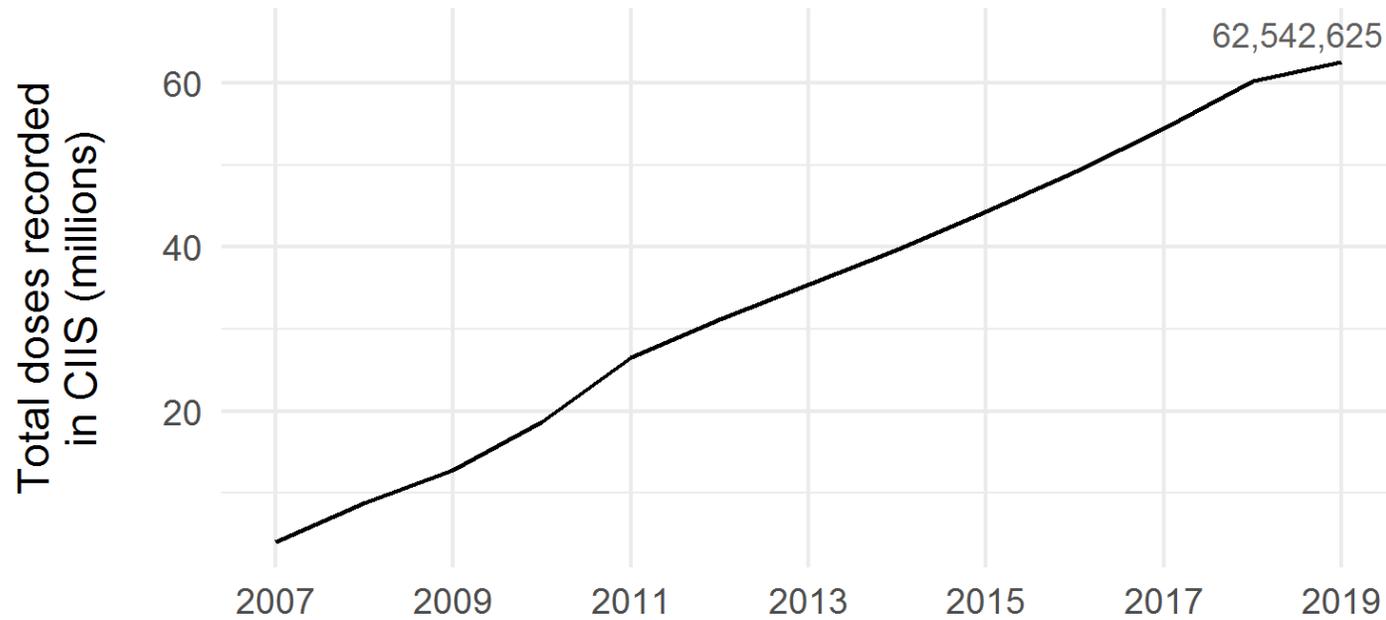
Motivation	Colorado Immunization Information System-based rates are consistently lower than National Immunization Survey results. IIS data has some important limitations.
Methods	We investigated four different strategies to adjust IIS-based immunization rates.
Results	How do rates calculated using different adjustment strategies compare to 2017 NIS results?
Recommendations	Different adjustment strategies are more appropriate for child vs. teen cohorts.
webiz R package	Designed to be useful for Envision IIS analysts in other states.

The **Colorado Immunization Information System (CIIS)** was established under the Colorado Immunization Registry Act of 2007.

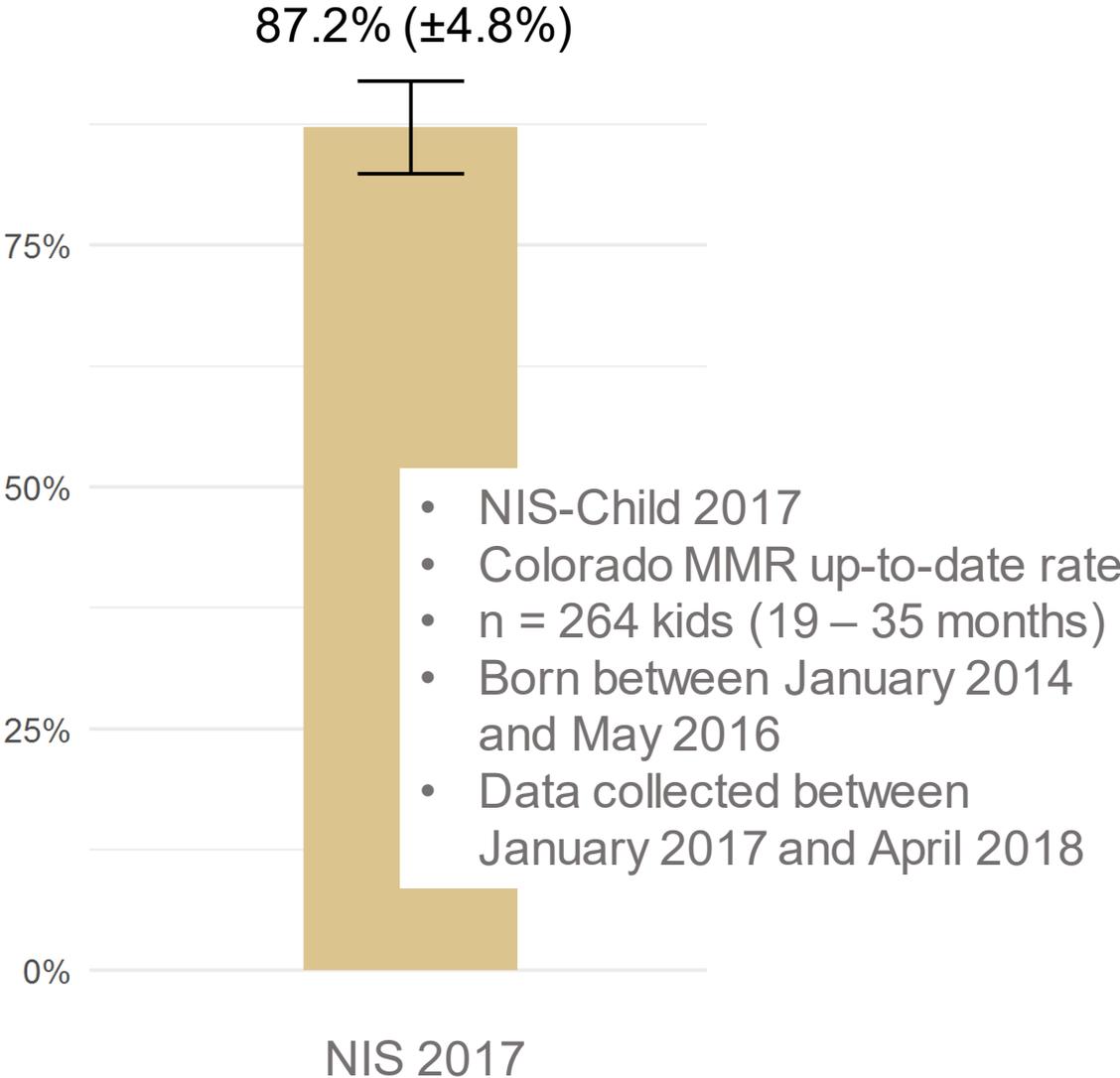
CIIS creates a universally accessible record for all Colorado providers.



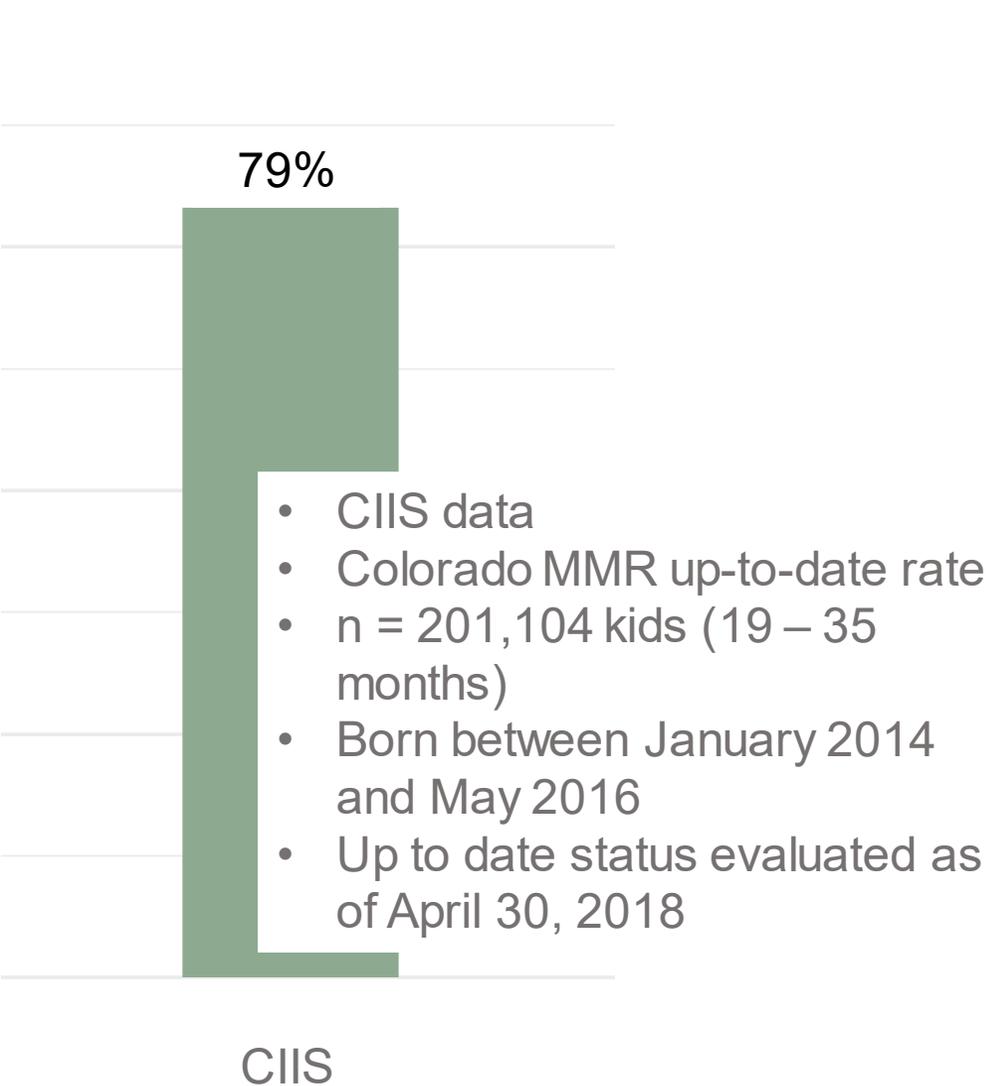
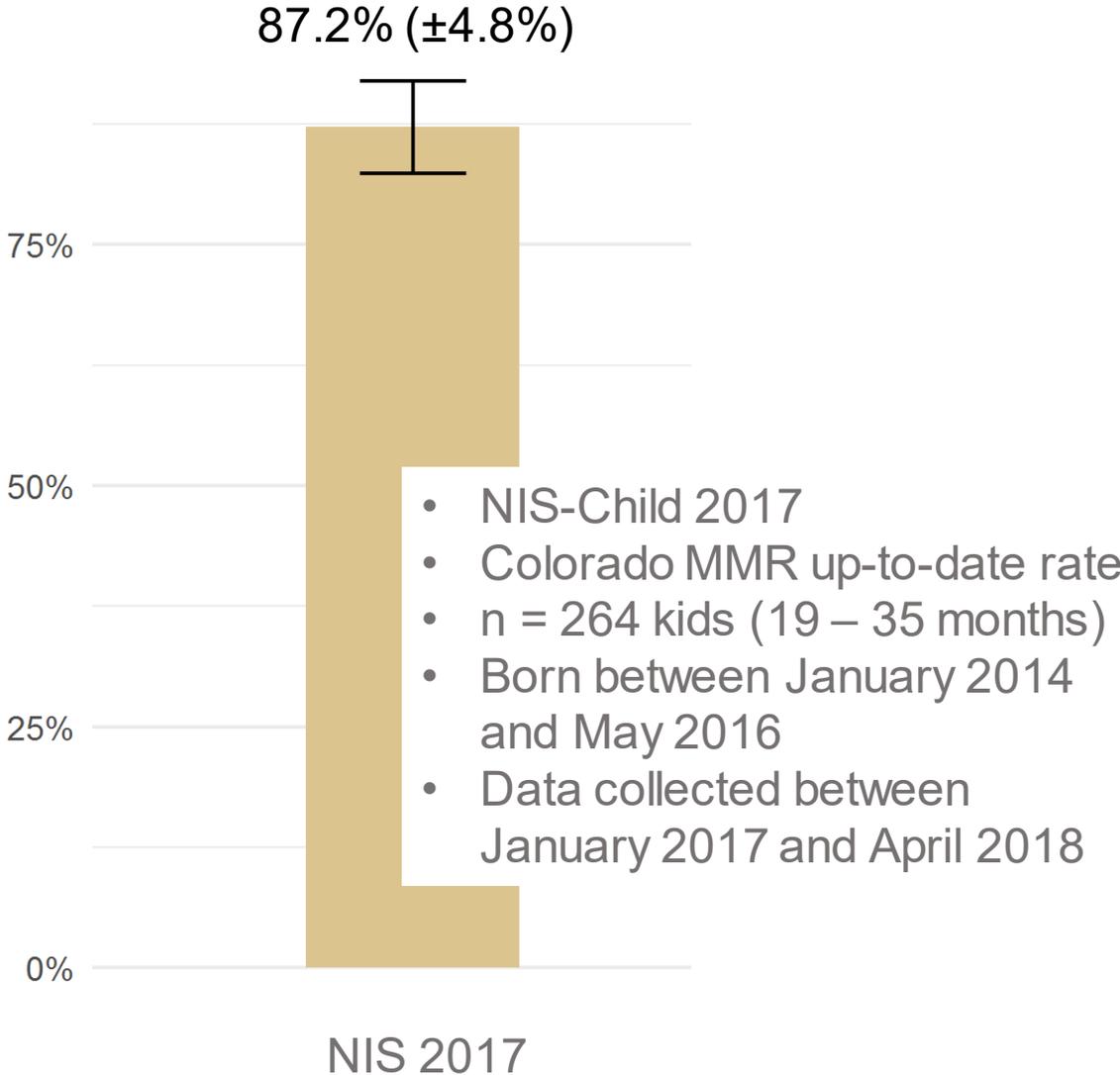
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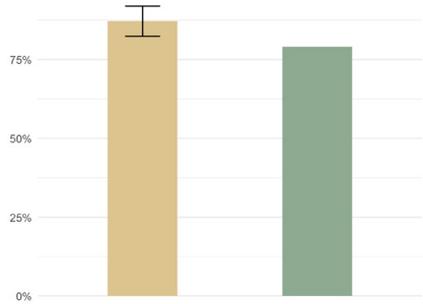
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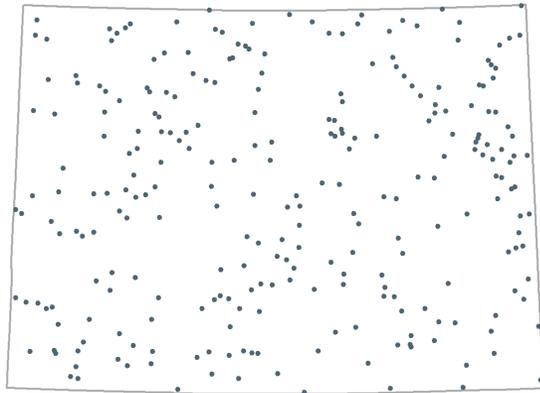


# Why the mis-match?



Our registry population isn't a reasonably accurate estimate of the Colorado population.

264 kids

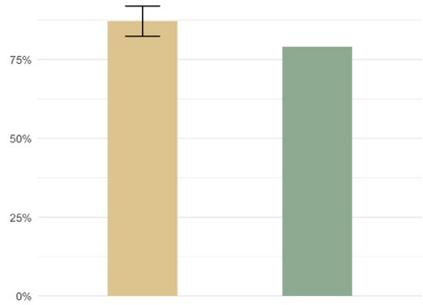


VS.

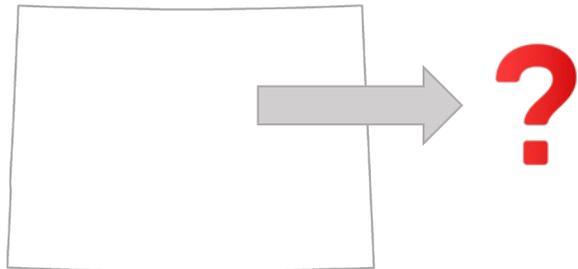
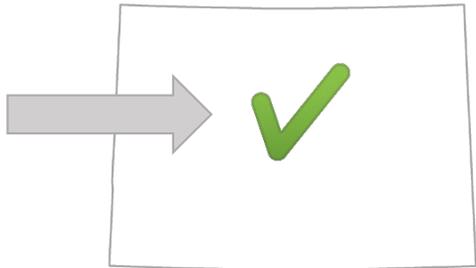
201,104 kids



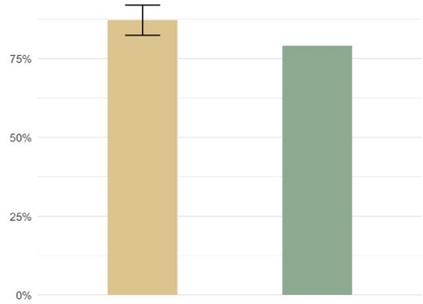
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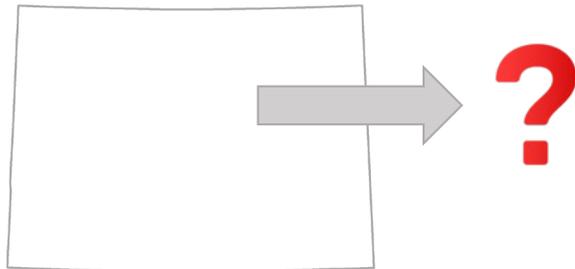
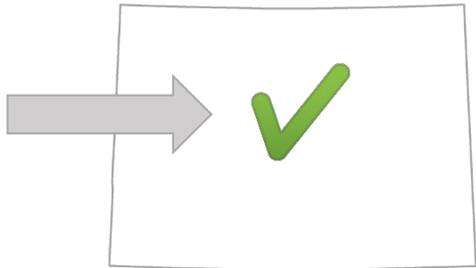
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# Why the mis-match?



Our registry population isn't a reasonably accurate estimate of the Colorado population.



Ideal:  $\frac{\#}{\text{completely accurate denominator}}$

vs. our situation:  $\frac{\#}{\text{too many people!}}$

# What can we do?

## RESEARCH ARTICLES

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# Addressing Immunization Registry Population Inflation in Adolescent Immunization Rates

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STEVE G. ROBISON, MPH<sup>a</sup>

### ABSTRACT

**Objective.** While U.S. adolescent immunization rates are available annually at national and state levels, finding pockets of need may require county or sub-county information. Immunization information systems (IISs) are one tool

Robison 2015, Public Health Reports

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① 2017 population estimates  
based on 2010 U.S. Census data

B. Adjust our registry denominator:

Systematically (i) remove or (ii) weight patients.

② Two non-flu visits  
before 9 months

③ One visit in the  
last 10 years

④ Weight assigned based on  
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- 1 Replace CIIS registry denominator with U.S. Census denominator

**5,765,527**  
(2019)

VS

**6,010,390**  
(2019)



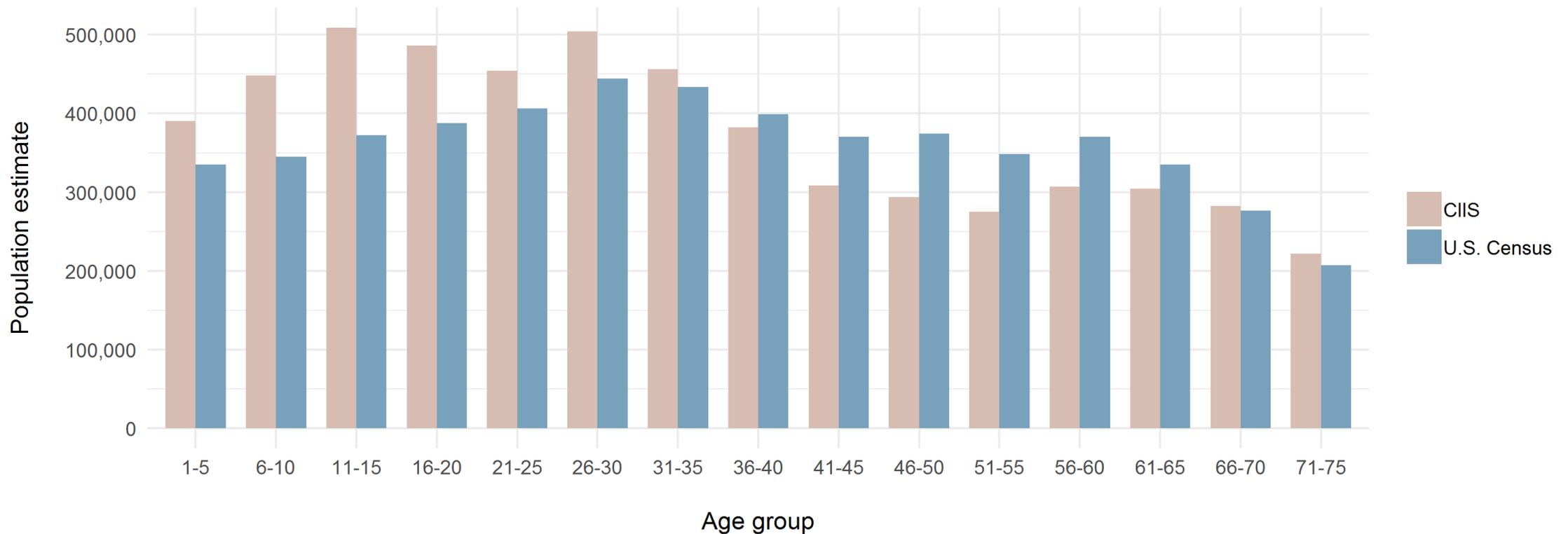
**COLORADO**  
Department of Local Affairs



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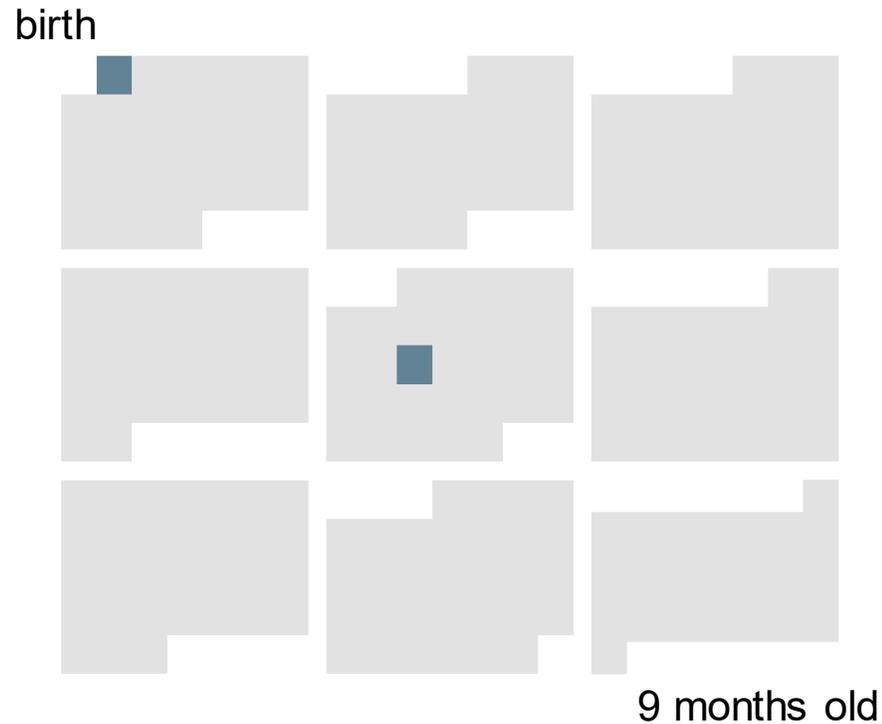


# We compared four adjusted rates and standard rates to NIS rates.

B. Adjust our registry denominator:

Systematically (i) **remove** or (ii) weight patients.

- 2 Remove patients who do not have at least two non-flu visits recorded before 9 months of age



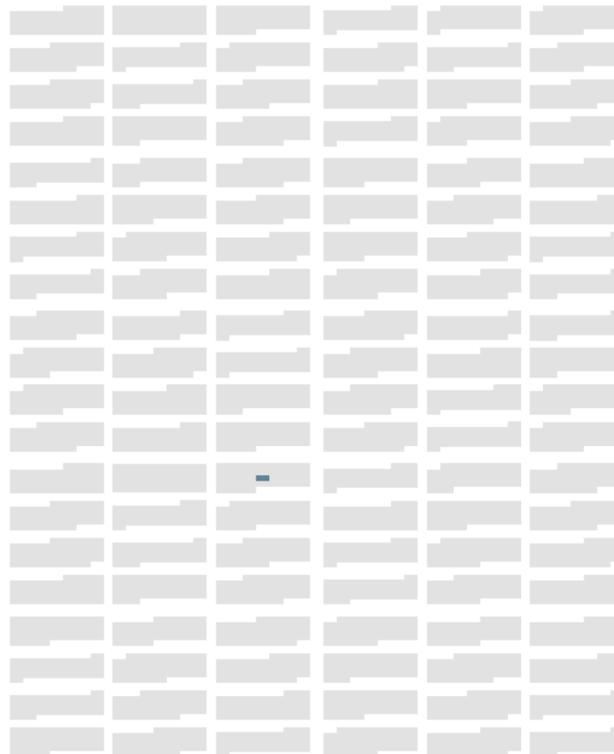
# We compared four adjusted rates and standard rates to NIS rates.

B. Adjust our registry denominator:

Systematically **(i) remove** or (ii) weight patients.

- 3 Remove patients who have not had at least one visit in the last 10 years

10 years ago

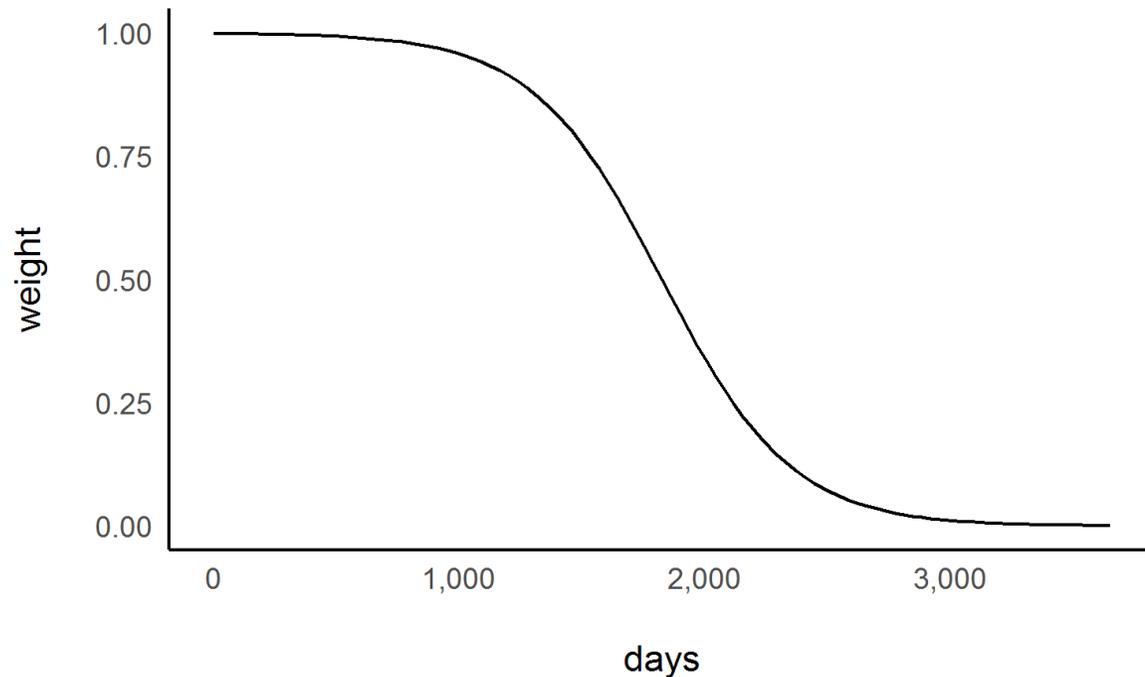


evaluation date

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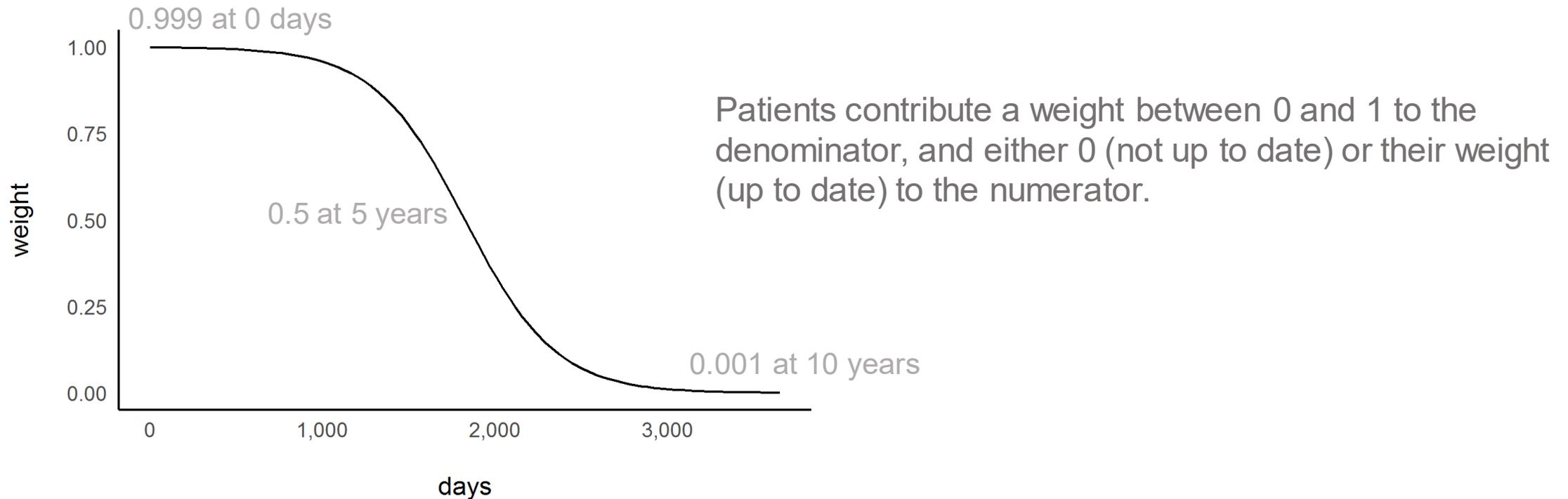
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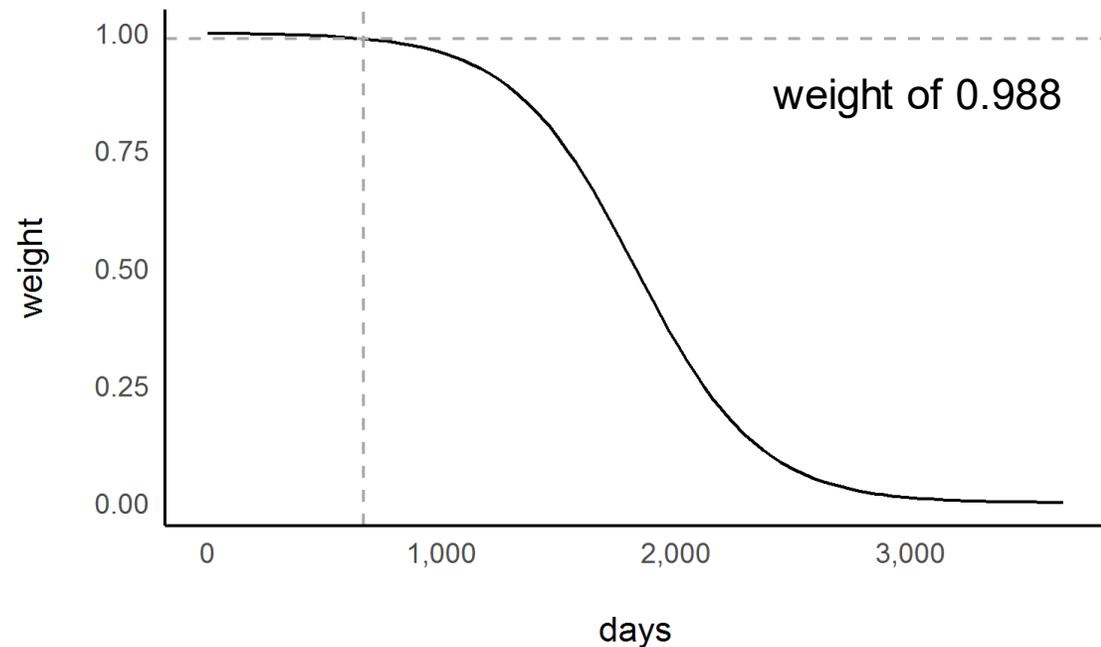
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Oct 18, 2017



665 days since  
last immunization  
visit

Aug 14, 2019



We compared four adjusted rates and standard rates to NIS rates.

## **Cohorts**

### *NIS-Child*

19 – 35 months  
Born between Jan  
2014 and May 2016  
n = 201,104

### *NIS-Teen*

13 – 17 years  
Born between Jan  
1999 and Jan 2005  
n = 596,425

We compared four adjusted rates and standard rates to NIS rates.

**Cohorts**

**Antigens**

*NIS-Child*

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*NIS-Child*

4313314 series  
4+ DTaP, 3+ Polio, 1+ MMR,  
3+ Hib, 3+ HepB,  
1+ Varicella, and 4+ PCV

*NIS-Teen*

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## Rates

- ① U.S. Census
- ② Two-visit
- ③ 10 years
- ④ Weighted
- ⑤ Standard

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<b>Cohorts</b>	<b>Antigens</b>	<b>Rates</b>	<b>NIS</b>
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<i>NIS-Teen</i> 13 – 17 years Born between Jan 1999 and Jan 2005 n = 596,425	<i>NIS-Teen</i> 1+ MCV, 1+Tdap, and HPV	② Two-visit  ③ 10 years  ④ Weighted  ⑤ Standard	<i>NIS-Teen</i> 13 – 17 years Born between Jan 1999 and Jan 2005 n = 354

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## Geography



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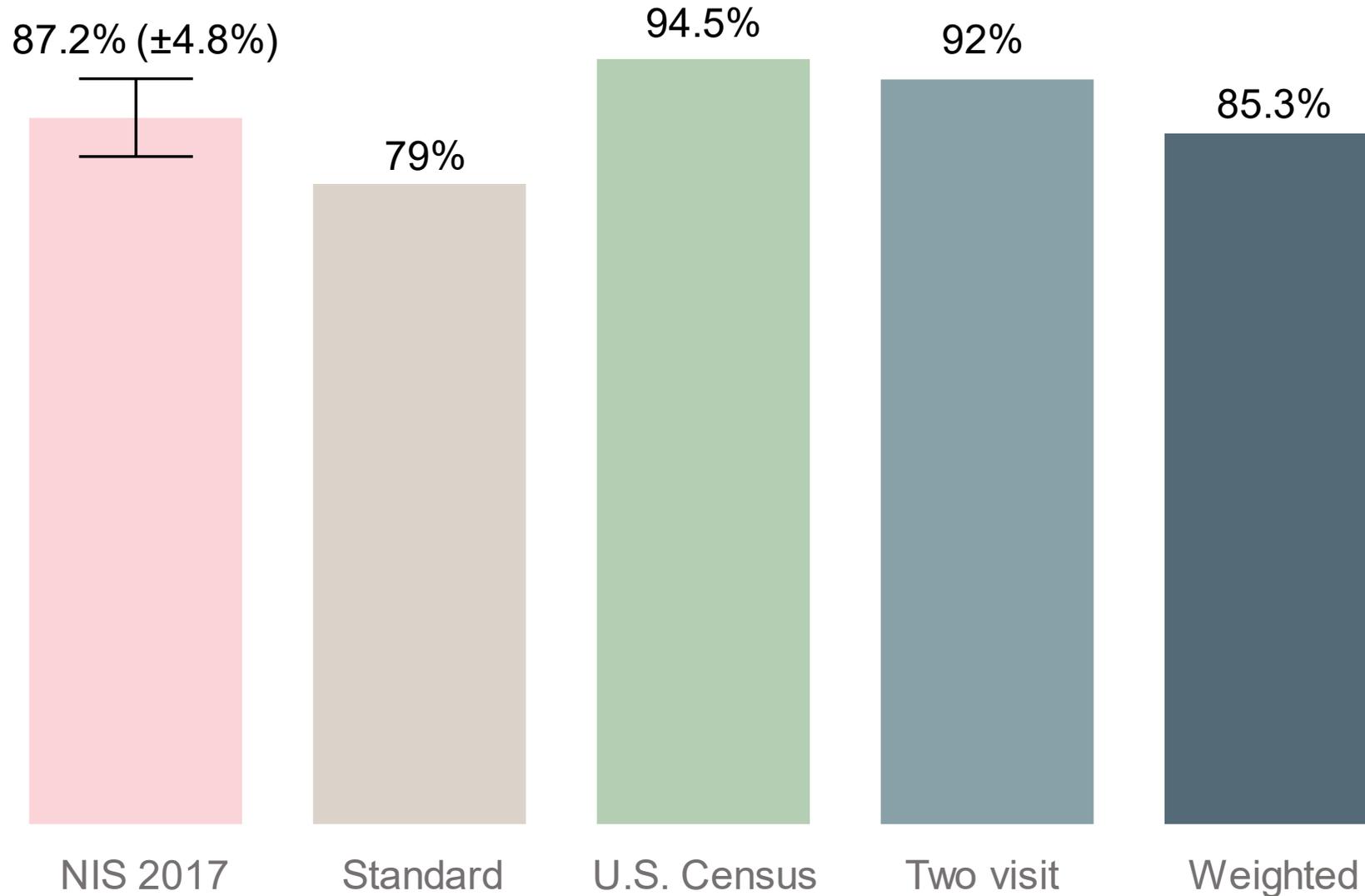
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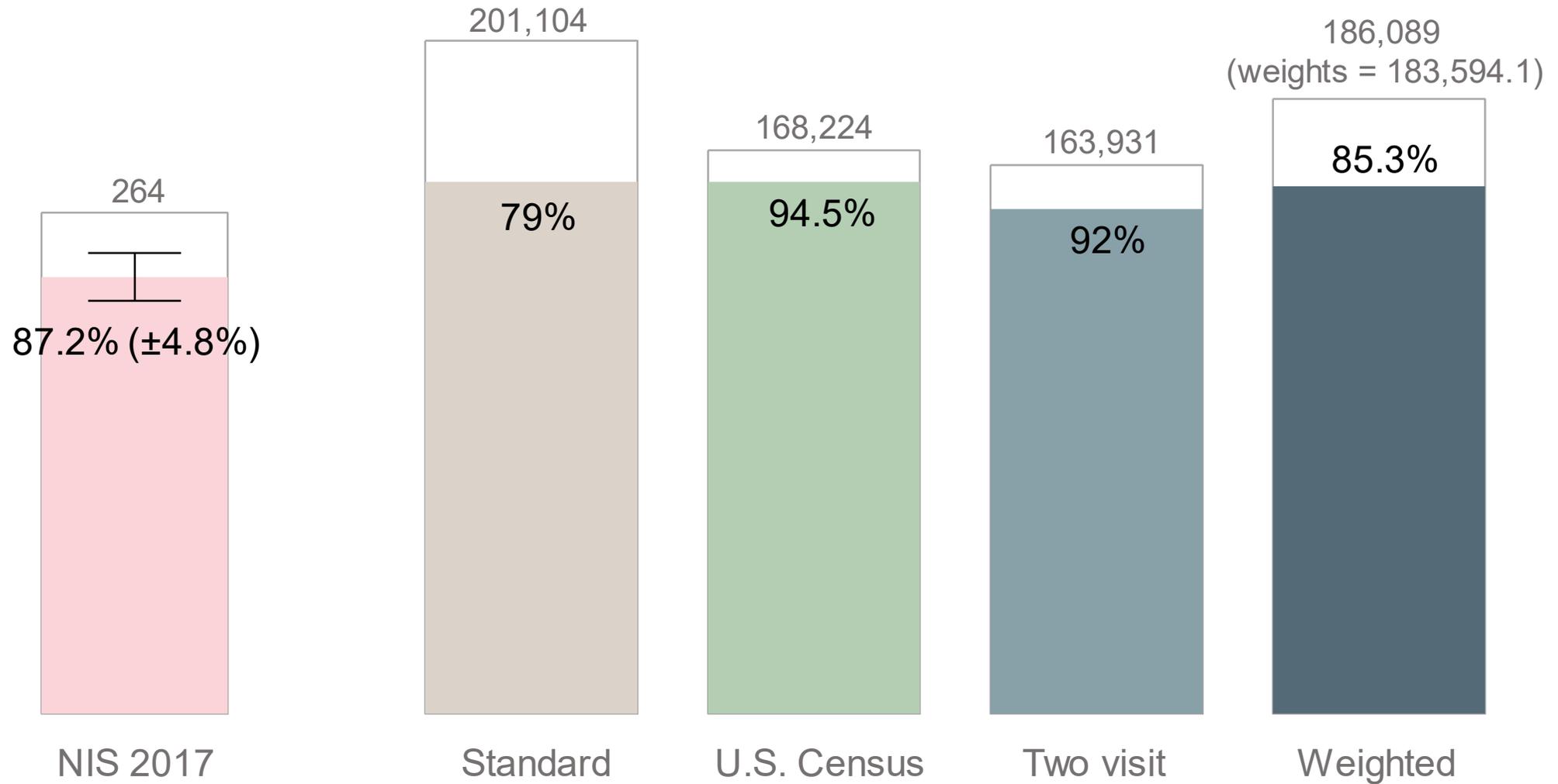
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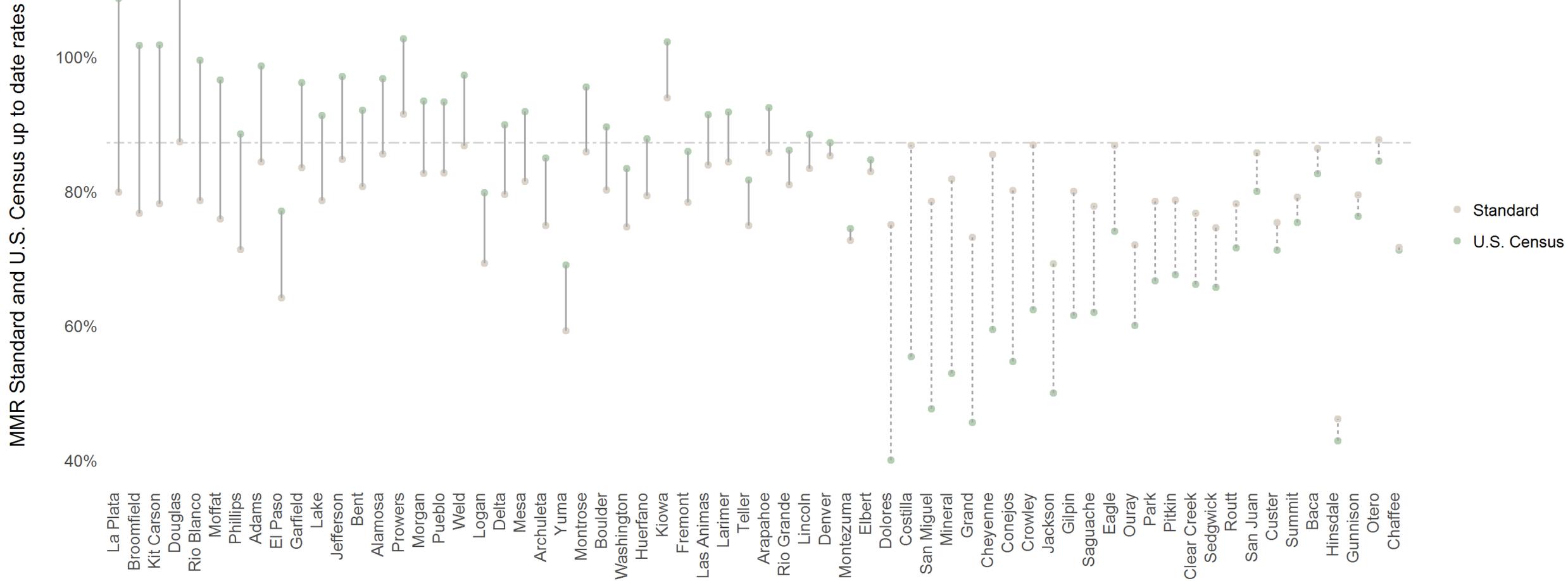
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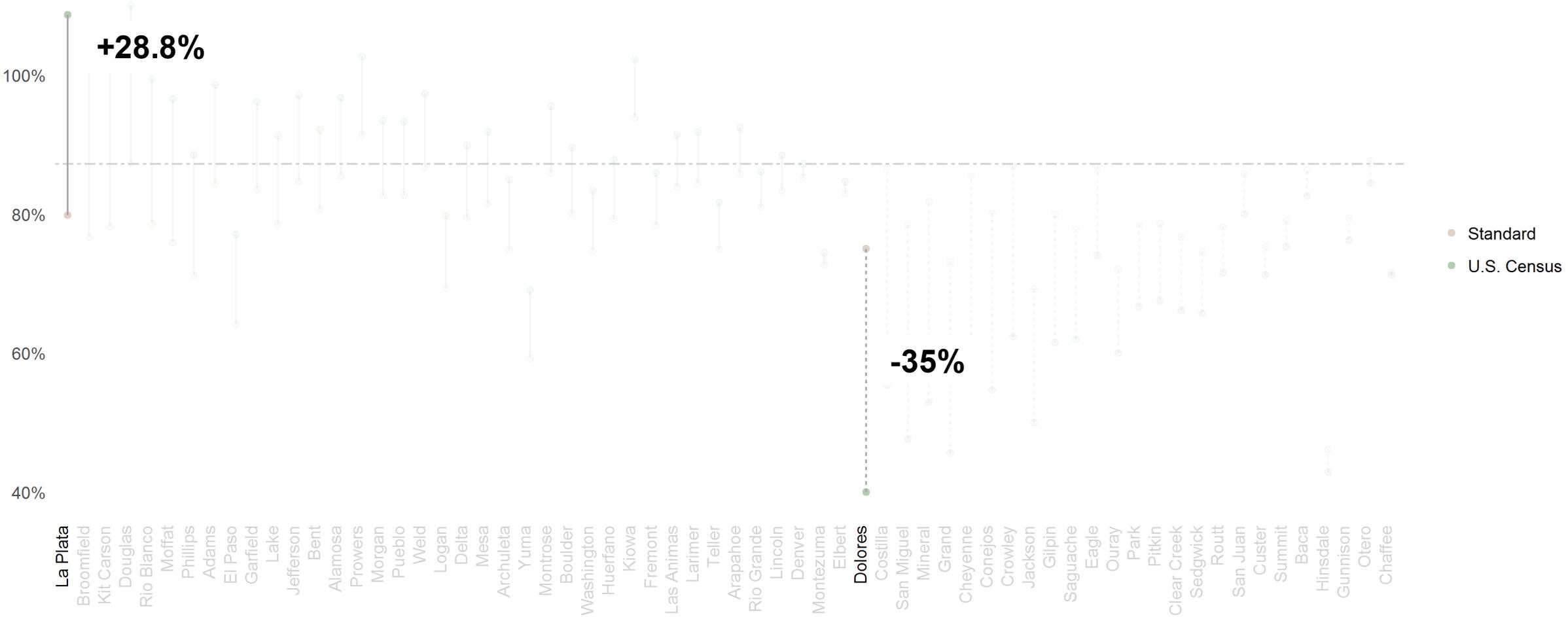


# U.S. Census MMR rates were often drastically different from standard and NIS rates

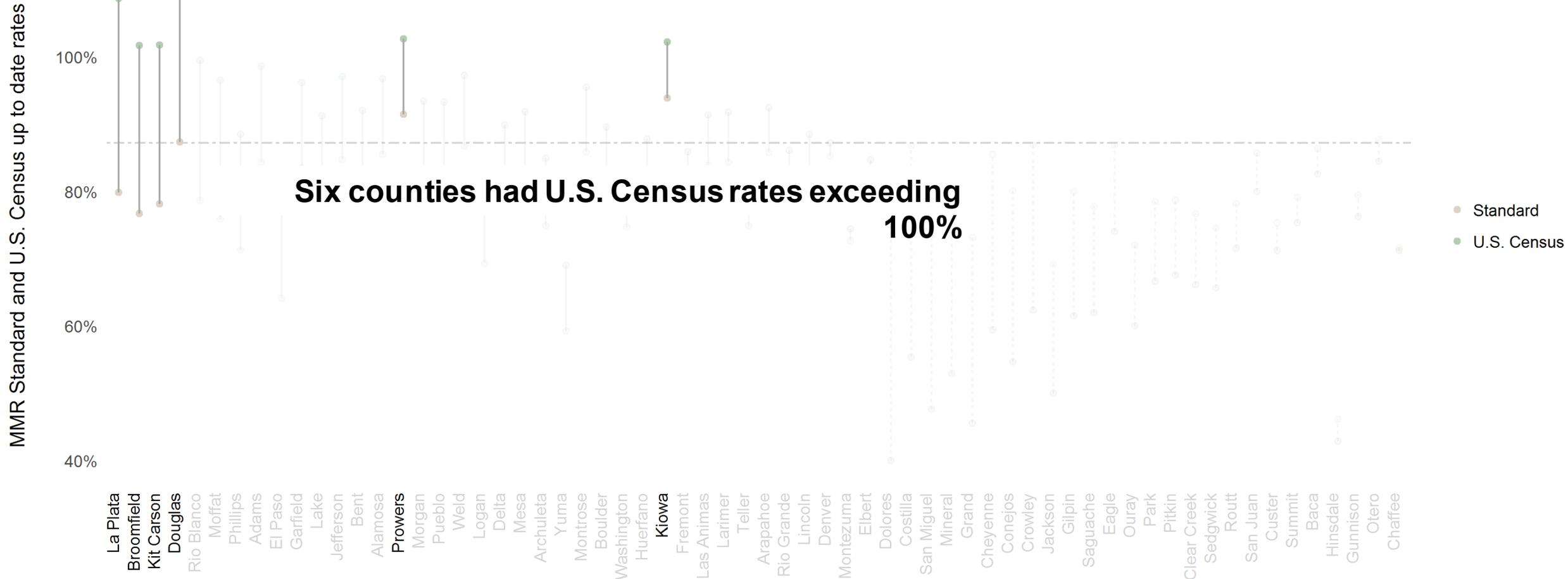


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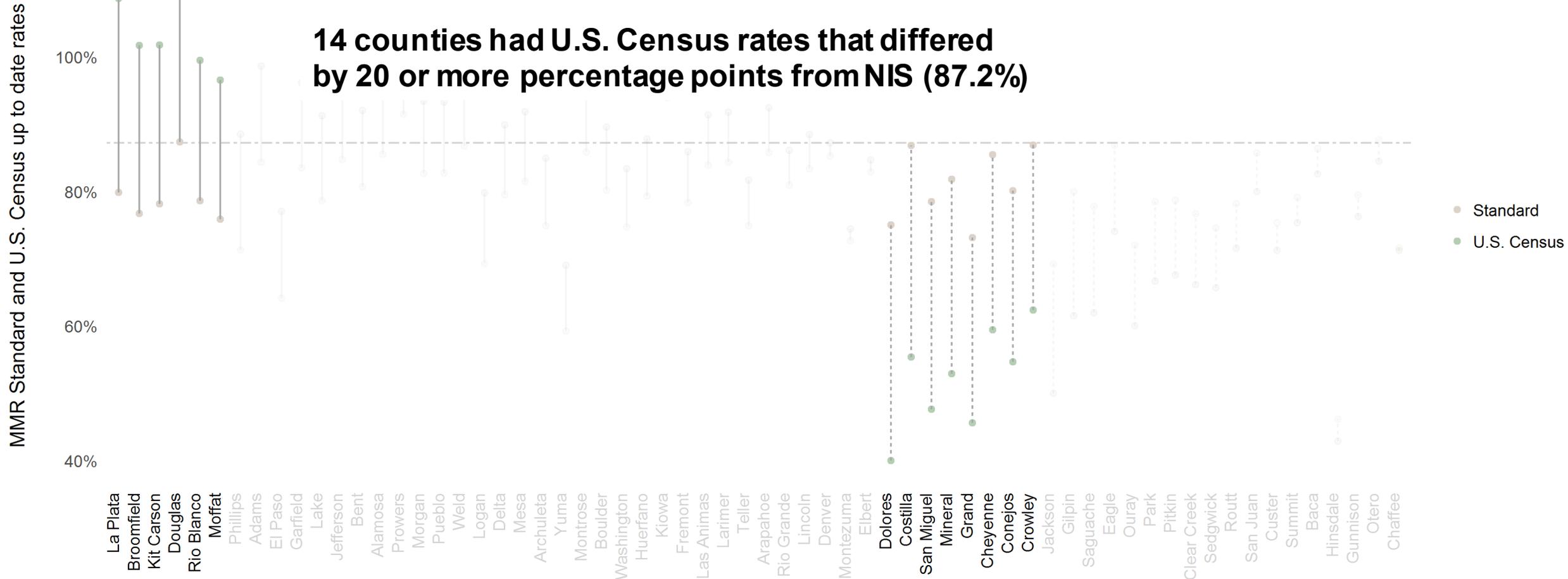
MMR Standard and U.S. Census up to date rates



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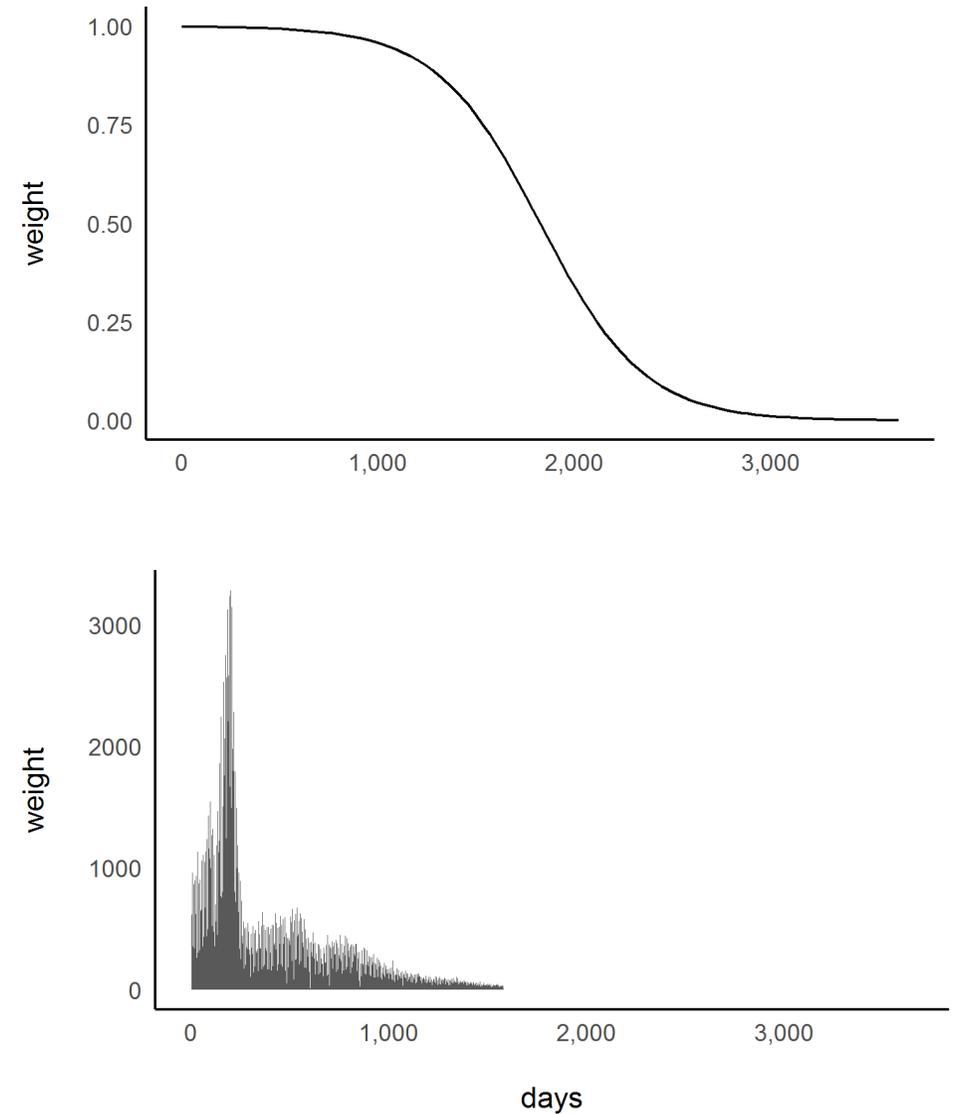
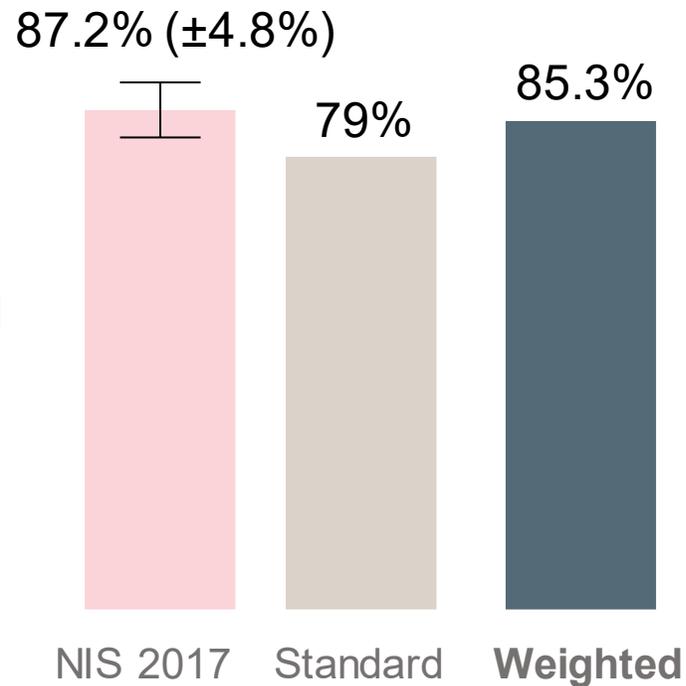
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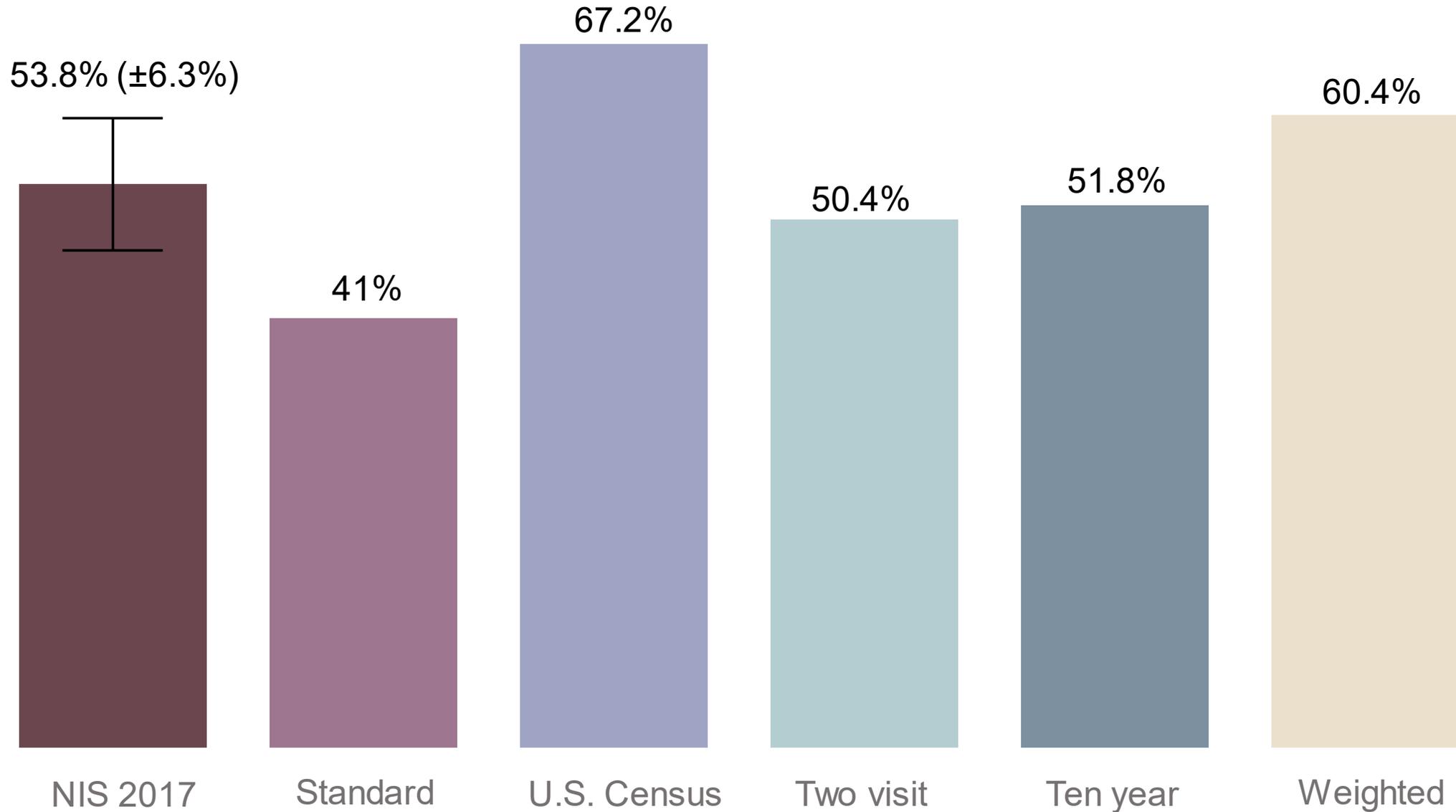
# 97% of 19 – 35 month old weights were 0.9 or higher

Weights were assigned to patients based on the length of time that had passed since their most recent visit

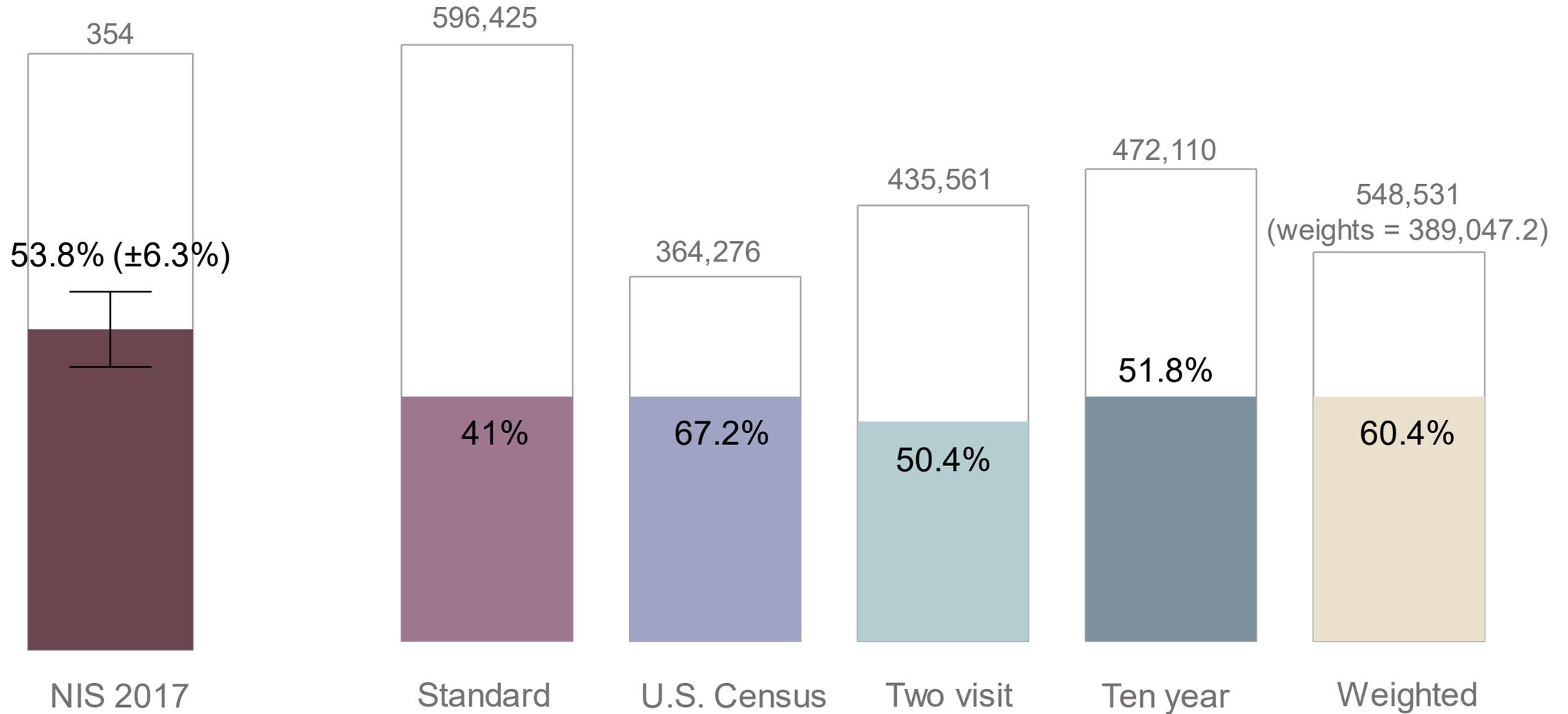
19 – 35 month old  
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# 13 – 17 year old 2017 HPV rates

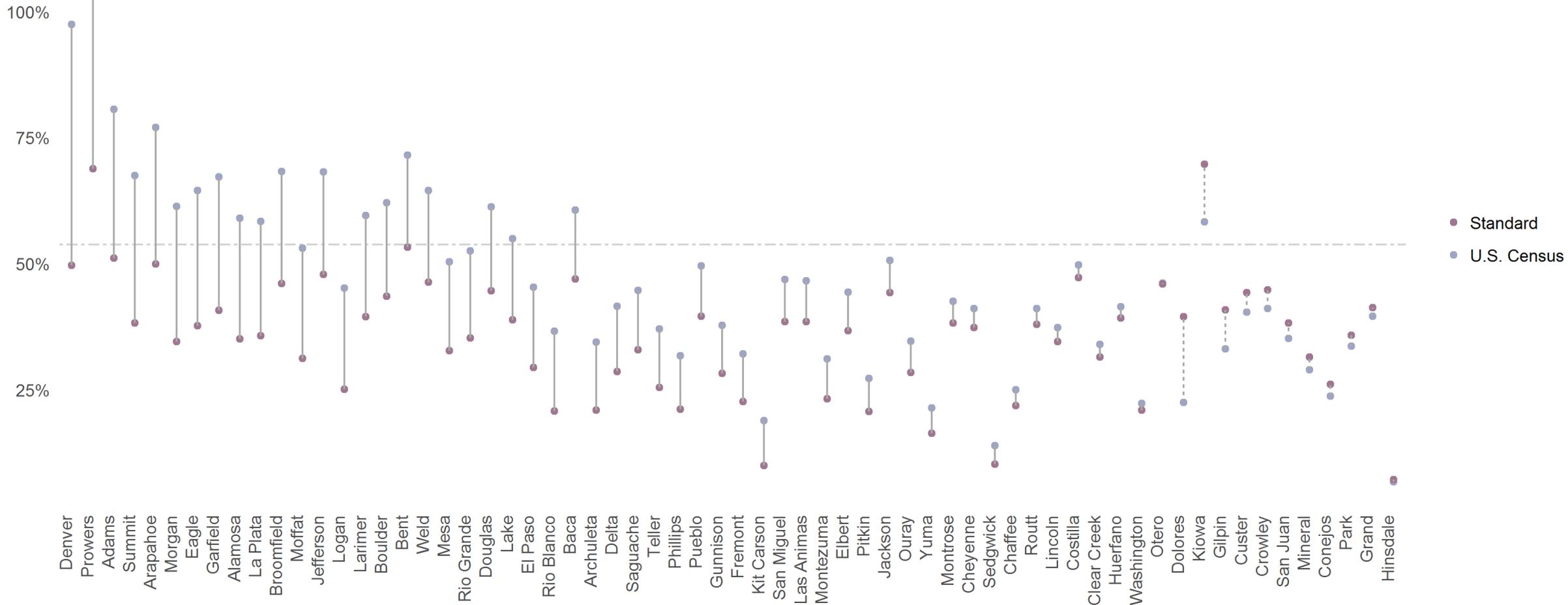


# 13 – 17 year old 2017 HPV rates



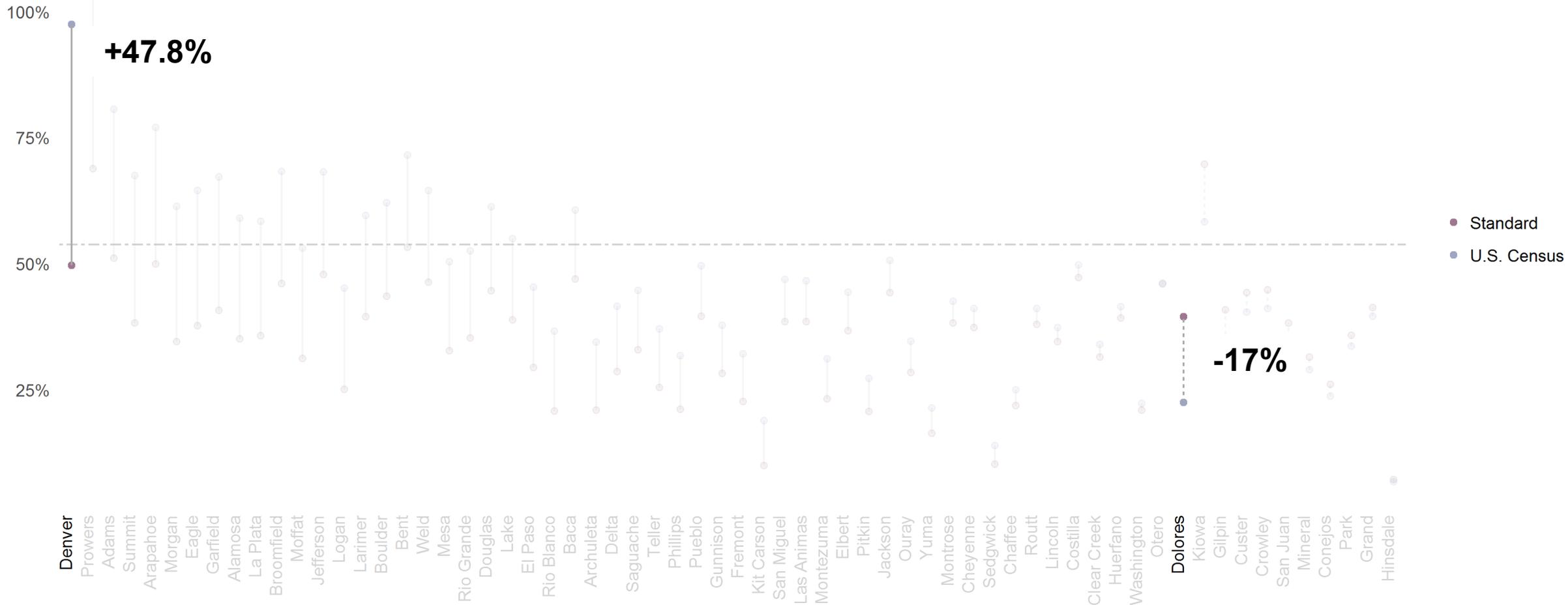
# U.S. Census HPV rates were often much higher than standard and NIS rates

HPV Standard and U.S. Census up to date rates



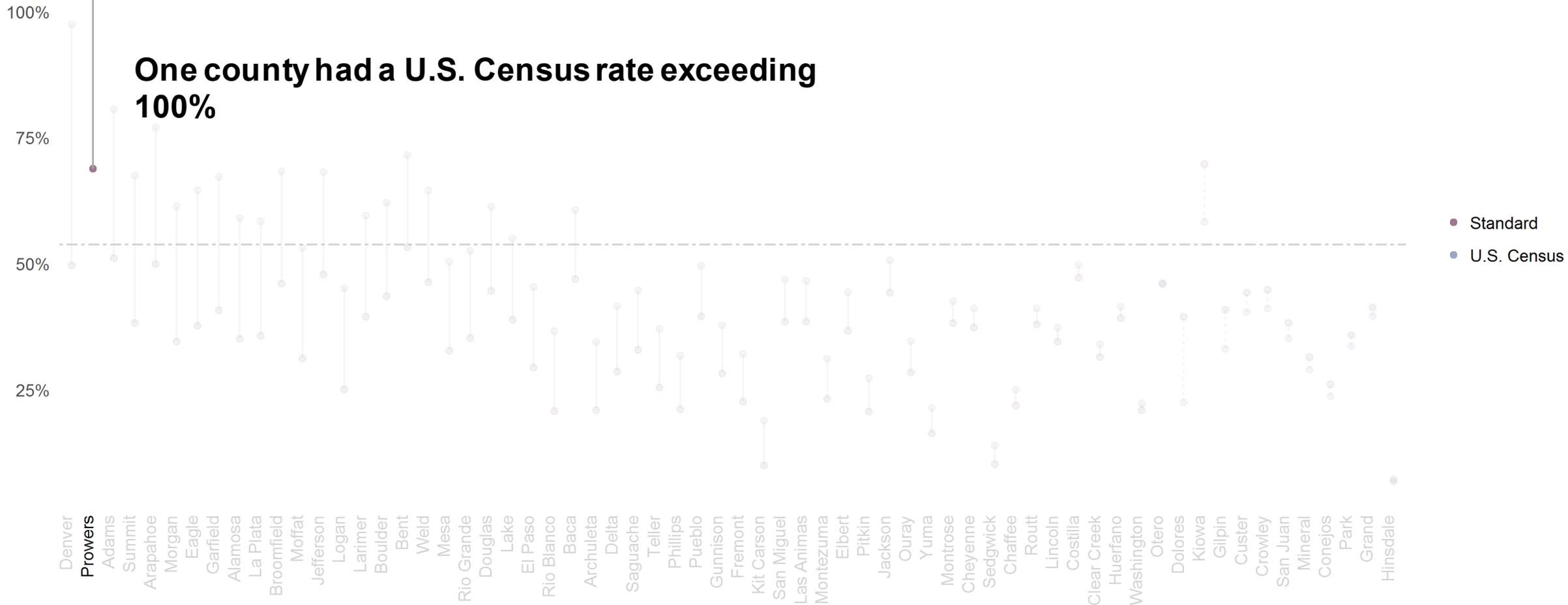
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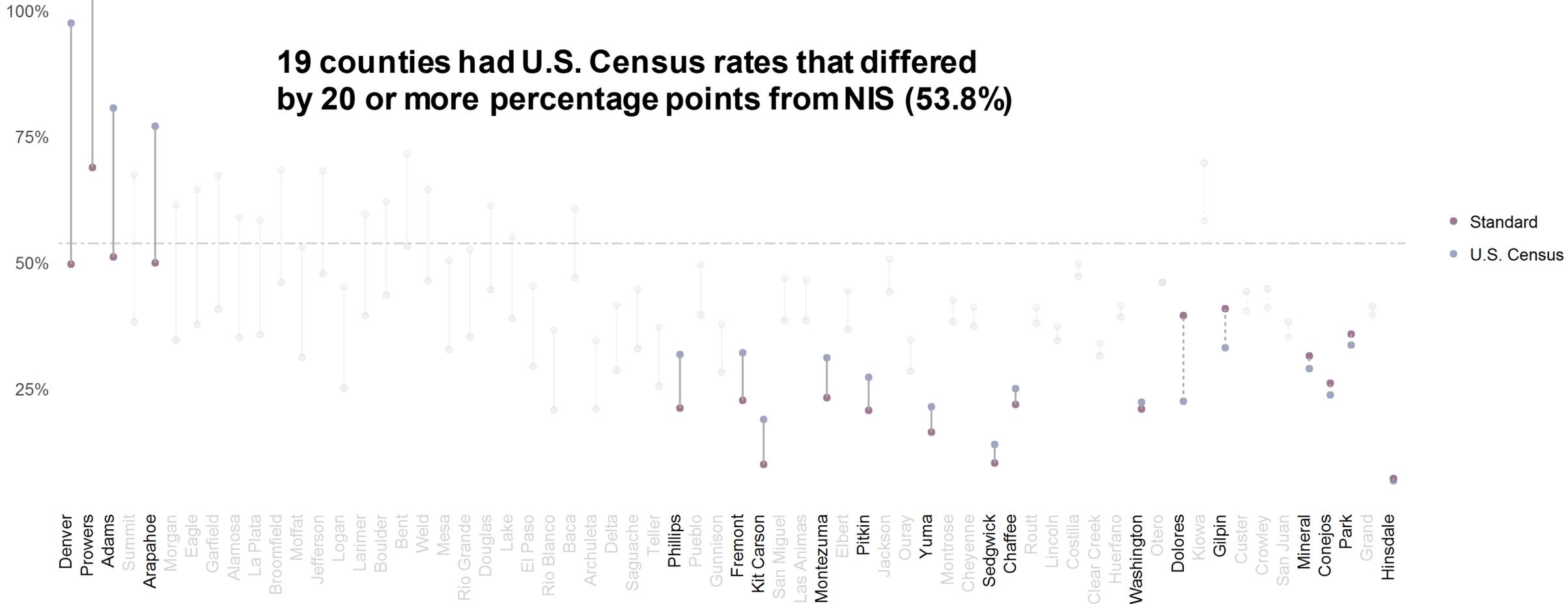
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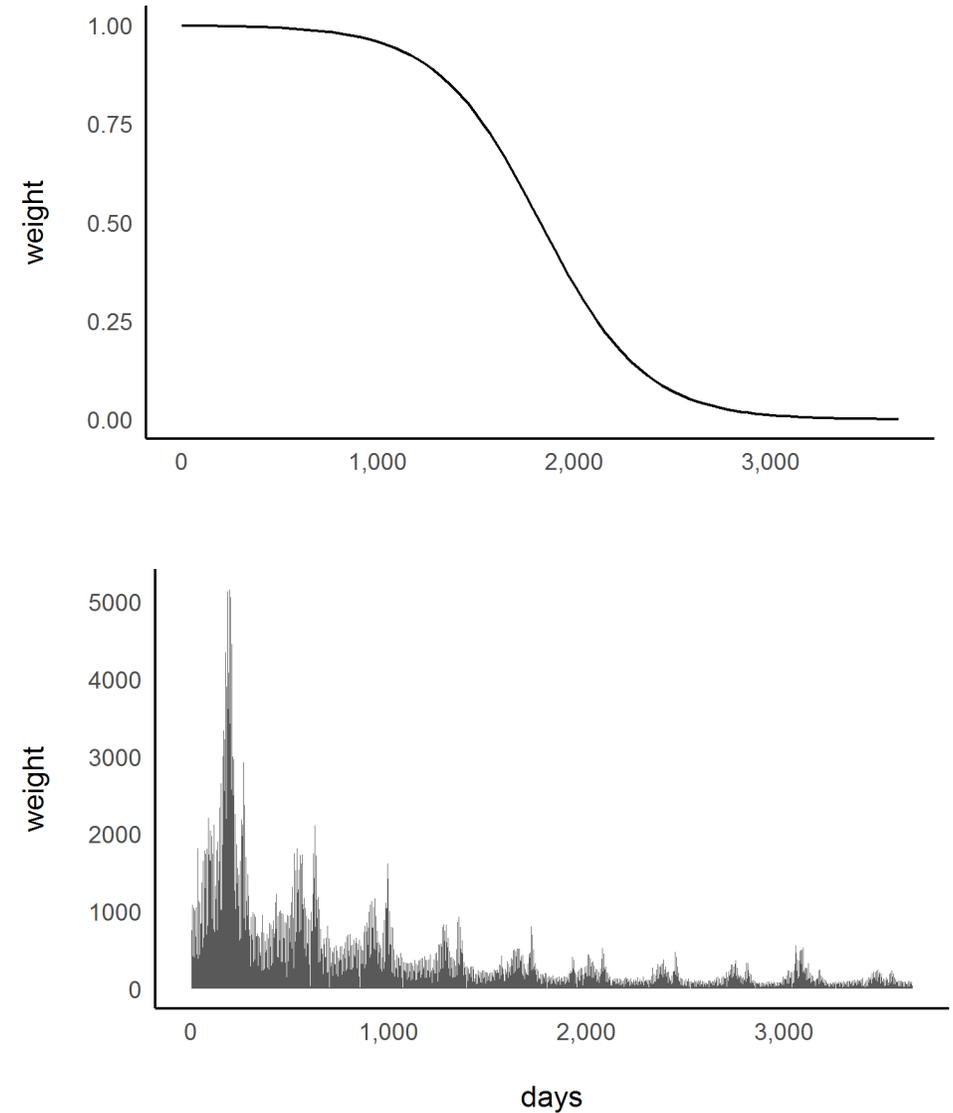
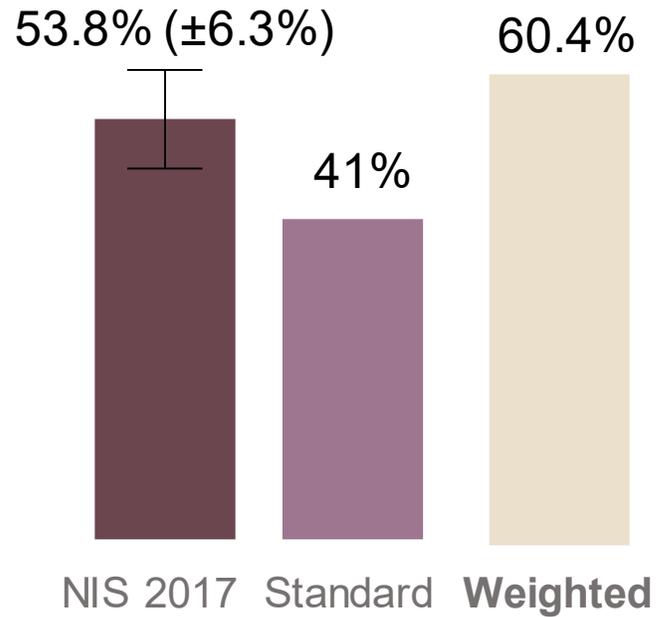
HPV Standard and U.S. Census up to date rates



# 62.8% of 13 – 17 year old weights were 0.9 or higher

Weights were assigned to patients based on the length of time that had passed since their most recent visit

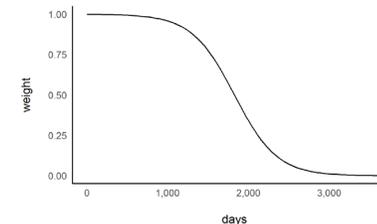
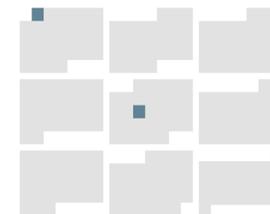
13 – 17 year old  
2017 HPV rates



1. Rates calculated using U.S. Census-based denominators could give results that are inappropriately high

2. Different adjustments could be more appropriate for different cohorts to increase the accuracy of calculated rates:

- 19 to 35 month old cohorts: Two-visit
- 13 to 17 year old cohorts: Weighted



# The webiz R package was written to work with our ENVISION WebIZ database



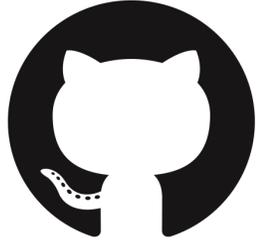
- Connect to an IIS database
- Get recommender results
- Calculate NIS-Child and NIS-Teen up to date status
- Work with patient locations and statuses

```
connect()
```

```
tbl(conn, "patients") %>%  
  select(patient_id, dob) %>%  
  get_recommender_results()
```

```
iz_data %>%  
  calculate_nis_child()
```

```
tbl(conn, "patients") %>%  
  get_status()
```



[github.com/leighseverson/webiz](https://github.com/leighseverson/webiz)

The package is in a private GitHub repository: email me!

[rachel.severson@state.co.us](mailto:rachel.severson@state.co.us)

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[github.com/leighseverson/webiz](https://github.com/leighseverson/webiz)