Innovating Data Privacy for the American Community Survey

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2019 ACS Data Users Conference

United States Census Bureau

U.S. Department of Commerce
Economics and Statistics Administration
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The Census Bureau is committed to data quality

- The Census Bureau's *mission* is to serve as the nation's leading provider of **quality** data about its people and economy.
- The Census Bureau's *goal* is to provide the best mix of timeliness, relevancy, **quality** and cost for the data we collect and services we provide.
- The American Community Survey (ACS) helps local officials, community leaders, and businesses understand the changes taking place in their communities. It is the **premier source** for detailed population and housing information about our nation.

The Census Bureau is also committed to data privacy protection

- The Census Bureau operates, collects data, and publishes statistics under the authority of several titles of the U.S. Code
- Title 13, Sec.9: Neither the Secretary, nor any other officer or employee of the Department of Commerce or bureau or agency thereof […] may […] make any publication whereby the **data furnished by any particular establishment or individual** under this title **can be identified**
- ACS response requirement is tied to guarantee of **confidentiality**
- Methods that protect **confidentiality/privacy** are vital for public data releases

Protect the person. Describe the people.

- ACS data products must be statistical rather than personal
- Public data releases contain information about each respondent
- Disclosure avoidance (DA) methods are used to control this risk
- Previous ACS products have used a number of DA methods

Internal Files	Public Tables	Public-Use Microdata
Household Swapping	Category Collapsing	Geographic aggregation
Synthetic Data		Sub-sampling
		Variable suppression
		Category collapsing
		Variable top-coding

We must innovate DA for the ACS while upholding quality

- Current DA methods are based on assumptions that no longer hold
- The Census Bureau's Data Stewardship Executive Policy committee has charged the ACS with improving its methods
- We are actively researching methods that will allow for provable privacy guarantees
- The ACS will use these methods once fully developed

First, we will consider expanding current DA methods

- The Census Bureau intends to release the standard complement of ACS tables and public-use microdata (PUMS) for 2018
- The detail in published tables and in the PUMS are major disclosure avoidance concerns and are co-dependent
- We will assess expanding the use of synthetic data to protect the PUMS
- Subject matter experts at the Census Bureau will evaluate the accuracy of new synthetic data methods

Then, ACS will transition to formal privacy methods

- Formal privacy methods allow policy makers to balance important social goods – data accuracy and data privacy
- Data users are already familiar with such tradeoffs and accounting for them
  - Complex sample design and survey weights to account for it
  - Effect of new DA methods will be another source of published error
- More transparency about DA methods and their effects will be possible
- We must have the involvement of data users to understand the effects of various options fully

Many experts are advising the Census Bureau as we modernize disclosure avoidance

- The Census Bureau has engaged academic and industry partners with expertise in modern data privacy methods
- Teams of experts are working with Census Bureau staff on multiple Census Bureau products, including 2020 Census, ACS and 2017 Economic Census
- The Census Bureau's subject matter experts are closely monitoring the effects of new methods on ACS accuracy
- The Census Bureau has actively sought feedback from the data user community

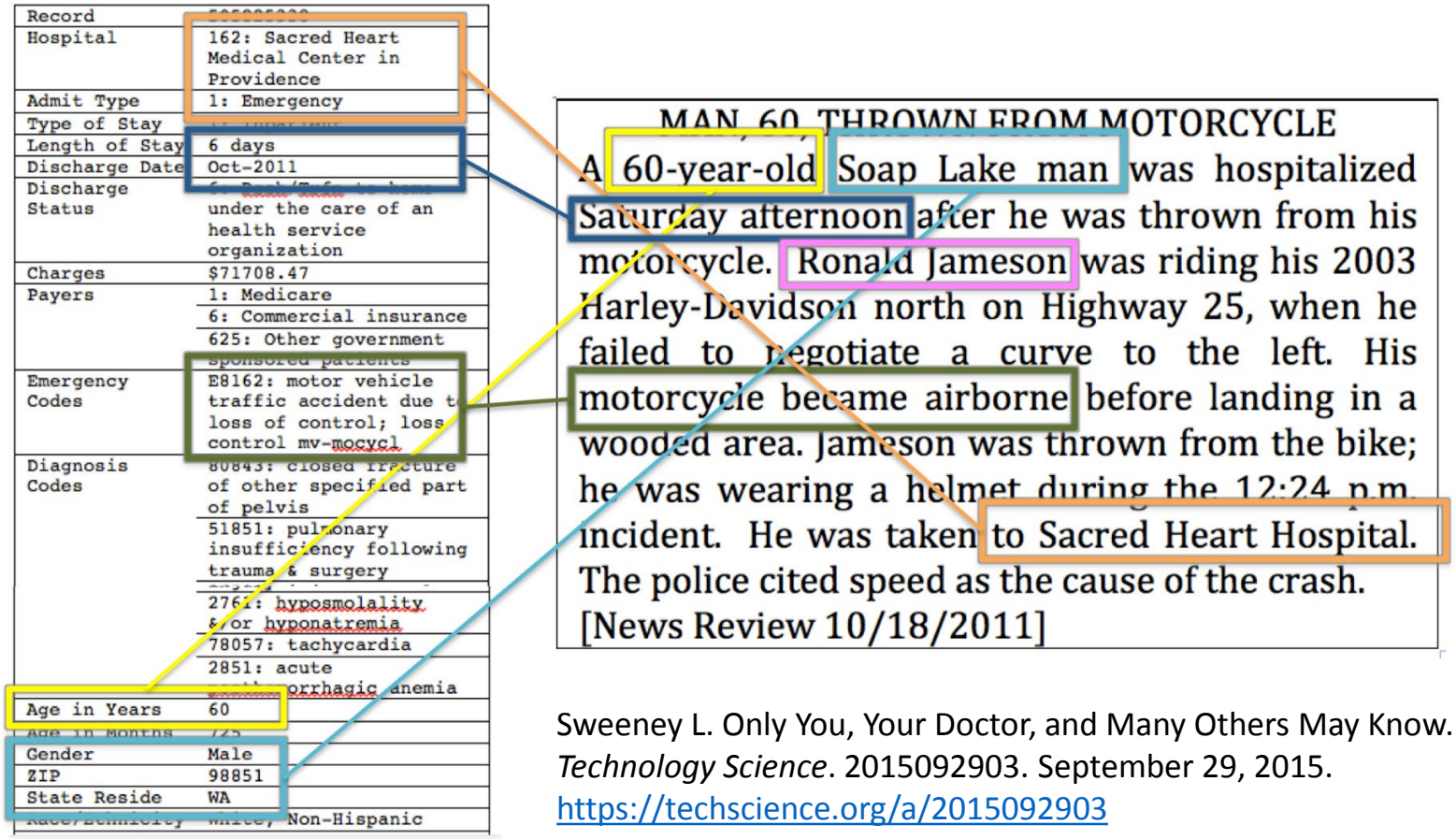
DA methods must adapt to a new data environment

- Data curators face an imposing global data environment
- Many sources of detailed personal information now readily available
- Modern computational methods designed to harness these sources
- ACS must maintain respondent privacy within this atmosphere
- Re-identification risks are an established reality, not merely a theoretical concept

In 1997, a governor had his medical records identified

- In 1996, the governor of Massachusetts collapsed at a keynote address
- After recovery, he oversaw the public release of hospital data for use in improving healthcare and related costs and assured its privacy
- Respondent privacy was protected by commonly used de-identification techniques
- For $20, an MIT graduate student purchased voter rolls, which included name, address, ZIP, birthdate, and sex
- She re-identified the governor's records in the hospital data and sent him a copy

In 2018, computational power makes similar attacks easier and more widespread



Record	
Hospital	162: Sacred Heart Medical Center in Providence
Admit Type	1: Emergency
Type of Stay	
Length of Stay	6 days
Discharge Date	Oct-2011
Discharge Status	under the care of an health service organization
Charges	$71708.47
Payers	1: Medicare
	6: Commercial insurance
	625: Other government
Emergency Codes	E8162: motor vehicle traffic accident due t loss of control; loss control mv-mocycl
Diagnosis Codes	80843: closed fracture of other specified part of pelvis
	51851: pulmonary insufficiency following trauma & surgery
	2761: hyposmolality &/or hyponatremia
	78057: tachycardia
	2851: acute orrhagic anemia
Age in Years	60
Age in Months	725
Gender	Male
ZIP	98851
State Reside	WA
	Non-Hispanic

MAN, 60, THROWN FROM MOTORCYCLE

A 60-year-old Soap Lake man was hospitalized Saturday afternoon after he was thrown from his motorcycle. Ronald Jameson was riding his 2003 Harley-Davidson north on Highway 25, when he failed to negotiate a curve to the left. His motorcycle became airborne before landing in a wooded area. Jameson was thrown from the bike; he was wearing a helmet during the 12:24 p.m. incident. He was taken to Sacred Heart Hospital. The police cited speed as the cause of the crash. [News Review 10/18/2011]

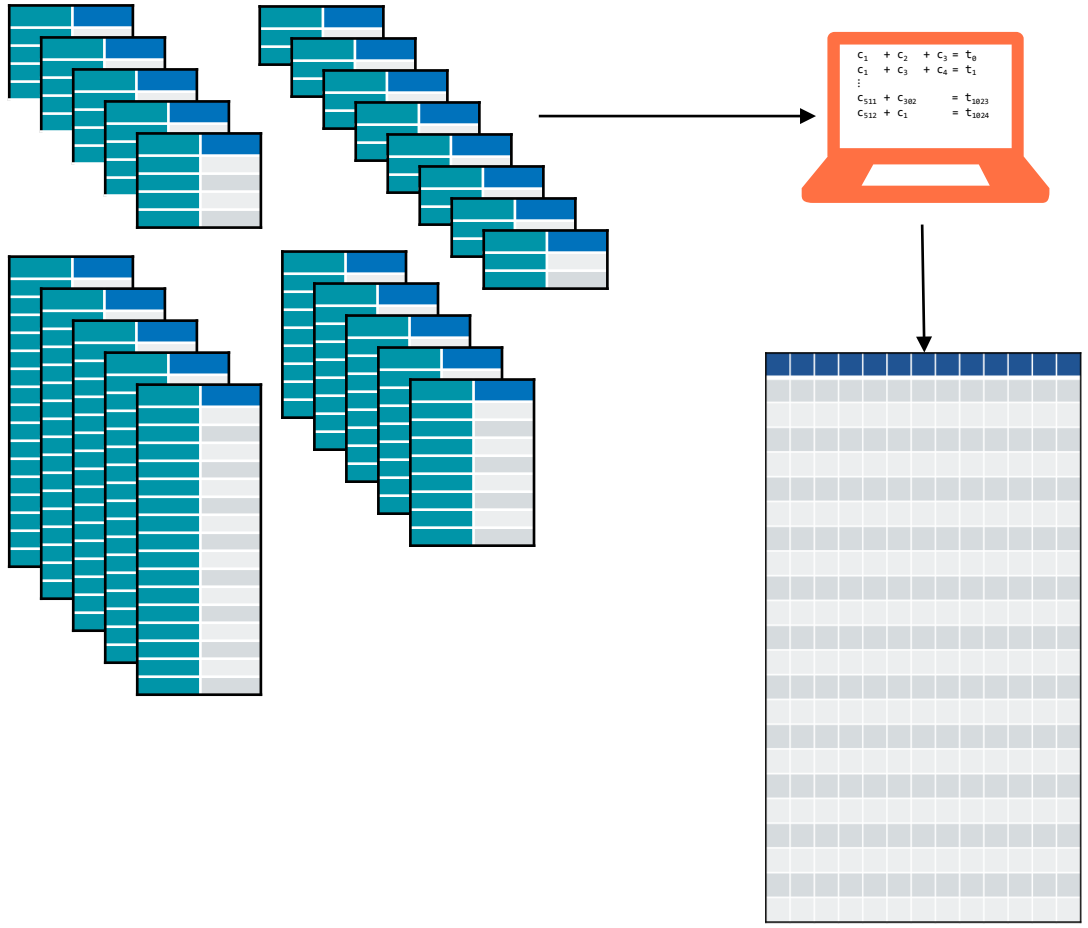
Sweeney L. Only You, Your Doctor, and Many Others May Know. *Technology Science*. 2015092903. September 29, 2015. https://techscience.org/a/2015092903

Several publicized re-identification attacks have happened

- Re-identification actually happens, with seemingly protected data
- Simple removal of obvious identifying information is not sufficient
- People can be unique on a relatively small set of attributes
- Current DA methods are not sufficient against known current risks
- Re-identification not limited to microdata releases
- Database reconstruction from public tables is possible

Database reconstruction turns statistics back into people

- Database reconstruction aims to recreate a non-public dataset from publicly available data
- Large table releases can easily yield multiple cells per item in the non-public file
- Modern software makes combining tables into microdata feasible
- Current ACS DA practices are not designed to protect from these types of attacks



The Census Bureau used 2010 Census tables to demonstrate database reconstruction

- Used public tables to create a database row for each person
- More than 50% of the population is unique on a combination of block, age, sex, race, and ethnicity (exact percentage is confidential)
- 45% of rows linkable to commercial data with personal information (138 million people)
- 38% of linked rows matched back to named Census records (52 million people)
- The overall vulnerability is 17% of population
- Previous re-identification study had overall vulnerability of 0.0038%

Public ACS data creates its own privacy risks

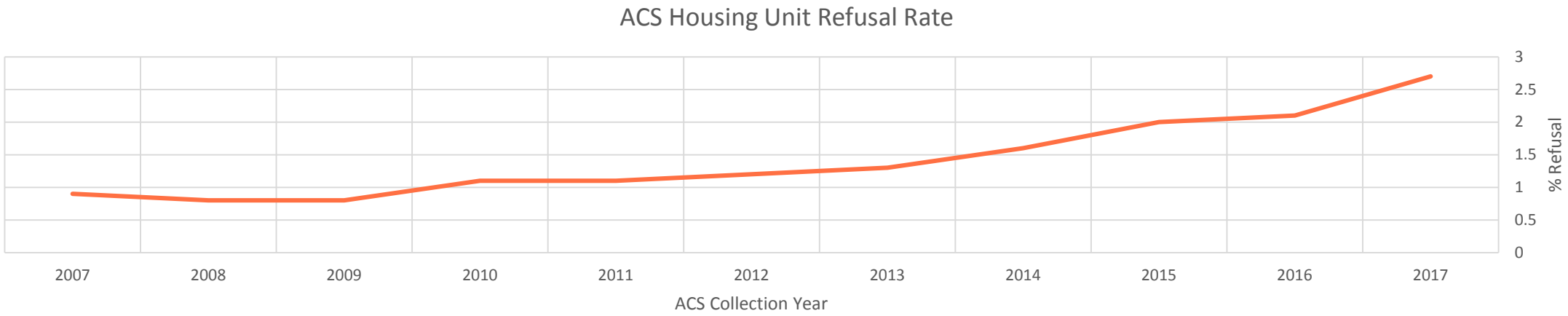
- The Census Bureau publishes multiple ACS data products
  - Summary tables
  - Custom tabulations
  - Public-use microdata samples (PUMS)
- The main DA method for ACS PUMS is limiting geography
  - The smaller the geography, the more likely someone is unique
  - Smallest geographic unit in PUMS is the public-use microdata area (PUMA)
  - PUMAs must contain populations of at least 100,000 people
- What if someone can break PUMAs into smaller geographies?

ACS tables are the key to unlocking PUMAs

- Information on smaller geographies already available from ACS tables
- ACS releases hundreds of 5-year tables by block group
- Innovative statistical models have combined PUMS and tables to make new sub-PUMA estimates
- Although not the intent of the models, new estimates can add to reconstruction and re-identification risk
- ACS needs DA methods that can protect against this kind of risk… and other risks that may come

The Census Bureau needs to maintain trust of our respondents

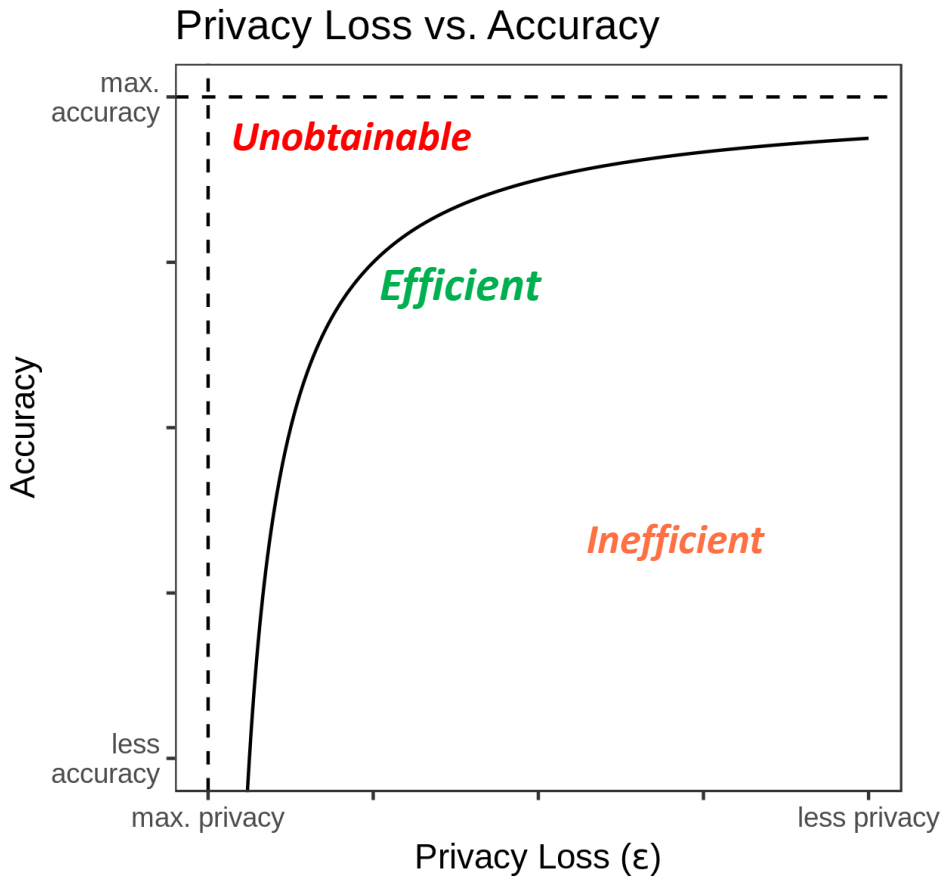
- People have growing concerns about their privacy
- ACS must maintain respondent trust within this environment
- Decreases in respondent trust could have negative impacts on quality
- Provable privacy guarantees will aid in keeping that trust



www.census.gov/acs/www/methodology/sample-size-and-data-quality/response-rates/

Formal privacy methods can future-proof the privacy of the ACS data

- Can guarantee privacy against broad classes of attacks
- Do not depend on which datasets are now or will be available
- Have a calculable, global privacy loss for a given set of releases at a given accuracy
- Allow for transparency about the method, data accuracy, and privacy loss



Formal privacy for the ACS is a work in progress

- Formal privacy methods developed for 2020 Census will inform ACS methods
- ACS has additional features that require further research
  - More topic areas
  - Complex survey design and survey weights
  - Population controls
- ACS will implement formal privacy methods once developed to have a satisfactory balance of data privacy and data usefulness
- Until then, ACS will expand non-formal methods to provide protection

New DA methods can also improve quality

- Some current DA methods may be reduced or removed
  - PUMS sub-sampling
  - PUMS geographic aggregation
  - Household swapping
  - Variable top-coding
  - Category collapsing
- New methods can work alongside other ACS innovations
  - Data modeling, especially for small areas and missing data
  - Use of administrative records
- Transparency of DA methods might allow data users to account for the effect of privacy protection in their analyses

Going forward together…

- The Census Bureau understands the importance of the ACS to the nation
- We understand many users will find these DA changes concerning
- The Census Bureau must act to fulfill our obligations to data users and to respondents
- Data user involvement is and will be vital
  - Provide input to the Census Bureau for data needs
  - Information sharing among peers for adapting to new public data
- These changes will let the Census Bureau better serve data users
  - Transparency
  - Data-driven decisions about balancing data privacy with data accuracy
  - Continue to have a quality, trusted, reputable product for years to come