

# Harmonization and Integration of Criminal Justice Administrative Records to Support Evidence-based Policy Making

2021 SEARCH Symposium on Justice Information Technology, Policy and Research

July 2021

CJARS is a next-gen data repository aiming to modernize research and statistical reporting capacities on the U.S. criminal justice system

CJARS adds to existing resources through three core innovations:

- 1 Longitudinal, multi-jurisdictional data is collected, harmonized, and linked to track individuals across space and time
- 2 Evolution of a criminal episode is traced through the justice system
- 3 Integration with extensive socio-economic survey and administrative data held by the Census Bureau

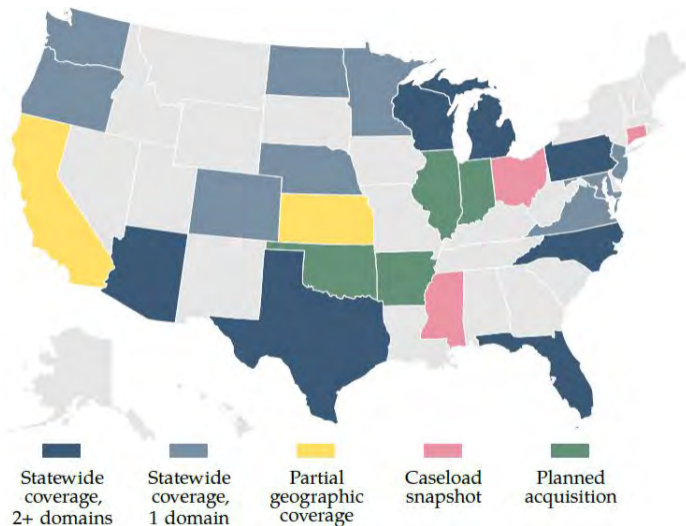
Uniquely challenging given the uncoordinated, non-centralized nature of U.S. CJ records

# Success to-date

## Currently hold:

- 2+ billion lines of raw data
- 178 million CJ events
- 36 million unique individuals
- 23 states

States with statewide coverage in at least one CJ domain constitute 50% of the U.S. population



# Panel Topics

- 1 Developing Modern Criminal Offense Classification Techniques  
- Jay Choi, University of Michigan
- 2 Benchmarking and Validating the Criminal Justice Administrative Records System  
- Jordan Papp, University of Michigan
- 3 Tracking Socio-Economic Characteristics and Outcomes in the U.S. Criminal Justice Caseload  
- Keith Finlay, U.S. Census Bureau

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- Harmonize data from different stages of the criminal justice system with a common schema
  - ▶ Generate meaningful statistics
  - ▶ Understand trends in crime and policy impacts
  - ▶ Compare across different geographical areas
- Challenges
  - ▶ Offense descriptions from arrest, adjudication, and prison data from 20+ states
  - ▶ 3,297,504 unique string descriptions
  - ▶ 159,188,266 total observations
  - ▶ Data entered as free text
- As a solution, develop a machine learning algorithm tool for classifying textual offense descriptions into standardized charge codes for statistical purposes

# Schema Challenges

- National Incident-Based Reporting System (NIBRS)
  - ▶ Complex database system
  - ▶ Offense crosswalks are not accessible to public
- National Corrections Reporting Program (NCRP)
  - ▶ Annual state-specific crosswalks
  - ▶ Inconsistent coding for a given description
  - ▶ Cannot be used to classify new descriptions

## Examples of Inconsistent Offense Classification in NCRP Crosswalks

State	State Description	BJS Code
AK	MANSLAUGHTER	013
AL	MANSLAUGHTER	030
AR	MANSLAUGHTER	015
AZ	MANSLAUGHTER	013
CA	VOLUNTARY MANSLAUGHTER	015
KY	VOLUNTARY MANSLAUGHTER	710
NV	VOLUNTARY MANSLAUGHTER	010
PA	VOLUNTARY MANSLAUGHTER	030
TN	VOLUNTARY MANSLAUGHTER	120
TN	VOLUNTARY MANSLAUGHTER	015
VA	VOLUNTARY MANSLAUGHTER	010
VA	VOLUNTARY MANSLAUGHTER	011

- Non-profit collecting, standardizing, and making publicly available criminal justice data at the county-level
- Acquired training data through partnership:
  - ▶ 386,906 unique descriptions labelled and reviewed by experts
  - ▶ 439,534,275 descriptions at case count
- Charge Indicators/Flags
  - ▶ 5,682 domestic violence
  - ▶ 332 gang
  - ▶ 5,735 gun
  - ▶ 3,978 habitual offender



# Unified Crime Classification Standard (UCCS)

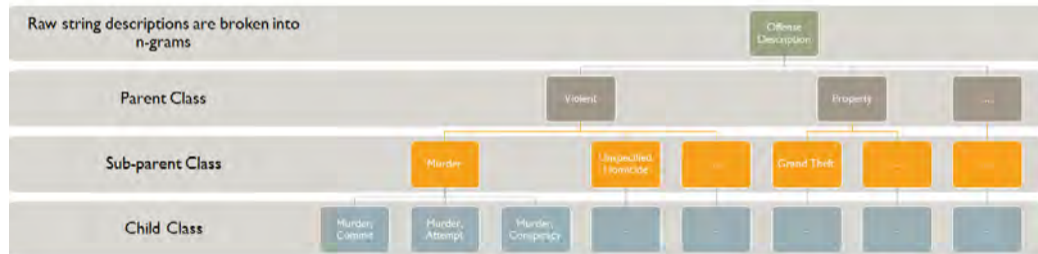
Adopt MFJ's hierarchical categories to generate hierarchical charge codes for the fine-grained categories

TYPE_CODE	TYPE_DESC	CATEGORY_CODE	CATEGORY_DESC	INCHOATE_CODE	UCCS_CODE	UCCS_DESC
		01	Murder	0	1010	Murder
				1	1011	Murder, Attempt
				2	1012	Murder, Conspiracy
1	Violent	02	Unspecified Homicide	0	1020	Unspecified Homicide
				1	1021	Unspecified Homicide, Attempt
				2	1022	Unspecified Homicide, Conspiracy
		.	.	.	.	.
		99	Other Violent Offense	0	1990	Other Violent Offense
				1	1991	Other Violent Offense, Attempt
				2	1992	Other Violent Offense, Conspiracy

By preserving the hierarchical attribute in the final UCCS code, users can generate meaningful, higher-level aggregate statistics by looking at either the first digit or the first three digits

# Text-based Offense Classification (TOC)

- Text classification tool that uses a hierarchical classification framework in which the data taxonomy used to create the hierarchy of classifiers is predefined in the UCCS schema



Standardize raw offense descriptions to common format

- Lowercase
- Remove stop words (e.g. " a ", " the ")
- Remove special characters except for relational operators (e.g. " < ", " > ")
- Remove multi-, leading, and trailing spaces
- Stem words (e.g. " possessing " to " possess ")

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## Original Description

893136A-DRUG3101 (FT) POSSESSION OF HERO  
SAO1000 (MS) DRIVING UNDER THE INF  
Theft from Persons >65 VALUE >300<10k

---

## Preprocessed Description

89313fdrug3100 ft possess hero  
sao1000 ns drive under inf  
theft from person >65 value >300<10k

---

# Feature Generation - Ngrams

theft from person > 65 value >300k<10k

theft from person > 65 value >300k<10k

theft from person > 65 value >300k<10k

...

theft from person > 65 value >300k<10k

theft from person > 65 value >300k<10k

theft from person > 65 value >300k<10k

- Sequence of N characters
- Better for data with abbreviations, spelling errors

'thef', 'heft', 'eft ', 'ft f', 't fr',  
' fro', 'from', 'rom ', 'om p',  
'm pe', ' per', 'pers', 'erso',  
'rson', 'son>', 'on>6', 'n>65',  
'>65 ', '65 v', '5 va', ' val',  
'valu', 'alue', 'lue>', 'ue>3',  
'e>30', '>300', '300<', '00<1',  
'0<10', '<10k'

# Feature Extraction

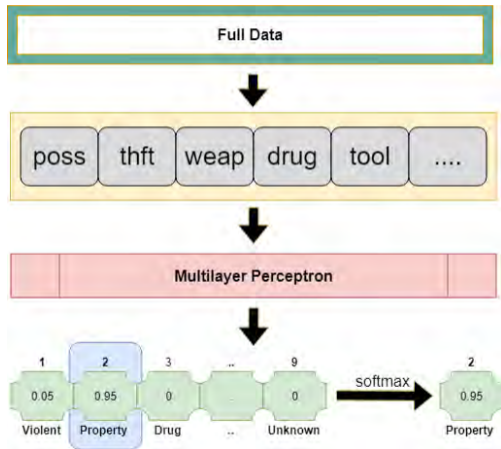
- TOC uses most representative list of 4 characters
  - ▶ 5,000 most frequently occurring characters
  - ▶ Average length of characters per words = 4.75
  - ▶ Useful abbreviations 4 characters (or 3 characters with a space)
    - ★ "pwid": "possession with the intention to distribute"
    - ★ " cds" or " cds ": "controlled dangerous substance"

'thef', 'heft', 'eft ', 'ft f', 't fr',  
'fro', 'from', 'rom ', 'om p',  
'm pe', ' per', 'pers', 'erso',  
'rson', 'son>', 'on>6', 'n>65',  
'>65 ', '65 v', '5 va', ' val',  
'valu', 'alue', 'lue>', 'ue>3',  
'e>30', '>300', '300<', '00<1',  
'0<10', '<10k', .....

Choose 5,000 most  
frequently occurring  
4-grams

'poss', 'thft', 'weap', 'drug',  
'burg', 'tool', 'meth', .....

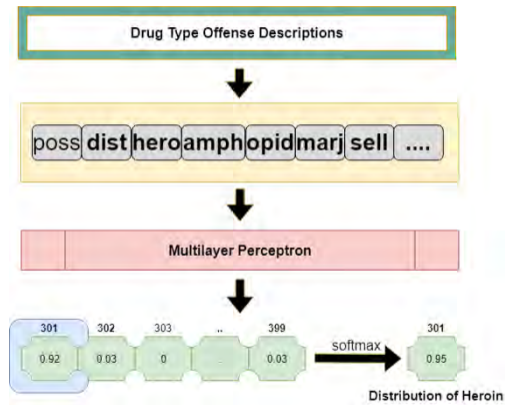
# Hierarchical Classification - Parent Group



- For the parent group classification, select 5,000 most frequently occurring sequence of 4 characters from the entire data
- These 4 characters are used as inputs to train and to predict parent groups
- Each parent group is scored over a probability distribution
- Parent group with the highest probability is selected as the predicted group (softmax)

# Hierarchical Classification - Child Group

- After the first classification level, the offense descriptions are partitioned by their parent group
- For each group, select 5,000 most frequently occurring sequence of 4 characters
  - ▶ Able to choose meaningful characters for further disambiguation
- These characters are then used to train and predict the child group conditional on parent group



# Parent Class Performance

	Actual Count	Prediction Count	Precision	Recall	F-Stat
<b>Violent [1]</b>	47,429	47,054	0.977	0.969	0.973
Property [2]	41,673	41,641	0.971	0.970	0.970
<b>Drug [3]</b>	43,246	43,085	0.994	0.990	0.992
DUI Offense [4]	5,151	4,896	0.996	0.946	0.970
Public Order [5]	42,287	41,600	0.944	0.928	0.936
Criminal Traffic [6]	2,436	4,009	0.583	0.959	0.725
Other [8]	2,242	1,467	0.831	0.544	0.657
Not Known/Missing [9]	7,893	8,605	0.789	0.861	0.823
<b>micro avg (all groups)</b>			0.955	0.955	0.955
<b>macro avg (average of per group)</b>			0.886	0.896	0.881

- Precision: Percentage of records correctly predicted out of all the predictions for the class
  - ▶ 0.977 for Violent: 97.7% of 47,054 (number of predictions) records were correctly identified as Violent
- Recall: Percentage of records correctly predicted out of the actual number of records identified as the class
  - ▶ 0.990 for Drug: 99.0% of 43,246 records (number of actual cases) were correctly identified as Drug



# Performance - Top 3 Violent Offense Types

	Actual Count	Prediction Count	Precision	Recall	F-Stat
Murder [1010]	2,207	2,573	0.858	1.000	0.923
Murder, Attempt [1011]	1,317	1,458	0.903	1.000	0.949
Murder, Conspiracy [1012]	995	976	1.000	0.971	0.980
Aggravated Assault [1200]	2,400	3,609	0.637	0.958	0.766
Aggravated Assault, Attempt [1201]	1,089	1,111	0.873	0.891	0.882
Aggravated Assault, Conspiracy [1202]	739	749	0.947	0.959	0.953
Armed Robbery [1180]	2,271	2,474	0.918	1.000	0.957
Armed Robbery, Attempt [1181]	1,174	1,285	0.914	1.000	0.955
Armed Robbery, Conspiracy [1182]	723	779	0.928	1.000	0.963

# Performance - Top 3 Drug Offense Types

	Actual Count	Prediction Count	Precision	Recall	F-Stat
Distribution of Opioids [3040]	2,601	2,743	0.941	0.992	0.966
Distribution of Opioids, Attempt [3041]	1,682	1,662	0.988	0.976	0.982
Distribution of Opioids, Conspiracy [3042]	1,017	1,097	0.900	0.971	0.934
Distribution of Unspecified Drug [3080]	1,631	1,854	0.718	0.816	0.764
Distribution of Unspecified Drug, Attempt [3081]	677	754	0.828	0.922	0.872
Distribution of Unspecified Drug, Conspiracy [3082]	877	724	0.970	0.800	0.877
Distribution of Marijuana/Hashish [3070]	1,621	1,591	0.956	0.938	0.947
Distribution of Marijuana/Hashish, Attempt [3071]	580	480	0.979	0.810	0.887
Distribution of Marijuana/Hashish, Conspiracy [3072]	729	1,000	0.729	1.000	0.843

# Examples of Misclassified Records

TOC accurately classified the parent group for 75% of the misclassified records.

Original Description	Actual L1 Code	Predicted L1 Code	Actual UCCS Code	Predicted UCCS Code
theft of property <1 000	2	2	2060	2050
exposure of child to chem subs meth	3	3	3180	3020
conspiracy to commit dealing in cocaine	3	3	3032	3030
soliciting on the roadway	5	5	5152	5170
manslaughter	1	1	1030	1050
sexual servitude child victim	1	1	1110	1090
narc marijuana	3	3	3230	3150
assault	1	1	1230	1200
pandering facilitation	5	5	5152	5150
conspire to traffic in cocaine	3	3	3032	3030
driving<21 consum contr sub	4	5	4030	5180
entic child enter	1	2	1091	2010
endanger child elder adult	1	9	1990	9990
deal proc unl act intent promot	2	5	2090	5150

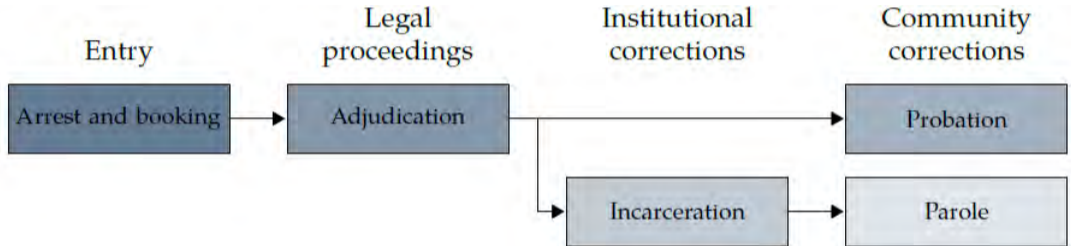
- Develop UCCS crosswalks for compatibility with:
  - ▶ NCRP BJS Offense Codes
  - ▶ NCIC Offense Codes
  - ▶ NIBRS Offense Codes
- Public interface for external researchers and users
  - ▶ Upload CSV file of charge descriptions, click button to run classifier, download the results
  - ▶ Keep metadata of submitted records for improving training data and model

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# Goals of benchmarking and validation efforts

- Evaluate efficacy of CJARS data products
- Identify and remedy issues identified in our data
- Create a system to continually evaluate data quality

# CJARS database structure



- Multi-pronged approach to data collection:
  - ▶ Data use agreements
  - ▶ Public records requests
  - ▶ Web scraping and bulk data downloads
- Advantages and disadvantages of data collection approach:
  - ▶ Advantage - our flexibility provides us with more opportunity for data collection
  - ▶ Advantage - less burdensome for agencies
  - ▶ Disadvantage - data comes in agency-provided formats that we must process and harmonize



- Challenges faced:
  - ▶ Distinct native data layouts
  - ▶ Free entry fields (e.g., offense codes)
  - ▶ Inadequate unique identifiers for individuals
  - ▶ Potential for duplicative coverage when gathering data from different agencies
- We have designed, tested, and implemented several innovative techniques to address these challenges:
  - ▶ Offense classification - validated with manually coded data
  - ▶ Entity resolution - validated with biometric data

# Motivation for benchmarking and validation

- Evaluate efficacy of CJARS data infrastructure
- Identify and remedy data processing and harmonization errors made
- Create system that delivers continual feed of data quality assessment

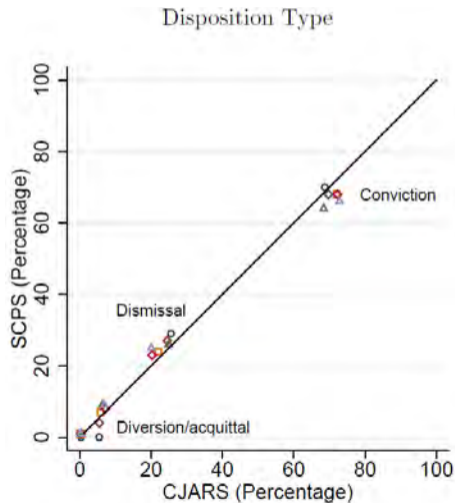
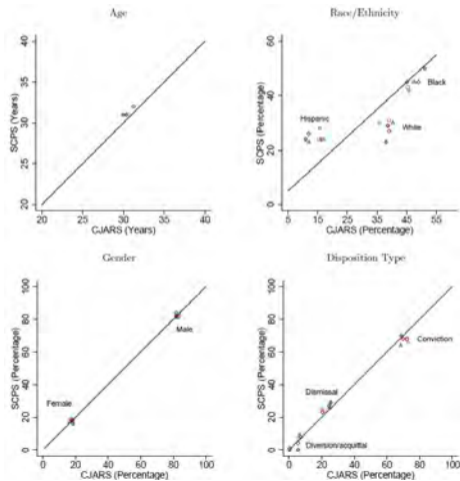
- Descriptive comparisons made between statistics generated using CJARS and other widely accepted sources of data
- Comparisons mainly included:
  - ▶ Caseload composition characteristics
  - ▶ Event counts

# Benchmarking data series

<b>Data Type</b>	<b>Benchmarking Data Source</b>
Arrest	Uniform Crime Report (UCR)
Adjudication	State Court Processing Statistics Series (SCPS)
Probation	Annual Probation Survey
Incarceration	National Prisoner Statistics Program (NPS) National Corrections Reporting Program (NCRP)
Parole	Annual Parole Survey

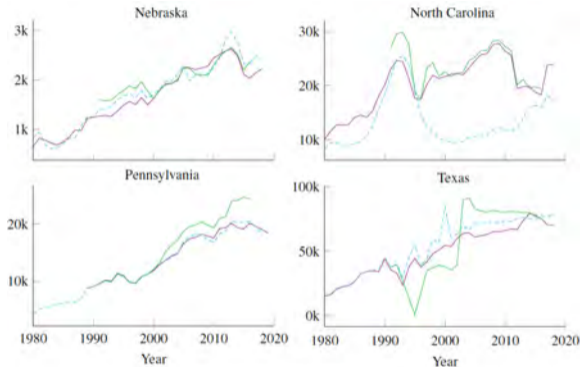
- Comparisons made between various caseload composition characteristics:
  - ▶ Offense type
  - ▶ Defendant age
  - ▶ Defendant race/ethnicity
  - ▶ Defendant gender
  - ▶ Disposition outcomes
  - ▶ Sentencing outcomes
- Comparisons made across all waves of SCPS data collection

# Correspondence Between CJARS and SCPS produced Caseload Statistics

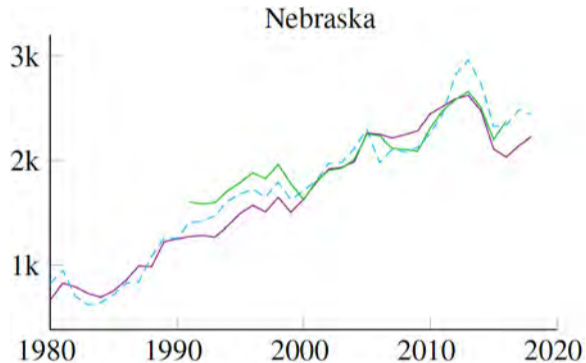


- Several comparisons of event counts made:
  - ▶ Entries
  - ▶ Exits
  - ▶ Year-end populations
  - ▶ Incarceration rates
- Data aggregated at year and state-level

# Yearly Counts of Incarceration Entries by State



Source of prison entry data  
— CJARS    - - - NPS    — NCRP



Source of prison entry data  
— CJARS    - - - NPS    — NCRP

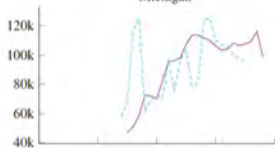


# CJARS Probation and Parole and Annual Probation and Parole Surveys

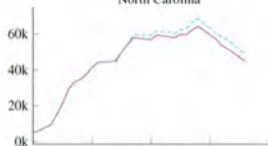
- Several comparisons of event counts made:
  - ▶ Entries
  - ▶ Exits
  - ▶ Year-end populations
  - ▶ Supervision rates
- Data aggregated at year and state-level

# Yearly Counts of Probation Entries by State

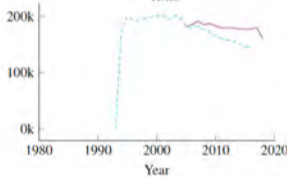
Michigan



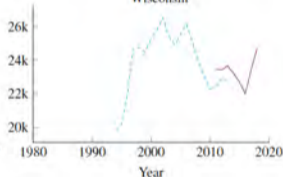
North Carolina



Texas

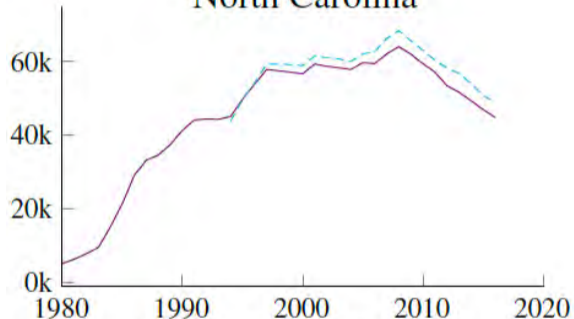


Wisconsin



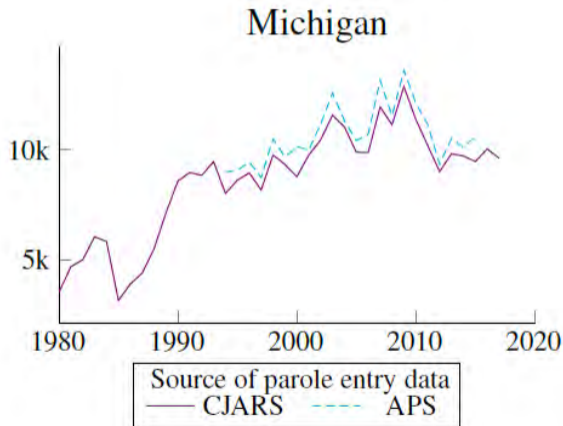
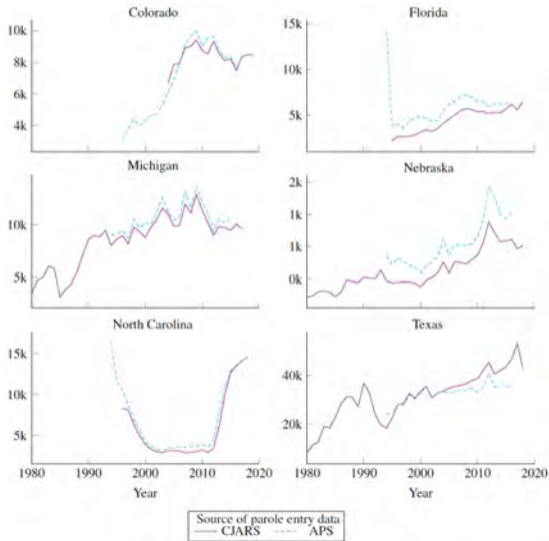
Source of probation data  
— CJARS    - - - APS

## North Carolina



Source of probation data  
— CJARS    - - - APS

# Yearly Counts of Parole Entries by State



- Benchmarking and validation exercises allow us to be transparent and accurately represent CJARS data
- Findings portray both our strengths and weaknesses and create opportunity for us to continually verify data quality
- Our approach is unique, yet we still can reproduce statistics generated using aggregate data collection efforts using CJARS micro-data
- Benchmarking and validation of the CJARS data provides evidence that supports its use in statistical reporting that will inform and support agency decision-making

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# Tracking Socioeconomic Characteristics and Outcomes in the U.S. Criminal Justice Caseload

Keith Finlay

U.S. Census Bureau

July 13, 2021

# Disclaimer

- ▶ Any opinions and conclusions expressed herein are those of the author and do not necessarily represent the views of the U.S. Census Bureau. While this work was not subject to formal Census Bureau content review, Census staff reviewed all statistical output to ensure that no confidential information was disclosed.
- ▶ This presentation meets all of the U.S. Census Bureau's Disclosure Review Board (DRB) standards and has been assigned DRB approval number CBDRB-FY21-ERD002-015 (approved 2/19/2021).

# Justice agencies tasked with new policies

- ▶ Justice reinvestment
- ▶ Pre-release reentry help (ID cards, public program enrollment)
- ▶ Record clearing
- ▶ How to evaluate?
  - ▶ CJ agencies can measure recidivism
  - ▶ Non-criminal justice outcomes could be important but data are siloed



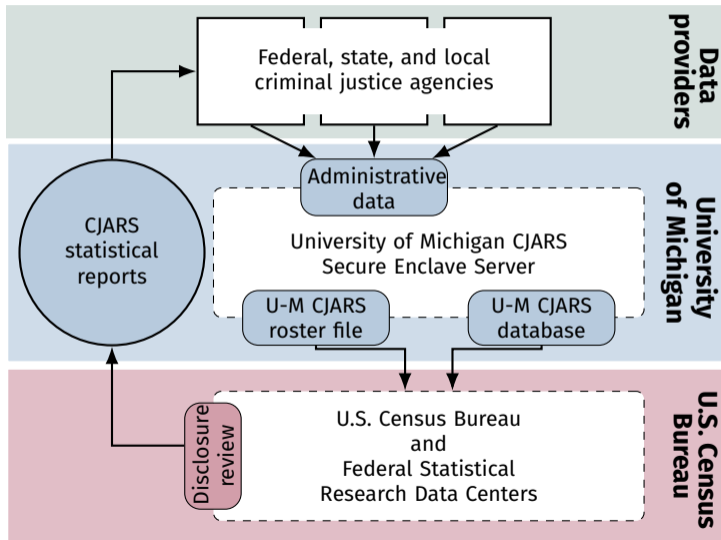
# Data products for CJARS data providers

- ▶ CJARS must provide value back to partnering agencies
- ▶ Data innovations:
  1. Longitudinal, multi-jurisdictional data collected, harmonized, and linked to track individuals across space and time
  2. Harmonized data integrated with non-CJ survey and administrative data held by the Census Bureau
- ▶ Statistical products created from linked data provide insight on caseloads even after disposition/supervision

# Census Bureau authority to produce CJARS reports

- ▶ 13 USC §6: acquire data from federal, state, and local governments
- ▶ 13 USC §101: produce statistics about criminal justice system
- ▶ 13 USC §141: produce statistics about characteristics of the population
- ▶ 13 USC §9: protect privacy/confidentiality by releasing only aggregate statistics
- ▶ CJARS helps Census increase data quality while lowering costs for collections like Decennial Census Group Quarters

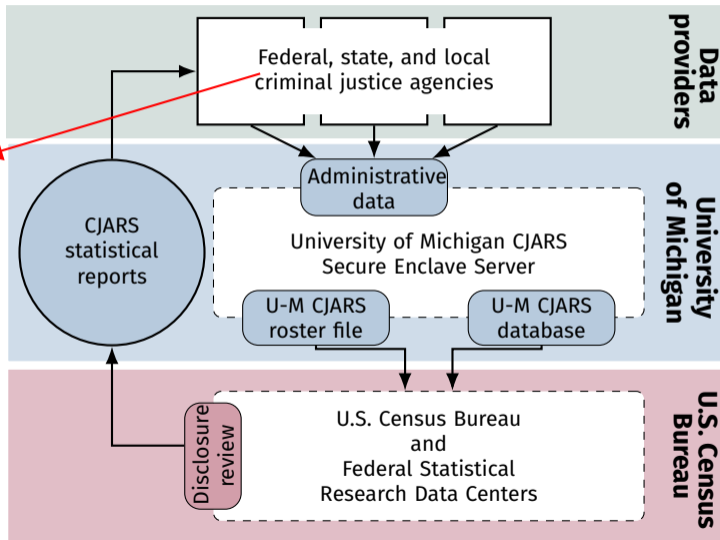
# CJARS stakeholders and data exchange



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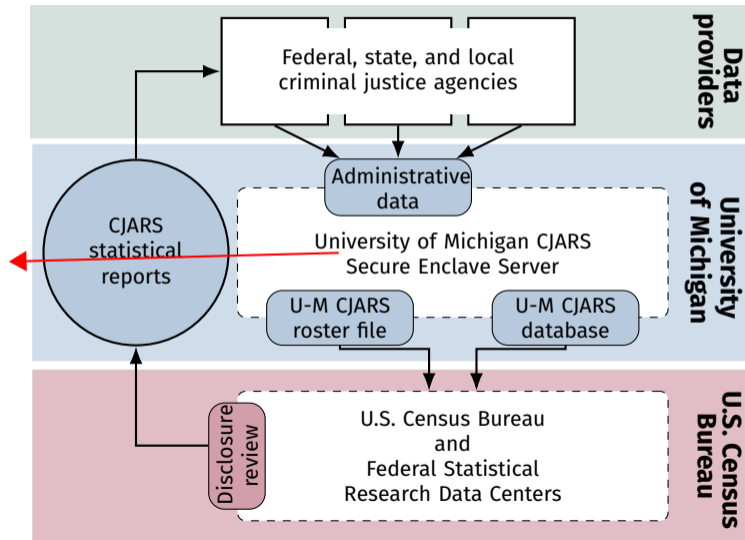
Data acquired via

- ▶ Data-use agreements
- ▶ Public-information requests
- ▶ Downloads/scraping



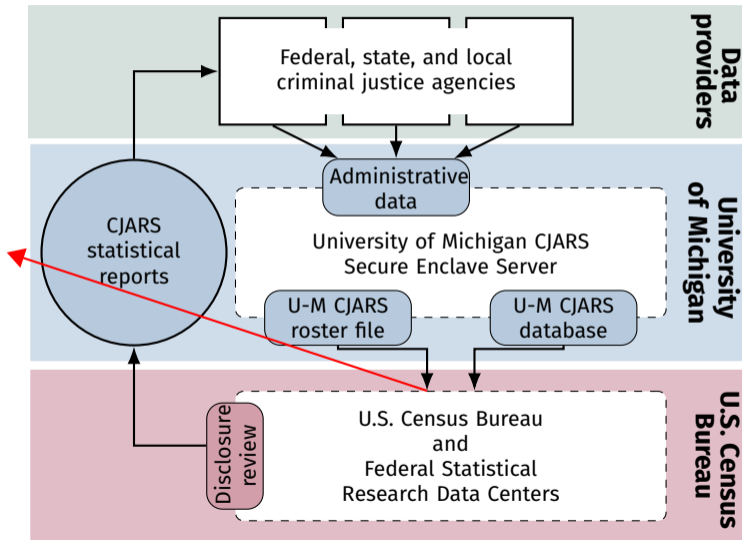
# CJARS stakeholders and data exchange

- ▶ Harmonization to national schema
- ▶ Entity resolution to identify unique individuals, assign CJARS IDs
- ▶ Episode resolution to identify linked processes



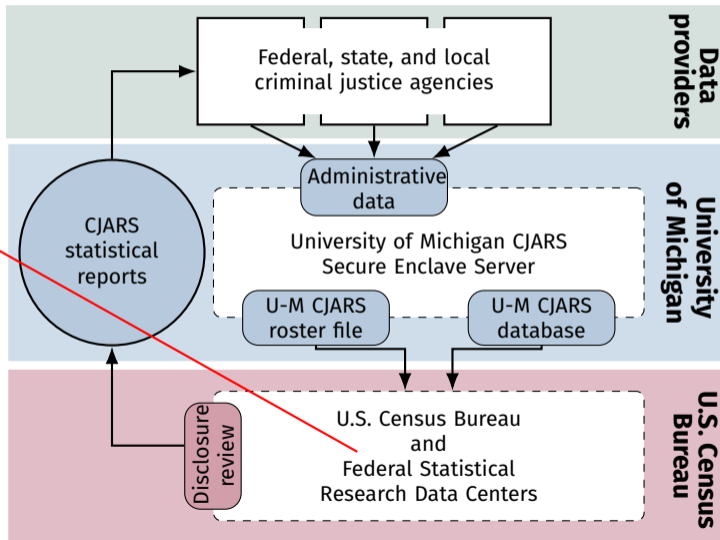
# CJARS stakeholders and data exchange

Census processes roster through Person Identification Validation System (PVS) to assign anonymous Protected Identification Keys (PIKs)



# CJARS stakeholders and data exchange

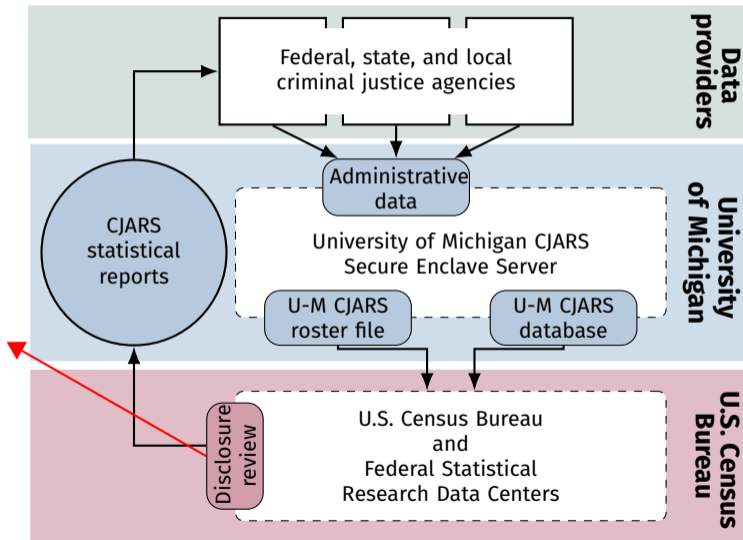
Data linkage at Census uses only anonymized data



# CJARS stakeholders and data exchange

Release only aggregate statistical material that:

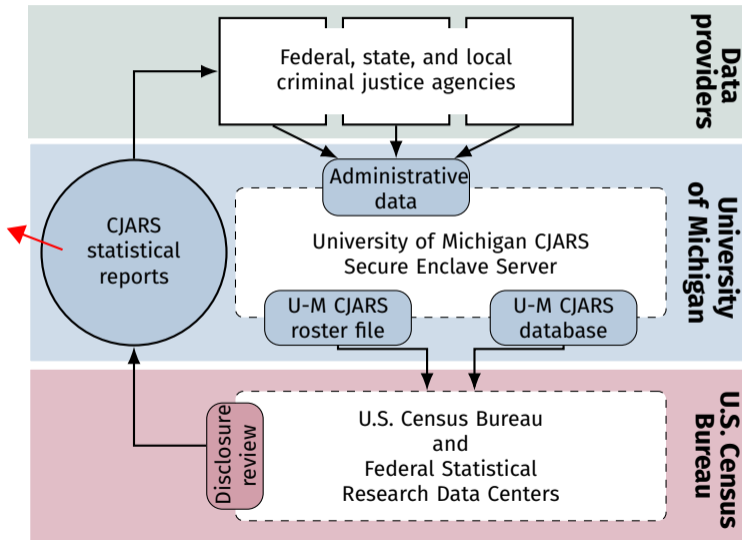
- ▶ Meets Disclosure Review Board standards
- ▶ Complies with agency data-use agreements





# CJARS stakeholders and data exchange

Agencies receive aggregate statistical products based on linked data



# Statistical reports for CJARS partners

- ▶ Produced in Census Bureau's Data Linkage Infrastructure: ecosystem of survey and administrative data linkable at person level using anonymous identifiers
- ▶ Population-level administrative data avoids much self-response bias
  - ▶ Birth and death dates
  - ▶ Employment, earnings, industry, self-employment
  - ▶ Public program participation
- ▶ Population-level decennial survey data on race, ethnicity, family structure
- ▶ Sample-based survey data on important socioeconomic outcomes like health and education

# Data available for statistical products

- ▶ Criminal Justice Administrative Records System (CJARS)
  - ▶ Felony conviction from state courts: AZ, MD, MI, NJ, NC, ND, OR, TX, WI
  - ▶ Prison release from DOCs: AZ, FL, MI, NE, NC, PA, TX, WA, WI
  - ▶ Pooling states today as example but products will be based on a single jurisdiction's data
- ▶ Self-reported race/ethnicity from synthesis of decennial census data, etc.
  - ▶ Most statistics about CJ system rely on administratively reported race
  - ▶ Study smaller demographic groups, reduce missing data
- ▶ Mortality from Social Security Administration Numident file

# Data available for statistical products

- ▶ Longitudinal residential location and family structure crosswalks synthesized from survey and administrative data, including IRS 1040s and federal program data
  - ▶ Link to residence/local labor markets
  - ▶ Link to family members
- ▶ Labor market participation from IRS tax data
  - ▶ Employment, earnings, industry from W-2 information returns
  - ▶ Self-employment from IRS 1040 Schedule C
  - ▶ Contract/gig economy work from IRS 1099 information returns
- ▶ Federal program participation: SNAP, HUD, Medicaid, Medicare

# Caseload characteristics

<i>Demographics</i>	Felony conviction in 2007	Prison release in 2007
Average year of birth	1977	1975
% male	80.6	86.7
% female	19.4	13.3
% White, non-Hispanic	48.6	45.9
% Black, non-Hispanic	38.4	42.1
% Asian/PI, non-Hispanic	0.2	0.2
% Hispanic	8.9	8.9
% Amer. Indian/Alaska Native	2.3	2.3
% 1099-MISC in 2018	9.5	8.5
% who have died by 2018	6.8	7.9
Observations	315,000	158,000

All figures have been rounded according to Census Bureau DRB rules. All results were approved for release by the Census Bureau, authorization number CBDRB-FY21-ERD002-015.

# Caseload characteristics

<i>Demographics</i>	Felony conviction in 2007	Prison release in 2007
Average year of birth	1977	1975
% male	80.6	86.7
% female	19.4	13.3
% White, non-Hispanic	48.6	45.9
% Black, non-Hispanic	38.4	42.1
% Asian/PI, non-Hispanic	0.2	0.2
<b>% Hispanic</b>	<b>8.9</b>	<b>8.9</b>
% Amer. Indian/Alaska Native	2.3	2.3
% 1099-MISC in 2018	9.5	8.5
% who have died by 2018	6.8	7.9
Observations	315,000	158,000

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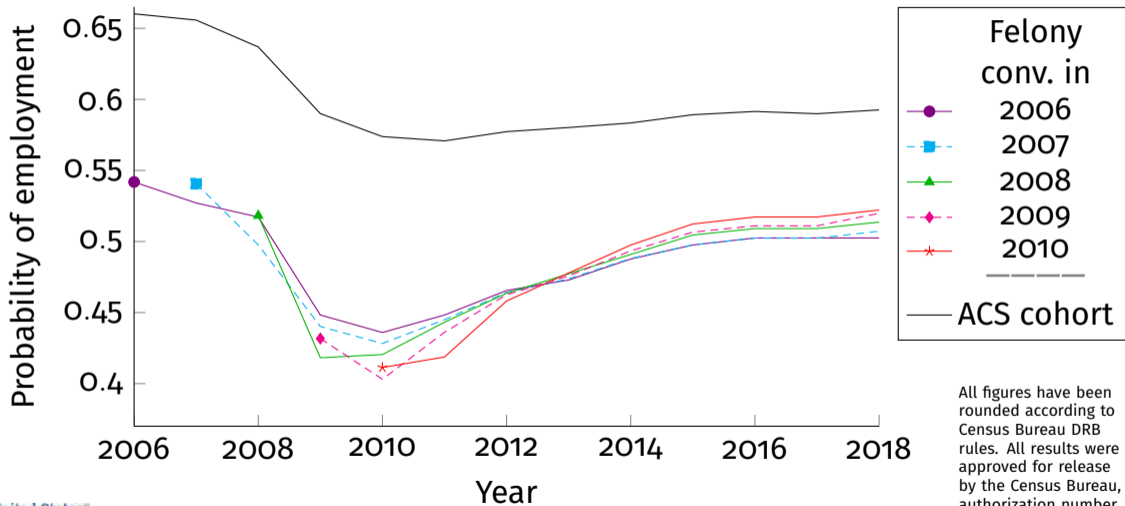


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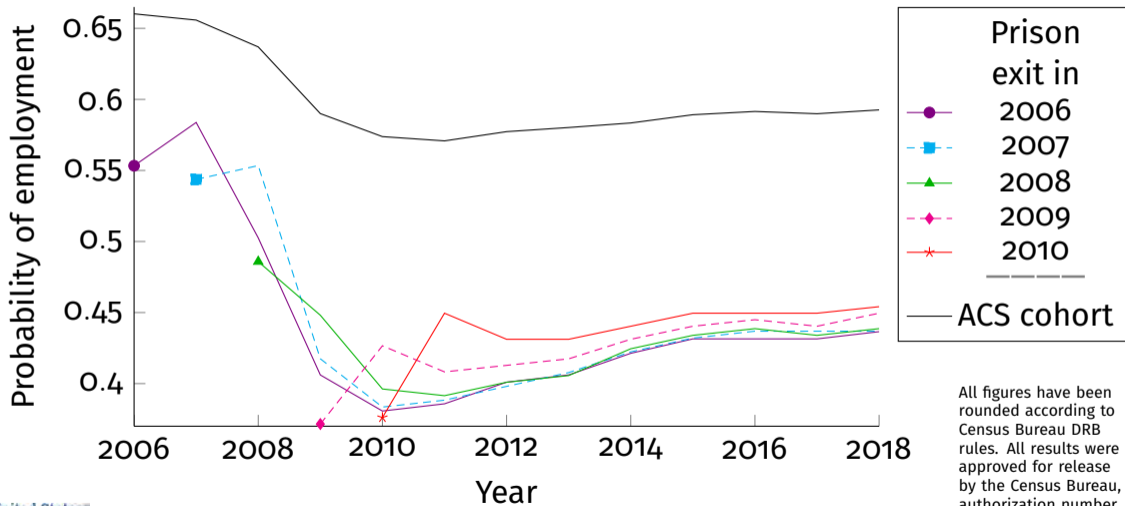
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# Employment: after felony conviction



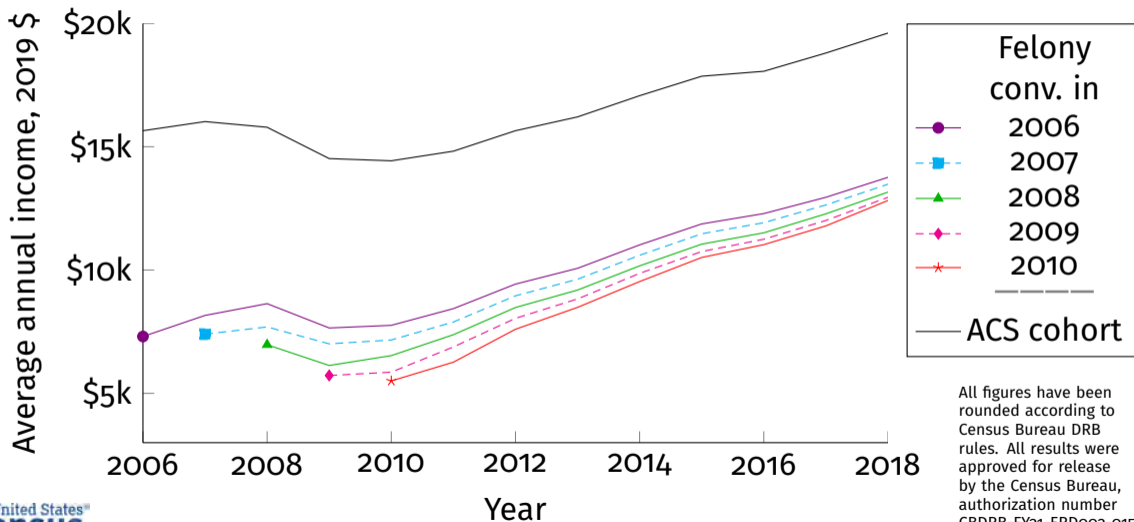
All figures have been rounded according to Census Bureau DRB rules. All results were approved for release by the Census Bureau, authorization number CDBRB-FY21-ERD002-015.

# Employment: after prison release



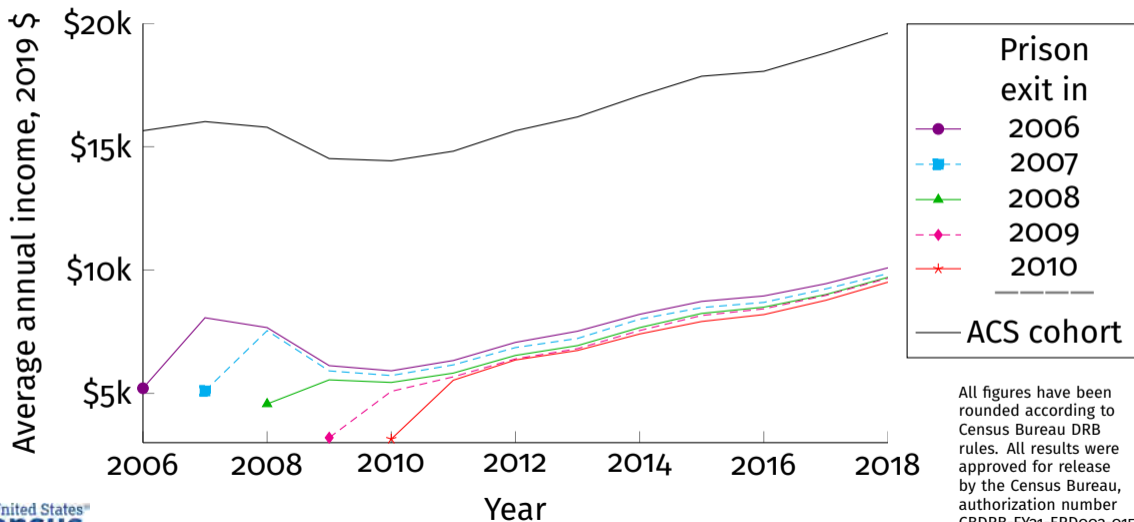
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# Annual income: after felony conviction



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# Annual income: after prison release



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# Production application in development

- ▶ Census Bureau developing an application to produce reports
  - ▶ With material similar to what was shown above
  - ▶ Data quality checks
  - ▶ Automated statistical disclosure avoidance control (e.g., censored stats from small subpopulations)
- ▶ Delivering first products to selected CJARS agency partners in Fall 2021 for feedback
- ▶ Please contact the CJARS team if your agency is interested in participating

# Thank you

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