Respondent Device Analysis for the Internet Instrument of the American Community Survey

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Federal Committee on Statistical Methodology
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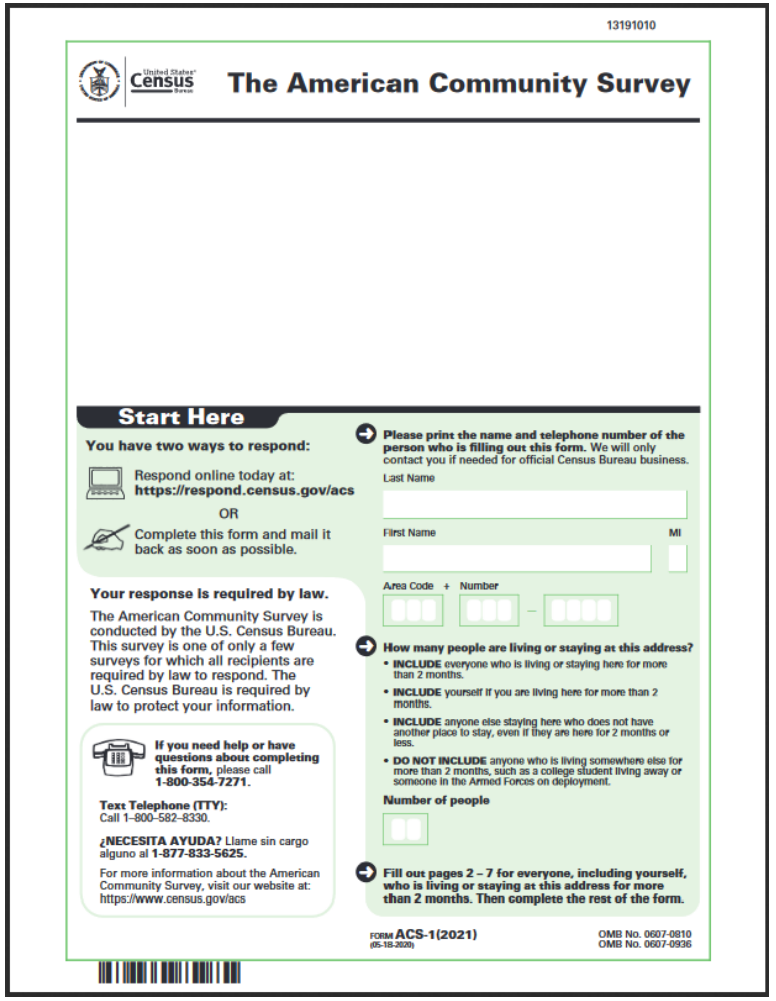
American Community Survey

The Foundation

The American Community Survey is on the leading edge of survey design, continuous improvement, and data quality

- The nation's most current, reliable, and accessible data source for local statistics on critical planning topics such as age, children, veterans, commuting, education, income, and employment
- Surveys **3.5 million** addresses and informs over **$675 billion** of Federal government spending each year
- Covers **40+ topics**, supports over **300** evidence-based Federal government uses, and produces **11 billion** estimates each year
- Three key annual data releases:
  - 1-year Estimates (for large populations, geographies of 65,000+ population)
  - 1-year Supplemental Estimates (for small populations, geographies of 20,000+ population)
  - 5-year Estimates (for very small populations, geographies down to Census Tracts and Block Groups)



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The American Community Survey

Start Here

You have two ways to respond:

Respond online today at:
https://respond.census.gov/acs

OR

Complete this form and mail it back as soon as possible.

Your response is required by law.

The American Community Survey is conducted by the U.S. Census Bureau. This survey is one of only a few surveys for which all recipients are required by law to respond. The U.S. Census Bureau is required by law to protect your information.

If you need help or have questions about completing this form, please call **1-800-354-7271.**

Text Telephone (TTY):
Call 1-800-582-8330.

¿NECESITA AYUDA? Llame sin cargo alguno al **1-877-833-5625.**

For more information about the American Community Survey, visit our website at: https://www.census.gov/acs

Please print the name and telephone number of the person who is filling out this form. We will only contact you if needed for official Census Bureau business.

Last Name

First Name MI

Area Code + Number

How many people are living or staying at this address?

- **INCLUDE** everyone who is living or staying here for more than 2 months.
- **INCLUDE** yourself if you are living here for more than 2 months.
- **INCLUDE** anyone else staying here who does not have another place to stay, even if they are here for 2 months or less.
- **DO NOT INCLUDE** anyone who is living somewhere else for more than 2 months, such as a college student living away or someone in the Armed Forces on deployment.

Number of people

Fill out pages 2 – 7 for everyone, including yourself, who is living or staying at this address for more than 2 months. Then complete the rest of the form.

FORM **ACS-1(2021)** (05-18-2020)

OMB No. 0607-0810
OMB No. 0607-0936

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ACS Data Collection Process

SELF-RESPONSE

NONRESPONSE FOLLOWUP

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Background

- ACS internet instrument launched in production in 2013
- 2011 Internet Test showed 95% of logins came from PCs and laptops, very little mobile phone (0.9%) or tablet usage (3.6%) (Hortwitz et al., 2012)
- Purpose of this report is to provide an update to these figures, and explore other device usage trends

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Research Goals

1. To understand how device usage trends on the ACS have changed over time
2. To understand how internet instrument usage patterns (multiple logins, changing device types, etc.) are associated with device type
3. A preliminary look at how demographic characteristics are associated with device type usage

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Data

- Useragent string information
  - Device type, operating system, browser, timestamps
- ACS control file systems for case dispositions
- Unedited response data
- 2013-2021 ACS sample cases for historical analyses
- 2019 ACS sample cases for cross sectional analyses

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Research Goal 1. To understand how device usage trends on the ACS have changed over time

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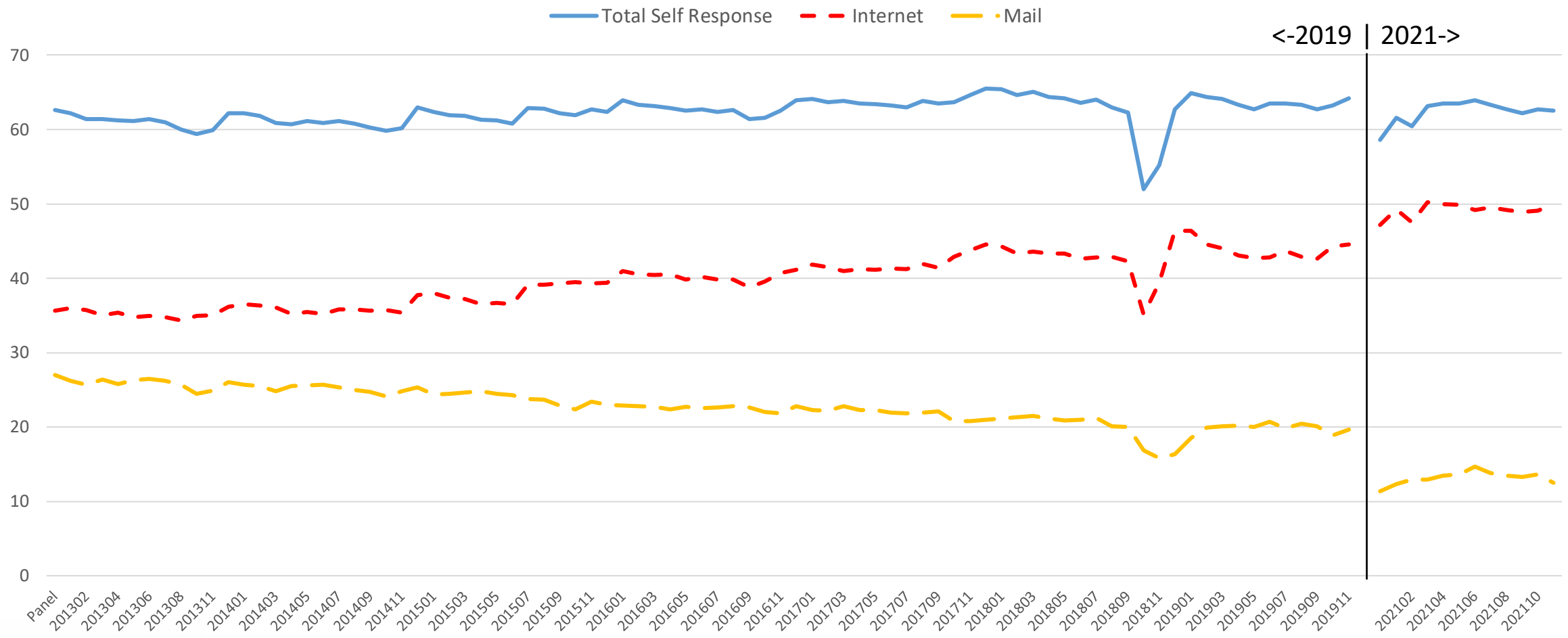
American Community Survey Self Response Rates, 2013-2019 and 2021 (chart excludes 2020 panels)



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Device Type and Operating System for all Internet Cases by Year, Using Final Login

Categories	2013	…	2019	2019-2013	P-value
PC	90.3 (<0.1)	…	73.1 (0.1)	-17.2 (0.1)	<0.01
Mobile	2.2 (<0.1)	…	18.3 (<0.1)	16.1 (<0.1)	<0.01
Tablet	7.4 (<0.1)	…	8.6 (<0.1)	1.2 (<0.1)	<0.01

- PC usage fell from 90.3 to 73.1 percent
- Mobile phone usage increased from 2.2 to 18.3 percent
- Less clear trend for tablets going forward

United States® Census Bureau

Device Type and Operating System for all Internet Cases by Year, Using Final Login

Categories	2013	2015	2017	2019
PC	90.3 (<0.1)	83.6 (<0.1)	78.2 (0.1)	73.1 (0.1)
Mobile	2.2 (<0.1)	5.9 (<0.1)	11.8 (<0.1)	18.3 (<0.1)
Tablet	7.4 (<0.1)	10.5 (<0.1)	10.0 (<0.1)	8.6 (<0.1)

- PC usage fell from 90.3 to 73.1 percent
- Mobile phone usage increased from 2.2 to 18.3 percent
- Less clear trend for tablets going forward

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Device Type and Operating System for all Internet Cases by Year, Using Final Login

Categories	2013	2015	2017	2019	2021
PC	90.3 (<0.1)	83.6 (<0.1)	78.2 (0.1)	73.1 (0.1)	70.4 (0.1)
Mobile	2.2 (<0.1)	5.9 (<0.1)	11.8 (<0.1)	18.3 (<0.1)	25.9 (<0.1)
Tablet	7.4 (<0.1)	10.5 (<0.1)	10.0 (<0.1)	8.6 (<0.1)	3.6 (<0.1)

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Device Type and Operating System for all Internet Cases by Year, Using Final Login

Categories	2013	2019	2019-2013	P-value
PC	90.3 (<0.1)	73.1 (0.1)	-17.2 (0.1)	<0.01
Mobile	2.2 (<0.1)	18.3 (<0.1)	16.1 (<0.1)	<0.01
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Device Type and Operating System for all Internet Cases by Year, Using Final Login

Categories	2013	2019	2019-2013	P-value
PC	90.3 (<0.1)	73.1 (0.1)	-17.2 (0.1)	<0.01
Windows	85.2 (<0.1)	75.3 (<0.1)	-9.9 (0.1)	<0.01
Mac OS X	14.3 (<0.1)	21.9 (<0.1)	7.7 (0.1)	<0.01
Chrome OS	0.2 (<0.1)	2.3 (<0.1)	2.1 (<0.1)	<0.01
Linux	0.2 (<0.1)	0.3 (<0.1)	0.1 (<0.1)	<0.01
Other PC	0.2 (<0.1)	0.2 (<0.1)	>-0.1 (<0.1)	0.02
Mobile	2.2 (<0.1)	18.3 (<0.1)	16.1 (<0.1)	<0.01
Tablet	7.4 (<0.1)	8.6 (<0.1)	1.2 (<0.1)	<0.01

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Device Type and Operating System for all Internet Cases by Year, Using Final Login

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Windows	85.2 (<0.1)	75.3 (<0.1)	-9.9 (0.1)	<0.01
Mac OS X	14.3 (<0.1)	21.9 (<0.1)	7.7 (0.1)	<0.01
Chrome OS	0.2 (<0.1)	2.3 (<0.1)	2.1 (<0.1)	<0.01
Linux	0.2 (<0.1)	0.3 (<0.1)	0.1 (<0.1)	<0.01
Other PC	0.2 (<0.1)	0.2 (<0.1)	>-0.1 (<0.1)	0.02
Mobile	2.2 (<0.1)	18.3 (<0.1)	16.1 (<0.1)	<0.01
iOS	48.8 (0.4)	54.3 (0.1)	5.5 (0.4)	<0.01
Android	49.5 (0.4)	45.7 (0.1)	-3.8 (0.4)	<0.01
Other Mobile	1.7 (0.1)	<0.1 (<0.1)	-1.7 (0.1)	<0.01
Tablet	7.4 (<0.1)	8.6 (<0.1)	1.2 (<0.1)	<0.01

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Device Type and Operating System for all Internet Cases by Year, Using Final Login

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PC	90.3 (<0.1)	73.1 (0.1)	-17.2 (0.1)	<0.01
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Mac OS X	14.3 (<0.1)	21.9 (<0.1)	7.7 (0.1)	<0.01
Chrome OS	0.2 (<0.1)	2.3 (<0.1)	2.1 (<0.1)	<0.01
Linux	0.2 (<0.1)	0.3 (<0.1)	0.1 (<0.1)	<0.01
Other PC	0.2 (<0.1)	0.2 (<0.1)	>-0.1 (<0.1)	0.02
Mobile	2.2 (<0.1)	18.3 (<0.1)	16.1 (<0.1)	<0.01
iOS	48.8 (0.4)	54.3 (0.1)	5.5 (0.4)	<0.01
Android	49.5 (0.4)	45.7 (0.1)	-3.8 (0.4)	<0.01
Other Mobile	1.7 (0.1)	<0.1 (<0.1)	-1.7 (0.1)	<0.01
Tablet	7.4 (<0.1)	8.6 (<0.1)	1.2 (<0.1)	<0.01
iOS	86.5 (0.1)	72.6 (0.2)	-13.9 (0.2)	<0.01
Android	12.5 (0.1)	19.0 (0.1)	6.6 (0.2)	<0.01
Windows	0.8 (<0.1)	8.4 (0.1)	7.6 (0.1)	<0.01
Other Tablet	0.3 (<0.1)	<0.1 (<0.1)	-0.2 (<0.1)	<0.01

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Device Type and Operating System for all Internet Cases by Year, Using Final Login

Categories	2013	2019	2021
PC	90.3 (<0.1)	73.1 (0.1)	70.4 (0.1)
Windows	85.2 (<0.1)	75.3 (<0.1)	70.1 (0.1)
Mac OS X	14.3 (<0.1)	21.9 (<0.1)	26.3 (<0.1)
Chrome OS	0.2 (<0.1)	2.3 (<0.1)	3.0 (<0.1)
Linux	0.2 (<0.1)	0.3 (<0.1)	0.3 (<0.1)
Other PC	0.2 (<0.1)	0.2 (<0.1)	0.2 (<0.1)
Mobile	2.2 (<0.1)	18.3 (<0.1)	25.9 (<0.1)
iOS	48.8 (0.4)	54.3 (0.1)	59.6 (0.1)
Android	49.5 (0.4)	45.7 (0.1)	40.4 (0.1)
Other Mobile	1.7 (0.1)	<0.1 (<0.1)	<0.1 (<0.1)
Tablet	7.4 (<0.1)	8.6 (<0.1)	3.6 (<0.1)
iOS	86.5 (0.1)	72.6 (0.2)	60.0 (0.3)
Android	12.5 (0.1)	19.0 (0.1)	36.6 (0.3)
Windows	0.8 (<0.1)	8.4 (0.1)	3.5 (0.1)
Other Tablet	0.3 (<0.1)	<0.1 (<0.1)	<0.1 (<0.1)

Operating system trends found in 2019 appear to mostly continue into 2021

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Final Outcome Code by Device Type

Outcome	PC	Mobile	Tablet	Chi-square	P-value
Complete or Sufficient Partial	97.3 (<0.1)	95.9 (0.1)	97.4 (<0.1)	251.5	<0.01
Vacant	1.2 (<0.1)	1.9 (<0.1)	1.3 (<0.1)		
Blank	1.5 (<0.1)	2.2 (<0.1)	1.4 (<0.1)		

- Over 95% completion rate for all devices at panel closeout
- Final outcome type is related to device type

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Research Goal 2. To understand how internet instrument usage patterns are associated with device type

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Number of Logins by Device Type

Categories	2013	2014	2015	2016	2017	2018	2019	2019-2013	p-value
1 login	78.2 (<0.1)	78.1 (0.1)	78.1 (<0.1)	79.8 (0.1)	80.0 (0.1)	79.9 (0.1)	78.1 (0.1)	-0.1 (0.1)	0.08
2 logins	15.3 (<0.1)	15.3 (<0.1)	15.4 (<0.1)	14.6 (<0.1)	14.5 (<0.1)	14.5 (<0.1)	15.5 (<0.1)	0.3 (0.1)	<0.01
3 logins	4.1 (<0.1)	4.2 (<0.1)	4.2 (<0.1)	3.8 (<0.1)	3.7 (<0.1)	3.7 (<0.1)	4.2 (<0.1)	<0.1 (<0.1)	0.15
4+ logins	2.3 (<0.1)	2.4 (<0.1)	2.3 (<0.1)	1.9 (<0.1)	1.9 (<0.1)	1.9 (<0.1)	2.2 (<0.1)	-0.1 (<0.1)	<0.01

- Changes statistically significant, but no clear directional shift
- 78 - 80 percent had 1 login overall
- 14 - 16 percent had 2 logins overall
- 5 - 7 percent had 3 or more logins overall

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Number of Logins by Device Type

Categories	2013	2014	2015	2016	2017	2018	2019	2019-2013	p-value
PC									
1 login	78.4 (<0.1)	78.3 (0.1)	78.0 (<0.1)	79.3 (<0.1)	79.4 (<0.1)	79.4 (<0.1)	77.1 (<0.1)	-1.2 (0.1)	<0.01
2 logins	15.3 (<0.1)	15.3 (<0.1)	15.5 (<0.1)	14.9 (<0.1)	14.9 (<0.1)	14.8 (<0.1)	16.0 (<0.1)	0.8 (0.1)	<0.01
3 logins	4.1 (<0.1)	4.1 (<0.1)	4.2 (<0.1)	3.9 (<0.1)	3.8 (<0.1)	3.8 (<0.1)	4.4 (<0.1)	0.3 (<0.1)	<0.01
4+ logins	2.3 (<0.1)	2.3 (<0.1)	2.3 (<0.1)	1.9 (<0.1)	1.9 (<0.1)	2.0 (<0.1)	2.4 (<0.1)	0.1 (<0.1)	<0.01
Mobile									
1 login	73.5 (0.3)	76.4 (0.2)	80.2 (0.2)	83.6 (0.1)	83.3 (0.1)	82.5 (0.1)	81.6 (0.1)	8.1 (0.3)	<0.01
2 logins	16.2 (0.2)	14.2 (0.2)	13.4 (0.1)	11.9 (0.1)	12.1 (0.1)	12.9 (0.1)	13.7 (0.1)	-2.5 (0.2)	<0.01
3 logins	5.6 (0.2)	5.0 (0.1)	3.9 (0.1)	2.9 (0.1)	2.9 (<0.1)	3.0 (<0.1)	3.2 (<0.1)	-2.3 (0.2)	<0.01
4+ logins	4.8 (0.2)	4.4 (0.1)	2.5 (0.1)	1.7 (<0.1)	1.6 (<0.1)	1.6 (<0.1)	1.5 (<0.1)	-3.3 (0.2)	<0.01
Tablet									
1 login	78.3 (0.2)	77.1 (0.1)	77.7 (0.1)	79.7 (0.1)	79.9 (0.1)	79.8 (0.1)	79.2 (0.1)	0.9 (0.2)	<0.01
2 logins	15.2 (0.1)	16.0 (0.1)	15.7 (0.1)	14.6 (0.1)	14.5 (0.1)	14.5 (0.1)	15.0 (0.1)	-0.2 (0.2)	0.29
3 logins	4.1 (0.1)	4.3 (0.1)	4.3 (0.1)	3.7 (0.1)	3.7 (0.1)	3.7 (<0.1)	3.9 (0.1)	-0.2 (0.1)	0.03
4+ logins	2.4 (0.1)	2.5 (0.1)	2.3 (0.1)	2.0 (<0.1)	1.9 (<0.1)	2.0 (<0.1)	2.0 (<0.1)	-0.4 (0.1)	<0.01

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Number of Logins by Device Type

Categories	2013	2014	2015	2016	2017	2018	2019	2019-2013	p-value
PC									
1 login	78.4 (<0.1)	78.3 (0.1)	78.0 (<0.1)	79.3 (<0.1)	79.4 (<0.1)	79.4 (<0.1)	77.1 (<0.1)	-1.2 (0.1)	<0.01
2 logins	15.3 (<0.1)	15.3 (<0.1)	15.5 (<0.1)	14.9 (<0.1)	14.9 (<0.1)	14.8 (<0.1)	16.0 (<0.1)	0.8 (0.1)	<0.01
3 logins	4.1 (<0.1)	4.1 (<0.1)	4.2 (<0.1)	3.9 (<0.1)	3.8 (<0.1)	3.8 (<0.1)	4.4 (<0.1)	0.3 (<0.1)	<0.01
4+ logins	2.3 (<0.1)	2.3 (<0.1)	2.3 (<0.1)	1.9 (<0.1)	1.9 (<0.1)	2.0 (<0.1)	2.4 (<0.1)	0.1 (<0.1)	<0.01
Mobile									
1 login	73.5 (0.3)	76.4 (0.2)	80.2 (0.2)	83.6 (0.1)	83.3 (0.1)	82.5 (0.1)	81.6 (0.1)	8.1 (0.3)	<0.01
2 logins	16.2 (0.2)	14.2 (0.2)	13.4 (0.1)	11.9 (0.1)	12.1 (0.1)	12.9 (0.1)	13.7 (0.1)	-2.5 (0.2)	<0.01
3 logins	5.6 (0.2)	5.0 (0.1)	3.9 (0.1)	2.9 (0.1)	2.9 (<0.1)	3.0 (<0.1)	3.2 (<0.1)	-2.3 (0.2)	<0.01
4+ logins	4.8 (0.2)	4.4 (0.1)	2.5 (0.1)	1.7 (<0.1)	1.6 (<0.1)	1.6 (<0.1)	1.5 (<0.1)	-3.3 (0.2)	<0.01
Tablet									
1 login	78.3 (0.2)	77.1 (0.1)	77.7 (0.1)	79.7 (0.1)	79.9 (0.1)	79.8 (0.1)	79.2 (0.1)	0.9 (0.2)	<0.01
2 logins	15.2 (0.1)	16.0 (0.1)	15.7 (0.1)	14.6 (0.1)	14.5 (0.1)	14.5 (0.1)	15.0 (0.1)	-0.2 (0.2)	0.29
3 logins	4.1 (0.1)	4.3 (0.1)	4.3 (0.1)	3.7 (0.1)	3.7 (0.1)	3.7 (<0.1)	3.9 (0.1)	-0.2 (0.1)	0.03
4+ logins	2.4 (0.1)	2.5 (0.1)	2.3 (0.1)	2.0 (<0.1)	1.9 (<0.1)	2.0 (<0.1)	2.0 (<0.1)	-0.4 (0.1)	<0.01

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Device Use Patterns for Users with Multiple Logins

First Device	Final Login with PC	Final Login with Mobile	Final Login with Tablet	Device Changers Comparison	*p-value*	Most Likely Changed to
PC	98.1 (<0.1)	1.1 (<0.1)	0.8 (<0.1)	0.3 (<0.1)	<0.01	Mobile
Mobile	14.2 (0.2)	84.0 (0.2)	1.8 (0.1)	12.4 (0.2)	<0.01	PC
Tablet	10.6 (0.2)	1.8 (0.1)	87.7 (0.3)	8.8 (0.3)	<0.01	PC

- Vast majority of multiple login cases do not switch devices
- Mobile phone most likely to change device types
- Both mobile and tablet users most likely to switch to a PC+
- Very small number PC users change devices

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Research Goal 3. A preliminary look at how demographic characteristics are associated with device type usage

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Demographics

	Odds Ratios from Logistic Regression Models		
Independent Variable	**PC Model**	**Mobile Model**	**Tablet Model**
Age	1.025	0.952	1.021
Educational Attainment	1.145	0.846	0.968
Household Size	0.944	1.123	0.925
Number of Logins	1.111	0.880	0.944
Sex – Female vs Male	0.729	1.338	1.338
Hispanic Origin – Hispanic vs Not Hispanic	0.977	1.042	0.937
Tenure – Renter vs Owner	0.896	1.206	0.778
Internet Access – No vs Yes	0.733	1.684	0.802
Smartphone Ownership – No vs Yes	1.447	0.672	0.739
Race – Black vs White	0.694	1.601	1.101
Race – Asian vs White	1.543	0.628	0.821 (NS)
Race – AIAN vs White	0.790	1.365	0.970
Race – NHPI vs White	0.705	1.429	1.201 (NS)
Race – SOR vs White	0.977 (NS)	1.090	0.832
Race – Multiple Races vs White	1.038	0.998 (NS)	0.873
Marital Status – Never Married vs Married	0.994 (NS)	1.034	0.811
Marital Status – Divorced vs Married	0.833	1.525	0.846
Marital Status – Separated vs Married	0.725	1.698	0.843
Marital Status – Widowed vs Married	0.729	1.814	0.816

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Conclusions

- ACS Internet instrument usage continues to increase
- PC usage still surpasses the other device types, but mobile phone usage has increased
  - Could show parity with PC usage within a decade
- Windows operating systems still outpace other operating systems for PCs
- Mobile phones are split about 60/40 for iOS and Android devices

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Conclusions, cont.

- Most cases complete the survey, regardless of device type
- About 79 percent of cases login once
  - Most multiple login cases do not switch devices
  - Mobile phone and tablet users show some propensity to change to a PC
- Based on the regression models, mobile phone response showed higher odds for younger respondents and minority groups, and also renters and nonmarried respondents
- PC and tablet on the other hand had higher odds for older, married respondents, and homeowners

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Future Directions

- Instrument research and planning should account for mobile phone usage
- Current research underway looking at how device usage relates to data quality and functionality
  - Data quality: Codability, breakoffs, item nonresponse
  - Functionality: Error messages, help screens, completion time

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Thank you!

ACS Research and Evaluation

https://www.census.gov/programs-surveys/acs/library/publications-and-working-papers/research-and-evaluation.html

Devices Paper

https://www.census.gov/library/working-papers/2021/acs/2022_Mills_04.html

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AMERICAN COMMUNITY SURVEY DATA USERS GROUP

- Purpose:
  - Improve understanding of the value and utility of ACS data.
  - Promote information sharing among data users about key ACS data issues and applications.
- Includes users group website and online community
- ACS Data Users Conference
- Membership is free and open to all interested ACS data users

acsdatacommunity.prb.org

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The American Community Survey

Continuing the Conversation

Website
census.gov/acs

ACS User Support
acso.users.support@census.gov

Census Customer Service Center
800-923-8282

Email Alerts
https://public.govdelivery.com/accounts/USCENSUS/signup/12426

Social Media
@uscensusbureau
#ACSdata

Source Us
U.S. Census Bureau, [YYYY – YYYY] American Community Survey
[1/5]-year [estimates/statistics/data release]

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