

Protecting Confidentiality in Public Data Reporting:

An Application of a Statistical Jitter Function

June 2015

Daniel Webster, MSW, PhD

Bill Dawson, MSW

Michael Armijo

California Child Welfare Indicators Project (CCWIP)

School of Social Welfare

University of California, Berkeley

CCWIP is a collaboration of the California Department of Social Services and the School of Social Welfare, University of California at Berkeley, and is supported by the California Department of Social Services and the Stuart Foundation

We would like to acknowledge the significant contribution of Partners for Our Children, School of Social Work, University of Washington in our development of this approach



STUART FOUNDATION

DHCS Public Reporting

- Per “Public Aggregate Reporting – DHCS Business Reports Guidelines”:
- In order to achieve the goals of public reporting and protection of personally identifiable information, “procedures that appropriately and accurately de-identify data when publicly reporting are necessary.”

Small cells

- *Per Public Aggregate Reporting – DHCS Business Reports Guidelines (pg. 11 of 41):*
- “Cell suppression includes two parts: suppression of the cell that has a **value less than 11** and suppression of other **complementary cells that may allow for calculation** of the cell being suppressed. Complementary cells may have larger cell sizes that support calculation of the exact number of cases in cells of less than 11 by subtraction or other mathematical means.”*

*Emphasis added

DHCS guidelines applied to 5F

- Applying these DHCS guidelines to the public report, *5F Children Authorized for Psychotropic Medications*, using an approach of masking (***) the small and complementary cells suppresses a lot of data.

An early masking attempt (no longer online) ...

CDSS Measure 5F [CI x]

cssr-test.berkeley.edu/develop/CDSS_5F.aspx

Apps bMail Trello Live Beta QW Test Dvlp QAPortal CR Other bookmarks

[Home](#) | [Start Over](#) | [Back to Form](#) | [View Methodology](#) | [View Output in Percent](#) | [Export Graph to Word](#) | [View Table in Excel](#)

California Department of Social Services, Child Welfare Data Analysis Bureau
California Child Welfare Indicators Project (CCWIP)
University of California at Berkeley

Children Authorized For Psychotropic Medications

Agency Type: Child Welfare
Oct 1, 2014 to Dec 31, 2014
California

| COUNT | Ethnic Group | | | | | | Total |
|---|--------------|--------|--------|----------|----------|---------|--------|
| | Black | White | Latino | Asian/PI | Nat Amer | Missing | |
| | n | n | n | n | n | n | n |
| Authorized for psychotropic medications | 1,571 | 1,735 | 2,633 | 109 | 77 | *** | *** |
| Not authorized for psychotropic medications | 9,609 | 11,443 | 26,370 | 1,050 | 671 | 175 | 49,318 |
| Total | 11,180 | 13,178 | 29,003 | 1,159 | 748 | *** | *** |

Data Source: CWS/CMS 2014 Quarter 4 Extract.
Program version: 2.00 Database version: 07AC8099
Values of 10 or less and calculations based on values of 10 or less are masked (***).

Citation:
The suggested way to cite the above data is as follows:
Needell, B., Webster, D., Armijo, M., Lee, S., Dawson, W., Magruder, J., Exel, M., Cuccaro-Alamin, S., Putnam-Hornstein, E., King, B., Morris, Z., Sandoval, A., Yee, H., Mason, F., Benton, C., & Puton, E. (2015). Child Welfare Services Reports for California. Retrieved 3/9/2015, from University of California at Berkeley Center for Social Services Research website, URL: <http://cssr.berkeley.edu/ucb_childwelfare>

[Home](#) | [Start Over](#) | [Back to Form](#) | [View Methodology](#) | [View Table in Excel](#) ||

California Department of Social Services, Child Welfare Data Analysis Bureau
California Child Welfare Indicators Project (CCWIP)
University of California at Berkeley

Children Authorized For Psychotropic Medications

Agency Type: Child Welfare

Oct 1, 2014 to Dec 31, 2014

| County | In care | Authorized for psychotropic medication | % |
|--------------|---------|--|-------|
| California | 55,452 | 6,134 | 11.1% |
| Alameda | 1,193 | 84 | 7.0% |
| Alpine | *** | *** | *** |
| Amador | 85 | 12 | 18.5% |
| Butte | 533 | 83 | 11.8% |
| Calaveras | 147 | *** | *** |
| Colusa | 26 | *** | *** |
| Contra Costa | 1,014 | 87 | 8.6% |
| Del Norte | 103 | *** | *** |

California Department of Social Services, Child Welfare Data Analysis Bureau
 California Child Welfare Indicators Project (CCWIP)
 University of California at Berkeley

Children Authorized For Psychotropic Medications
Agency Type: Child Welfare
Oct 1, 2014 to Dec 31, 2014
California

| COUNT | Ethnic Group | | | | | | Total |
|---|---------------|---------------|---------------|--------------|------------|------------|------------|
| | Black | White | Latino | Asian/PI | Nat Amer | Missing | |
| | n | n | n | n | n | n | n |
| Authorized for psychotropic medications | 1,571 | 1,735 | 2,633 | 109 | 77 | 9 | *** |
| Not authorized for psychotropic medications | 9,609 | 11,443 | 26,370 | 1,050 | 671 | 175 | 49,318 |
| Total | 11,180 | 13,178 | 29,003 | 1,159 | 748 | 184 | *** |

6,134

55,452

Data Source: CWS/CMS 2014 Quarter 4 Extract.
 Program version: 2.00 Database version: 07AC8099
 Values of 10 or less and calculations based on values of 10 or less are masked (***)

Citation:
 The suggested way to cite the above data is as follows:
 Needell, B., Webster, D., Armijo, M., Lee, S., Dawson, W., Magruder, J., Exel, M., Cuccaro-Alamin, S., Putnam-Hornstein, E., King, B., Morris, Z., Sandoval, A., Yee, H., Mason, F., Benton, C., & Pison, E. (2015). *Child Welfare Services Reports for California*. Retrieved 3/9/2015, from University of California at Berkeley Center for Social Services Research website, URL: <http://cssr.berkeley.edu/ucb_childwelfare>

Masking Solution Currently Online ...

California Department of Social Services, Child Welfare Data Analysis Bureau
California Child Welfare Indicators Project (CCWIP)
University of California at Berkeley

Children Authorized For Psychotropic Medications

Agency Type: Child Welfare

Oct 1, 2014 to Dec 31, 2014

California

| COUNT | Ethnic Group | | | | | | Total |
|---|--------------|--------|--------|----------|----------|---------|--------|
| | Black | White | Latino | Asian/PI | Nat Amer | Missing | |
| | n | n | n | n | n | n | n |
| Authorized for psychotropic medications | 1,571 | 1,735 | 2,633 | 109 | *** | *** | 6,134 |
| Not authorized for psychotropic medications | 9,609 | 11,443 | 26,370 | 1,050 | 671 | 175 | 49,318 |
| Total | 11,180 | 13,178 | 29,003 | 1,159 | *** | *** | 55,452 |

Data Source: CWS/CMS 2014 Quarter 4 Extract

Program version: 2.00 Database version: 67AC8089

Values of 10 or less and calculations based on values of 10 or less are masked (***).

Additional values (the lowest available) are masked to prevent calculation of values of 10 or less.

Children Authorized For Psychotropic Medications

Agency Type: Child Welfare

Oct 1, 2014 to Dec 31, 2014

| County | In care | Authorized for psychotropic medication | % |
|--------------|---------|--|-------|
| California | 55,452 | 6,134 | 11.1% |
| Alameda | 1,193 | 84 | 7.0% |
| Alpine | *** | *** | *** |
| Amador | 65 | 12 | 18.5% |
| Butte | 533 | 63 | 11.8% |
| Calaveras | 147 | *** | *** |
| Colusa | 26 | *** | *** |
| Contra Costa | 1,014 | 67 | 6.6% |
| Del Norte | 103 | *** | *** |
| El Dorado | 296 | *** | *** |
| Fresno | 1,959 | 243 | 12.4% |
| Glenn | 93 | 12 | 12.9% |
| Humboldt | 316 | 28 | 8.9% |
| Imperial | 426 | 57 | 13.4% |
| Inyo | 14 | *** | *** |
| Kern | 1,375 | 143 | 10.4% |
| Kings | 483 | 30 | 6.2% |
| Lake | 110 | 18 | 16.4% |
| Lassen | 57 | *** | *** |
| Los Angeles | 18,412 | 1,908 | 10.4% |
| Madera | 327 | 17 | 5.2% |
| Marin | 88 | *** | *** |
| Mariposa | 11 | *** | *** |
| Mendocino | 245 | 29 | 11.8% |

Children Authorized For Psychotropic Medications

Agency Type: Child Welfare

Oct 1, 2014 to Dec 31, 2014

Contra Costa

| COUNT | Placement Type | | | | | | | | | | | | | | Total |
|---|----------------|-----|--------|-----|-----------------|-------|---------|--------|----------------------|--------------------|---------|------------------|-------|---------|-------|
| | Pre-Adopt | Kin | Foster | FFA | Court Specified | Group | Shelter | Non-FC | Transitional Housing | Guardian-Dependent | Runaway | Trial Home Visit | Other | Missing | |
| | n | n | n | n | n | n | n | n | n | n | n | n | n | n | |
| Authorized for psychotropic medications | *** | *** | *** | 20 | *** | 35 | *** | *** | *** | *** | *** | *** | *** | *** | 67 |
| Not authorized for psychotropic medications | 47 | 354 | 170 | 240 | *** | 68 | *** | *** | *** | 39 | *** | *** | 18 | *** | 947 |
| Total | *** | *** | *** | 260 | *** | 103 | *** | *** | *** | *** | *** | *** | *** | *** | 1,014 |

http://cssr.berkeley.edu/ucb_childwelfare/CDSS_5F.aspx

The “Jitter” Function*

- Goals:
 - Prevent the identification of individuals
 - Preserve general trends and the overall integrity of the data

* We would like to acknowledge the significant contribution of Partners for Our Children, School of Social Work, University of Washington in our development of this approach.

The “Jitter” Function

- A random number is added to each non-zero cell in each table that is returned. The random numbers are generated from a specific probability distribution.
- Zero values remain as zero. This preserves the presence/absence of an event.
- Jittered results are set to 1 if the jitter function reduces them to a value less than 1.

* We would like to acknowledge the significant contribution of Partners for Our Children, School of Social Work, University of Washington in our development of this approach.

The Jitter Function: Potential Concerns

- Output tables, rather than underlying data are jittered.
- As a result, output tables in which totals would match with non-jittered data, may differ slightly

| COUNT | Gender | | | Missing | Total |
|---|--------|------|---------|---------|-------|
| | Female | Male | Missing | | |
| | n | n | n | n | |
| Authorized for psychotropic medications | 31 | 38 | 0 | 0 | 69 |
| Not authorized for psychotropic medications | 502 | 445 | 0 | 0 | 947 |
| Total | 533 | 483 | 0 | 0 | 1,016 |

| COUNT | Age Group | | | | | | | Missing | Total |
|---|-----------|-----|-----|------|-------|-------|-------|---------|-------|
| | Under 1 | 1-2 | 3-5 | 6-10 | 11-15 | 16-17 | | | |
| | n | n | n | n | n | n | n | n | |
| Authorized for psychotropic medications | 0 | 0 | 0 | 2 | 33 | 3 | 35 | 70 | |
| Not authorized for psychotropic medications | 63 | 146 | 149 | 264 | 225 | 104 | 1,009 | 951 | |
| Total | 63 | 146 | 149 | 266 | 258 | 139 | 1,019 | 1,021 | |

| COUNT | Ethnic Group | | | | | | Missing | Total |
|---|--------------|-------|--------|----------|----------|---------|---------|-------|
| | Black | White | Latino | Asian/PI | Nat Amer | Missing | | |
| | n | n | n | n | n | n | n | |
| Authorized for psychotropic medications | 39 | 14 | 12 | 0 | 0 | 0 | 65 | |
| Not authorized for psychotropic medications | 397 | 290 | 218 | 29 | 12 | 0 | 946 | |
| Total | 436 | 304 | 230 | 29 | 12 | 0 | 1,015 | |

| COUNT | Placement Type | | | | | | | | | | | | | | Missing | Total |
|---|----------------|-----|--------|-----|-----------------|-------|---------|--------|----------------------|--------------------|---------|------------------|-------|---------|---------|-------|
| | Pre-Adopt | Kin | Foster | FFA | Court Specified | Group | Shelter | Non-FC | Transitional Housing | Guardian-Dependent | Runaway | Trial Home Visit | Other | Missing | | |
| | n | n | n | n | n | n | n | n | n | n | n | n | n | n | n | |
| Authorized for psychotropic medications | 0 | 5 | 2 | 21 | 0 | 34 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 66 | |
| Not authorized for psychotropic medications | 46 | 354 | 170 | 240 | 0 | 68 | 0 | 0 | 1 | 39 | 10 | 0 | 19 | 0 | 947 | |
| Total | 46 | 359 | 172 | 261 | 0 | 102 | 0 | 0 | 2 | 40 | 11 | 0 | 20 | 0 | 1,013 | |

- With jittered data, county totals differ slightly from table to table

The Jitter Function: Potential Concerns

- Output tables, rather than underlying data are jittered.
- As a result, output tables in which totals would match with non-jittered data, may differ slightly
 - **This issue can be addressed in presentation and documentation of the jitter function**

[Non-public site with jittered data](#)

The Jitter Function: Potential Concerns

- A malicious user could attempt to determine the true value of certain cells by averaging multiple runs of the same query.
 - However, for a given extract, our system returns the same (jittered) results each time the same query is called.
 - Averaging values returned from different views of the same data won't necessarily return the true value. Even if it does, uncertainty remains.

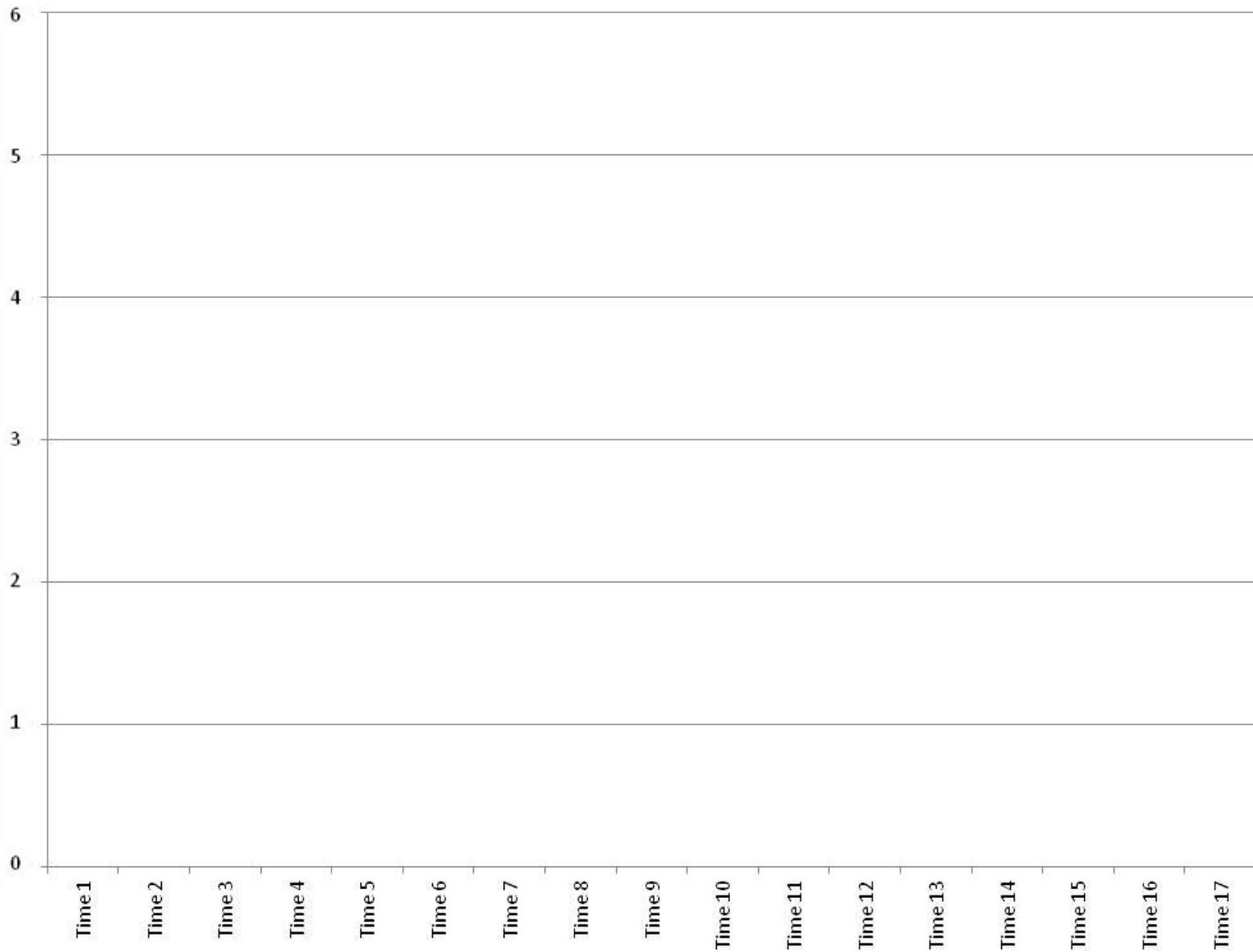
The Jitter Function: Potential Concerns

- To provide additional anonymity, the specifics of the jitter function can be kept confidential: the type of the random distribution, standard deviation, and other details.

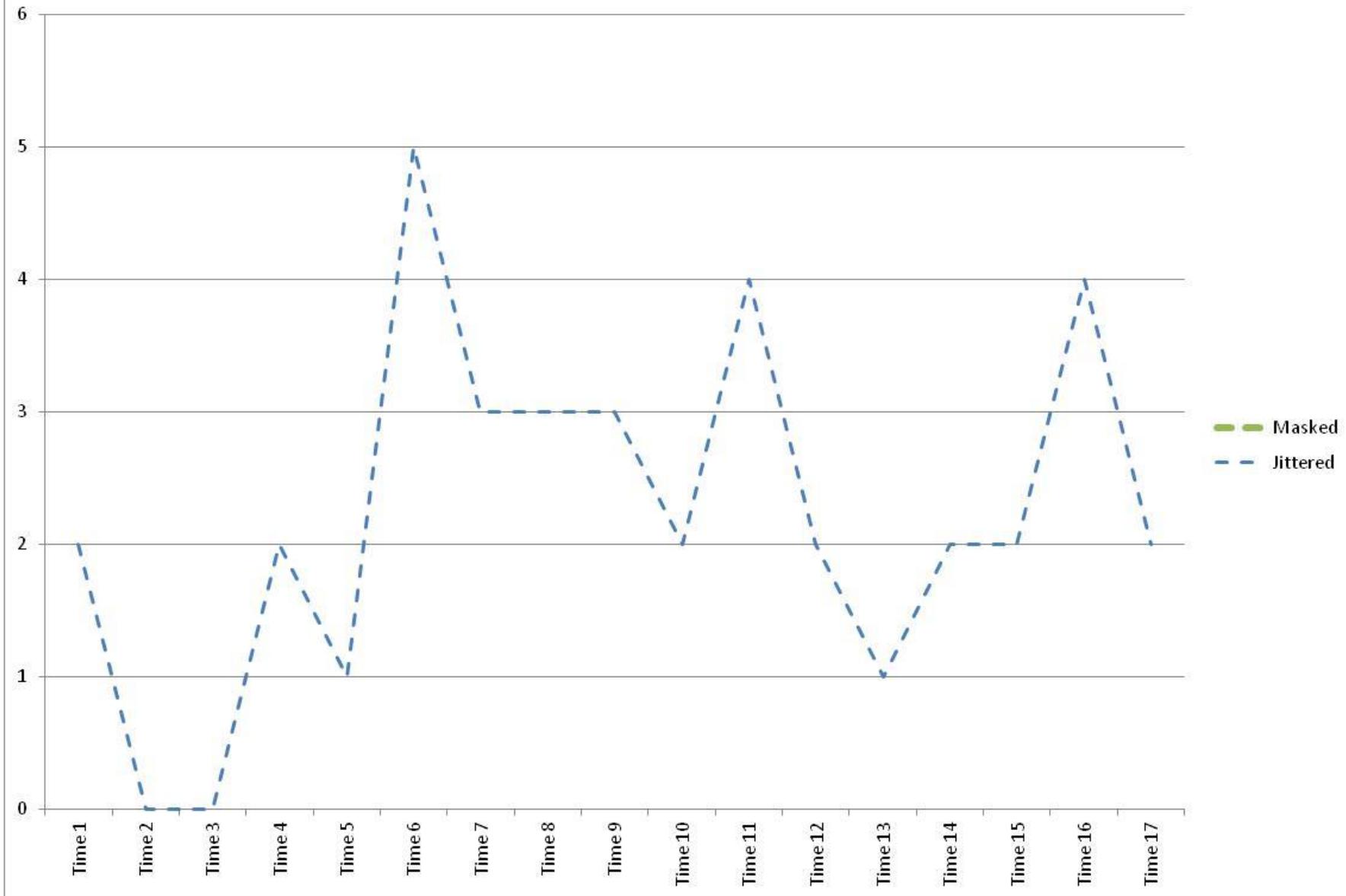
Sample Effects of Jitter Function

- The following slides show available numerators in three versions of the data:
 - (1) With values masked (as currently on the live site)
 - (2) Jittered values
 - (3) Actual values

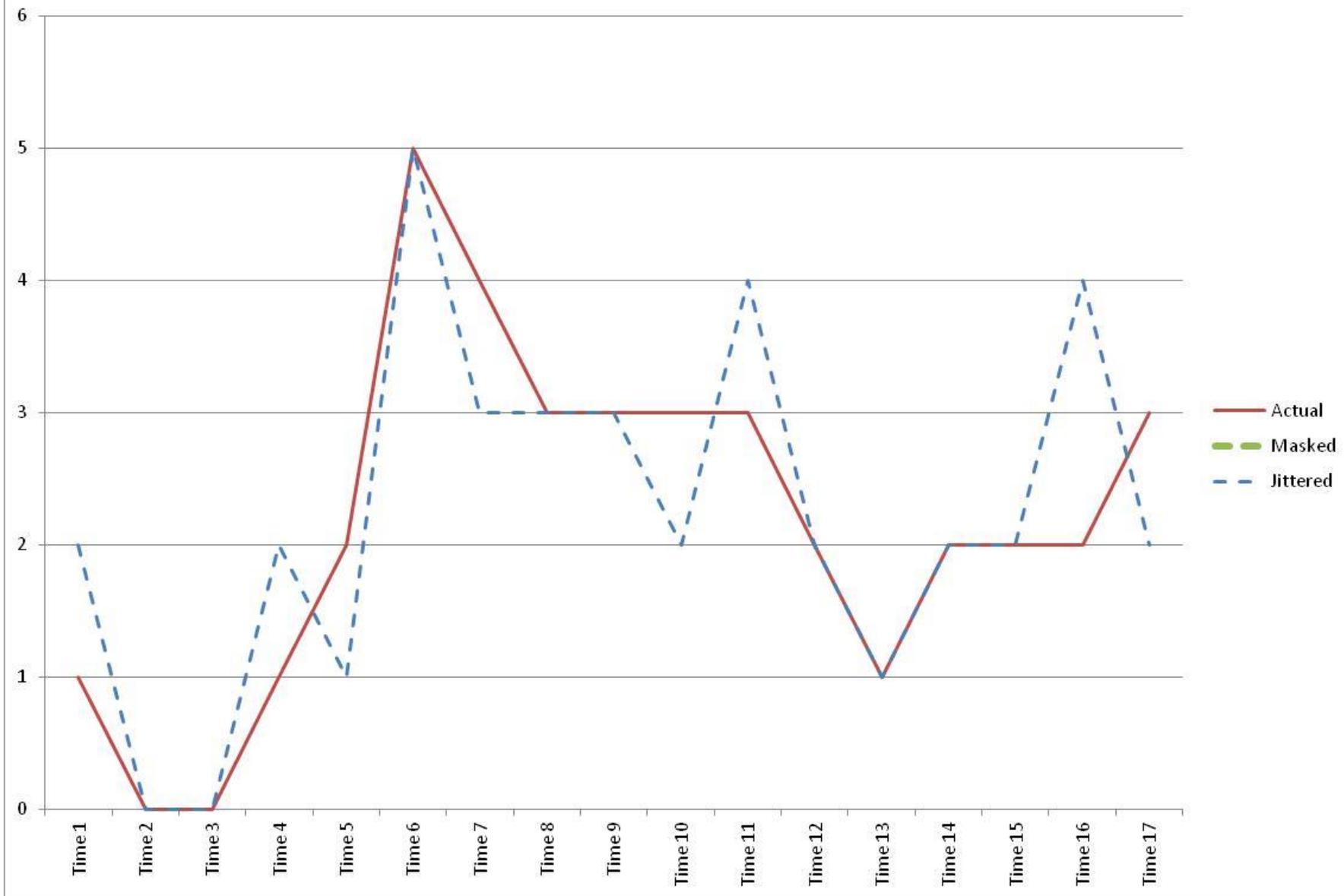
Sample County 1--Number Authorized for Psychotropic Medications



Sample County 1--Number Authorized for Psychotropic Medications



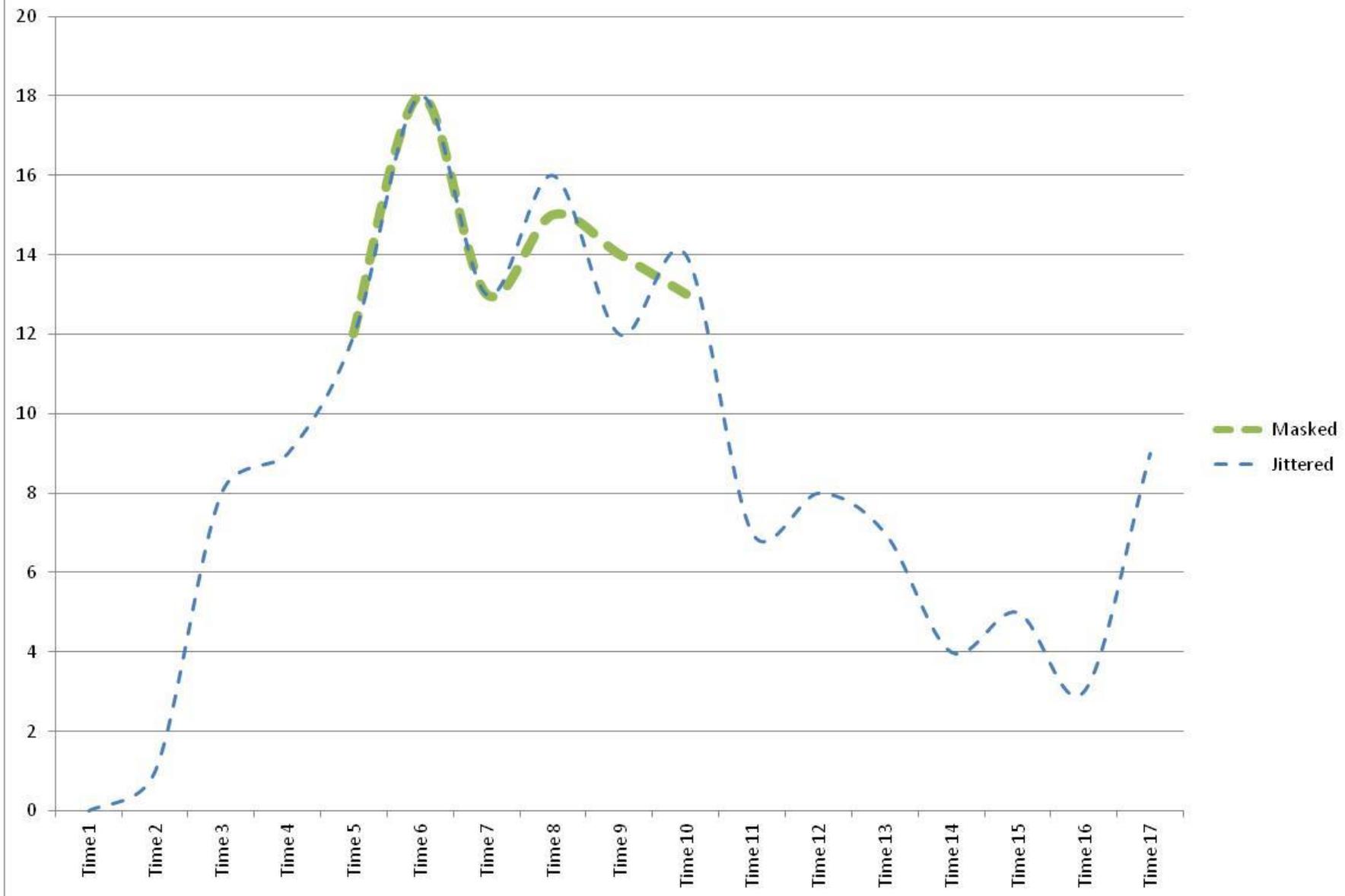
Sample County 1--Number Authorized for Psychotropic Medications



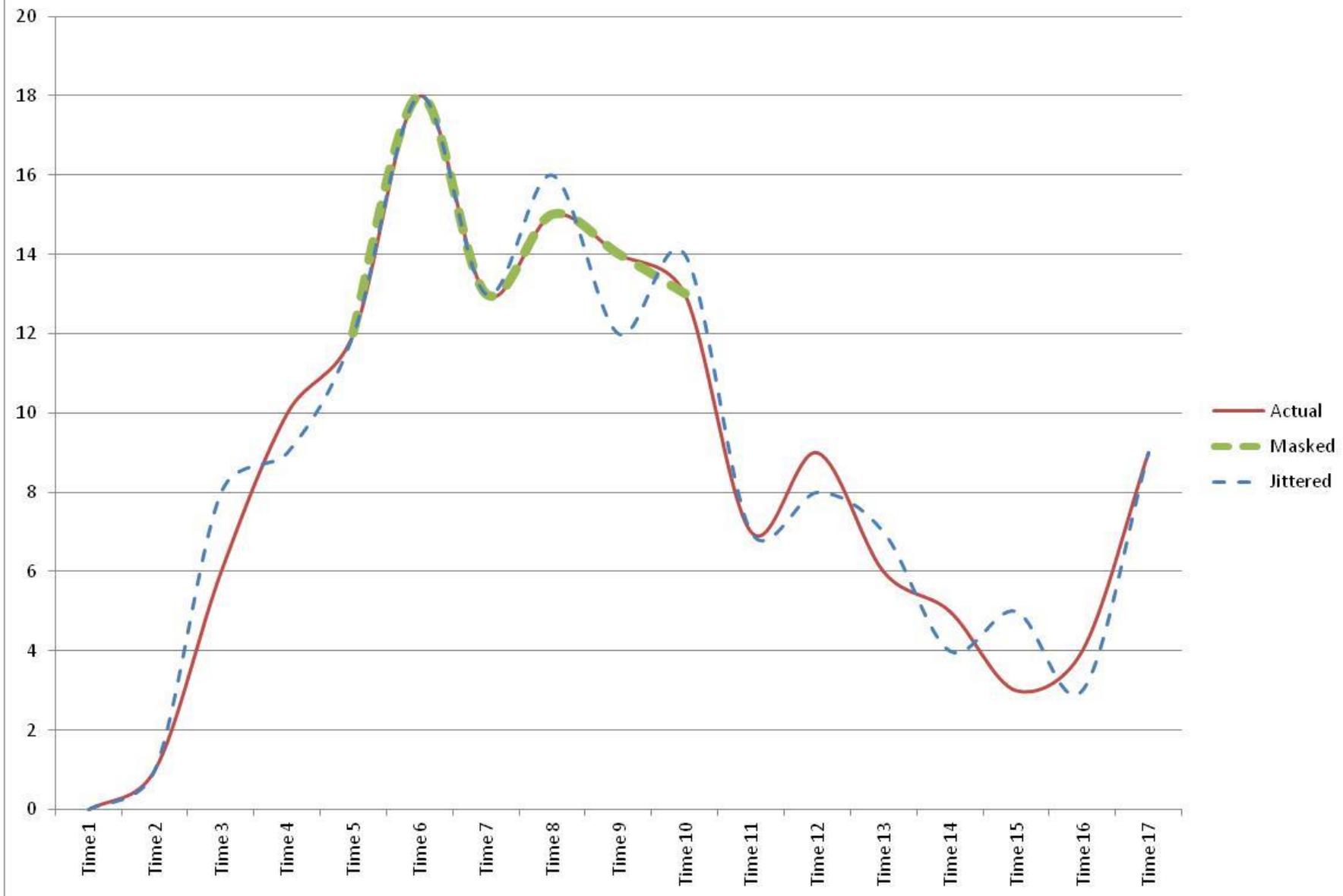
Sample County 2--Number Authorized for Psychotropic Medications



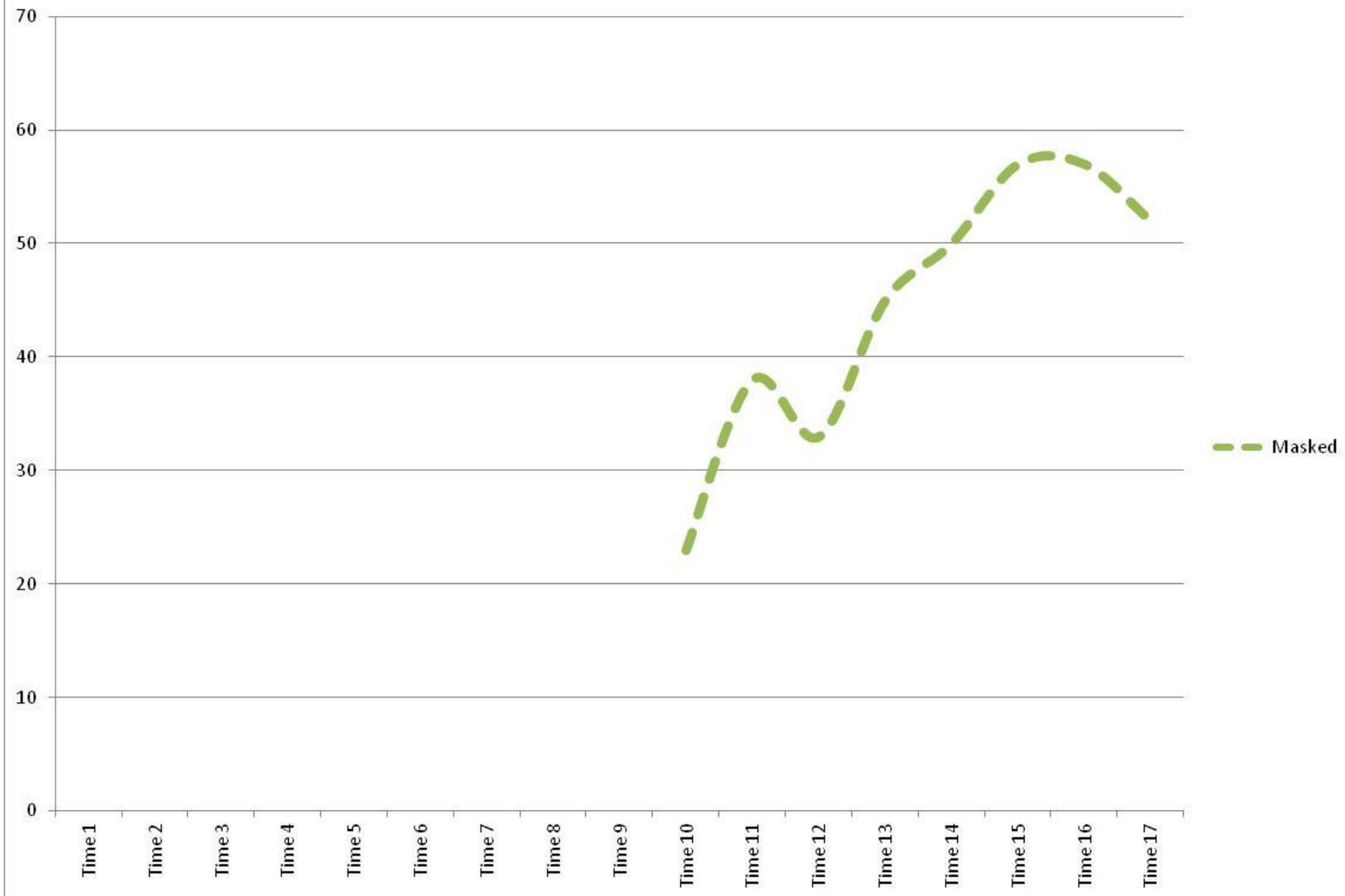
Sample County 2--Number Authorized for Psychotropic Medications



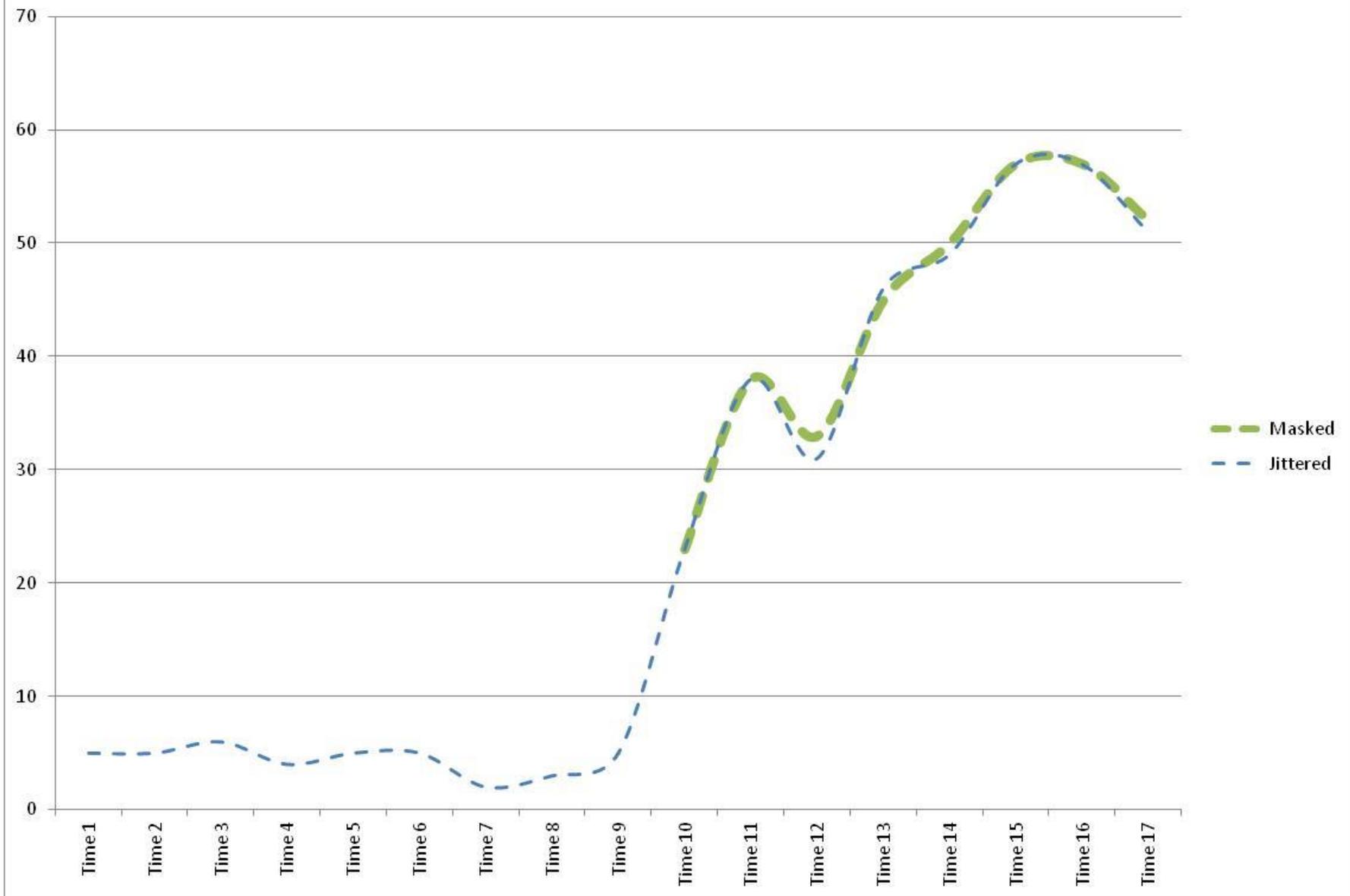
Sample County 2--Number Authorized for Psychotropic Medications



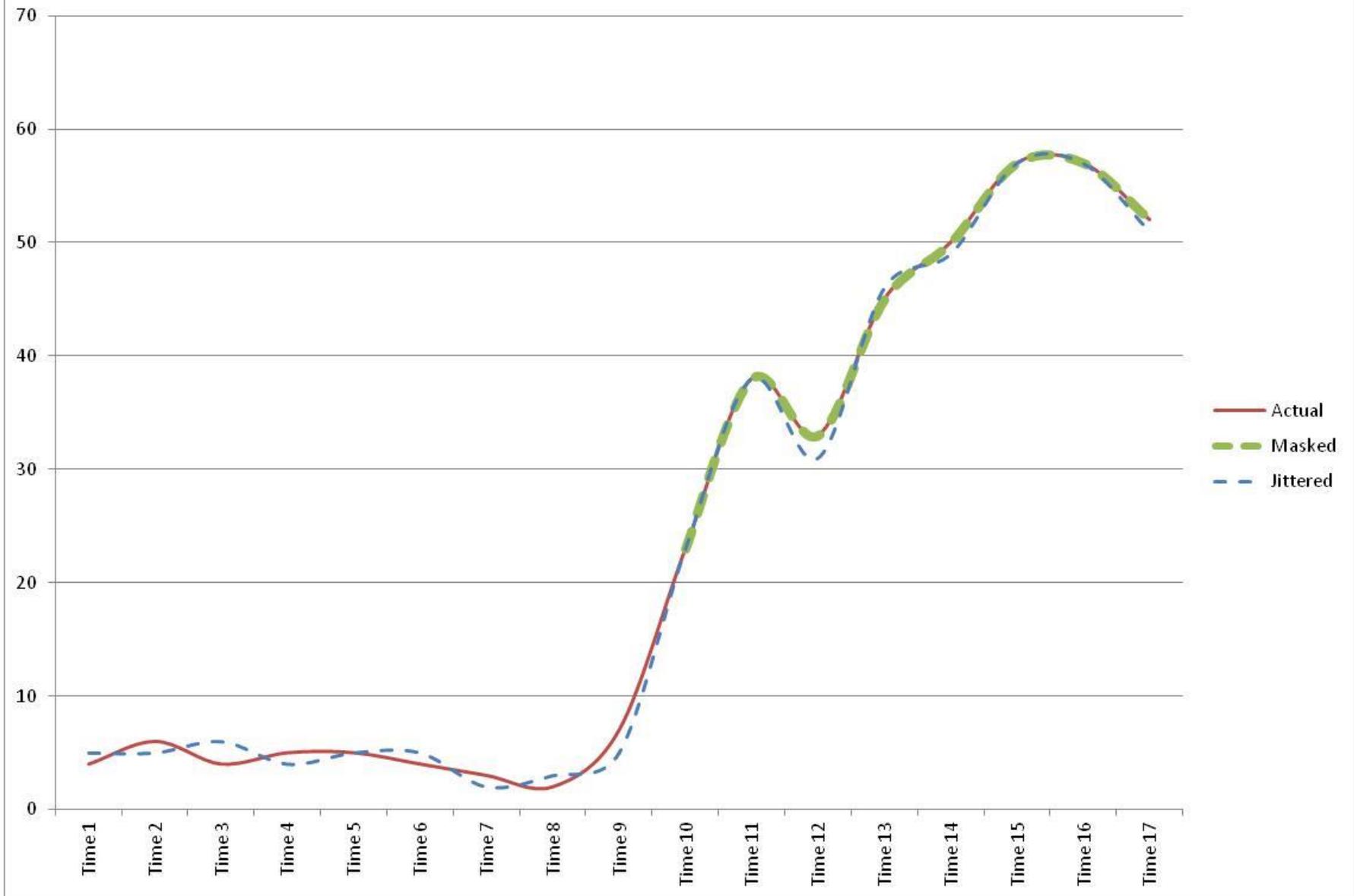
Sample County 3--Number Authorized for Psychotropic Medications



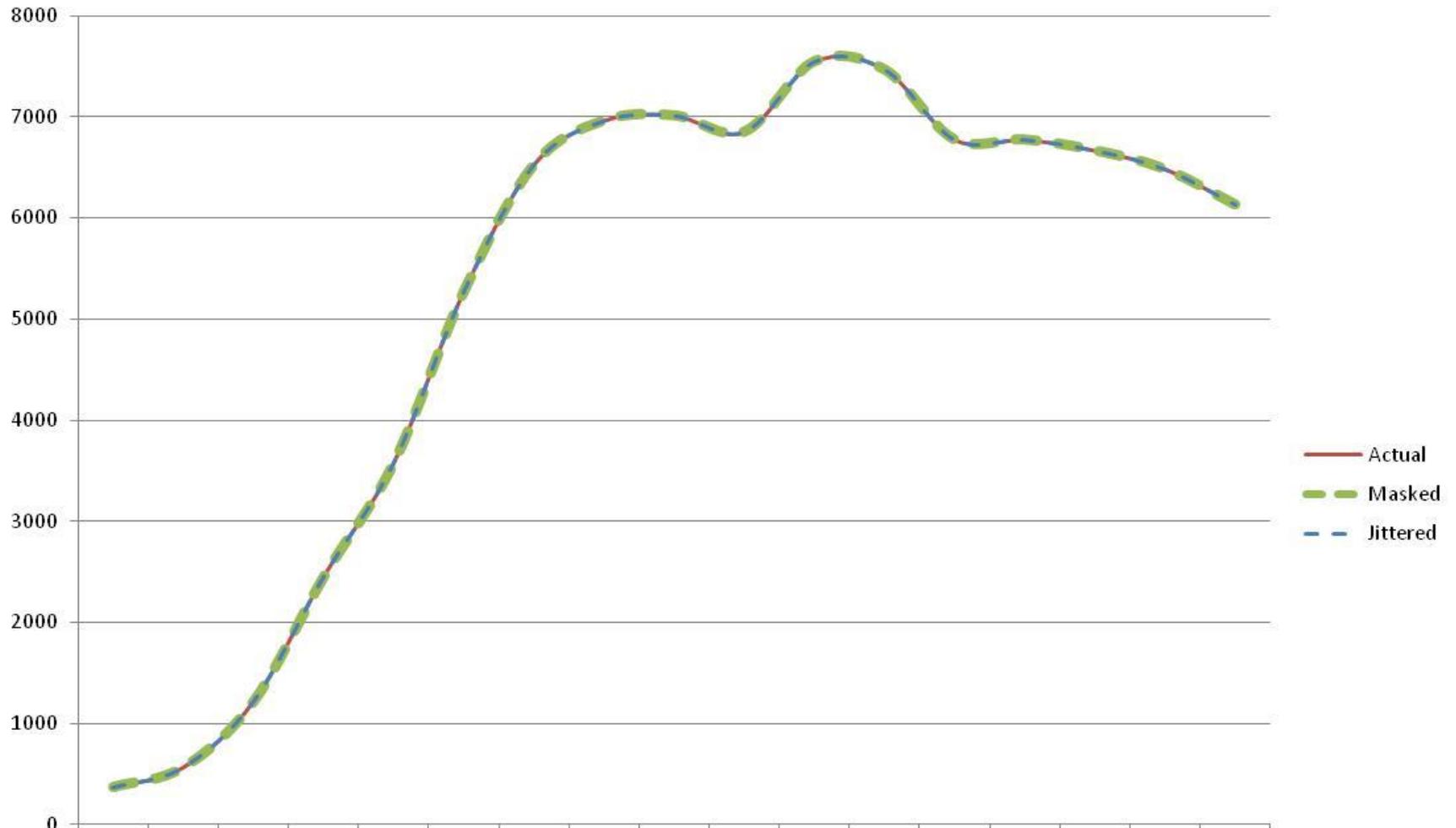
Sample County 3--Number Authorized for Psychotropic Medications



Sample County 3--Number Authorized for Psychotropic Medications



California-Number Authorized for Psychotropic Medications



| | Time 1 | Time 2 | Time 3 | Time 4 | Time 5 | Time 6 | Time 7 | Time 8 | Time 9 | Time 10 | Time 11 | Time 12 | Time 13 | Time 14 | Time 15 | Time 16 | Time 17 |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|---------|---------|
| Actual | 371 | 568 | 1,218 | 2,451 | 3,578 | 5,273 | 6,529 | 6,965 | 7,015 | 6,853 | 7,550 | 7,469 | 6,776 | 6,776 | 6,669 | 6,485 | 6,134 |
| Masked | 371 | 568 | 1,218 | 2,451 | 3,578 | 5,273 | 6,529 | 6,965 | 7,015 | 6,853 | 7,550 | 7,469 | 6,776 | 6,776 | 6,669 | 6,485 | 6,134 |
| Jittered | 370 | 568 | 1,217 | 2,451 | 3,578 | 5,271 | 6,530 | 6,965 | 7,015 | 6,854 | 7,550 | 7,471 | 6,775 | 6,776 | 6,669 | 6,484 | 6,135 |

Questions?

510.290.6779

dwebster@berkeley.edu