

Investigation of the NCHS Data Presentation Standards for Proportions: A Simulation Study

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Background

- Should an estimate be presented? Is it accurate, could it be misleading?
- Does the estimate of 4% from our sample reflect the true prevalence in the population?
- How do we decide? Presentation Standards/Guidelines

Typical Standards

- Based on sample size and sampling error
 - Sample size - some set a minimum for the denominator and others set it for the numerator, often set at 30 or 50 observations
 - Sampling error is often assessed via the relative standard error (RSE = standard error/estimate), RSE > 30% (or some other threshold) identified as less reliable

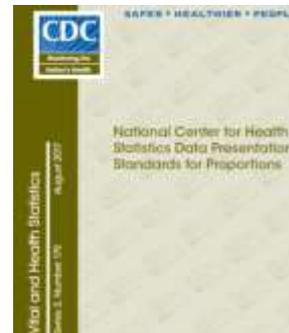
Focus on Presentation of Estimates

- Estimates can be informative even if they're not precise
- Estimates for small subgroups which may not meet conventional standards might be useful and acceptable for some objectives

NCHS Workgroup

- Focus on criteria for **proportions** estimated from **complex surveys** in **general health data products**
- The workgroup decided against criteria based on RSE
 - The RSE for proportions can perform poorly: too conservative for small p and too liberal for large p .
- Confidence intervals (CI) provide more information and are better indicators of precision
 - Commonly used Wald intervals perform poorly so others considered
 - Exact Clopper Pearson intervals, adapted for surveys by Korn-Graubard, incorporate design effects and degrees of freedom (DF)
 - The relative CI width has similar shortcomings as the RSE so guidelines based on both relative and absolute CIs were developed.

https://www.cdc.gov/nchs/data/series/sr_02/sr02_175.pdf



Questions and Approach

Questions:

- How do different specifications (4) compare with one another in terms of the number of estimates that would be presented?
- When estimates are suppressed using the new recommendations, which criterion or combination of criteria most often lead to suppression of an estimate? What types of estimates are being suppressed?
- What sample characteristics are associated with a lower frequency of estimate presentation?

Approach:

- Sampling-based study
- Considered 2 “old” and 2 “new”:

OLD: sample size ≥ 30 & RSE $\leq 30\%$ or RSE $\leq 50\%$

NEW: effective sample size ≥ 30 & absolute Korn-Graubard confidence interval width ≤ 5 **OR** effective sample size ≥ 30 and absolute Korn-Graubard confidence interval width > 5 and < 30 (alternative of 20) and relative confidence interval width $\leq 130\%$

Methods

- Created a known population using IHIS (Integrated Health Interview Surveys) data 1997-2014 (N=1,710,059) - now, IPUMS (Integrated Public Use Microdata Series) Health Surveys
- Combined existing strata to create 15 strata, randomly split existing PSUs to create smaller PSUs for sampling purposes – 64 PSUs per strata
- SAS SURVEYSELECT was used to generate 1000 samples, selecting 2 PSUs per strata
 - Weights were assigned proportional to PSU size
 - PSUs approximately the same size
- 1000 samples used for these analyses provide a data structure characteristic of NCHS surveys

Methods

- Focused on 2 subpopulations:
 - Age ≤ 5 (8.9% of the total population) ←
 - Age ≤ 5 & female (effectively reduces the sample by half)
- For each of the 1000 samples, prevalence estimates were obtained for 7 outcomes by majority/minority status and region (4 levels):
 - Fair/poor health & on Medicaid (1.03%), Reverse outcome (98.97%)
 - Fair/poor health (1.75%)
 - Excellent health & no insurance (4.81%), Reverse outcome (95.19%)
 - No insurance (9.91%)
 - Poor (21.14%)
 - Medicaid (32.6%)
 - Excellent/very good health (82.53%)
- Majority/Minority was defined in 2 ways:
 - Any one NOT Mexican vs Mexican ←
 - Any one NOT African American vs African American
- Analyses were conducted using PROC DESCRIPT and Korn-Graubard confidence intervals were calculated based on the recommendations

Results

- Across the 1000 samples:
 - Mean total sample size was 53471 with a minimum 52509 and a maximum of 54266
- Table below shows sample sizes for each region by minority designation, subpopulation age ≤ 5

Mexican as Minority Group				
By group	N	Mean	Min	Max
Total	1000	4769	4537	5039
Majority	1000	3667	3496	3925
Minority	1000	1101	1003	1204
Region A	1000	733	637	828
Region B	1000	971	870	1065
Region C	1000	1704	1582	1828
Region D	1000	1360	1236	1489
Mj/Rg A	1000	710	612	805
Mj/Rg B	1000	861	768	953
Mj/Rg C	1000	1352	1229	1493
Mj/Rg D	1000	744	654	846
Mn/Rg A	1000	23	7	44
Mn/Rg B	1000	110	78	140
Mn/Rg C	1000	352	306	412
Mn/Rg D	1000	616	540	685

Minimum and maximum degrees of freedom and percent of samples with degrees of freedom <8

Mexican as
Minority Group

By group	Min	Max	% of samples df<8
Total	15	15	0
Majority	15	15	0
Minority	15	15	0
Region A	9	9	0
Region B	11	11	0
Region C	11	12	0
Region D	10	11	0
Mj/Rg A	9	9	0
Mj/Rg B	11	11	0
Mj/Rg C	11	12	0
Mj/Rg D	10	11	0
Mn/Rg A	0	7	100
Mn/Rg B	4	11	39
Mn/Rg C	9	12	0
Mn/Rg D	10	11	0

Results

How do the 4 different specifications compare with one another in terms of the number (proportion) of estimates that would be presented?

Subpopulation Age <=5, Mexican Minority

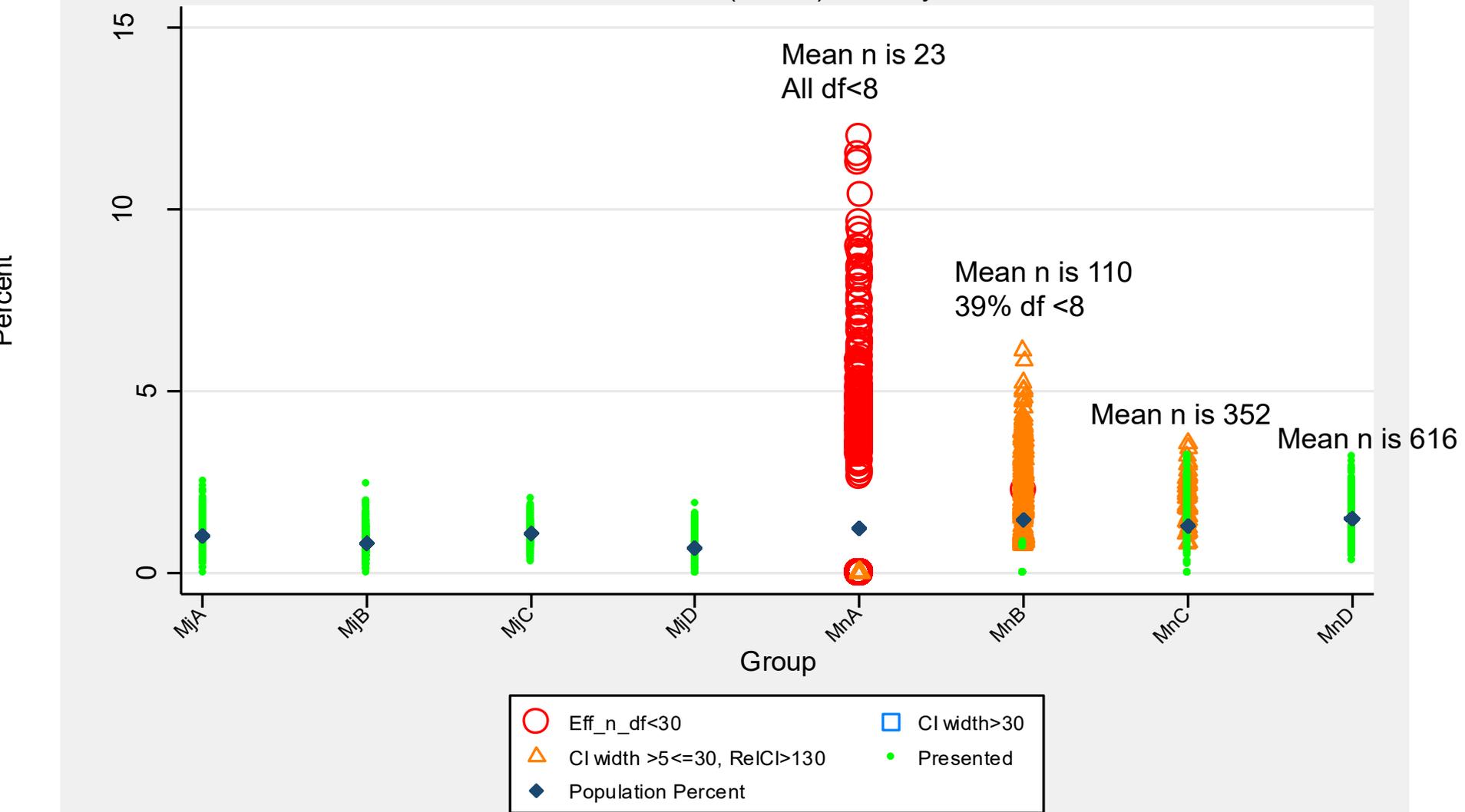
By Group	Fair/Poor Health & Medicaid (1.03%)				Fair/Poor Health (1.75%)				Excellent Health & No Insurance (4.81%)				No Insurance (9.91%)			
	O1	O2	N1	N2	O1	O2	N1	N2	O1	O2	N1	N2	O1	O2	N1	N2
Total	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Majority	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Minority	0.843	0.999	1	1	0.987	1	1	1	1	1	1	1	1	1	1	1
Region A	0.341	0.875	1	1	0.626	0.972	0.997	0.997	0.945	1	0.991	0.991	0.999	1	0.990	0.990
Region B	0.348	0.873	1	1	0.731	0.99	1	1	0.997	1	0.997	0.997	1	1	1	1
Region C	0.928	1	1	1	0.995	1	1	1	1	1	1	1	1	1	1	1
Region D	0.752	0.991	1	1	0.977	1	1	1	1	1	1	1	1	1	1	1
Mj/Rg A	0.310	0.840	1	1	0.600	0.969	0.997	0.997	0.941	0.999	0.989	0.989	0.998	1	0.989	0.989
Mj/Rg B	0.206	0.754	1	1	0.641	0.976	1	1	0.991	1	0.998	0.998	1	1	1	1
Mj/Rg C	0.767	0.997	1	1	0.967	1	1	1	1	1	1	1	1	1	1	1
Mj/Rg D	0.101	0.583	1	1	0.499	0.964	1	1	0.996	1	0.982	0.982	1	1	1	1
Mn/Rg A	0	0	0	0	0	0	0	0	0.002	0.008	0	0	0.010	0.037	0	0
Mn/Rg B	0.039	0.116	0.204	0.204	0.076	0.214	0.123	0.123	0.299	0.797	0.069	0.069	0.729	0.991	0.504	0.531
Mn/Rg C	0.110	0.565	0.942	0.942	0.259	0.834	0.873	0.873	0.995	1	0.980	0.980	1	1	1	1
Mn/Rg D	0.483	0.946	1	1	0.824	0.999	0.998	0.998	0.998	1	0.995	0.995	1	1	1	1

O1: total sample size >=30 & rel SE<=30%, O2: total sample size >=30 & rel SE<=50%

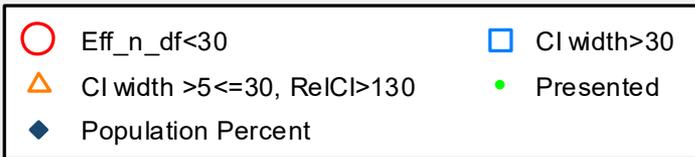
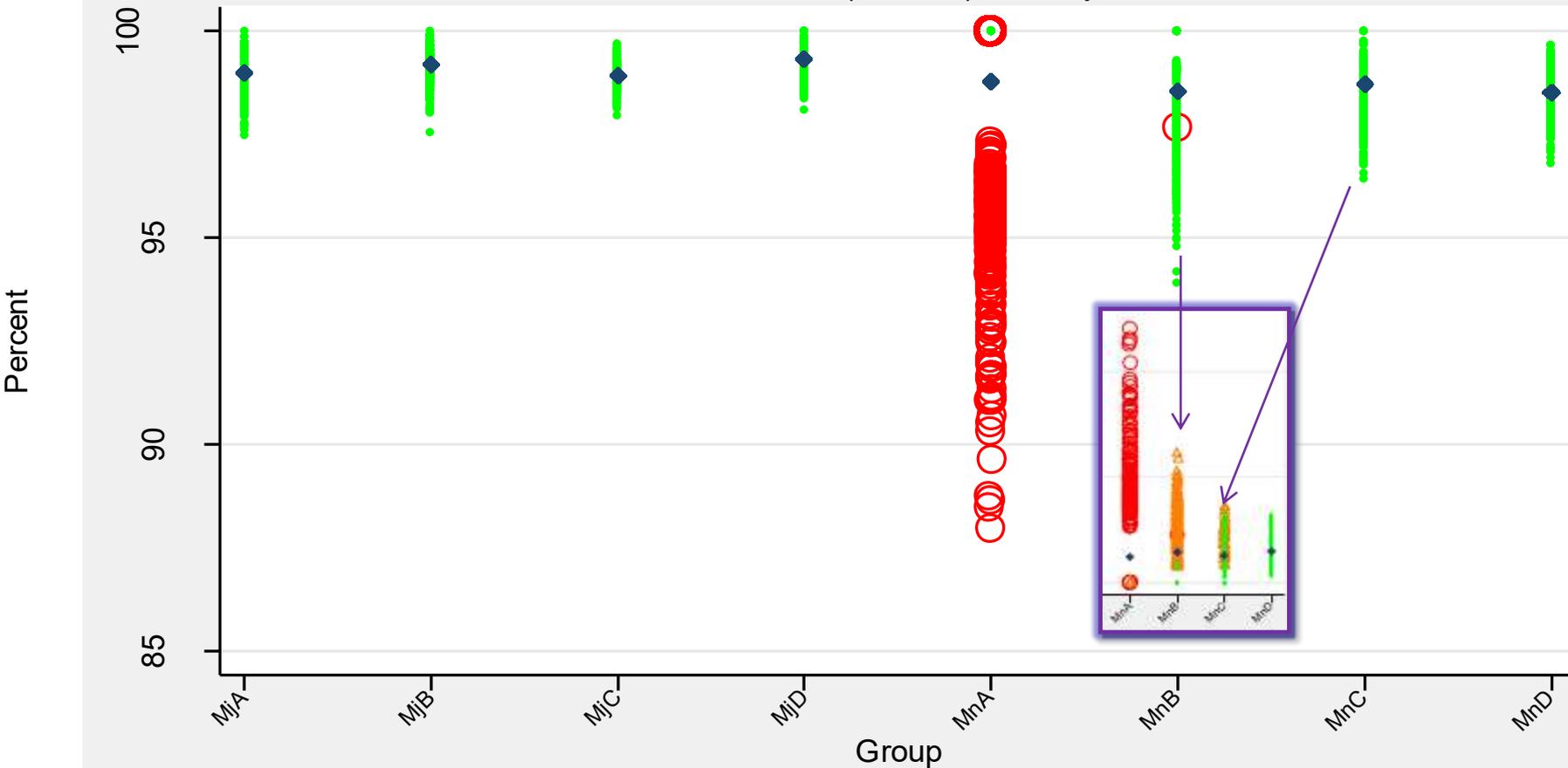
N1: effective sample size >=30 & CI width <20 & rel CI width<=130%, N2: : effective sample size >=30 & CI width <30 & rel CI width<=130%

When estimates are suppressed using the new recommendations, which criterion or combination of criteria lead to suppression of an estimate? And what types of estimates are getting suppressed?

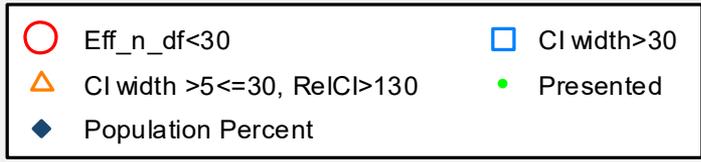
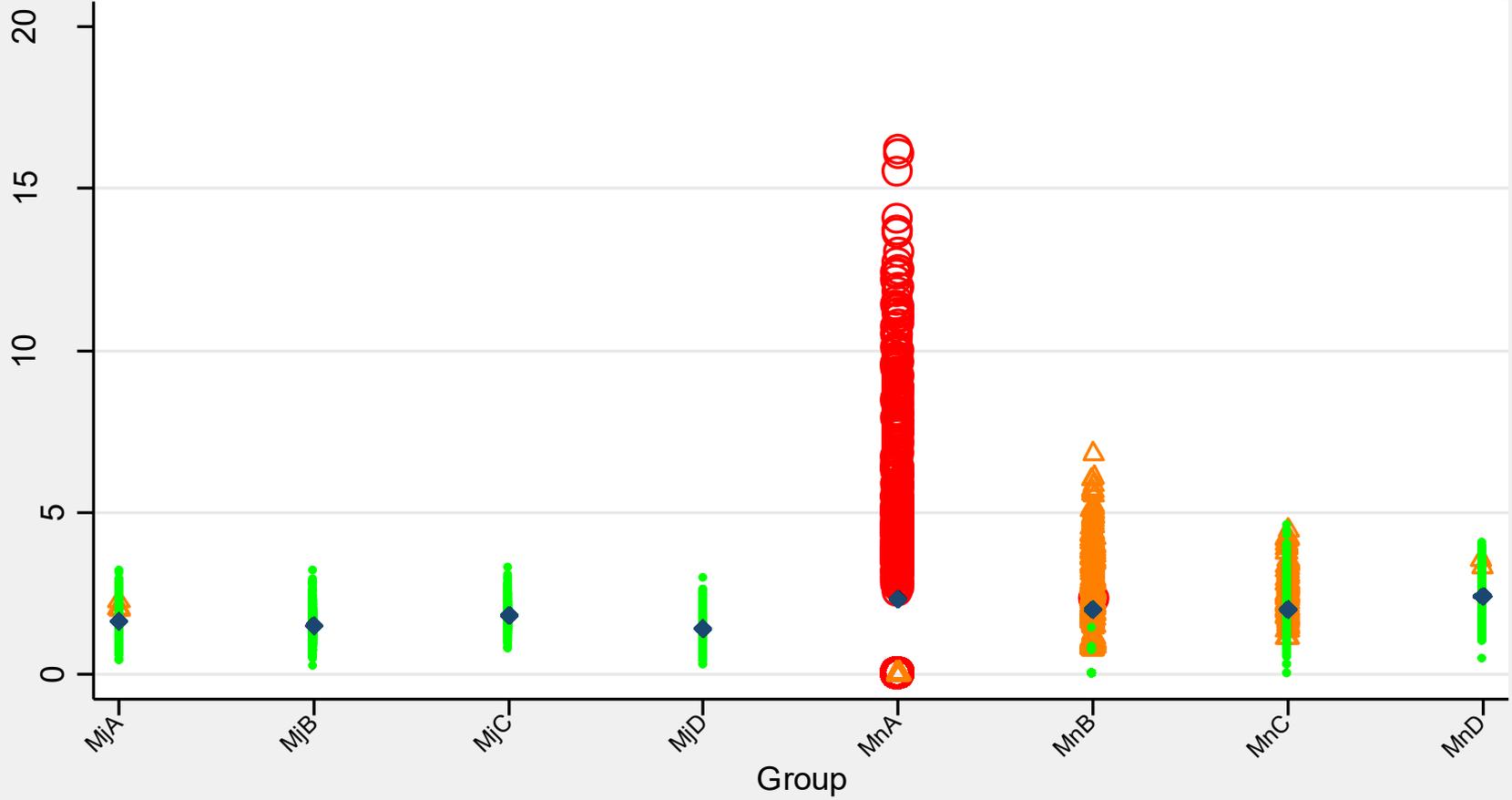
Estimates by Group According to Presentation Status
Outcome 1 (1.03%): Minority Mx



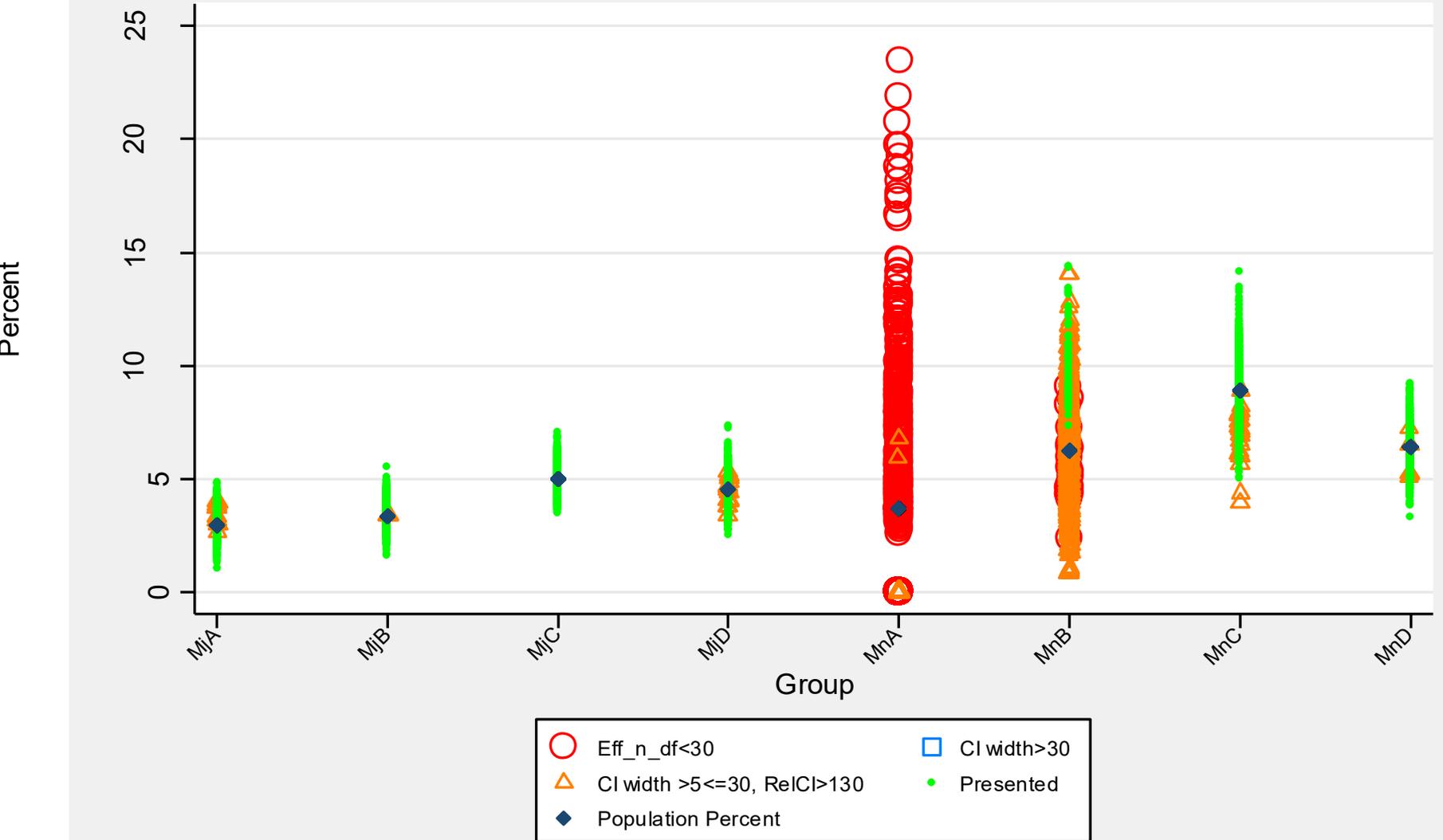
Estimates by Group According to Presentation Status Outcome 1R (98.96%): Minority Mx



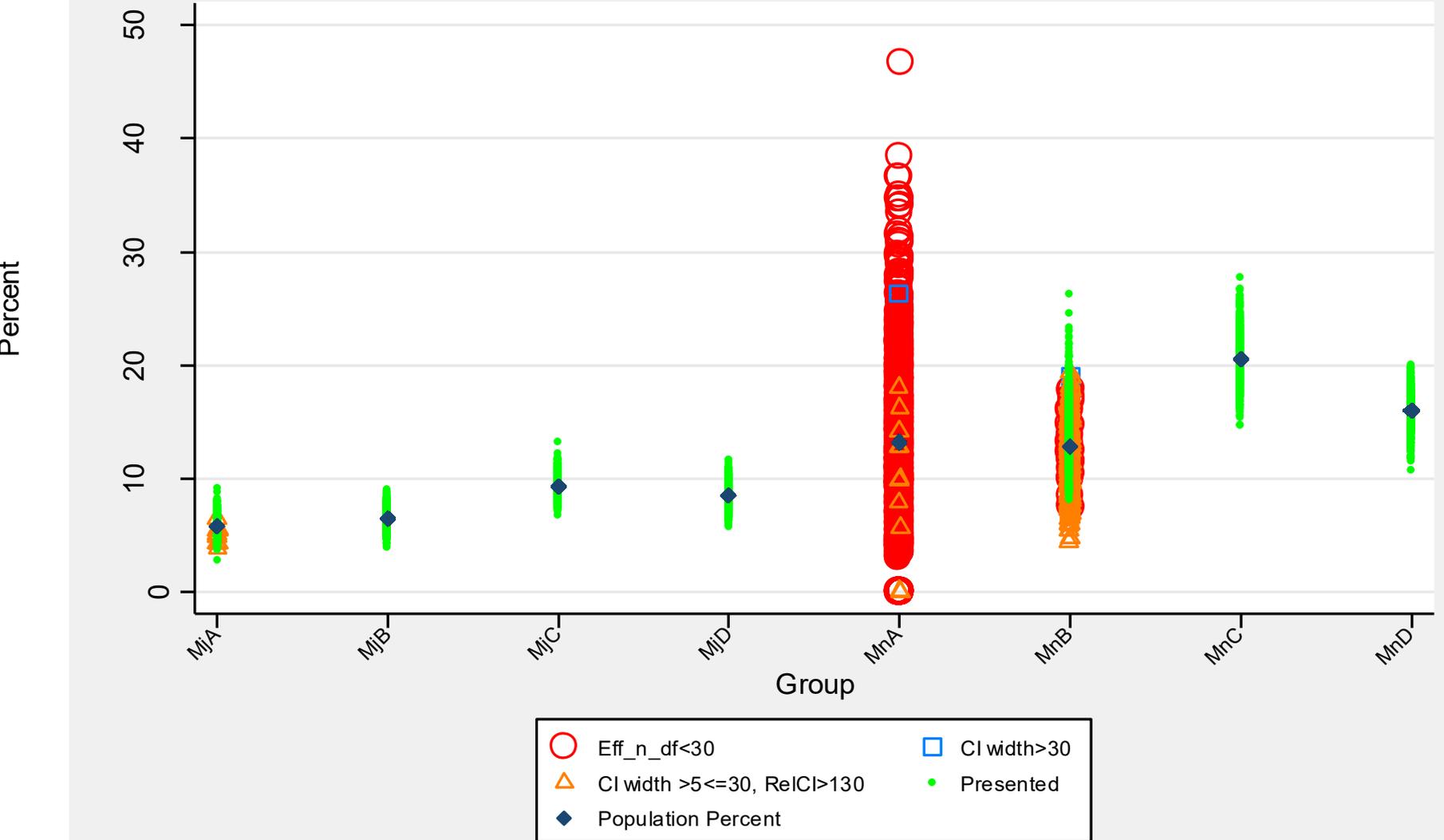
Estimates by Group According to Presentation Status
Outcome 2 (1.75%): Minority Mx



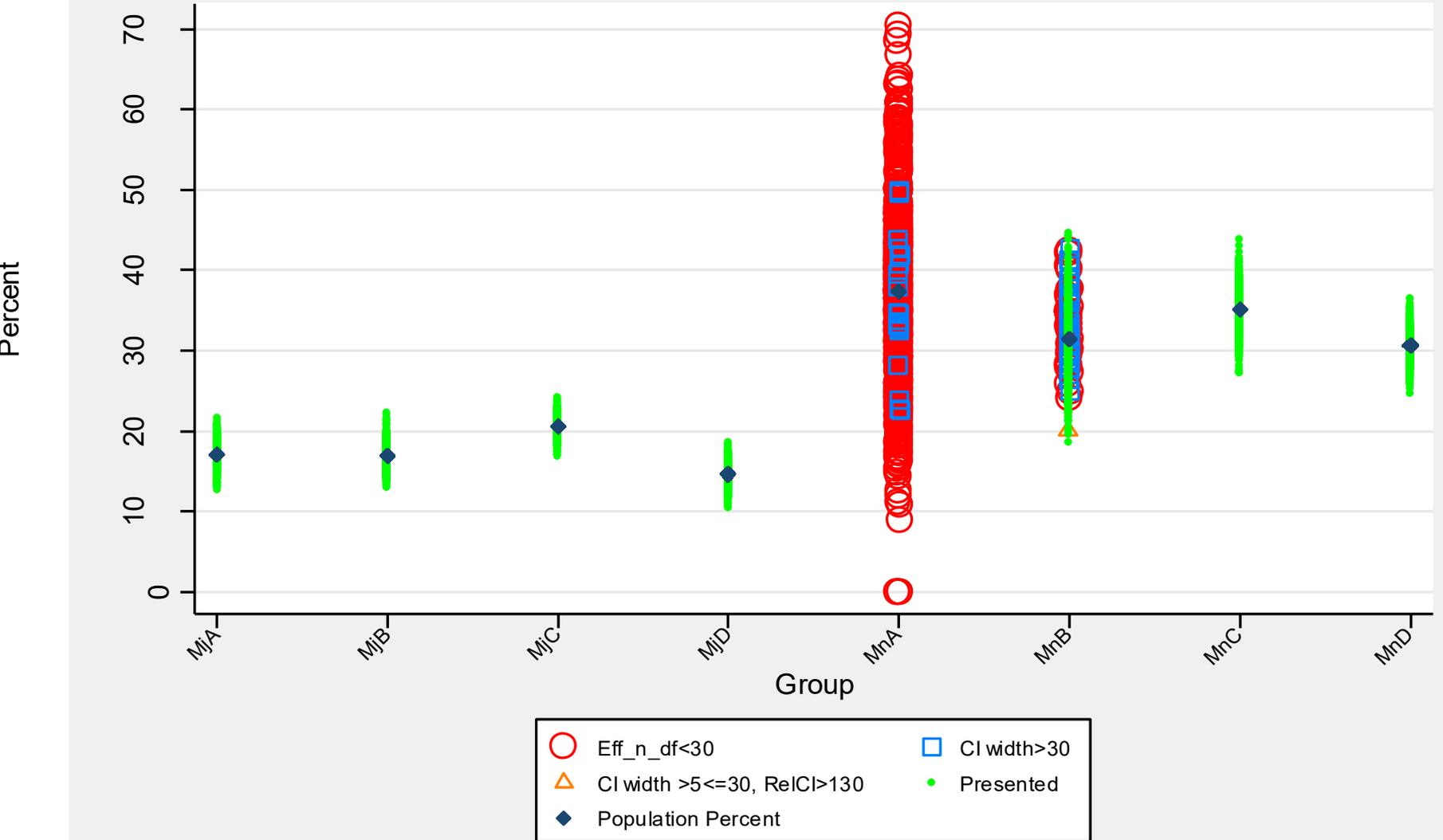
Estimates by Group According to Presentation Status
Outcome 3 (4.81%): Minority Mx



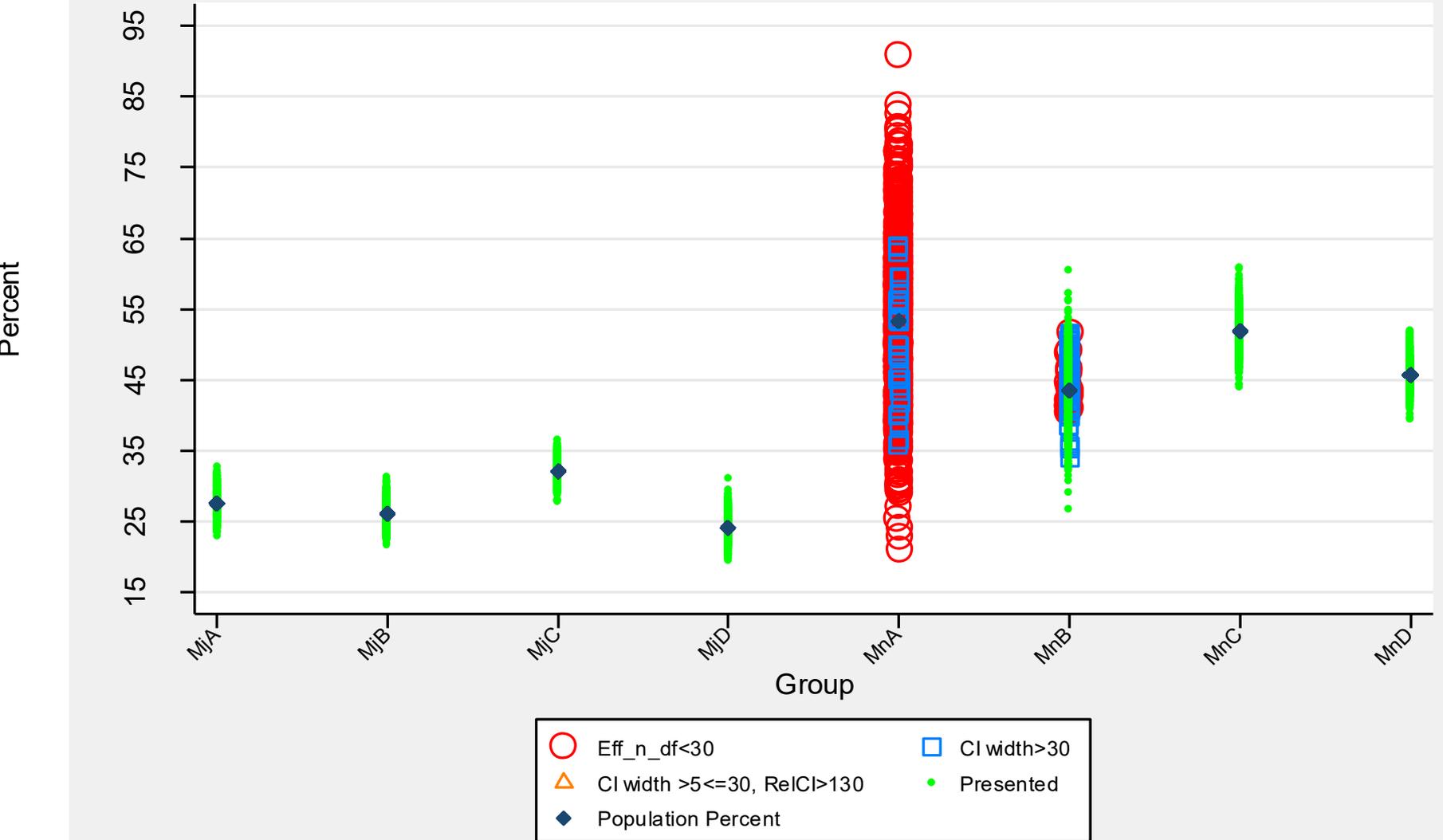
Estimates by Group According to Presentation Status
Outcome 4 (9.91%): Minority Mx



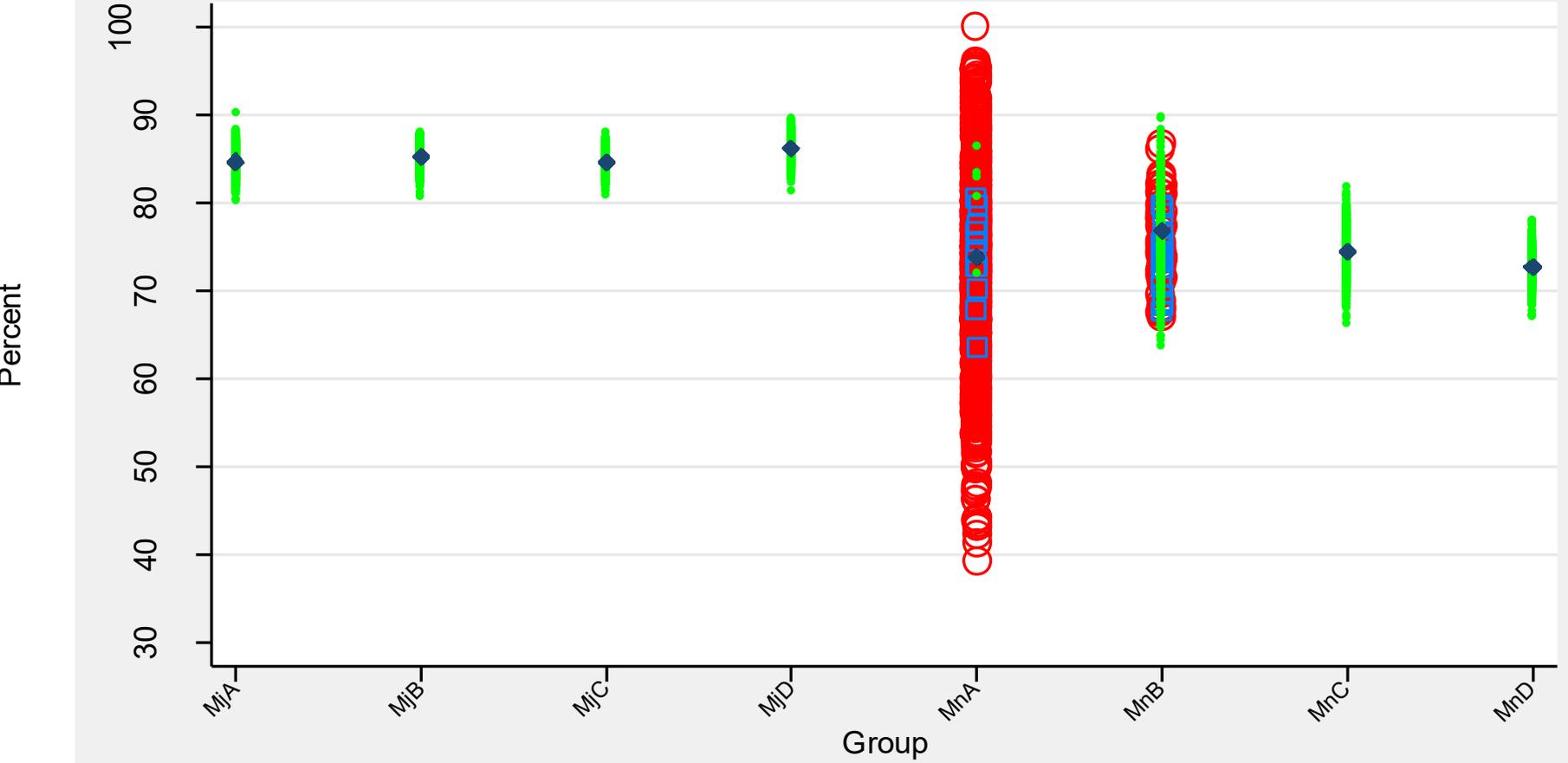
Estimates by Group According to Presentation Status
Outcome 5 (21.14%): Minority Mx



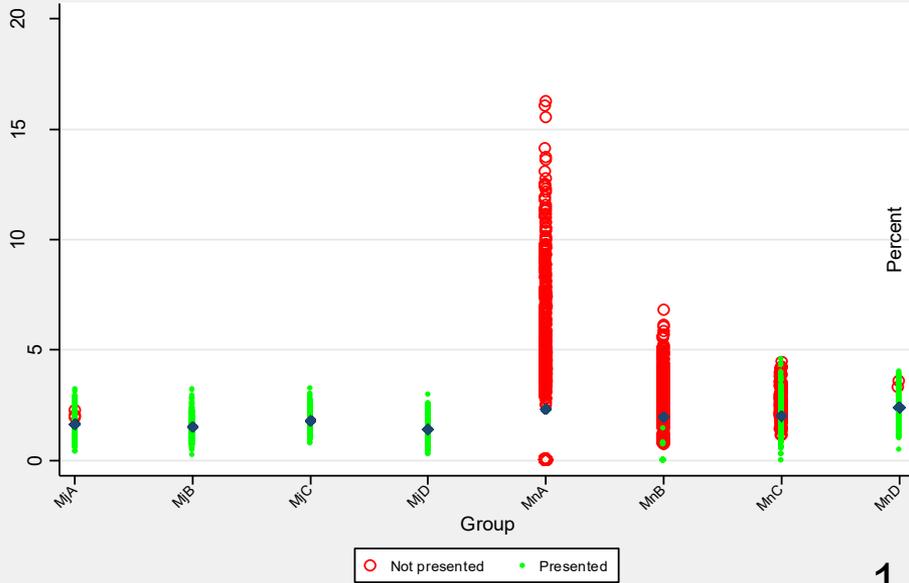
Estimates by Group According to Presentation Status
Outcome 6 (32.60%): Minority Mx



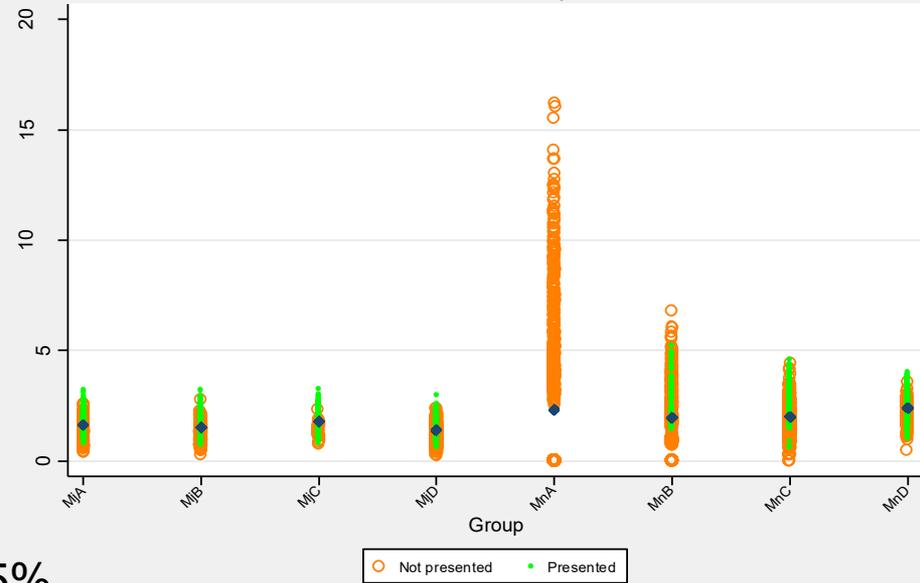
Estimates by Group According to Presentation Status
Outcome 7 (82.53%): Minority Mx



Presentation Status of Estimates - New Method
Outcome 2: Minority Mx

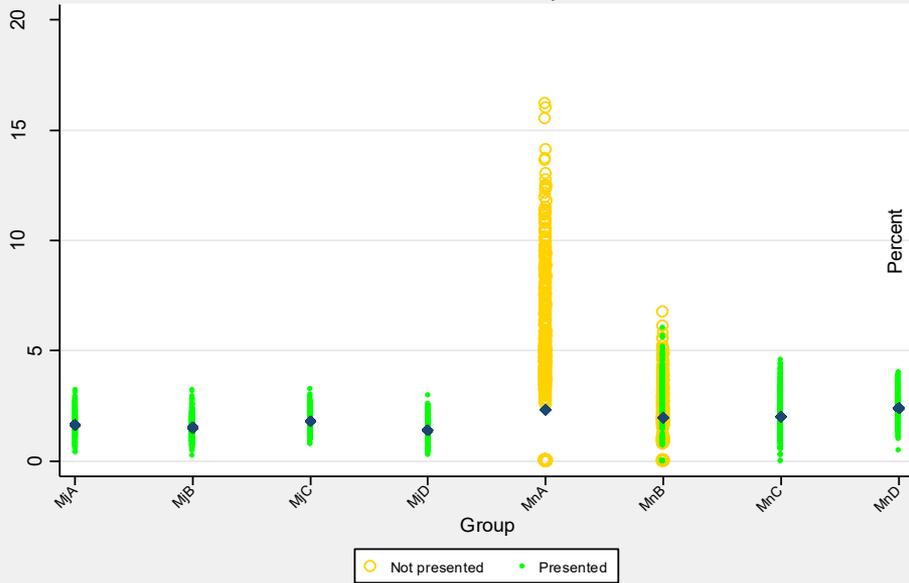


Presentation Status of Estimates - Old Method
Outcome 2: Minority Mx

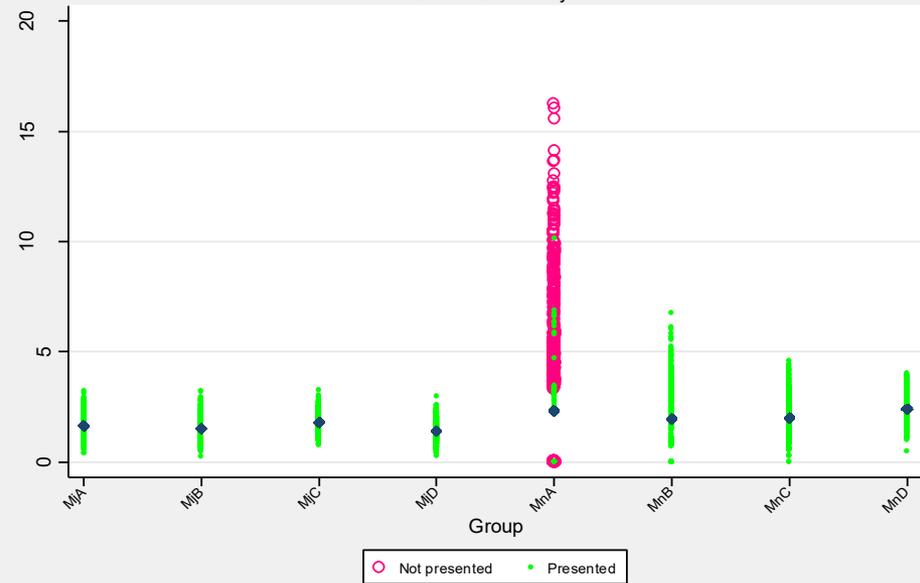


1.75%

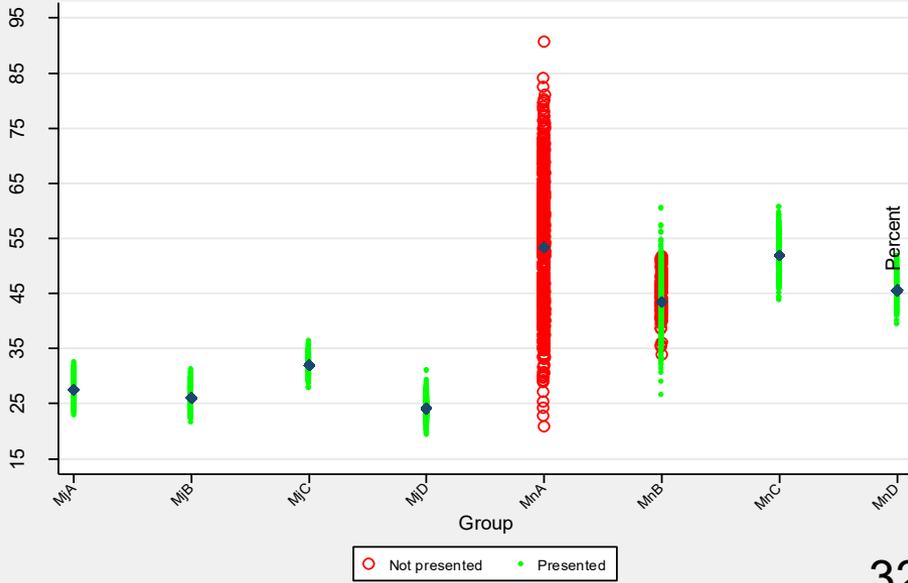
Presentation Status of Estimates - Alternative $n \geq 50$ & $df \geq 8$
Outcome 2: Minority Mx



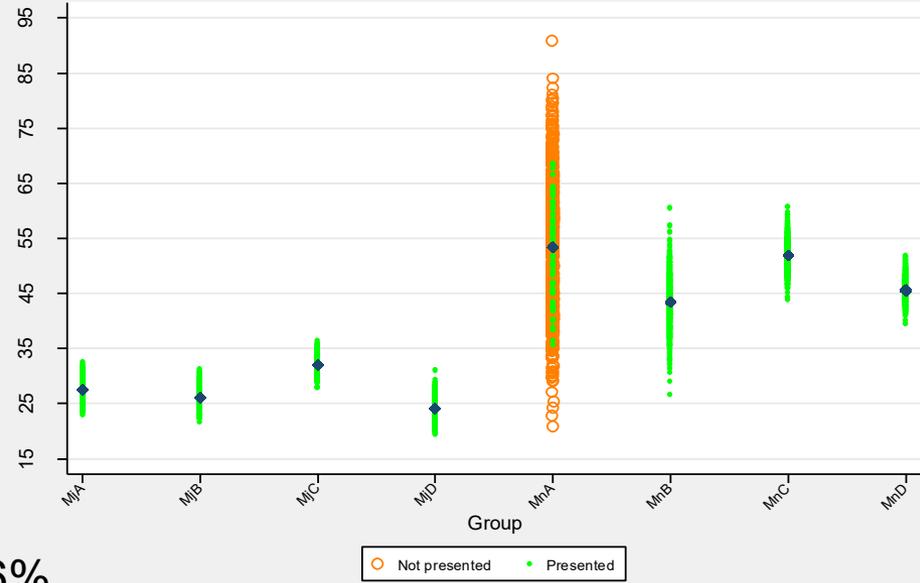
Presentation Status of Estimates - Alternative $n \geq 30$
Outcome 2: Minority Mx



Presentation Status of Estimates - New Method
Outcome 6: Minority Mx

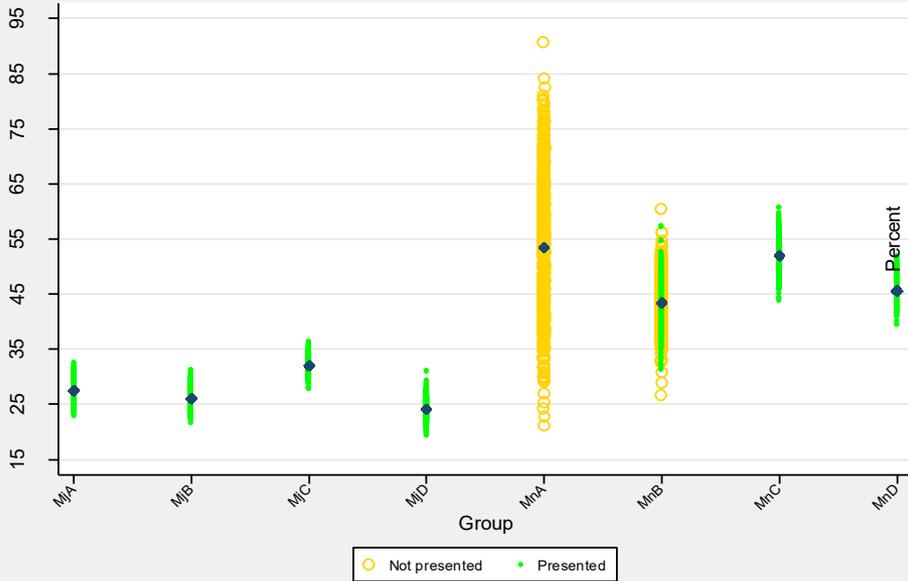


Presentation Status of Estimates - Old Method
Outcome 6: Minority Mx

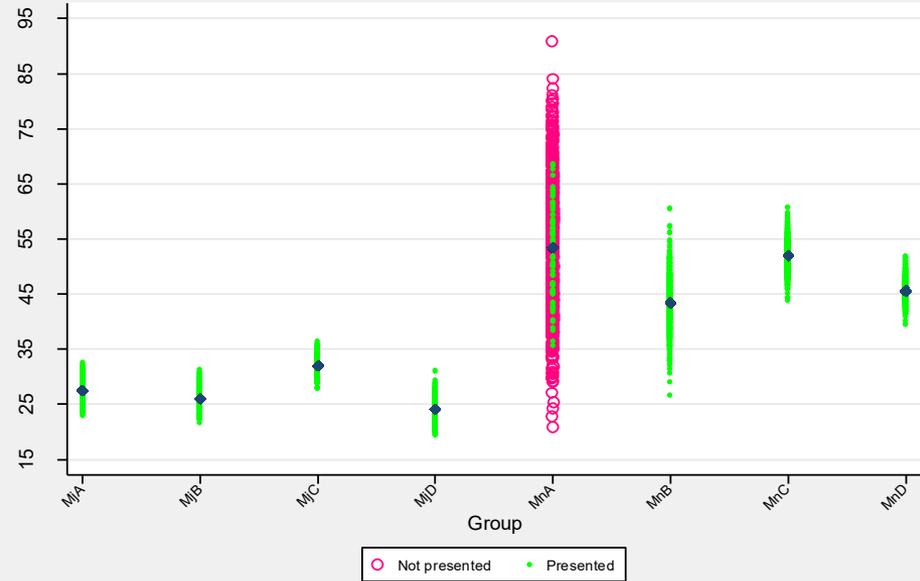


32.6%

Presentation Status of Estimates - Alternative n>=50 &df>=8
Outcome 6: Minority Mx



Presentation Status of Estimates - Alternative n>=30
Outcome 6: Minority Mx



Summary

- New presentation guidelines allow for presentation of estimates that might not have been presented using previous guidelines
- Guidelines incorporate sample size information as well as information about the uncertainty of a particular estimate
- In general, you see suppression of overestimates for smaller proportions and underestimates for larger ones
- Any method will lead to suppression of some “good” estimates because of the uncertainty associated with a particular estimate

Thank You

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