Methodology Note 2022 Update: Percentage Point Gap Minus One

2022 Update[1]: Percentage Point Gap Minus One Method

Introduction

This document presents an overview of the percentage point gap minus one (PPG-1) method which can be used to examine disproportionate impact (DI), with guidelines to better understand the disaggregated subgroups that are significantly impacted. This method can be applied to assess disproportionate impact across a variety of indicators, including those in the Student Success Metrics, successful course completion, ESL & basic skills completion, degree and certificate completion, transfer, and others.

Disproportionate impact occurs when a subset of students based on a student characteristic such as age, race, or gender have observably different outcomes when compared to the total student population. The Chancellor's Office seeks to ensure policies and practices are not designed in ways that impede or interfere with or differentially support student progress or success for a given student population. Over the past few years, colleges have used various methods to measure disproportionate impact; but due to the passage of AB 504, the California Community Colleges are legislatively mandated to use at least one common methodology across all colleges and districts. Additionally, using one method across all the colleges in the system will make it easier to measure the magnitude of issue system wide and track our efforts to equity gaps in our outcomes.

## What is the Percentage Point Gap Minus One (PPG-1) Method?

The original percentage point gap (PPG) method is a straightforward way to determine inequities in outcomes between student populations (Center for Urban Education, 2015). The PPG-1 method updates the original PPG method to increase the sensitivity of the PPG method to detect instances of DI where a student group potentially experiencing DI comprises a substantial proportion of the overall student body. This adjustment removes the influence of the group's own performance on the overall comparison rate, improving the accuracy for detecting cases of disproportionate impact for groups that might make up a sizable proportion of a college.

The PPG-1 method compares the outcomes of a disaggregated subgroup and the reference group - all **OTHER** students (e.g., compares the persistence rate of Hispanic students to the persistence rate of all non-Hispanic students). The percentage point gap minus one for the persistence rate is calculated as follows:

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[1] This is the updated version of the original Percentage Point Gap Method listed on CCCCO's website.

Figure 1. Percentage Point Gap Minus One Formula, adapted from Center for Urban Education (2015)
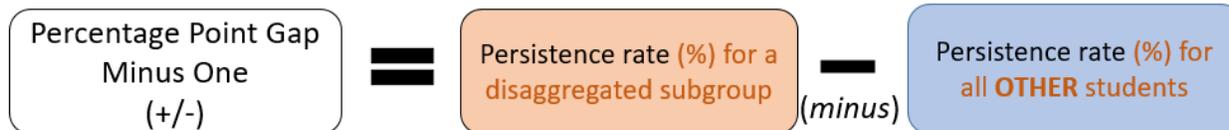
The PPG-1 method subtracts the percentage of all other students (p_o) from the percentage of the disaggregated subgroup (p̂):

$$PPG\text{-}1 = \hat{p} - p_o$$

$$PPG\text{-}1 = (\% \text{ of subgroup}) - (\% \text{ of all other})$$

Where p̂ = percentage (%) of subgroup ("p-hat") and p_o = percentage (%) of all other students.

In this context, the sample proportion ($\hat{p}$ or "p-hat") is the percentage for a disaggregated subgroup, which is a subset of the population, while the comparison proportion (p_o) is the percentage of all other students. Note that the percentage point gap minus one can have positive (+) or negative values (-). A negative PPG-1 means that the disaggregated subgroup, in the example above, has a lower persistence rate compared to the persistence rate of all other students, and might be experiencing significant disproportionate impact. A positive PPG-1 means that the subgroup has a higher persistence rate and is not experiencing disproportionate impact.

The detection of disproportionate impact in the PPG-1 method employs a threshold or margin of error (E) that is adjusted by the sample size (n) or cohort size of the subgroup[2], as well as sample proportion ($\hat{p}$) or outcome rate of subgroup.

If the two proportions are the same ($\hat{p}$ versus p_o), then the observed difference, the value of PPG-1, would be zero (no disparity). Where the observed difference is within the corresponding margin of error based on the sample size and sample proportion, the observed difference is not sufficient to conclude that there is disproportionate impact. If the observed difference is outside of the lower end of the margin of error, then there is considered to be disproportionate impact for that student group for that outcome. Table 1 provides the thresholds to determine the presence of disproportionate impact for cohorts examined.

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[2] The margin of error decreases as the sample size increases. In the method deployed by the Chancellor's Office, the floor used for the margin of error is set at 2% to address the potential of a large sample size to reduce the margin of error to a value approaching zero, increasing the likelihood of DI identification for any observed negative PPG-1 value.

Table 1. Margin of Error (E) or Thresholds in Identifying Disproportionate Impact

PPG-1 ≤ -E%	*Disproportionately lower than all other students*
-E% < PPG-1 < E%	*No disproportionate impact*
PPG-1 ≥ E%	*Disproportionately higher than all other students* *(or no adverse disproportionate impact for positive outcomes)*

- *For calculated E ≥ 2%, use the actual E calculated from the margin of error formula below*
- *For calculated E < 2%, use E = 2% as the margin of error.*

Where does the margin of error (E) come from?

The margin of error can be calculated based on a 95% confidence level, and the given sample size (n). As the sample size gets smaller, the margin of error increases – i.e., the larger the observed difference in outcomes needs to be in order to be confident that the difference observed between the outcomes for a subgroup of students are different from the outcomes of all other students. Below is the formula used in calculating the thresholds in the previous page. Note that:

$\hat{q} = 1 - \hat{p}$ and so, $\hat{p}\hat{q} = \hat{p}(1 - \hat{p}) = \hat{p} - \hat{p}^2$ is a quadratic bounded by 0.25, or $0 \leq \hat{p}\hat{q} \leq 0.25$.
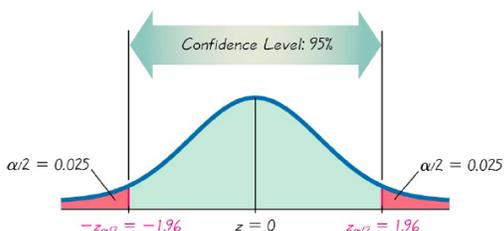

Figure 2. Critical Values for a 95% Confidence Interval (Triola, 2010)

Margin of Error Formula:

$$E = Z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

Margin of Error Formula for a 95% Confidence Interval and sample proportion of .50:

$$E = 1.96\sqrt{\frac{(.25)}{n}}$$

Table 2 provides an example calculating the PPG-1 for persistence rate by ethnicity. In this example, African American students had a persistence rate of 40.0%, and the persistence rate of all other students was 52.2%. So, the observed difference is calculated as:

PPG-1 = 40.0% - 52.2% = -12.2%

and the margin of error is calculated as:

$$E = 1.96\sqrt{\frac{40.0\% * (1 - 40.0\%)}{80}} = 10.7\%$$

Table 2. Percentage Point Gap minus one of Persistence Rate by Ethnicity

Subgroup	Cohort Size	Persistence Rate	Rate - All Other	PPG-1	threshold (E)	Comparison of E and PPG-1
African American	80	40.0%	52.2%	-12.2%	10.7%	-12.2% < -10.7%
American Indian/ Alaska Native	17	29.4%	52.0%	-22.6%	21.7%	-22.6% < -21.7%
Asian	112	61.6%	51.5%	10.1%	9.0%	10.1% > 9.0%
Filipino	36	66.7%	51.7%	15.0%	15.4%	-15.4% < 15.0% < 15.4%
Hispanic	761	46.9%	53.4%	-6.5%	3.5%	-6.5% < -3.5%
Pacific Islander	13	38.5%	51.9%	-13.5%	26.4%	-26.4% <-13.5% <26.4%
White	1978	53.3%	49.6%	3.7%	2.2%	3.7%>2.2%
All	3182	51.9%	-	-	-	-

As we examine each of the groups in the table and compare the observed PPG-1 value to the margin of error based on the sample size and sample persistence rate, the persistence rates of African American, American Indian/Alaska Native and Hispanic students demonstrate observable disproportionate impact, because the PPG-1 of -12.2% is below -10.7%, -22.6% is below -21.7%, and -6.6% is below -3.5%, respectively. That is, proportionate impact is observed when the PPG-1 value is equal to or below the threshold (-E)[3].

The remaining groups of students have PPG-1 values that are either:

- Inside the threshold of the margin of error: *-E < PPG-1 < E*

- Greater than or equal to the positive threshold (E): *PPG-1 ≥ E* (suggesting that the group of students is doing *better* when compared to all other students.

In these cases, there is either no evidence for disproportionate impact or there is evidence, but it is not conclusive. Colleges and programs *may* take action to address differences that do not reach the margin of error threshold, but colleges *should* work to address disproportionate impact that is larger than the margin of error threshold.

One common way to create a quick visualization of disproportionate impact at your college is through a bar graph. Figure 3 is a bar graph of the persistence rate by ethnicity from Table 2, with the horizontal red line representing the overall persistence rate of the entire population (51.9%). However, this chart has two key limitations. It does not take into account the size of the group, either in the margin of error calculations or its impact on the overall persistence rate being used (e.g., in this case, the number of Hispanic students has an impact on the overall persistence rate and ends up comparing Hispanics partly to themselves to determine

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[3] Disproportionate impact is observed when the PPG-1 value is less than or equal to the outcome rate minus the margin of error for positive outcomes. For negative outcomes (e.g., failure rates) DI would be observed when the PPG-1value is greater than or equal to the outcome rate plus the margin of error

the presence of disproportionate impact. As a result, it may potentially mislead the reader about the confidence one should have in the presence or absence of disproportionate impact.

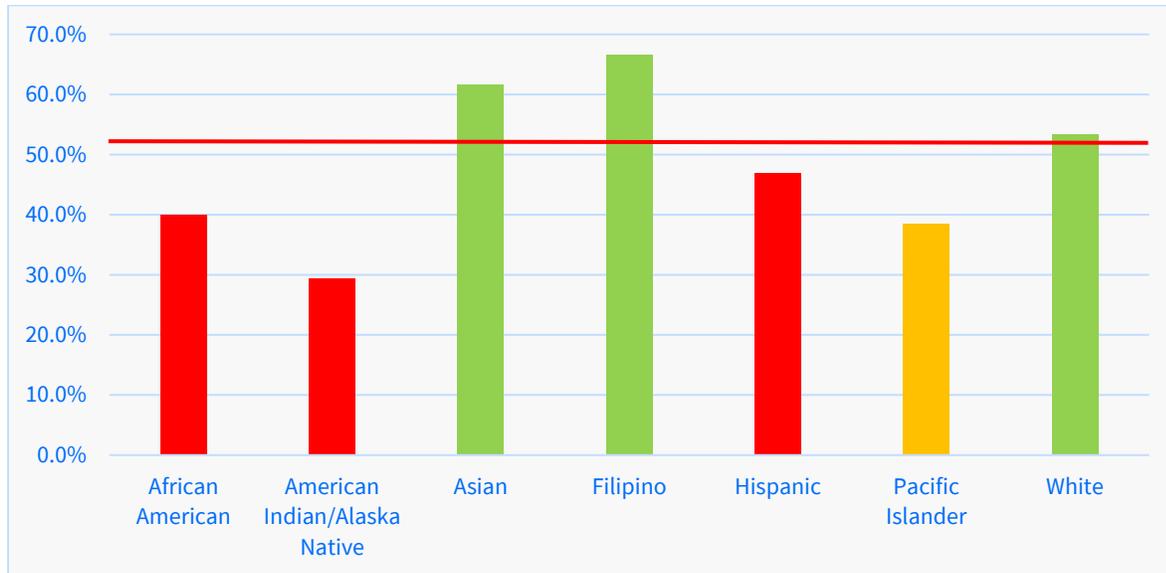*Figure 3. Persistence Rates by Ethnicity/Race*

Figure 4 below instead shows the location of the PPG-1 value in comparison to the margin of error (E) based on the sample size. If the PPG-1 is below the interval, adverse disproportionate impact is observed, as in the cases of the African American, American Indian/Alaska Native and Hispanic students (circled in red). One can also see that White and Asian students exhibiting positive disproportionate impact or disproportionate advantage, i.e., their PPG-1 values are above the interval reflecting that the outcomes for these two groups of students are higher than students other than themselves.

Figure 4. Percentage Point Gap Minus One and the Error Bar

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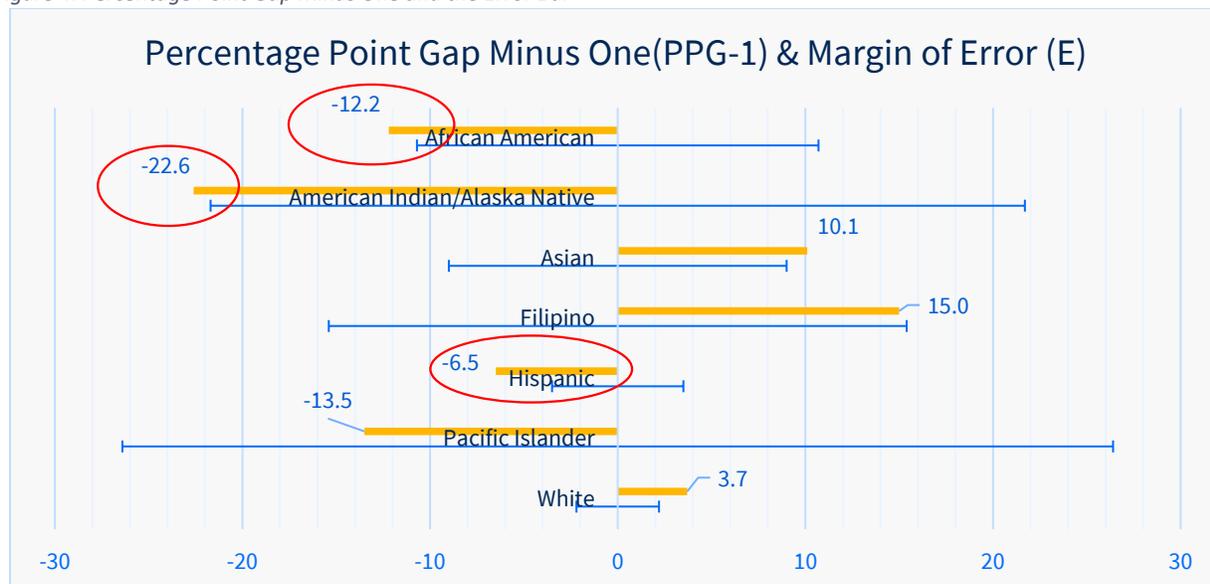
Number of Students Needed to Close the Equity Gap:

One advantage of using the percentage point gap minus one method is that it allows for the estimation of the number of additional students achieving the outcome needed to close the equity gap. In the previous example, adverse disproportionate impact was observed for Hispanic students. How many students would be needed to close the observed equity gap? Table 3 shows how to calculate this number by taking the absolute value of PPG-1 value (removing the negative sign) and multiplying its decimal equivalent with the cohort size (or sample size). Remember to round the number of students to the nearest whole number. For example, 0.066 x 761 is ~ 50 Hispanic students, meaning that 50 additional students would need to achieve the outcome for the equity gap to be closed, considerably larger than for other groups of students, suggesting an important potential focus of a college's equity efforts.

Table 3. Number of Students Needed to Close the Equity Gap, or Full Equity

	Absolute value of PPG-1	Decimal Equivalent	Multiply	Cohort Size	Students Needed to Close the Equity Gap
African American	12.2%	0.122	x	80	10
American Indian/ Alaska Native	22.6%	0.226	x	17	4
Hispanic	6.6%	0.066	x	761	50
Pacific Islander	13.5%	0.135	x	13	2

Note

This provides an overview of the use of the PPG-1 method as a guide for understanding where a college may have adverse disproportionate impact that needs to be addressed. Additionally, there may be potential ways to locally prioritize efforts (e.g., by the size of the observed DI or by the number of students impacted/the number of students whose outcomes need to be improved to fully close the observed equity gap). However, colleges may include other historically disadvantaged groups of students in their equity efforts when differences between the group and all other students may be apparent but are smaller than the margin of error, which may frequently occur for smaller student groups at the college. In such cases, colleges should review previous years of data to help ascertain the reliability of such observations.

Steps in Using the Percentage Point Gap Minus One Method:

- Identify a particular outcome or student equity indicator (e.g., access, course completion or retention, ESL and basic skills completion, degree and certificate completion, or transfer rate).

- Obtain the disaggregated data to identify the percentage for the subgroups $(\hat{p})$ and the percentage for all other students (p_o) within each primary characteristic: gender, age, ethnicity/race, foster youth, veterans, low-income or students with disabilities.

- Subtract the percentage of all other students(p_o) from the percentage of the subgroup $(\hat{p})$: PPG-1 = $\hat{p} - p_o$

- Use the margin of error (E) formula to calculate the E. If the calculated E is larger than or equal to 2%, use the calculated E; if the calculated E is less than 2%, use 2% as the E.

- Remember that adverse disproportionate impact is observed for positive outcomes when the value of PPG-1 is $\leq$ -E; this is when the percentage point gap is equal to or below the threshold (-E), in other words, PPG-1 is at most -E.

- For very small subgroups or cohort size (n ≤ 10), data is typically suppressed to ensure confidentiality and privacy. The margin of error will also typically be too wide—greater than 30% when the sample size is less than 10, so it is not advisable to estimate disproportionate impact under those conditions.

- To calculate the number of students needed to close the equity gap to help guide local planning and efforts:

    o change the percentage point gap minus one into its decimal equivalent
    o turn the negative into positive numbers (absolute value)
    o multiply the decimal number to the sample size or cohort size
    o round up the answer to the nearest whole number

Works Cited:

A.B. 504, Medina, Community Colleges: Student Success and Support Program Funding. (2017). Sacramento, CA:Legislative Assembly.

California Code of Regulations, Title 5. (2022). https://www.cde.ca.gov/ls/fa/sf/title5regs.asp

Center for Urban Education. (2015). Equity Academy Participant Workbook, AAC&U Committing to Equity andInclusive Excellence: Campus-based strategies for student success. Los Angeles, CA: Rossier School ofEducation, University of Southern California.

Triola, M. (2010). Elementary Statistics, 11th Ed. Pearson Publishing.

Appendix A: Margin of Error – Thresholds for the Percentage Point Gap (based on 50% sample proportion).

Appendix A provides a very rough estimation of the margin of error threshold, assuming 50% sample proportion; therefore, it is often an overestimation. The purpose of this appendix is to show the general idea that as sample size increases, margin of error decreases. Accurate margin of error calculation uses both sample size (n) and sample proportion ($\hat{p}$) and is potentially different from the percentages listed in the Appendix.

n	E	n	E	n	E	n	E
11	30%	41	15%	71	12%	110	9%
12	28%	42	15%	72	12%	120	9%
13	27%	43	15%	73	11%	130	9%
14	26%	44	15%	74	11%	140	8%
15	25%	45	15%	75	11%	150	8%
16	25%	46	14%	76	11%	160	8%
17	24%	47	14%	77	11%	170	8%
18	23%	48	14%	78	11%	180	7%
19	22%	49	14%	79	11%	190	7%
20	22%	50	14%	80	11%	200	7%
21	21%	51	14%	81	11%	210	7%
22	21%	52	14%	82	11%	220	7%
23	20%	53	13%	83	11%	230	6%
24	20%	54	13%	84	11%	240	6%
25	20%	55	13%	85	11%	250	6%
26	19%	56	13%	86	11%	260	6%
27	19%	57	13%	87	11%	270	6%
28	19%	58	13%	88	10%	280	6%
29	18%	59	13%	89	10%	290	6%
30	18%	60	13%	90	10%	300	6%
31	18%	61	13%	91	10%	310	6%
32	17%	62	12%	92	10%	320	5%
33	17%	63	12%	93	10%	330	5%
34	17%	64	12%	94	10%	340	5%
35	17%	65	12%	95	10%	350	5%
36	16%	66	12%	96	10%	360	5%
37	16%	67	12%	97	10%	370	5%
38	16%	68	12%	98	10%	380	5%
39	16%	69	12%	99	10%	390	5%
40	15%	70	12%	100	10%	400	5%

*The margin of error calculation uses 95% CI.