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Using Disproportionate Impact Methods to Identify Equity Gaps

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Introduction

What is Data Disaggregation?

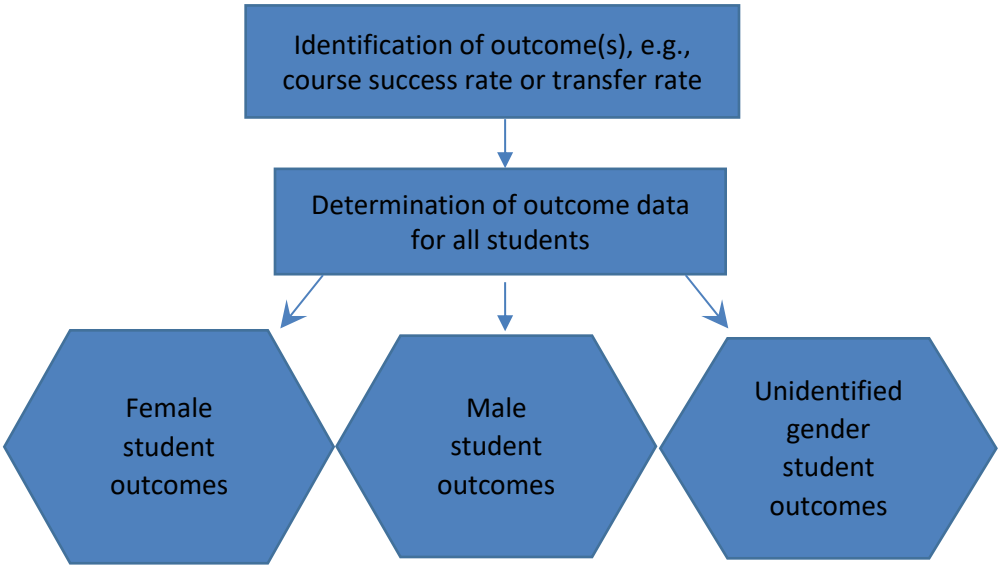
One of the most significant challenges that community colleges around the country face is how to achieve equity in educational outcomes, such as degree attainment or transfer to four-year universities, across various sub-populations of students (Bensimon, 2005). Indeed, a plethora of research studies point to gaps in educational outcomes, particularly among historically underrepresented groups, like African-American students (Harper, Patton, & Wooden, 2009; Lee, 2002; Ward, 2006).

When examining student data, one of the first things colleges may do is look at whether there are differences among particular student groups, such as males and females, with respect to one or more educational outcomes, such as degree completion rates. The process of examining outcomes separately by student groups is known as data disaggregation.

Figure 1 illustrates the data disaggregation process. The first step is identification of an outcome of interest, such as course success rates. In this case, the average course success rate for all students would then be calculated to provide a starting point for comparison. Then, average course success rates would be determined for specific subgroups of students, such as males and females. By comparing success rates for these subgroups to the success rates among all students, variations in achievement of this educational outcome can be identified.

Although Figure 1 offers a visual representation of the data disaggregation process as it pertains to examining differences between the educational outcomes of male and female students, this process can be used with respect to any subgroup of students, such as students of different ethnicities, ages, or other characteristics.

Figure 1. Example of the data disaggregation process



When one subgroup of students attains an outcome such as degree completion at a rate that is substantially lower than the benchmark rate, that subgroup may be referred to as "disproportionately impacted." According to the California Community Colleges Chancellor's Office (CCCCO), "disproportionate impact is a condition where some students' access to key resources and supports and ultimately their academic success may be hampered by inequitable practices, policies and approaches to student support" (Harris , 2013). Therefore, differences in educational outcomes between subgroups of students may suggest that one group has less access to support services, is in need of relatively greater support, and/or must address certain obstacles in order to attain those outcomes at rates comparable to their peers.

When examining student data for evidence of disproportionate impact, one of the questions faced by colleges is how to measure that impact. The primary method by which to measure disproportionate impact, as determined by the California Community Colleges Chancellor's Office (CCCCO, 2017), is the percentage point gap method. However, there are two other methods to measuring disproportionate impact, both of which are also introduced in this paper: The 80% index and the proportionality index. This paper offers readers an overview of each method, as well as a variety of examples of actual data from colleges around the state.

Reader's Guide

The first step in addressing equity gaps is to identify them. How can we determine, with some degree of certainty, whether one or more student groups on our campus is in particular need of assistance in order to succeed?

This paper tackles this question by delving into the three methods typically used to identify equity gaps, comparing and contrasting the benefits of each approach, and then demonstrating how these methods can be utilized through examination of three case studies. While data and statistics are discussed, this review is intended for a general audience of educators and practitioners. The goal is to help readers garner the skills and knowledge that will facilitate dialogue, planning, and action concerning equity gaps.

Overview of Three Approaches to Measuring Disproportionate Impact

The Percentage Point Gap Index

California Assembly Bill 504 (2017) requires that the California Community College Chancellor's Office establish a single standard method by which to measure disproportionate impact. The CCCCO selected the percentage point gap method as the standard method, largely due to ease with which it can be applied (CCCCO, 2017). The percentage point gap approach measures the difference in percentage points between a given demographic group's educational outcomes and the overall average (or mean) for those outcomes across all demographic groups (CCCCO, 2017; Harris, 2015). Those differences may be positive (as when a subgroup achieves better

than average mark) or negative (as when a subgroup achieves lower than average mark). For instance, if 10% of one subgroup of students placed into transfer-level math, but 20% of all students placed into transfer-level math, then the point gap value for the subgroup in question would be negative ten (-10). In contrast, if 30% of another sub-group of students placed into transfer-level math, but 20% of all students placed into transfer-level math, then the point gap value for the subgroup in question would be positive ten (10). Therefore, the percentage point gap approach can be expressed as follows:

> *Percentage point gap = % of outcome for students in subgroup – % of outcome for all students*

The larger the negative difference between these two figures, the more likely that such a difference is reflective of disproportionate impact. According the chancellor's office (CCCCO, 2017), point gap values of negative three or higher are indicate of disproportionate impact *when the subgroup in question comprises 800 or more cases*. So, if you are examining ethnic group differences in transfer-level placement and you find that the 800 African American students in your comparison achieve a placement rate three percentage points lower than the overall average at your college, then that finding would constitute an instance of disproportionate impact.

However, if you have fewer than 800 students in the subgroup in question (as may be the case at smaller colleges or when working with special populations of students), then the point gap value necessary for documenting an instance of disproportionate impact will be higher than three percentage points described earlier. The point gap value necessary for identifying an instance of disproportionate impact depends upon the number of students in your subgroup (i.e., sample size). As described by the chancellor's office (CCCC, 2017), you must compute what is known as the margin of error (E).[1] While an explanation of the statistical underpinnings of the margin of error falls beyond the scope of this paper, it is helpful to think of it as how large we can reasonably expect a percentage point gap value to be given how many students are in our subgroup. A margin of error of 10 percentage points for a subgroup means that if we were to conduct the same comparison of that subgroup to the overall average 100 times, we would likely find the percentage point gap value between the subgroup and the overall average to be within 10 points 95 out those 100 times that we conducted that comparison.[2] The margin of error (E) formula put forth by the chancellor's office (CCCCO, 2017), expressed as a percentage, is as follows:

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[1] An alternative approach recommended by the chancellor's office is to compute a standard score (or z-score) that reflects the difference between the subgroup and the overall average (Ramirez-Faghih & Fuller, 2017). Standard scores of two or greater (i.e., $\geq$ -2) would be indicative of disproportionate impact. For more information on standard scores, please see https://statistics.laerd.com/statistical-guides/standard-score.php

[2] Please note that this is based upon a 95% confidence level. For a brief overview of margin of error and confidence level, please see https://www.isixsigma.com/tools-templates/sampling-data/margin-error-and-confidence-levels-made-simple

$$E = \left(1.96\sqrt{\frac{(.25)}{n}}\right) * 100$$

Where n refers to the number of students in your subgroup. Thus, if you are examining the transfer placement rate among 100 Asian students, the margin of error (E) would be as follows:

$$E = \left(1.96\sqrt{\frac{(.25)}{100}}\right) * 100 = 9.8\%$$

This means that you would have to find a point gap value of -9.9 percentage points or greater for your group of Asian students to conclude that that they are disproportionately impacted. In other words, values more positive than -9.8 percentage points (e.g., - 5.0, -3.0) would not be large enough to conclude that disproportionate impact was present. The reason for this is that, given the 100 Asian students in your comparison, you should expect to find point gap values of as low as -9.8 percentage points (in fact, you will likely find corresponding point gap values for this subgroup to be between -9.8% and 9.8% 95 out of the 100 times that you examined such data). Values of -9.9 or -10, on the other hand, would be considered large enough for us to conclude that a real difference exists between the subgroup (e.g., Asian students) and the overall average of all students at our college.

To facilitate the computational process required for this approach, the chancellor's office (CCCCO, 2017) has included an appendix (Appendix A) that provides readers with a listing of margin of error values for all sample sizes up to 800; thus a reader need only refer to this table to determine whether the point gap value they have computed represents an instance of disproportionate impact. Also noteworthy is that the chancellor's office does not recommend colleges employ the percentage point gap method (and presumably, any other disproportionate impact method) in instances when the sample size for a given subgroup is lower than ten – this is in part due to privacy concerns and in part due to the fact that the resulting margin of error would be greater than 30% (CCCCO, 2017). When faced with these circumstances (as may be the case at smaller colleges), it is recommended that colleges consider aggregating two or more years of data to achieve the recommended sample size of ten (J. Lessard, personal communication, December 5, 2017).

Table 1 on the following page illustrates course success rates across ethnic groups reported by Fullerton College as part of their 2014-2015 Student Equity Plan (Vurdien, DuBois, Nunez, Foster, & Greenhalgh, 2014). The success rate against which each subgroup's success rate is compared is 66.3% because it is the average success rate across all the subgroups. The first column from the right, Point Gap Value, reflects the difference between each group's specific course success rate and the overall course success rate. A positive sign in front of the point gap value indicates that a group's course success rate is higher than the overall success rate, while a negative sign reflects a lower success rate in the corresponding group. It is these negative values we are particularly interested in to identify possible instances of disproportionate impact. In this case, we have negative point gap values for three groups, African American students (-11.8), Pacific Islander students (-12.8), and unknown students (-6.1). The question is

whether such gaps are large enough to be considered instances of disproportionate impact. Based on each group's margin of error, as defined by the chancellor's calculation of margin of error (see the aforementioned formula or Appendix A in CCCCO, 2017), we are able to identify a margin of error (labeled MOE Threshold in Table 1) threshold for each group; this threshold reflects the cut-off value beyond which a subgroup's point gap value must be to be considered an instance of disproportionate impact. For example, in the case of African American students, the MOE threshold value is -3 percentage points and the observed percentage point gap value is -11.8; given that the observed value is more negative than its corresponding MOE threshold value, we can conclude that African American students are indeed disproportionately impacted. Similarly, the MOE threshold for Pacific Islander students is -6 percentage points and the observed percentage point gap value is -12.8; because the observed value is more negative than its corresponding MOE threshold value, we can conclude that Pacific Islander students are also disproportionately impacted. Lastly, because the observed negative percentage point gap value for students about whom we do not have any ethnicity information (-6.1) exceeds its corresponding MOE threshold (-3 percentage points), we also conclude that they are disproportionately impacted.

Table 1. Course Success Rates by Ethnicity and Percentage Point Gap Value

Ethnic Group	Cohort Count	Outcome Count	Success Rate (Per Group)	MOE Threshold	Point Gap Value
African American	**2,547**	**1,388**	**54.50%**	**-3%**	**-11.8**
American Indian	213	144	67.61%	-7%	+1.3
Asian	9,834	7,166	72.87%	-3%	+6.6
Hispanic	35,055	22,304	63.63%	-3%	-2.7
Multi Ethnic	2,261	1,468	64.93%	-3%	+1.4
Pacific Islander	**286**	**153**	**53.50%**	**-6%**	**-12.8**
White	16,696	11,878	71.14%	-3%	+4.8
Unknown	**2,508**	**1,509**	**60.17%**	**-3%**	**-6.1**
Total	**69,400**	**100%**	**66.30%**		

Note. Percentage point gaps values were computed by taking the difference between each subgroup's success rate and the overall success rate (e.g., 54.5% - 66.3% = -11.8 percentage point gap).

Source: Vurdien, et al. (2014)

Figure 2. Percentage Point Gap Values and Margin of Errors by Ethnicity

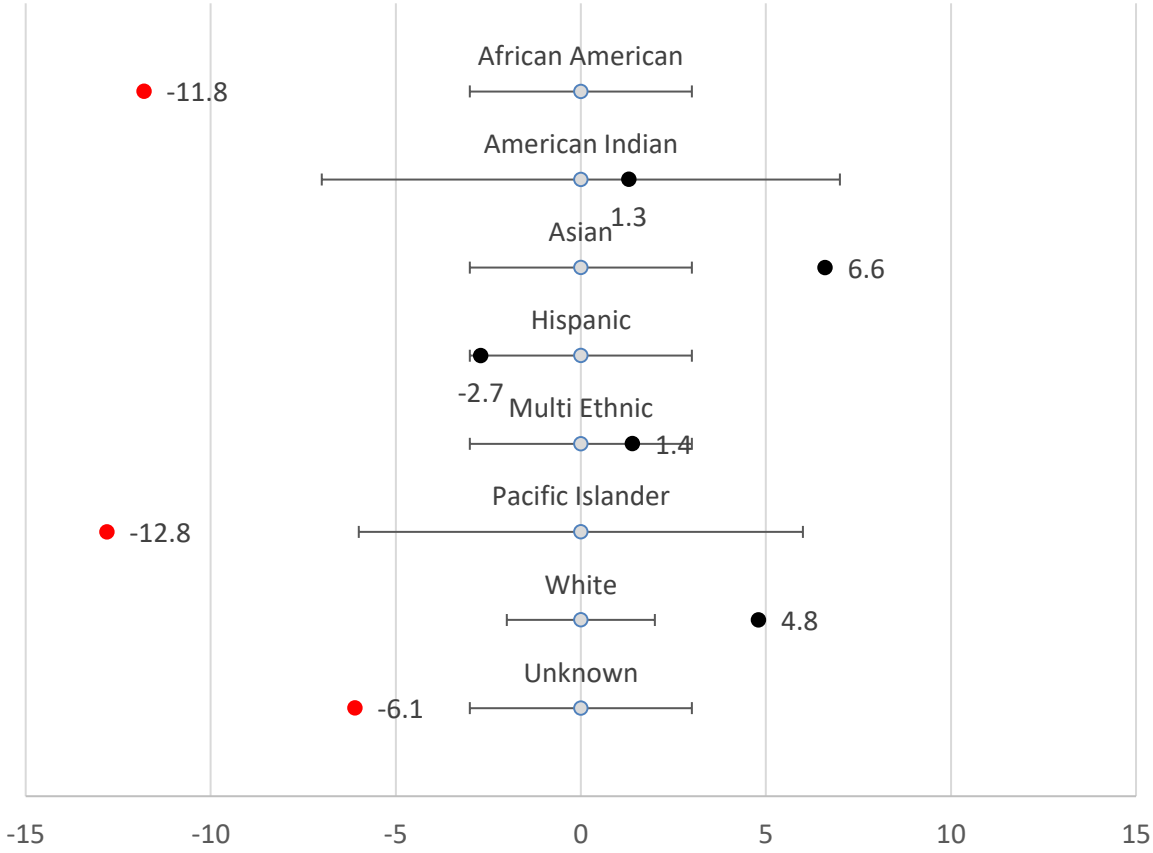


Figure 2 illustrates the same findings illustrated in Table 1, except it offers readers a visual depiction of the point gap values and corresponding margin of errors. Negative percentage point gap values exceeding the range offered by a given margin of error denote instances of disproportionate impact, as is the case with African American, Pacific Islander, and unknown students. Thus, findings stemming from the use of the percentage point gap approach indicate that those groups are disproportionately impacted. As such, these are the student groups for which institutional strategies should be implemented to improve their chances for educational success.

Limitations of the Percentage Point Gap Index

The percentage point gap method serves as the standard methodology for California community colleges – all colleges will likely be required to employ this method for all planning documents submitted to the chancellor's office. However, there are a few noteworthy limitations associated with using the percentage point gap and margin of error approach. First, the use of the margin of error presumes one is working with samples rather than populations of students. The margin of error reflects one's best guess concerning the success rate of a given ethnic group in the population of students we are working with (e.g., based on the earlier example with an average success rate of 66.3%, African American students were hypothesized

to have success rates between 63.3% and 69. 3% due to the margin of error of three percentage points). However, in many cases, colleges have access to the success rates of all the students at their campus, meaning that they have access to the entire population of students. For instance, there is no need to use a sample of Hispanic students at a college to estimate the success rates of all the Hispanic students when said college can simply examine the grades of each and every one of its Hispanic students, calculate a percentage point gap to determine if the success rate among Hispanic students is lower than that of all students, and if so, conclude that Hispanic students are disproportionately impacted. From this standpoint, the margin of error represents an unnecessary step for many colleges. On the other hand, the margin of error approach does underscore the importance of the number of student records one is using to make potential institutional decisions. Even when working populations of students, one should be mindful of the number of students belonging to a subgroup identified as disproportionately impacted. Disproportionate impact findings based upon a small number of students (e.g., fewer than 30) should be examined with some caution as such findings are subject to greater variability than seen with larger groups. In other words, the results observed for such small groups may fluctuate greatly when examined in the future, calling into question the reliability of the findings. It is for this reason that colleges may want to establish a higher disproportionate impact threshold (e.g., a point gap greater than seven points) or rely on the CCCCO's margin of error approach to identify disproportionate impact among smaller groups. Correspondingly, a smaller threshold (e.g., a point gap value greater than three points) can be used to identify disproportionate impact in larger groups. To reiterate, disproportionate impact findings stemming from fewer than 30 students should be viewed with caution. Additional data collection or combining multiple years of data is recommended to increase confidence in the reliability of findings in these cases.

A second limitation is that the point gap approach is founded upon the notion of generating an overall benchmark value based upon outcomes data aggregated from all of the demographic groups. This means that demographic groups with the highest number of students will tend to show outcomes with values that are close to the overall average, resulting in relatively low point gap differences. These minimal differences, however, do not necessarily indicate a lack of disproportionate impact; rather, the large number of students in such subgroups may inadvertently obscure cases of disproportionate impact when using the percentage point gap approach. To address this issue, the CCCCO recommends that colleges consider comparing the performance of such groups to the same demographic groups at other similar colleges (Harris, 2015). In addition, the author recommends that colleges consider comparing larger demographic groups to an aggregate value that does *not* include the demographic group in question. For instance, if Hispanic students represent 50% of the student body at a particular campus, then a comparison of success rates using the percentage point gap method may yield a small point gap difference between Hispanic students and the student population as a whole. To address this potentially misleading result, one could calculate the aggregate success rate by including data only for non-Hispanic student groups. This approach would highlight any difference between Hispanic students (or any highly represented group at the college) and the remainder of the student population. Another approach is to use the highest performing group, rather than the overall average, as the reference group (CCCCO, 2017).

The 80% Rule Index

In light of the aforementioned limitations, the author recommends that colleges employ additional disproportionate impact methods to corroborate findings stemming from the use of the percentage point gap method. Employing more than one method to identify disproportionate impact can increase colleges' certainty concerning which groups of students are disproportionately impacted, and the approach can help colleges identify groups of students that are consistently found to be disproportionately impacted across a variety of methods.

One of those additional method for assess disproportionate impact is the 80% rule index. This index helps answer the question, "Do any subgroups achieve a particular educational outcome less than 80% of the time that the highest achieving subgroup successfully attains that outcome?" The 80% criterion is drawn from the guidelines codified in the 1978 Uniform Guidelines on Employee Selection Procedures (U.S. Equal Opportunity Commission, 1979).

Table 2 below examines the same course success rate by ethnicity data from Fullerton College shown in the previous two tables. For each ethnic group, the total number of students in the cohort is identified (i.e., all students who took a graded class), along with the number of students who achieved a successful course outcome (grade C or better). The success rates (successful outcomes divided by total cohort count) are then listed in the adjacent column.

Table 2. Course Success Rates by Ethnicity with 80% Rule Indices

Ethnic Group	Cohort Count	Outcome Count	Success Rate	80% Index
African American	**2,547**	**1,388**	**54.5%**	**74.8%**
American Indian	213	144	67.6%	92.8%
Asian	9,834	7,166	72.9%	100%
Hispanic	35,055	22,304	63.6%	87.3%
Multi Ethnic	2,261	1,468	64.9%	89.1%
Pacific Islander	**286**	**153**	**53.5%**	**73.4%**
White	16,696	11,878	71.1%	97.6%
Unknown	2,508	1,509	60.2%	82.6%
Total	69,400	46,010	66.3%	

Source: Vurdien, et al. (2014)

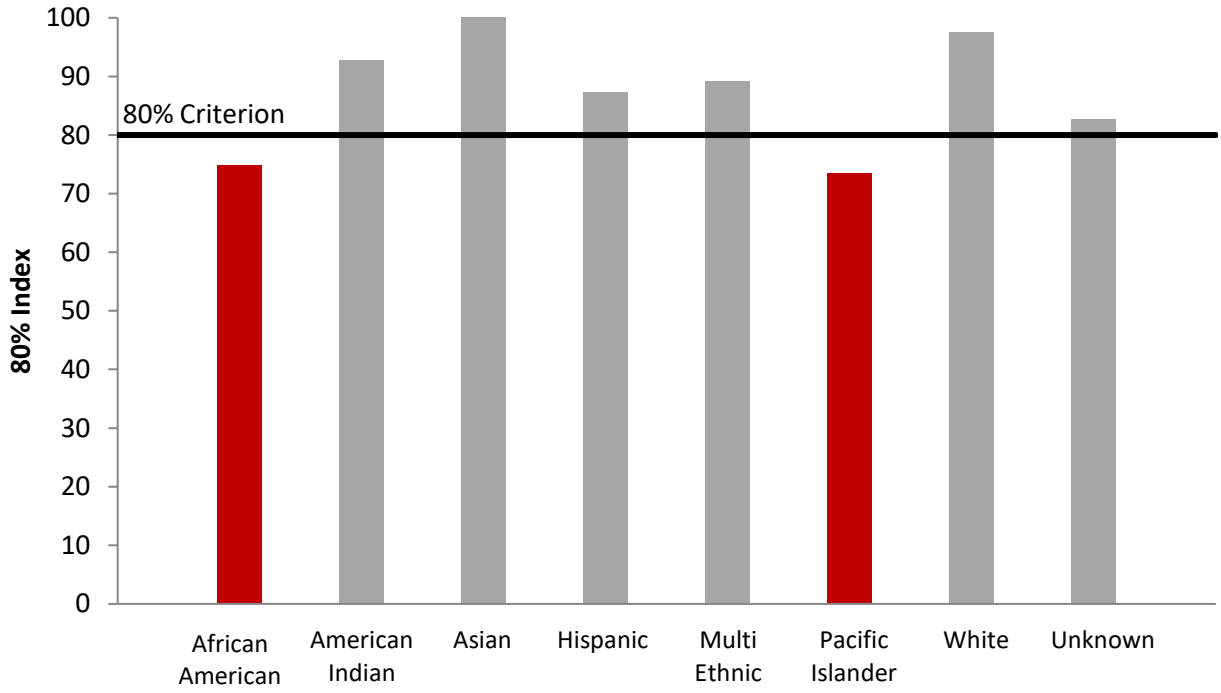
Utilization of the 80% rule index to assess disproportionate impact starts with the identification of the subgroup with the highest rate of success, referred to as the "reference" group. In this case, Asian students represent the reference group, with a success rate of 73%. The next step is

to divide the success rate of each ethnic group by that of the reference group. This method can be summarized as follows:

80% index = cohort group rate ÷ reference group rate

The term *cohort group rate* refers to the success rate of the particular subgroup being examined (e.g., African-American students), and the term *reference group rate* refers to that of the group earning the highest success rate (e.g., Asian students). As illustrated in the column in Table 1 labeled 80% Index, the majority of ethnic groups in this example achieved success rates that were within 80% of the rate achieved by Asian students. However, two groups—African-American students and Pacific Islander students—had success rates that were less than 80% of the reference group's success rate. This indicates that African-American and Pacific Islander students were disproportionately impacted. This is further illustrated in Figure 3, which displays the 80% indices relative to the 80% criterion; again, African-American and Pacific Islander students were to the two groups with success rates below the 80% criterion, pointing to disproportionate impact. As a result of these findings, Fullerton College proceeded to identify activities designed to address these gaps in educational success in their student equity plan.

Figure 3. The 80% Indices by Ethnicity



One limitation to using this index is the same one that can be leveled against any of the three disproportionate impact methods (and discussed earlier with respect to the percentage point gap method) – practitioners should be mindful of the records of students that the corresponding percentages are based upon. Percentages based on fewer than 30 student records are subject to fluctuate more from year-to-year than are percentages based on more

than 30 records. As noted earlier, colleges faced with a such a predicament are urged to aggregate across two or more years.

The Proportionality Index (PI)

The proportionality index (PI) is a third method for identifying disproportionate impact. This method addresses the question, "If a subgroup of students represents 45% of the student body, does that subgroup also represent at least 45% of the students who achieve a specific educational outcome?" Theoretically, if educational achievement was equitable across all subgroups of students, the answer to this question would be "yes." However, when a group's representation with respect to one or more educational outcomes is found to be at a lower rate than its representation in the general student body, disproportionate impact may be indicated (depending on the size of the observed difference).

The calculation used to measure the PI can be described as follows:

Proportionality index = proportion in outcome group ÷ proportion in cohort

In the equation above, the proportion of students in a particular cohort reflects that subgroup's relative representation across an entire student body; the proportion of students in the outcome group reflects the representation of that same subgroup among all students achieving a certain educational outcome. A proportionality index of 1.00 indicates that a group's representation among those achieving an educational outcome is identical to that group's representation in the student population. In contrast, a PI value of less than 1.00 indicates that a group's representation among those achieving an educational outcome is lower compared to that same group's representation in the student population – it is this circumstance that reflects a possible instance of disproportionate impact.

While PI values less than 1.00 reflect possible instances of disproportionate impact, Bensimon and Malcolm-Piqueux (as cited by Harris, 2015) have recommended using values equal to or less than 0.85 to identify instances of disproportionate impact. The author explored this further by reviewing 28 randomly selected student equity plans from community colleges around California. The author found that 14 of the 28 colleges utilized the PI index to help identify gaps in achievement between student demographic groups. Ten of these colleges (71%) employed a cut-off value between 0.80 and 0.89, and among them, six colleges (43% of original sample of 14) employed cut-off values between 0.80 and 0.85. Taken together, such evidence corroborates the 0.85 value recommended by Bensimon and Malcolm-Piqueux. More recently, the chancellor's office (Ramirez-Faghih & Fuller, 2017) offered a two-tiered approach whereby PI index values between 0.80 and 0.89 reflect "some evidence" of disproportionate impact and values below 0.80 reflect a clear instance of disproportionate impact. Thus, while this matter merits further investigation, the available sources suggest that readers should feel confident in employing a cut-off value between 0.80 and 0.89.

Table 3 presents the same data from Fullerton College's student equity plan that was shown in Table 2. However, this table compares the percentage of students in a particular subgroup

found in the student population (i.e., cohort percentage) to the percentage of students in that subgroup who achieved a successful course outcome. A PI cut-off of 0.85 would identify the same groups as disproportionately impacted as the 80% rule did (see Table 2).

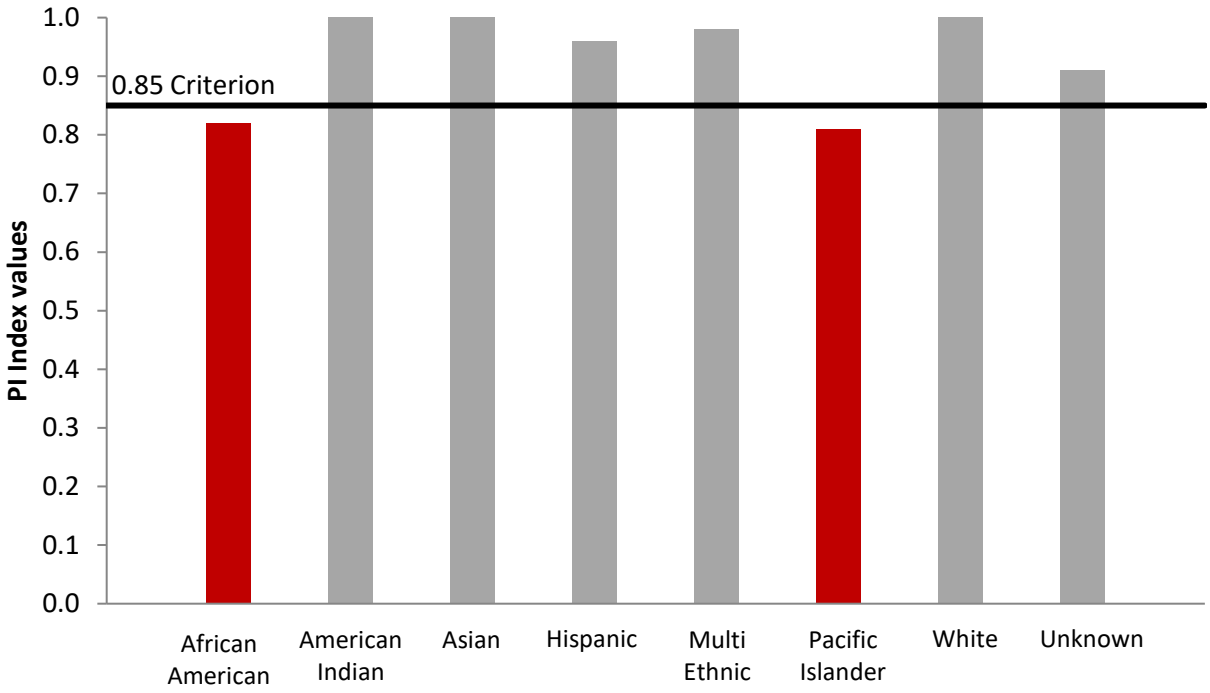
Table 3. Course Success Rates by Ethnicity and Proportionality Indices

Ethnicity	Proportion of Cohort		Proportion of Successful Grade Outcomes		Proportionality Index
	Count	Percent	Count	Percent	
African American	**2,547**	**3.67%**	**1,388**	**3.02%**	**0.82**
American Indian	213	0.31%	144	0.31%	1.02
Asian	9,834	14.17%	7,166	15.57%	1.10
Hispanic	35,055	50.51%	22,304	48.48%	0.96
Multi Ethnic	2,261	3.26%	1,468	3.19%	0.98
Pacific Islander	**286**	**0.41%**	**153**	**0.33%**	**0.81**
White	16,696	24.06%	11,878	25.82%	1.07
Unknown	2,508	3.61%	1,509	3.28%	0.91
Total	**69,400**	**100%**	**46,010**	**100%**	**1.00**

Source: Vurdien, et al. (2014)

As illustrated in Table 3, proportionality indices are greater than 0.90 for all groups except two: African-American students (0.82) and Pacific Islander students (0.81). These PI results reflect, for example, that although African-American students make up 3.67% of the overall student population, they are successful in courses only 3.02% of the time (see Figure 4 for a graphical illustration). This suggests, as Fullerton College concluded, that these two groups may be considered to be disproportionately impacted.

Figure 4. The Proportionality Indices by Ethnicity



Broad Considerations When Employing Disproportionate Impact Approaches and the Student Equity Number

The methods outlined in this paper offer readers some insight in to the approaches typically utilized to determine instances of disproportionate impact. The methods are easy to employ from a mathematical standpoint (arguably, I suppose) and generally offer practitioners with standard benchmarks to work with. However, as noted earlier, there are some limitations associated with the methods (see Table 4 for an outline of the advantages and disadvantages of each of the three methods discussed in this paper). Additional work in this area should provide practitioners with practical advice concerning the circumstances when one or two of the indices are especially likely to yield findings consistent with a conclusion of disproportionate impact or when the methods may yield conflicting findings. Until such work is conducted, the author recommends that practitioners consistently employ the percentage point gap method endorsed by the chancellor's office coupled with at least either the 80% index and/or the PI index. Indeed, a practical approach would be to employ all three methods and prioritize the instances of disproportionate impact in which two or three methods point to it.

Table 4. Comparison of Disproportionate Impact Methods

	Advantages	Disadvantages
80% Rule Index	• Clearly establishes cutoff value for determining DI • Effective method for comparisons between subgroups	• Rigid 80% cutoff can curtail discussion or further exploration • May be subject to error if sample size is very small
Proportionality Index	• Effective method for assessing equitable group representation	• No universally agreed-upon benchmark value for DI • May be subject to error if sample size is very small
Percentage Point Gap Index/ Margin of Error	• Easy to calculate • Places emphasis on number of student records	• DI of most well-represented group(s) may be obscured • MOE is based on sample estimates when colleges typically work with populations

Another method that may offer users a practical way by which to gauge the magnitude of equity gaps that exist at their colleges is to examine the number of students needed to close said gap (CCCCO, 2017; Ramirez-Faghih & Fuller, 2017). The author refers to this as the *student equity number* because it reflects the number of students you need to experience a successful outcome to eliminate an observed equity gap. The benefit to this approach is that rather than relying on metrics and thresholds, it places the focus on the actual number of students whose outcomes must change to close an observed gap. For instance, if the average success rate at your college is 70% and the success rate of African American students is 60%, the equity number reflects the number of African American students you would need to achieve a successful grade to increase that success rate of 60% to 70%. In this way, the equity number offers practitioners – faculty, staff, and administrators – some perspective as to the scope of the challenge they face in minimizing or eliminating that gap (after all, an equity number of 1,000 would likely present a greater institutional challenge than would an equity number of 10). The chancellor's office has offered a method by which to readily obtain the equity number, based on the obtained percentage point gap (CCCCO, 2017):

$$Equity\ Number = \frac{|PPG|}{100} * (Cohort\ Count)$$

Where the $|PPG|$ refers to the absolute value of the observed percentage point gap (i.e., any negative values would be converted to positive values) and *Cohort Count* refers to the number of individuals in a given cohort. Consider Table 5 – it depicts all the negative PPG values illustrated in Table 1. Since they are negative values, we know that they reflect instances in which the corresponding ethnic group achieved a lower than average success rate. Employing the aforementioned approach to calculating the equity number, we can then see, for each ethnic group, the number of additional students that would need to achieve a successful

outcome in order to eliminate the observed percentage point gap. In our example, 301 additional African American students in the cohort would have to achieve a successful outcome to eliminate the observed gap in success. Similarly, we would need 37 additional Pacific Islander students to eliminate the observed gap in success. Also notable is the equity number of for Hispanic students. While the percentage point gap value for the group was not large enough to count as an instance of disproportionate impact (based upon the aforementioned margin of error method), we would need over 900 more Hispanic students (more than three times the number of African American students) to eliminate the observed gap in success among Hispanic students. The reason for this is due to number of students in the cohort; the equity number of 946 is commensurate with 2.7% of all Hispanic students (35,055). In this way, the observed equity gap is driven both by the observed percentage point gap value *and* the number of individuals in a given cohort (i.e., cohort count). This means that just because a group is not identified as disproportionately impacted, it does not mean that no equity gap exists; in fact, depending on the size of the cohort, the observed gap for a group not found to be disproportionately impacted may actually be a larger than that of another group found to be disproportionately impacted. See Figure 5 for a visual depiction of these equity numbers (bars highlighted in red reflect groups found to be disproportionately impacted, based upon the chancellor's office margin of error approach).

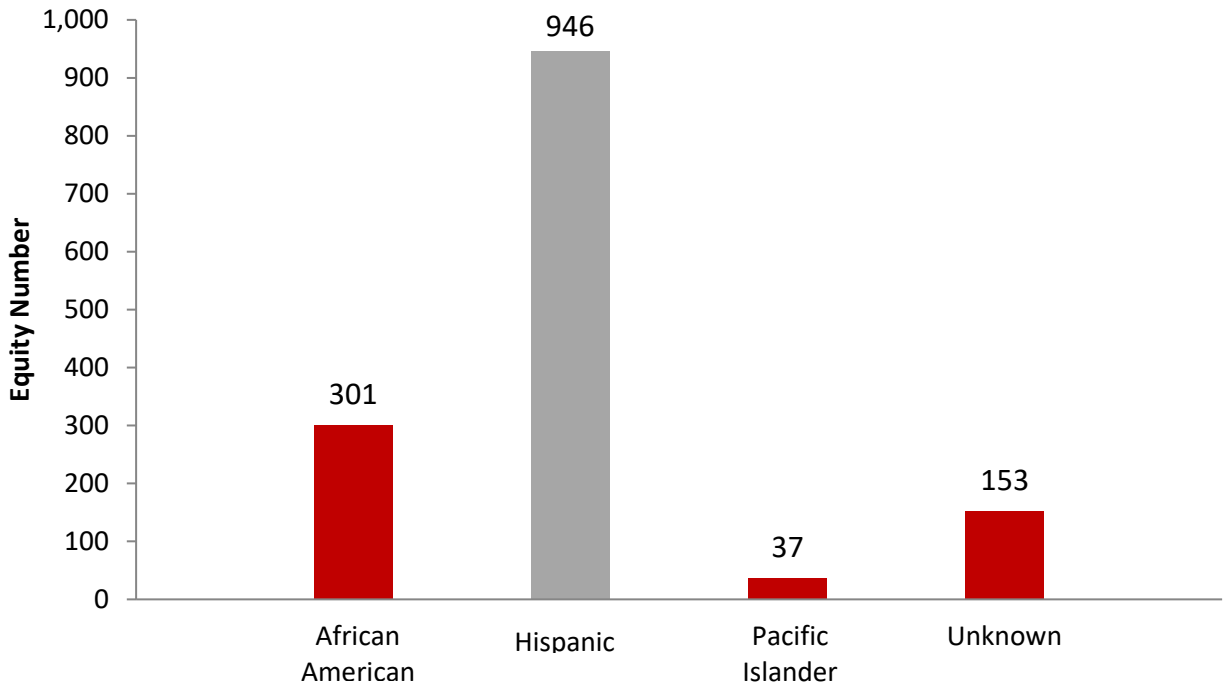
To be clear, practitioners should still use the aforementioned methods to identify instances of disproportionate impact, including the percentage point gap method. Nevertheless, the equity number offers practitioners another tool in their efforts to identify and address local equity gaps. Indeed, the chancellor's office stresses that the equity number should not be construed as a quota in any way – but rather, an estimate of the number of students a college should strive to reach out to in order to address the observed gap (CCCCO, 2017). One way to conceptualize the benefits of examining the equity number is to consider the aforementioned approaches (i.e., PPG, 80% Index, Proportionality Index) as approaches by which to identify potential instances of disproportionate impact and the equity number as a key method by which to examine how large that disproportionate impact might be.

Table 5. Equity Numbers Stemming from the Negative Percentage Point Gap Values Depicted in Table 1

Ethnicity	|PPG|	Decimal Equivalent	Multiply	Cohort Count	Equity Number
African American	**11.8**	.118	X	2,547	301
Hispanic	2.7	.027	X	35,055	946
Pacific Islander	**12.8**	.128	X	286	37
Unknown	**6.1**	.061	X	2,508	153

Note. The formatting of this table was adapted from chancellor's office documentation (CCCCO, 2017). The reported PPG values are based upon an average success rate of 66.3. PPG values in red font are ones that were also found to reflect instances of disproportionate impact, based upon the chancellor's office margin of error method. Equity number values were rounded up (or down) to the nearest whole number.

Figure 5. Equity Numbers by Ethnic Groups



The Use of DI Measurement Approaches in Three Case Studies

In the following section, the report offers three case studies to demonstrate the results of utilizing each of the previously described data disaggregation measurement methods with real-world California Community College data.

Case Study 1: Identifying Disproportionate Impact among Students Applying but not Partaking in Orientation

This first case study addresses potential disproportionate impact among students applying to a community college but not participating in the college's orientation. Are certain subgroups more likely than others to apply but not complete their orientation? If so, then which aspect of the matriculation process appears to present the largest obstacle? The data for this case study come from the fall 2016 semester at Crafton Hills College in Yucaipa, California. A key question the college sought to answer was whether disproportionate impact existed with respect to the percentage of students that participated in the college's student orientation. Such findings would shed light on the demographic groups that might need additional outreach and education so as to complete a key step in the matriculation process.

Table 6 illustrates the orientation participation rates for students of various age groups among Crafton Hills College applicants that did not enroll in any classes. Additionally, the table presents findings on the basis of the three aforementioned disproportionate impact indices.

Table 6. Orientation Rates by Age Groups Among Students Applying but Not Participating in Orientation at Crafton Hills College

Age Group	Cohort Count	Outcome Count	Orientation Participation Rate	80% Index	Point Gap Index	Proportion Index
19 or younger	957	322	33.65%	100%	+6.66	1.25
20 – 24	562	130	23.13%	68.74%	-3.86	0.86
25+	574	113	19.69%	58.51%	-7.30	0.73
Total	**2,093**	**565**	**26.99%**			
Source: Sosa (2016)						

Percentage Point Gap Index Analysis

To analyze the above data using the percentage point gap approach, one measures the difference between the orientation participation rate for all 2,093 applicants and that of students in each individual age group. Given the orientation rate of 26.99% across all 2,093 students, and bearing in mind the chancellor's office margin of error approach, the findings suggest that both 20-24 year olds (-3.86) and those 25 or older (-7.30) were disproportionately impacted.

80% Rule Index Analysis

The youngest age group (19 or younger) was identified as the reference group, as these students had the highest orientation participation rate. The participation rates of the two older age groups were then divided by that of the rate for students age 19 or younger. This approach also revealed that the two older age groups were disproportionately impacted: 20-24 year olds (68.74%) and those 25 or older (58.51%).

Proportionality Index Analysis

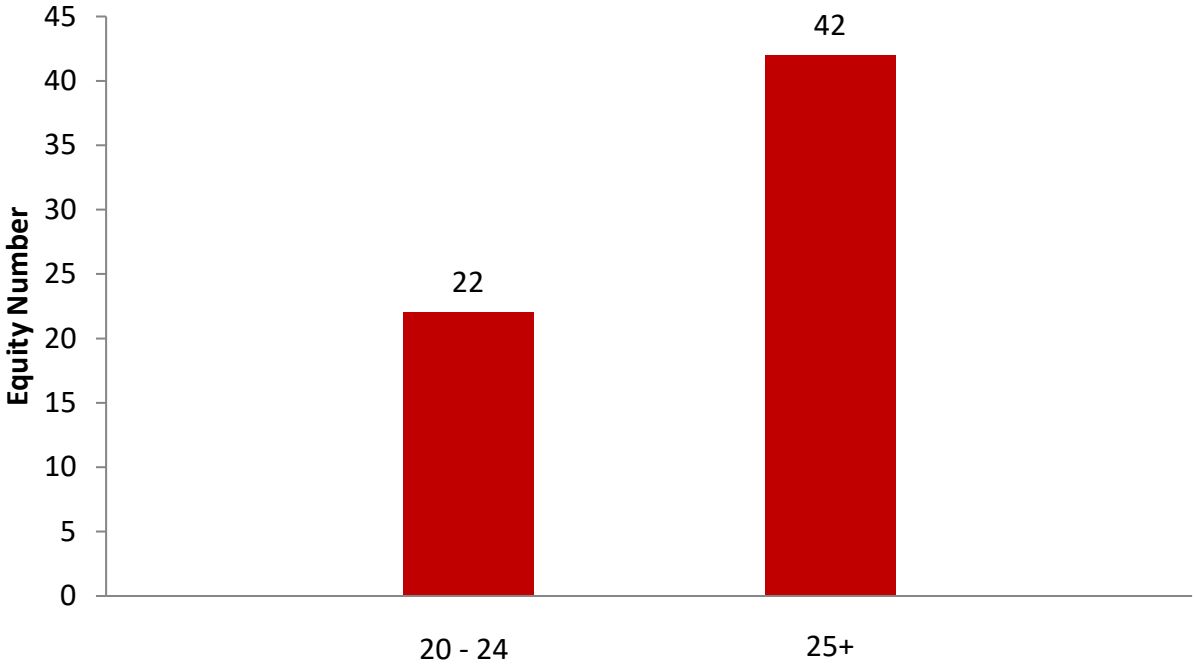
As described earlier, the proportionality index compares a demographic group's representation across the college to the same demographic group's representation among those achieving a particular educational outcome. To use the proportionality index in this case study, the number of individuals in a specific age group that participated in orientation is divided by the total number of individuals that participated in orientation. For instance, one would divide the number of students ages 25 or older who participated in orientation (113) by the total number of individuals participating in orientation (565), producing a result of .20. The second step in

this process would be to divide the total number of individuals in that age group (574 total students over age 25) by the number of individuals in the entire cohort (2,093), which comes to .27. Finally, the PI is determined by dividing those resulting ratios (0.20 ÷ 0.27 = 0.73). The same approach would yield a PI value of 0.86 for those between the ages of 20 and 24, and a PI value of 1.25 for those students 19 years of age or younger. On the basis of these findings, and using the 0.89 cutoff put forward by the chancellor's office (Ramirez-Faghih & Fuller, 2017), we conclude that both students between 20 and 24, and students 25 or older, were disproportionately impacted.

Equity Number Analysis

Figure 6 for illustrates the equity numbers among the age groups with negative percentage point gap values (both bars in the figure are in red because, as noted earlier, both groups were identified as disproportionately impacted based upon the chancellor's office margin of error approach). The equity number reflects the number of students in potentially disproportionately impacted groups that would have to achieve a successful outcome to eliminate the observed equity gap. It thus functions a practical approach by which to gauge the magnitude of the observed equity gap. In the context of this cases study, the equity numbers were examined among the two age groups with lower than average orientation participation – those between the ages of 20 and 24, and those 25 or older. In the case of those between 20 and 24, the equity number was 22; this means that 22 additional students out of the 562 total students in that cohort would have to participate in the orientation for the observed gap to be eliminated. Similarly, in the case of those 25 or older, the equity number was found to be 42, indicating that 42 additional students out of the 574 total students in the cohort would have to participate in the orientation to eliminate the observed equity gap.

Figure 6. Equity Numbers by Age Groups with Negative PPG Values



Overall Data Disaggregation Determination

Given the evidence generated using the three disproportionate impact methods, it appears that two groups in this example are disproportionately impacted: Applicants between the ages of 20 and 24 and those 25 or older. In addition, the respective equity numbers indicate that over 20 additional students in each age group would have to participate in the college's orientation to eliminate the observed equity gaps. Such findings suggest that the institution should prioritize developing and implementing strategies designed to mitigate (or eliminate) obstacles that older applicants might be experiencing by exploring, perhaps via survey or focus groups, why such applicants are not taking the next step in the matriculation process.

Case Study 2: Investigating Disproportionate Impact in the Context of Course Placements

This second case study addresses possible disproportionate impact among ethnic groups in the context of course placements. This case examines fall 2015 data submitted by Riverside Community College District as part of their participation in the California Acceleration Project.

Table 7 below displays data related to placement rates into transfer-level English courses, disaggregated by ethnic group. In addition, the table illustrates the findings stemming from the use of the three disproportionate impact indices. Due to the small number of students within several ethnic groups at Riverside Community College, this analysis focuses on only four groups: (1) African American, (2) Asian, (3) Hispanic, and (4) White.

Table 7. Course Placement Rates in Transfer-Level English at Riverside Community College by Ethnicity and the Three Disproportionate Impact Indices

Ethnic Group	Cohort Count	Outcome Count	Placement Rate	80% Index	Percentage Point Gap	Proportionality Index
African-American	335	38	11.34%	39.94%	-6.46	0.64
Asian	141	30	21.28%	73.08%	3.48	1.20
Hispanic	2310	357	15.45%	53.06%	-2.35	0.87
White	625	182	29.12%	100.00%	11.32	1.64
Total	**3,411**	**607**	**17.80%**			

Source: Riverside Community College (2015).

Point Gap Index Analysis

The aim here is to take the difference between the placement rate for all 3,411 students in the cohort and that of each individual ethnic group. Given the overall placement rate of 17.80% across all students in the cohort, and the chancellor's office margin of error approach, African-American students were found to be disproportionately impacted with a -6.46 percentage point gap. While Hispanic students were placed intro transfer-level courses at lower than average rates, the observed gap (PPG = -2.35) was not low enough, based on the chancellor's office margin of error approach, to be identified as reflective of disproportionate impact. However, it is not surprising to find that Hispanic students are not disproportionately impacted. As noted earlier, one drawback of using the percentage point gap method is that demographic groups with the highest number of students will often show outcomes that are highly correlated with the aggregate value, resulting in relatively low observed percentage point gap differences. Since Hispanic students make up 59% of all placements, the observed placement rate for the group (15.45%) is quite similar to the overall placement rate (17.80%). In fact, removing Hispanic students from the computation of the overall placement rate results in a larger percentage point gap value for that group (PPG = -7.25) that is consistent with disproportionate impact.

80% Rule Index Analysis

White students served as the reference group, so the placement rates of the remaining groups were divided by those of White students. Using this approach, the three remaining groups appear to be disproportionately impacted: African-American (39.94%), Asian (73.08%), and Hispanic (53.06%) students.

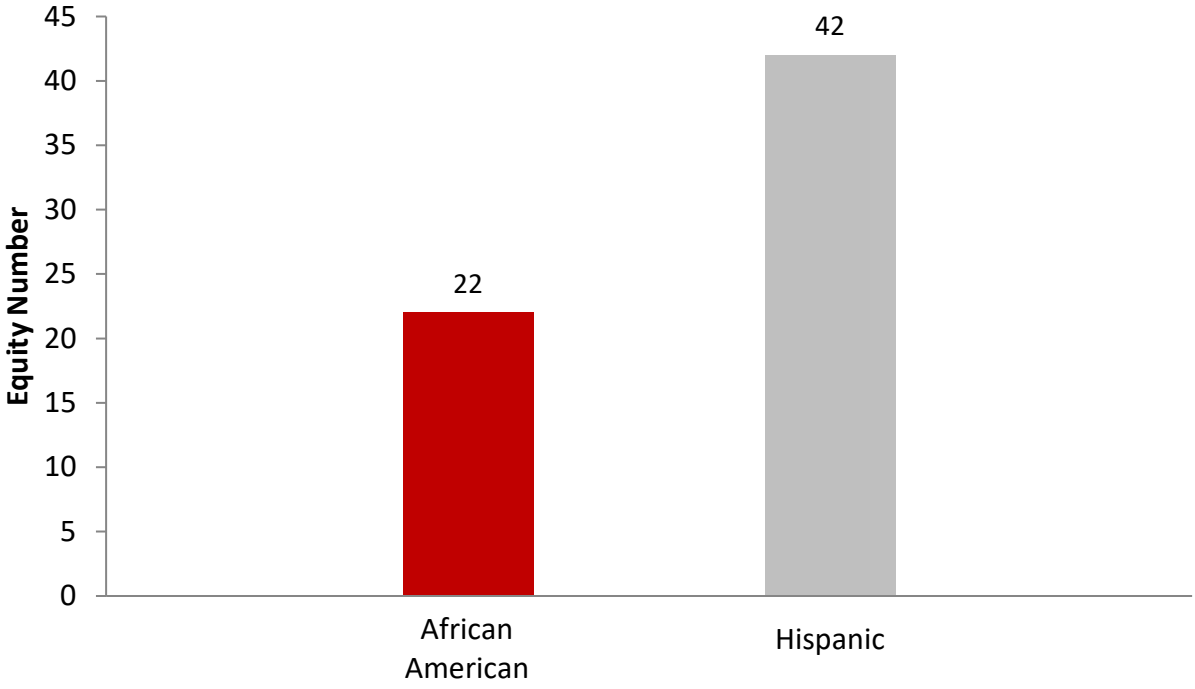
Proportionality Index Analysis

The proportionality index compares a demographic group's representation across the college to the same demographic group's representation among all students who achieve a particular outcome. In the current context, this method entails dividing a group's representation among students being placed into a course one level below transfer English by that same ethnic group's representation among all students being placed into transfer-level English courses. Using this approach, along with the chancellor's office recommendation for identifying meaningful proportionality indices (Ramirez-Faghih & Fuller, 2017), African-American (0.062 ÷ 0.098 = 0.64) and Hispanic students (0.59 ÷ 0.68 = 0.87) were identified as being disproportionally impacted.

Equity Number Analysis

Figure 7 for illustrates the equity numbers among the ethnic groups with negative percentage point gap values (one bar in the figure is in red because, as noted earlier, African American students were identified as disproportionately impacted based upon the chancellor's office margin of error approach). The equity number reflects the number of students in potentially disproportionately impacted groups that would have to achieve a successful outcome to eliminate the observed equity gap. In this case the equity numbers were calculated for both African American and Hispanic students because those were the two student groups found to be placing in transfer-level courses at a lower than average rates (hence the negative percentage point gaps value). Such analysis revealed that 22 additional African American and 42 additional Hispanic students would have place into transfer-level English in order to eliminate the observed gaps. Note that while Hispanic students were not identified as disproportionately impacted (as per CCCCO, 2017), that is the group for which a larger number of students would have place into transfer-level coursework to eliminate the observed equity gap. This is because, as noted earlier, the observed equity gap is driven both by the observed percentage point gap value *and* the number of individuals in a given cohort (i.e., cohort count). A combination of both large negative PPG values and large cohort counts will yield a relatively large equity number while a combination of small negative PPG values coupled with small cohort counts will yield a relatively small equity number.

Figure 7. Equity Numbers by Age Groups with Negative PPG Values



Overall Disproportionate Impact Determination

Given the evidence generated using the three disproportionate impact methods, it appears that at least one group—African American students—is disproportionately impacted with respect to course placement in transfer-level English classes. However, two of the three indices suggested that Hispanic students were also disproportionately impacted. In addition, on the basis of the observed equity numbers, a larger gap exists among Hispanic than African American students. These findings suggest that the institution should prioritize developing and implementing strategies designed to ameliorate, if not eliminate, the disproportionate impact that African-American and Hispanic students are experiencing.

Conclusions

Data disaggregation is a key first step in identifying potential equity gaps across an array of academic outcomes. With disaggregated data, it is possible to complete the critical task of conducting disproportionate impact analyses. Disproportionate impact analyses help educators and education researchers better understand the extent to which one or more student demographic groups is potentially disadvantaged in their quest for academic success.

There are various approaches to determining disproportionate impact, each of which offers certain advantages and disadvantages. While the author recommends that practitioners always examine the percentage point gap and employ its corresponding margin of error approach, the author also recommends that colleges consider using more than one method to identify disproportionate impact; in doing so, colleges can increase their certainty that the student groups they identify as disproportionately impacted are indeed in need of institutional intervention. One comprehensive approach, for instance, would be to apply all three disproportionate impact methods described in this paper and identify equity gaps only in cases for which at least two of the methods pointed to disproportionate impact. In addition, the author recommends that the equity number be consistently examined to glean the practical significance of the observed equity gaps.

Finally, while this paper has focused on methodological and statistical methods underlying the identification of disproportionate impact, readers are urged to consider that the most important step in this process comes *after* the data have been analyzed: The resulting institutional dialogue which ideally leads to substantive changes in students' educational outcomes. Upon the identification of likely equity gaps, it is incumbent upon colleges to develop and implement a plan for how to potentially ameliorate the obstacles faced by disproportionately impacted groups. Objective evidence that does not lead to informed dialogue, planning, and ultimately action will do little to close equity gaps.

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