



AAC Participation and Student Success

This report uses a nearest neighbor propensity score matching (PSM) approach to estimate the effect of being an Academic Advancement Center (AAC) student on persistence and graduation rates. The PSM approach allows us to better control for selection bias, or the fact that students who select into pursuing AAC affiliation are likely to differ from their non-AAC peers in ways that a basic logistic regression run on a large analytic sample is not able to account for properly. Our estimates from matched samples represent more *causal* estimations of the relationship between AAC status and student success.

This analysis is restricted to full-time, RI-funded undergraduates in the FA12 - FA21 cohorts who meet at least one of the following criteria: (i) AAC student, (ii) first generation student, or (iii) limited income student¹ in their cohort term at CSU. We restrict to this group because program eligibility for the AAC is restricted to students who meet criteria (ii) or (iii), or to those students who have a documented disability.²

We compare students who enter CSU as AAC students to those who do not along four primary outcomes: 2nd fall persistence, 3rd fall persistence, 4-year graduation, and 6-year graduation. For each outcome, we look at patterns among the most recent five cohorts (e.g., for 2nd fall persistence we look at FA17-FA21 cohorts and for 6-year graduation rates we look at FA12-FA16 cohorts). We also distinguish between students who enter CSU as new, first-time students and those who enter as transfer students throughout the report.

Key Findings

Among new students, being an AAC student is associated with a statistically significantly higher likelihood of persisting to 2nd fall and 3rd fall and of graduating in 4 years and in 6 years.

- AAC students have a **9 - 11 percentage point (PP) higher likelihood** of persisting to 2nd fall and 3rd fall, holding constant student-level characteristics.
 - AAC students' observed 2nd fall persistence rate is 90.9% compared to 81.8% for non-AAC students. Their observed 3rd fall persistence rate is 85.9% compared to 73% for non-AAC students.
- AAC students have a **12 PP higher likelihood** of graduating in 4 years and a **19 PP higher likelihood** of graduating in 6 years, holding constant student-level characteristics.
 - AAC students' observed 4-year graduation rate is 51.2% compared to 38.6% for non-AAC students. Their observed 6-year graduation rate is 81% compared to 61.9% for non-AAC students.
- The estimated effect of being an AAC student on persistence and graduation is the same, even when we account for students' affiliation with Key and/or C4E.

Among transfer students, being an AAC student is associated with a statistically significantly higher likelihood of persisting to 3rd fall and of graduating in 4 years. There is no meaningful effect of being an AAC student on 2nd fall persistence. Headcounts among the transfer group are small, however, so the exact magnitude of the AAC effect is highly sensitive to small shifts in student behavior.

- AAC students have a **9 - 11 percentage point (PP) higher likelihood** of persisting to 3rd fall, holding constant student-level characteristics.

¹ Limited income is defined here as Pell recipients or any students who received institutional grant aid.

² Disability status is not a consideration for our sample construction because we do not have access to that federally protected data.

- AAC students’ observed 3rd fall persistence rate is 83.1% compared to 76.5% for non-AAC students.
- AAC students have roughly a **15 - 18 PP higher likelihood** of graduating in 4 years, holding constant student-level characteristics.
 - AAC students’ observed 4-year graduation is 78.3% compared to 67% for non-AAC students.
- The estimated effect of being an AAC student on persistence and graduation is the same, even when we account for transfer students’ affiliation with C4E (no transfer AAC students are in Key).

Comparison of Persistence and Graduation Rates

The four figures in this section help contextualize how AAC and non-AAC students in our analytic sample of first generation and/or limited income students compare on baseline, before we do any matching or run any formal statistical tests. Persistence and graduation rates are shown for four different groups of students: (1) AAC students who are also in Key and/or C4E, (2) Just AAC students, (3) Non-AAC students in Key and/or C4E, and (4) Students who are not in AAC, Key, or C4E.

Figure 1 displays the 2nd fall and 3rd fall persistence rates among new students in our analytic sample. The dashed gray line provides CSU’s overall 2nd fall persistence rate for full-time, new undergraduates from the FA17-FA21 cohorts as a reference point. Group headcounts can be found in the table notes in order from left to right.

Figure 1: Persistence rates among new students

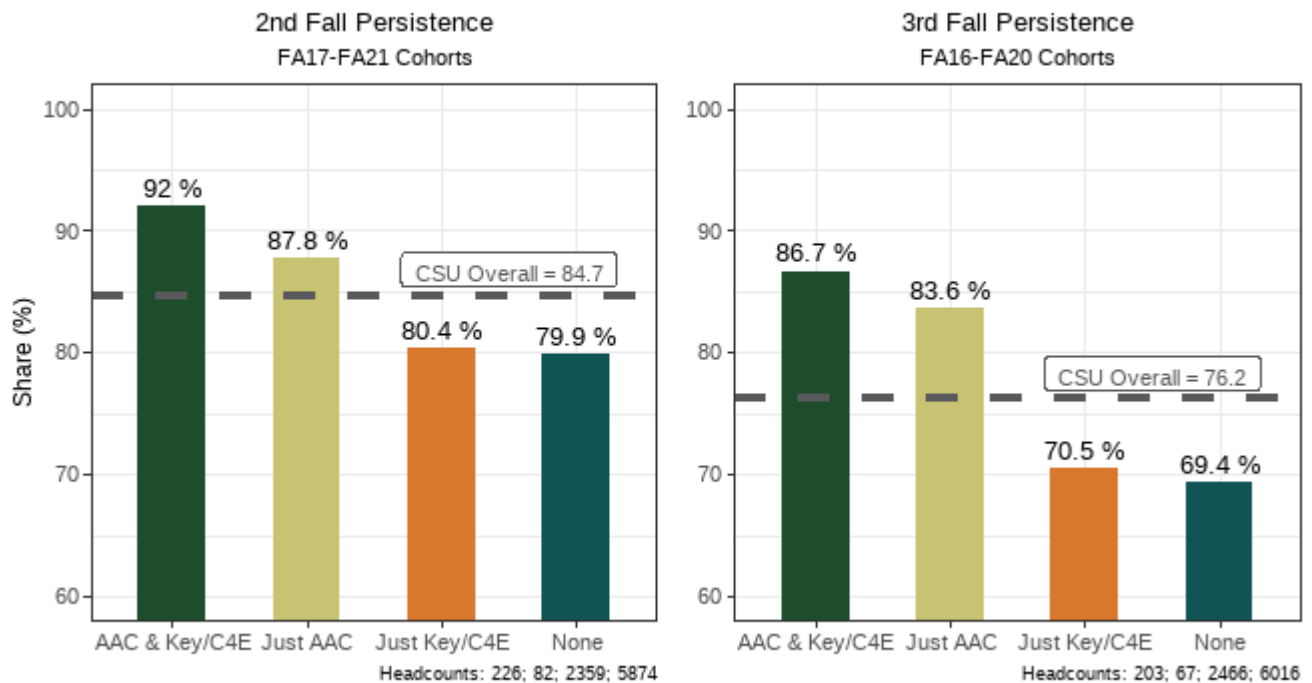


Figure 1 shows that AAC students who are also in Key and/or C4E in their cohort term have the highest 2nd fall persistence rate at 92%. AAC students who are not in Key or C4E have the next highest persistence rate at 87.8%. Behind them, non-AAC students in Key and/or C4E persist at a rate (80.4%) similar to students in our analytic sample who have no affiliation with the AAC, Key, or C4E (79.9%).

The 3rd Fall Persistence panel in Figure 1 shows an analogous story to the 2nd Fall Persistence panel. AAC students served also by Key and/or C4E have the highest rate at 86.7%. Meanwhile, non-AAC students in Key

and/or C4E have a similar 3rd fall persistence rate to students with no Key or C4E affiliation, and these rates hover 13 - 16 PP below those of AAC students.

When it comes to both 2nd fall and 3rd fall persistence rates, new AAC students persist at higher rates relative to non-AAC students and to new undergraduates at CSU overall. These patterns continue when we focus on graduation rates as well. Figure 2 displays 4-year graduation and 6-year graduation rates among new students by their AAC, Key, and C4E affiliation in their cohort term. As with persistence rates, new AAC students graduate at higher rates than their non-AAC peers.

Figure 2: Graduation rates among new students

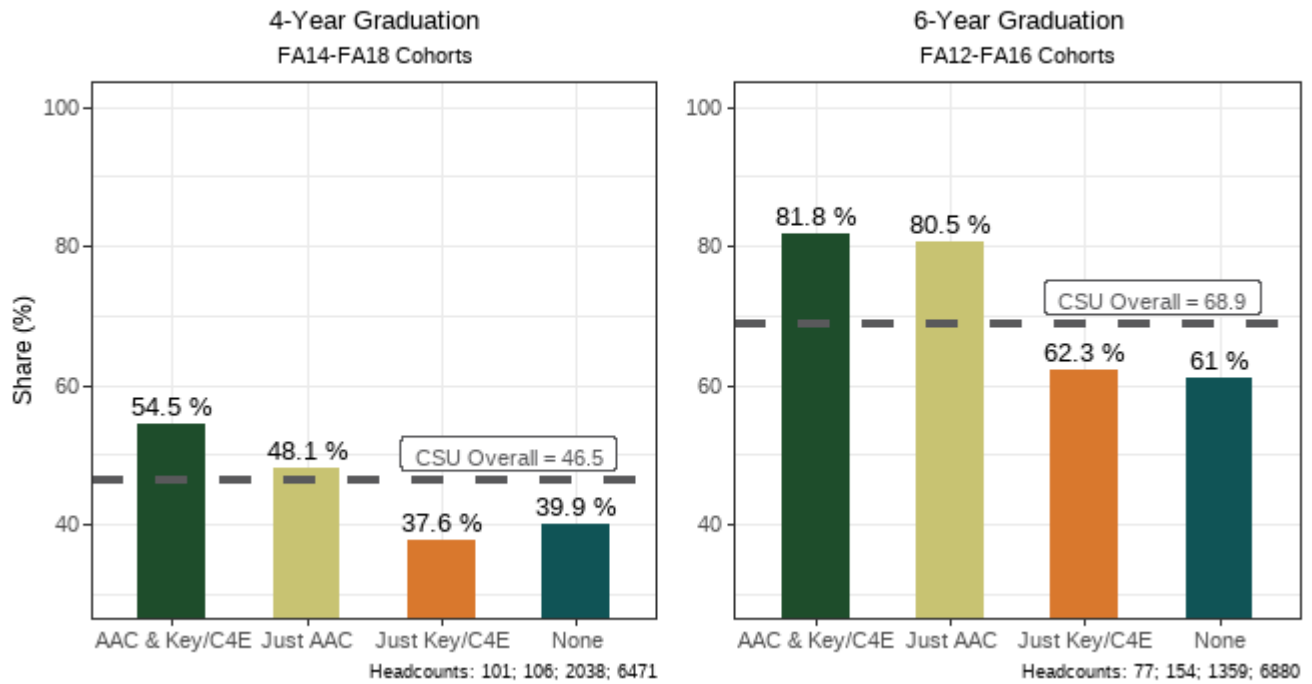


Figure 2 shows that AAC students who are also in Key and/or C4E have the highest 4-year graduation rate at 54.5% followed by Just AAC students at 48.1%. Both of these rates are higher than CSU’s overall 4-year graduation rate for the FA14-FA18 cohorts at 46.5%. Comparatively, the 4-year graduation rates for non-AAC students hover at 37.6% for Just Key/C4E students and 39.9% for first generation and/or limited income students with no program affiliation.

Six-year graduation rates tell a similar story, though the gap between AAC students who are also in Key and/or C4E and Just AAC students has essentially closed (81.8% vs. 80.5%). AAC students graduate within 6 years at a rate that is more than 10 PP higher than the overall CSU 6-year graduation rate among full-time, new students and roughly 20 PP higher than the 6-year graduation rate among non-AAC students (regardless of Key and/or C4E affiliation as well).

Figure 3 and Figure 4 display the same information for persistence rates and graduation rates among transfer students in the analytic sample by their cohort term AAC, Key, and C4E affiliation. Before proceeding, it is important to note the relatively small headcounts among the transfer student population – especially with respect to AAC, Key, and C4E affiliation (note: no transfer AAC students are in Key). This means that the persistence and graduation rates for these groups can fluctuate widely even with only a small shift in the total number of students who persist or graduate, respectively.

Figure 3: Persistence rates among transfer students

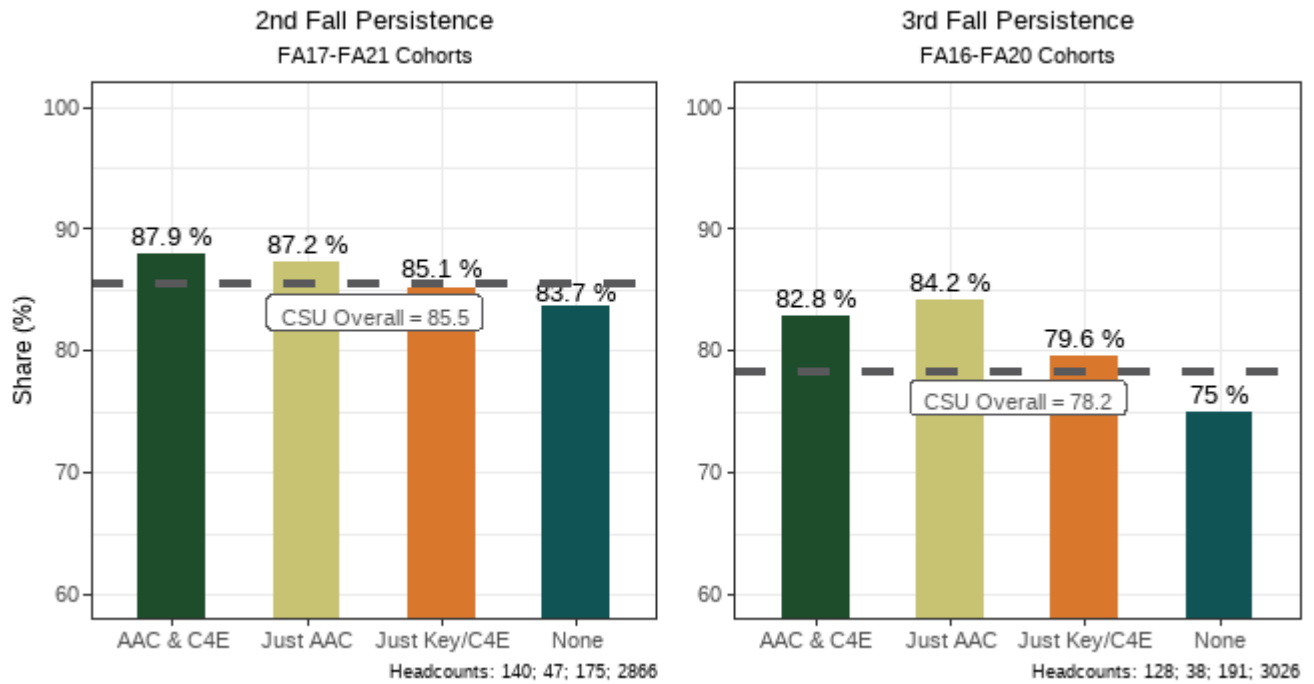
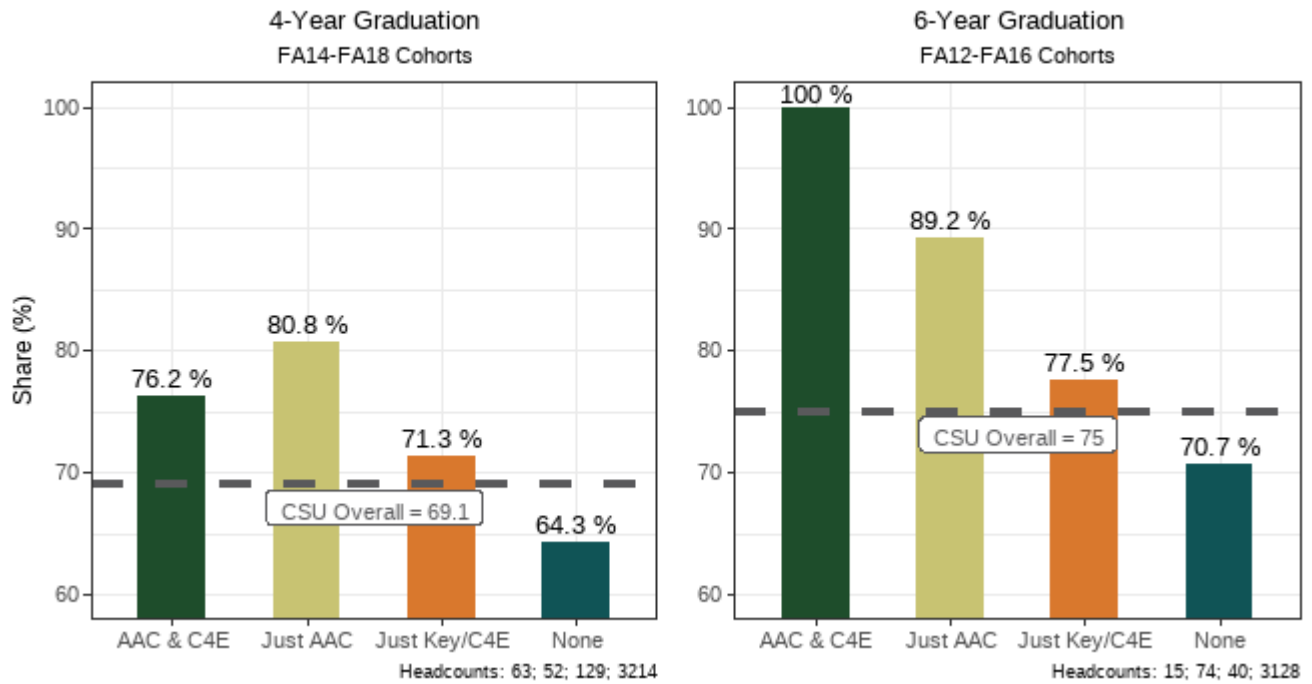


Figure 3 shows that the gaps in persistence rates between AAC and non-AAC transfer students are less substantial than among the new students in our analytic sample. There is also less of a noteworthy difference between AAC students who are in C4E and only AAC students. As mentioned above, this is probably also an artifact of the relatively small headcounts for these groups.

Figure 4 displays 4-year and 6-year graduation rates among the transfer student groups.

Figure 4: Graduation rates among transfer students



AAC-supported transfer students have higher 4-year and 6-year graduation rates relative to non-AAC students, and especially those first generation and/or limited income students who are also not supported by Key or C4E.

Matching AAC Students

Propensity Score Matching Approach

While informative at providing an initial picture of how AAC students fare relative to their peers when it comes to persistence and graduation, [Figure 1](#) through [Figure 4](#) display raw, unadjusted rates that do not account for underlying student-level differences between AAC, Key, and C4E students and their peers in ways that are *also perhaps correlated* with their likelihood to persist to subsequent terms and ultimately graduate.

[Appendix Tables A1 through A4](#) highlight the ways the four groups of students (AAC and Key/C4E, Just AAC, Just Key/C4E, and None) differ from one another along a host of demographic and academic variables. We want to account for these underlying student-level differences when estimating the most accurate “effect” of being an AAC student on persistence and graduation rates. Moreover, we want to best account for selection bias, or the fact that the type of student who *selects into* being an AAC student is likely different from a student who does not choose to pursue AAC support.

To account for these differences, we use nearest neighbor propensity score matching (PSM) to pair an AAC student in our analytic sample with a non-AAC student who, based on their demographic and academic characteristics, appears to have a similar underlying propensity to be an AAC student. To match students, we run a logistic regression on all students where our dependent variable is “Cohort AAC” and is equal to 1 if a student is an AAC student in their cohort term and 0 otherwise.

We include a broad suite of independent variables including gender, first generation status, limited income status, residency, racially minoritized status, and duplicated race/ethnicity variables that account for the full spectrum of identities that students hold rather than placing them into a singular bin based on federal priority

order. We also include students' high school/transfer GPA and indicators about their curricular and co-curricular status in their cohort term such as whether their primary major is STEM or is Exploratory Studies and whether they are also supported by Key and/or C4E. Please consult [Appendix Table A5](#) for the full list of independent variables included in the matching process.

It is important to note that with any PSM analysis we are only able to match students based on observable characteristics in the data. In this case, it means matching on the demographic features and academic variables we can leverage from the system of record. Like with any quasi-experimental techniques, we cannot account for unobservable differences between students that would also relate to their propensity to be an AAC student, such as motivation or familiarity/confidence navigating campus resources. This is an important limitation to keep in mind when interpreting results below.

Altogether, we run logistic regressions separately by new/transfer status and for each success outcome of focus (e.g., 2nd fall persistence, 4-year graduation, etc.) because included cohorts vary based on outcome. This means we run eight regressions in total to create eight different matched samples.

Quality of Matches

Every logistic regression computes a probability for each student that they would be an AAC student, estimating that likelihood based solely on the independent variables we included in the model. These probabilities are propensity scores, and we match students who were in fact AAC students in our sample to those who were not, *but who had similar propensities to be AAC students* based on underlying demographic and academic characteristics. We use a 1-to-1 nearest neighbor approach which matches one AAC student to one non-AAC student based how similar their propensity scores are to one another.³ In essence, matching in this manner allows us to construct a more apt comparison group to benchmark AAC students against.

One way to evaluate the quality of our matches is to assess the degree of common support of propensity scores across actual AAC students and non-AAC students. If we made quality matches in our process, we would observe a high level of overlap in the proportion of AAC students and non-AAC students with the same propensity scores in the matched sample. [Appendix Figures A1 through A8](#) show that we have a very high level of common support across all eight distinct outcome-sample combinations (e.g., the 2nd fall persistence-new student sample, the 4-year graduation-transfer student sample, etc.). For each outcome-sample, these figures show common support in the raw data and in the matched data among "treated" (AAC) and "control" (non-AAC) students.

Another way to assess match quality is to compare the covariate balance between AAC and non-AAC students in our matched data sets. In other words, we compare how the representation of different identities and attributes we included as independent variables in our propensity logistic regressions compare between matched AAC and non-AAC students. We know that we have well-balanced matched data sets when there is no statistically significant difference in representation between AAC and non-AAC students.

[Appendix Tables A5 and A6](#) show the covariate balance between AAC and non-AAC students in the pre-matched samples of new and transfer students. We see that across outcome-samples in both tables, there is a lot of covariate imbalance in student characteristics before we match students. For example, in [Table A5](#) outcome 2nd

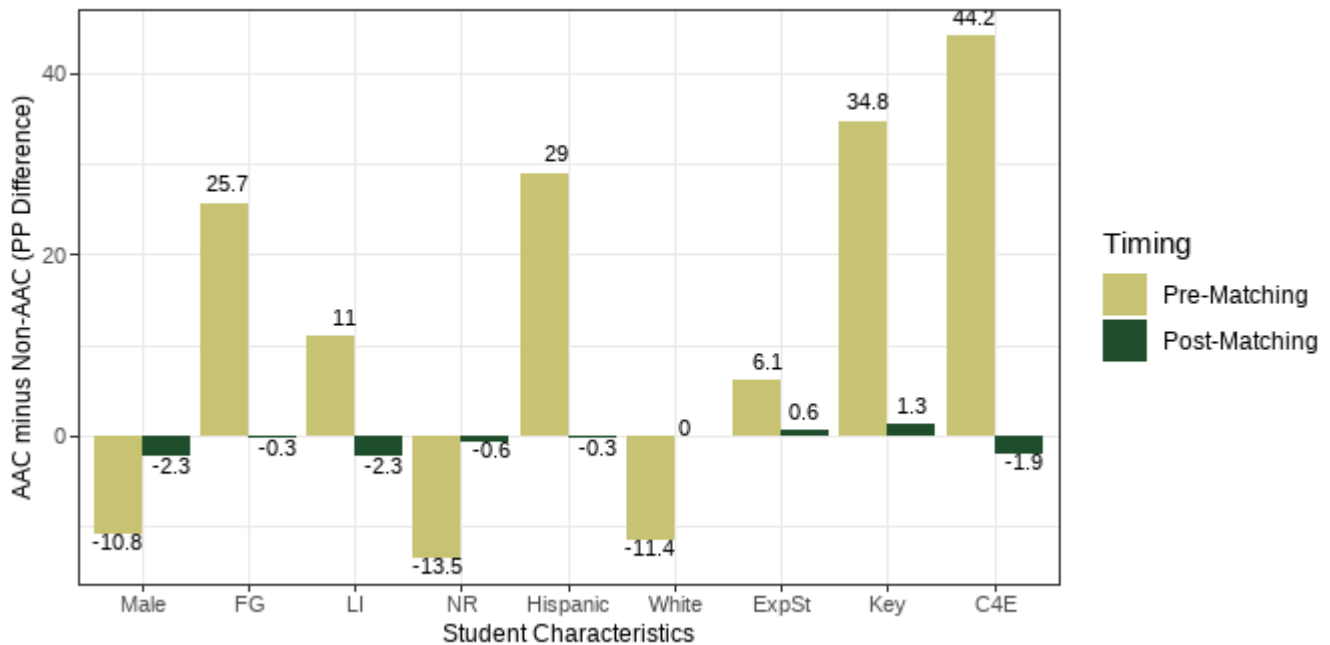
³ We do evaluate other matching techniques such as exact matching and optimal matching, but nearest neighbor matching yielded the best matched samples, given the independent variables we match students along and our relatively small samples sizes, especially among transfer students. One-to-one matching also yielded samples with the most common support.

Fall Persistence, the share of male students in the pre-matched AAC group is 29% compared to 39% among the pre-matched non-AAC group. A chi-square test reveals that this ~10 PP difference between the groups is statistically meaningful at a p-value of less than 0.001.

However, [Tables A7](#) shows that this imbalance disappears in the matched sample. Where the share of male students in the post-matched AAC group is 29%, the share of males in the post-matched non-AAC group is 31%. This ~2 PP difference between groups is no longer statistically significant. In fact post-matching, there are no longer any statistically meaningful differences between AAC and non-AAC students in any outcome-sample group in either [Table A7](#) (new students) or [Table A8](#) (transfer students).

Figure 5 visually displays how the balance in several key covariates changes between the pre-matching and post-matching samples for the new student sample, outcome 2nd fall persistence.

Figure 5. Pre- and post-matching differences between AAC and Non-AAC students
Outcome = 2nd fall persistence among new students



The gold and green bars represent the difference in the share of each characteristic on the x-axis between AAC and non-AAC students pre- and post-matching, respectively. For instance, the - 10.8 PP difference between AAC and non-AAC groups for Male in the pre-matched sample corresponds to the numbers we observed above in [Table A5](#). The adjacent -2.3 PP difference between AAC and non-AAC groups for Male in the post-matched sample corresponds to the numbers we observed above in [Table A7](#). In all instances, the covariate gaps between AAC and non-AAC students are large and statistically significant pre-matching, but become small and statistically insignificant post-matching. We, therefore, have well-balanced matched samples.

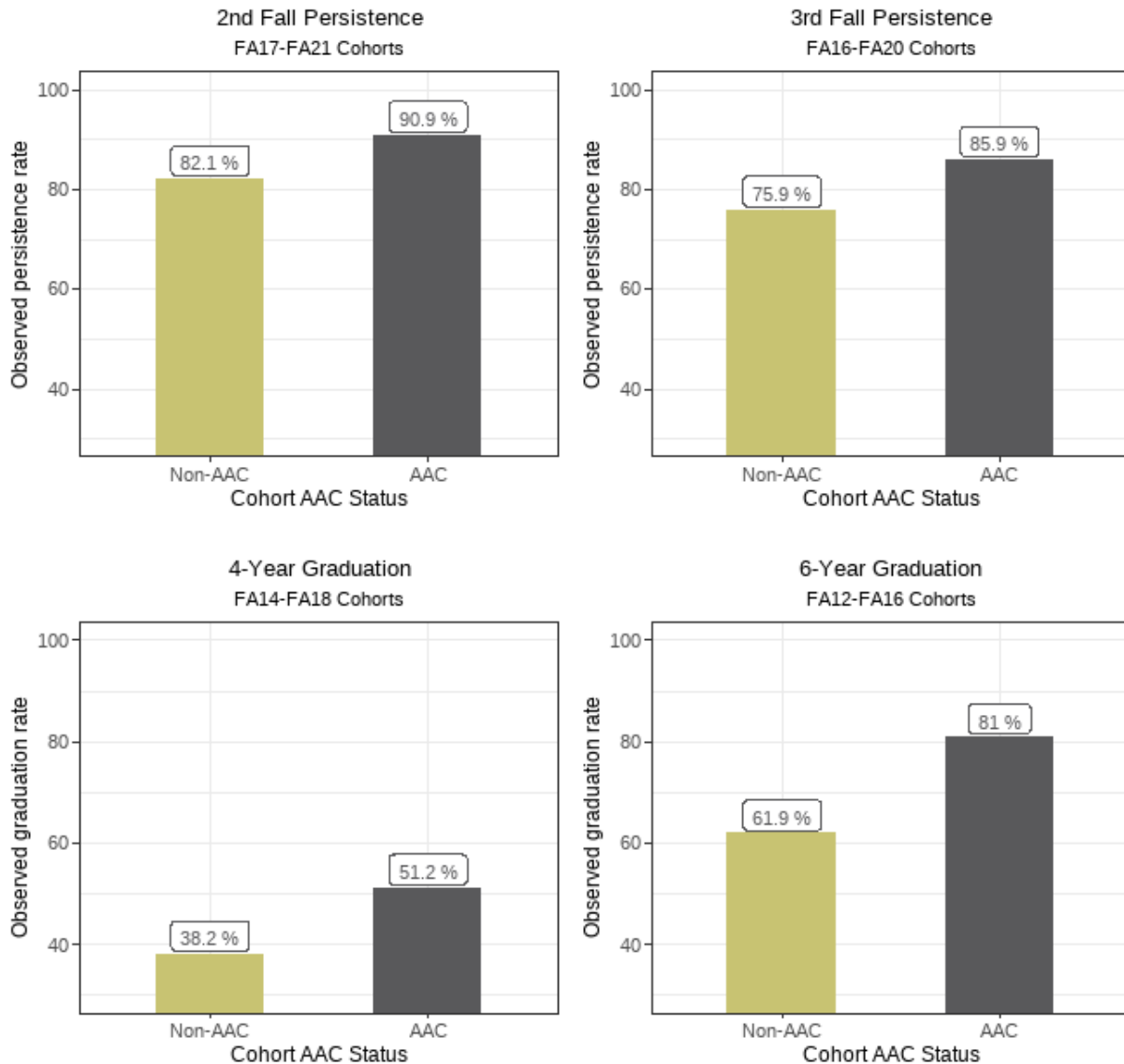
AAC Participation and Student Success

Observed Rates in Matched Samples

After constructing our matched samples using PSM, we can now evaluate the association between AAC participation and student success outcomes. We do that first by displaying the differences in observed

persistence and graduation rates between AAC and non-AAC students in the matched samples – without including any student-level covariates. Figure 6 shows these observed rates by AAC status for new students.

Figure 6: Observed persistence & graduation rates by cohort AAC status among the matched, new sample

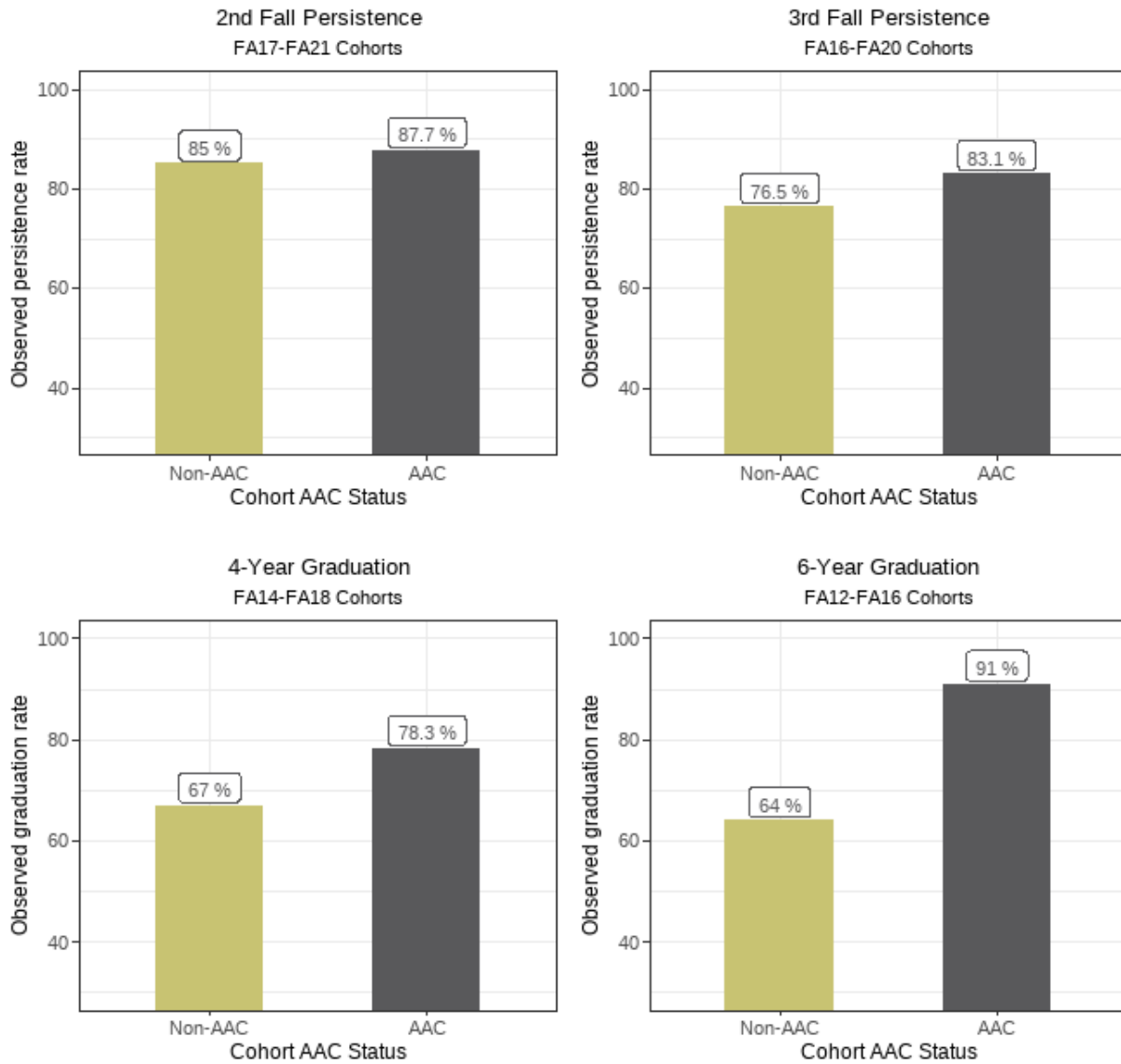


Notes: Observed rates for the matched sample do not account for other student-level differences between AAC and non-AAC students.

Figure 6 shows that AAC students have higher observed 2nd fall and 3rd fall persistence rates compared to non-AAC students by 9-10 PP. The gap in observed graduation rates is even larger between AAC and non-AAC students. Where 51.2% of AAC students graduate in 4 years, 38.2% of non-AAC students in the matched sample graduate in 4 years – a gap of 13 PP. Meanwhile, 81% of AAC students graduate in 6 years compared to 61.9% of non-AAC students – a gap of 19 PP.

Figure 7 shows the same observed persistence and graduation rates by AAC status among the matched transfer samples.

Figure 7: Observed persistence & graduation rates by cohort AAC status among the matched, transfer sam



Notes: Observed rates for the matched sample do not account for other student-level differences between AAC and non-AAC students.

Figure 7 shows that there is only a small 2 PP gap in 2nd fall persistence rates between AAC students and non-AAC students. The 3rd fall persistence gap is larger at around 7 PP (83.1% compared to 76.5%). However, the gap between AAC and non-AAC transfer students is most substantial when it comes to 4-year graduation rates. AAC students have a 4-year graduation rate of 78.3% compared to 67% for non-AAC students – a gap of 11 PP. Though we display 6-year graduation results for comparison, we only discuss 4-year graduation rates for this group in the report.

Marginal Effect of Being in AAC

While the observed rates for the matched samples in [Figure 6](#) and [Figure 7](#) are meaningful in showing how AAC and non-AAC students compare when we construct a better comparison group against which to benchmark AAC students, they do not answer the more causal question about what is the “effect” of participating in AAC on a

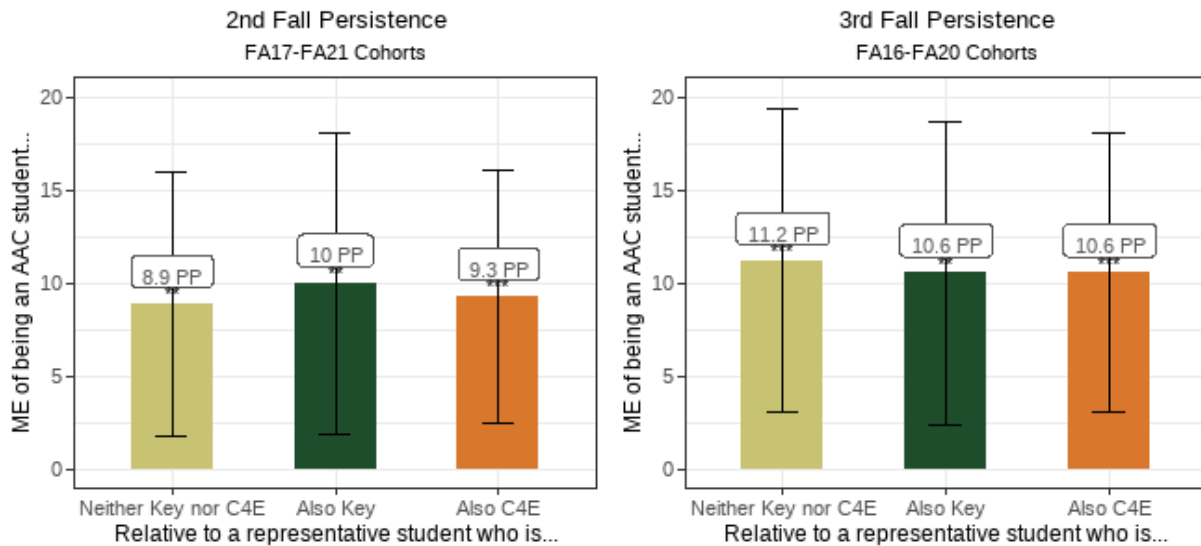
student’s likelihood of success, holding constant student-level characteristics. They do not test whether the differences are statistically significant. Further, they also do not probe how much of the difference in persistence or graduation rates between AAC and non-AAC students is related to the other support AAC students are likely to receive from Key and/or C4E.

To evaluate these aspects, we use the same logistic regression approach as before. However, this time, the dependent variable is the student success outcome of interest – persistence and graduation. For each logistic regression, we include whether the student is an AAC student in their cohort term as our primary independent variable of interest, but include the same suite of student demographic and academic covariates in the model as well. We cluster standard errors by matched pair (each AAC student matched to their nearest neighbor non-AAC student with a similar propensity score).

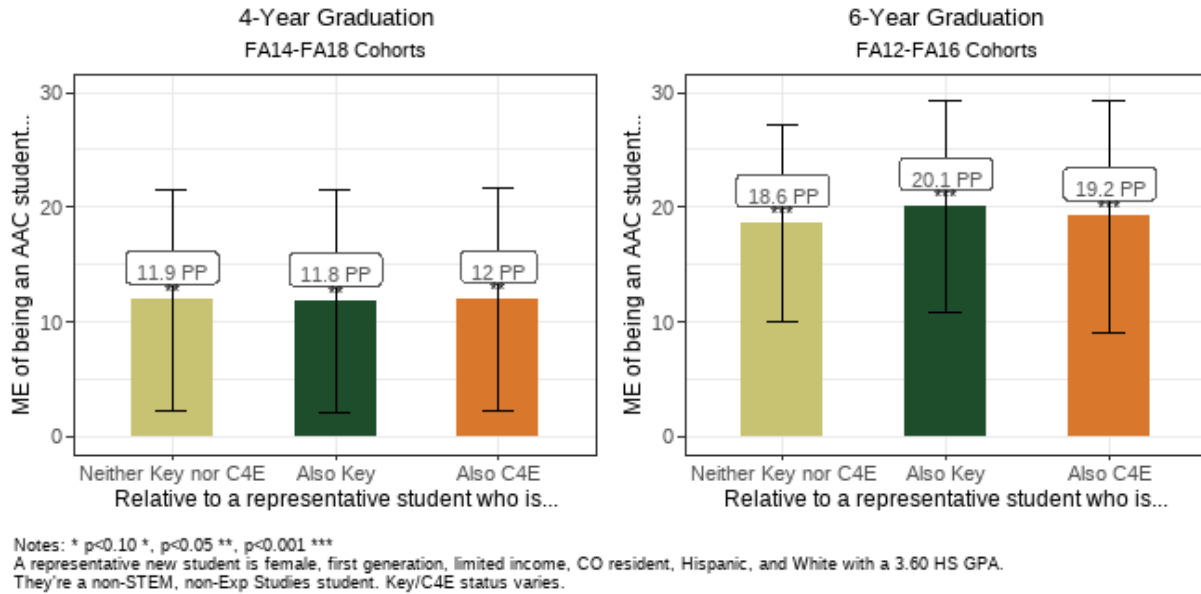
[Tables A9 and A10](#) show the full logistic regression output for each outcome by new and transfer status, respectively, as odds ratios. However, [Figure 8](#) and [Figure 9](#) translate the output into more meaningfully interpretations of marginal effects. Figure 8 focuses on new students and Figure 9 focuses on transfer students.

The four quadrants of Figure 8 display the marginal effect (ME) of being an AAC student on 2nd fall persistence, 3rd fall persistence, 4-year graduation, and 6-year graduation among new students. The PP values represent the “effect” of being an AAC student on the outcome of focus, holding constant student-level characteristics (which we do by performing the PSM analysis and by including these measures as covariates). The ME of being an AAC student is estimated for a representative⁴ student in three different contexts: (i) when the student is neither Key nor C4E, (ii) when the student is in Key, and (iii) when the student is in C4E. Estimating MEs across these different contexts allows us to observe how much AAC participation uniquely predicts student success, separate from other support programs they may belong to as well.

Figure 8: Marginal effect (ME) of being an AAC student among new students



⁴ A representative new student is female, first generation, limited income, CO resident, Hispanic, and White with a 3.60 HS GPA. They’re a non-STEM, non-Exploratory Studies student. They’re Key/C4E status varies. A representative transfer student is the same on all dimensions except for two: their transfer GPA is 3.17 and their Key status is not included/does not vary because no transfer students in the matched sample are in Key. These characteristics are selected based on what a typical AAC student looks like in our data.



The 2nd Fall Persistence quadrant of Figure 8 shows that the ME of being an AAC student on their likelihood of persisting to 2nd fall ranges from 8.9 - 10 PP, depending on whether the representative student is in Key or C4E as well. In other words, all else being equal, an AAC student is more likely to persist to 2nd fall by approximately 9 - 10 PP compared to a non-AAC peer. In all instances, these MEs are statistically significant at the 5-percent level or lower.

This quadrant also highlights that it does not matter whether we are talking about AAC students who also receive support from Key or C4E: the estimated ME of being an AAC student is about the same magnitude. Moreover, the confidence interval ranges (displayed by the error bars) show that these MEs are not very different from one another. From this, we can see that AAC participation itself is what is driving the additional likelihood these students have of persisting to their 2nd fall in our analytic sample.⁵

The 3rd Fall Persistence quadrant of Figure 8 tells a similar story for AAC students' increased likelihood of persisting to their 3rd fall. All else equal, AAC students are 10.6 - 11.2 PP more likely to persist to their 3rd fall compared to a representative student who is not in AAC, regardless of their Key or C4E affiliation as well. All MEs are statistically significant at the 5-percent level or lower.

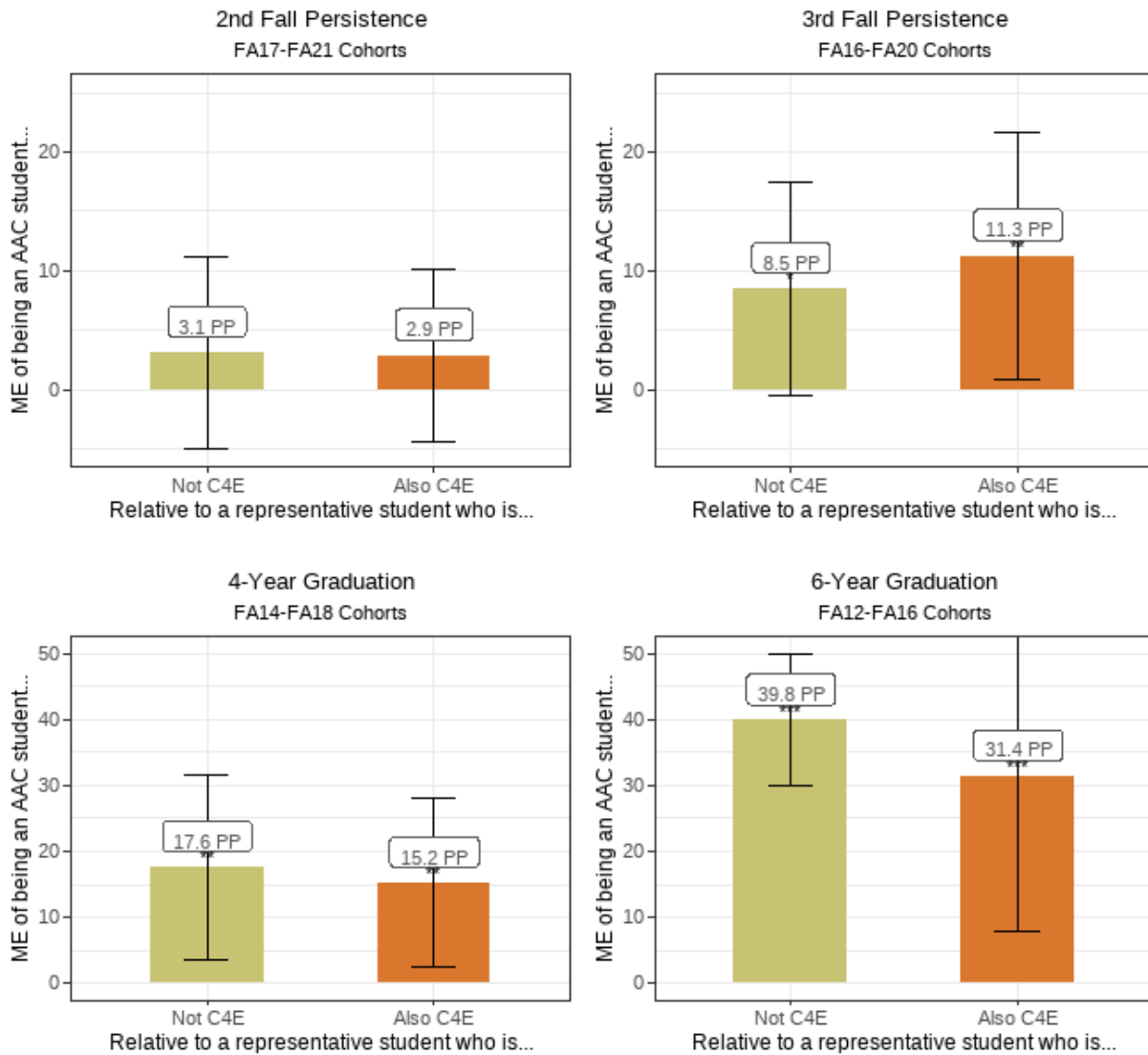
The bottom quadrants focus on graduation likelihoods among news students, and we observe the same increased likelihood of graduating among AAC students. AAC students are 12 PP more likely to graduate in 4 years and roughly 19 PP more likely to graduate in 6 years than their otherwise similar non-AAC peers. These MEs are about the same in magnitude, regardless of Key or C4E status as well.

Altogether, these ME estimates are about the same in magnitude as the differences in observed persistence and graduation rates between AAC and non-AAC students displayed in [Figure 6](#) above, which we would expect given the matching process we used to construct the sample.

⁵ Please note that we are not saying Key or C4E participation does not affect students' likelihood of persisting or graduating. Rather, in the analytic samples we derive for this analysis focused on AAC participation and its possible overlap with other support programs, we find AAC participation to be the main factor increasing students' likelihood of success.

Figure 9 displays analogous information for transfer students. Recall that no transfer students in the matched sample are in Key and we display 6-year graduation results for reference only.

Figure 9: Marginal effect (ME) of being an AAC student among transfer students



Notes: * p<0.10 *, p<0.05 **, p<0.001 ***
 A representative transfer student is female, first generation, limited income, CO resident, Hispanic, and White with a 3.17 transfer GPA.
 They're a non-STEM, non-Exp Studies student. C4E status varies.

The top two quadrants of Figure 9 show that, while there is no statistically significant ME of being an AAC student on 2nd fall persistence among transfer students, there is an effect of being an AAC student on 3rd fall persistence. Relative to a representative transfer student who is not in AAC, an AAC student has a higher likelihood of persisting to 3rd fall by 8.5 PP. Among representative transfers who are also in C4E, an AAC student's likelihood of persisting is 11.3 PP higher than a non-AAC student. However, as with the new student samples, these ME differences are not meaningfully different from one another, and AAC participation itself is what is driving the additional likelihood these students have of persisting to their 3rd fall.

The 4-Year Graduation quadrant shows that AAC transfer students are roughly 15 - 18 PP more likely to graduate in 4 years compared to their non-AAC peers.

Conclusion

Using a PSM approach to create a better control group to compare AAC students against, we find that AAC participation is highly associated with a student’s likelihood of persisting and graduating relative to their otherwise similar peer who is not in AAC. The results do not change substantively when we account for students’ affiliation with Key or C4E as well, suggesting that AAC participation itself meaningfully drives student success in our analytic samples of first generation and/or limited income students.

Among new students, AAC participation increases the likelihood a student will persist to 2nd fall and 3rd fall, as well as graduate in 4 years and 6 years relative to their otherwise similar non-AAC peers. Among transfer students, AAC participation increase the likelihood a student will persist to 3rd fall and graduate within 4 years.

Appendix Tables

Summary Statistics by Group

Table A1. Summary statistics by persistence group among new students

Characteristic	2nd Fall Persistence				3rd Fall Persistence			
	AAC & Key/C4E N = 226	Just AAC N = 82	Just Key/C4E N = 2359	None N = 5874	AAC & Key/C4E N = 203	Just AAC N = 67	Just Key/C4E N = 2466	None N = 6016
Male	29%	27%	40%	39%	31%	25%	40%	40%
First Generation	92%	82%	77%	58%	88%	84%	76%	58%
Limited Income ¹	92%	61%	86%	68%	92%	58%	86%	67%
Nonresident	4.4%	24%	11%	28%	4.9%	27%	11%	25%
Racially Minoritized	89%	49%	78%	34%	89%	51%	76%	32%
Asian ²	6.6%	11%	6.1%	7.5%	7.9%	15%	5.8%	7.5%
Black	11%	6.1%	15%	6.4%	13%	6.0%	16%	6.0%
Hawaiian/Pac. Islander	0%	2.4%	1.3%	1.2%	0%	1.5%	1.3%	1.2%
Hispanic	71%	30%	56%	21%	67%	30%	55%	20%
Multi-Racial	3.1%	12%	8.7%	7.9%	3.9%	13%	8.2%	7.5%
Native American	6.2%	4.9%	9.3%	3.7%	4.4%	6.0%	8.6%	3.6%
White	66%	80%	68%	87%	69%	82%	66%	87%
International	0%	0%	0.3%	1.1%	0%	0%	0.2%	1.3%
HS/Transfer GPA	3.70	3.63	3.63	3.63	3.72	3.65	3.63	3.62
Cohort STEM	32%	43%	30%	41%	33%	45%	30%	41%
Cohort Exp Studies	32%	23%	33%	20%	35%	25%	33%	21%
Cohort Key	75%	0%	71%	0%	75%	0%	71%	0%
Cohort C4E	87%	0%	68%	0%	86%	0%	68%	0%

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

Table A2. Summary statistics by graduation group among new students

Characteristic	4-Year Graduation				6-Year Graduation			
	AAC & Key/C4E N = 101	Just AAC N = 106	Just Key/C4E N = 2038	None N = 6471	AAC & Key/C4E N = 77	Just AAC N = 154	Just Key/C4E N = 1359	None N = 6880
Male	38%	47%	40%	42%	30%	41%	36%	42%
First Generation	86%	87%	76%	62%	83%	87%	76%	64%
Limited Income ¹	89%	75%	85%	64%	88%	75%	83%	65%
Nonresident	5.0%	13%	11%	24%	3.9%	12%	12%	19%
Racially Minoritized	89%	54%	73%	30%	87%	51%	66%	28%
Asian ²	5.9%	7.5%	5.7%	6.2%	7.8%	2.6%	5.7%	5.7%
Black	14%	7.5%	18%	5.4%	19%	4.5%	21%	4.8%
Hawaiian/Pac. Islander	0%	0.9%	1.0%	1.2%	0%	0%	1.0%	0.9%
Hispanic	66%	36%	51%	19%	58%	43%	41%	17%
Multi-Racial	5.0%	5.7%	6.6%	5.4%	2.6%	2.6%	6.2%	5.2%
Native American	3.0%	6.6%	6.1%	3.2%	2.6%	5.2%	4.7%	3.3%
White	69%	70%	63%	84%	32%	69%	57%	83%
International	0%	0%	0.2%	1.6%	0%	0%	0.1%	0.9%
HS/Transfer GPA	3.65	3.65	3.58	3.58	3.54	3.61	3.56	3.57
Cohort STEM	33%	52%	28%	40%	22%	45%	25%	37%
Cohort Exp Studies	37%	25%	37%	24%	36%	21%	39%	26%
Cohort Key	70%	0%	77%	0%	90%	0%	89%	0%
Cohort C4E	86%	0%	53%	0%	31%	0%	24%	0%

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

Table A3. Summary statistics by persistence group among transfer students

Characteristic	2nd Fall Persistence				3rd Fall Persistence			
	AAC & C4E N = 140	Just AAC N = 47	Just Key/C4E N = 175	None N = 2866	AAC & C4E N = 128	Just AAC N = 38	Just Key/C4E N = 191	None N = 3026
Male	46%	34%	47%	49%	48%	34%	50%	50%
First Generation	90%	81%	84%	63%	88%	74%	83%	62%
Limited Income ¹	89%	85%	89%	71%	88%	82%	91%	71%
Nonresident	0%	21%	9.1%	26%	0%	13%	8.9%	25%
Racially Minoritized	66%	40%	67%	28%	66%	34%	64%	28%
Asian ²	2.9%	4.3%	5.7%	5.9%	3.9%	5.3%	5.8%	6.1%
Black	8.6%	4.3%	10%	5.4%	9.4%	2.6%	8.9%	5.2%
Hawaiian/Pac. Islander	2.1%	2.1%	0%	1.2%	1.6%	2.6%	0%	1.1%
Hispanic	57%	34%	48%	18%	55%	29%	46%	17%
Multi-Racial	6.4%	4.3%	9.1%	6.1%	7.8%	5.3%	8.9%	5.7%
Native American	7.9%	4.3%	14%	3.7%	7.0%	2.6%	14%	3.6%
White	78%	85%	70%	86%	79%	89%	64%	85%
International	0%	0%	0%	3.9%	0%	0%	0%	4.5%
HS/Transfer GPA	3.26	3.25	3.36	3.15	3.22	3.25	3.36	3.13
Cohort STEM	46%	47%	42%	42%	51%	45%	42%	41%
Cohort Exp Studies	6.4%	13%	12%	14%	7.0%	16%	12%	14%
Cohort Key	0%	0%	3.4%	0%	0%	0%	2.6%	0%
Cohort C4E	100%	0%	98%	0%	100%	0%	98%	0%

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

Table A4. Summary statistics by graduation group among transfer students

Characteristic	4-Year Graduation				6-Year Graduation			
	AAC & C4E N = 63	Just AAC N = 52	Just Key/C4E N = 129	None N = 3214	AAC & C4E N = 15	Just AAC N = 74	Just Key/C4E N = 40	None N = 3128
Male	51%	48%	51%	51%	47%	50%	57%	52%
First Generation	89%	81%	84%	64%	87%	77%	82%	65%
Limited Income ¹	84%	88%	89%	69%	87%	86%	92%	70%
Nonresident	0%	3.8%	9.3%	25%	0%	2.7%	12%	20%
Racially Minoritized	57%	29%	62%	25%	67%	35%	57%	22%
Asian ²	6.3%	5.8%	7.8%	5.2%	6.7%	5.4%	5.0%	4.0%
Black	11%	3.8%	7.0%	4.3%	27%	5.4%	5.0%	3.5%
Hawaiian/Pac. Islander	0%	1.9%	0%	0.9%	0%	1.4%	0%	0.5%
Hispanic	43%	21%	44%	16%	40%	23%	35%	14%
Multi-Racial	9.5%	1.9%	7.0%	4.1%	20%	1.4%	10%	3.4%
Native American	6.3%	1.9%	14%	3.0%	6.7%	2.7%	20%	3.0%
White	79%	71%	60%	82%	73%	64%	42%	81%
International	0%	0%	0%	4.8%	0%	0%	0%	2.7%
HS/Transfer GPA	3.19	3.20	3.36	3.15	3.18	3.21	3.27	3.17
Cohort STEM	57%	37%	40%	40%	60%	42%	40%	36%
Cohort Exp Studies	4.8%	13%	13%	16%	6.7%	16%	15%	18%
Cohort Key	0%	0%	4.7%	0%	0%	0%	10%	0%
Cohort C4E	100%	0%	96%	0%	100%	0%	90%	0%

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

Covariate Balance, Pre- and Post-matching

Table A5. Covariate balance pre-matching by outcome group among new students

Characteristic	2nd Fall Persistence			3rd Fall Persistence			4-Year Graduation			6-Year Graduation		
	AAC N = 308	Not AAC N = 8233	p-value	AAC N = 270	Not AAC N = 8482	p-value	AAC N = 207	Not AAC N = 8509	p-value	AAC N = 231	Not AAC N = 8239	p-value
Male	29%	39%	<0.001	29%	40%	<0.001	43%	41%	0.73	37%	41%	0.21
First Generation	89%	64%	<0.001	87%	63%	<0.001	86%	65%	<0.001	86%	66%	<0.001
Limited Income ¹	84%	73%	<0.001	83%	73%	<0.001	82%	69%	<0.001	79%	68%	<0.001
Nonresident	9.7%	23%	<0.001	10%	21%	<0.001	9.2%	21%	<0.001	9.1%	18%	<0.001
Asian ²	7.8%	7.1%	0.64	9.6%	7.0%	0.10	6.8%	6.1%	0.70	4.3%	5.7%	0.38
Black	9.4%	8.9%	0.76	11%	8.9%	0.20	11%	8.4%	0.25	9.5%	7.5%	0.26
Hawaiian/Pac. Islander	0.6%	1.3%	0.59	0.4%	1.2%	0.27	0.5%	1.1%	0.73	0%	0.9%	0.27
Hispanic	60%	31%	<0.001	57%	30%	<0.001	51%	26%	<0.001	48%	21%	<0.001
Multi-Racial	5.5%	8.1%	0.10	6.3%	7.7%	0.40	5.3%	5.7%	0.82	2.6%	5.4%	0.065
Native American	5.8%	5.3%	0.67	4.8%	5.0%	0.88	4.8%	3.9%	0.51	4.3%	3.5%	0.53
White	70%	82%	<0.001	72%	81%	<0.001	70%	79%	<0.001	57%	78%	<0.001
International	0%	0.9%	0.12	0%	1.0%	0.19	0%	1.2%	0.18	0%	0.8%	0.42
HS/Transfer GPA (m) ³	3.67	3.62	0.027	3.71	3.62	0.002	3.65	3.57	0.033	3.59	3.56	0.76
HS/Trans GPA Missing	0.3%	0.2%	0.40	0%	0.2%	>0.99	0%	0.3%	>0.99	0%	0.4%	>0.99
Cohort STEM	35%	38%	0.29	36%	38%	0.45	43%	37%	0.11	38%	35%	0.35
Cohort Exp Studies	30%	24%	0.013	33%	24%	0.001	30%	27%	0.24	26%	28%	0.52
Cohort Key	55%	20%	<0.001	56%	21%	<0.001	34%	19%	<0.001	30%	15%	<0.001
Cohort C4E	64%	19%	<0.001	65%	20%	<0.001	42%	13%	<0.001	10%	3.9%	<0.001

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

³Students with missing HS/transfer GPAs have a value of 0 for their GPA and a value of 1 for the variable HS/Trans GPA Missing

Table A6. Covariate balance pre-matching by outcome group among transfer students

Characteristic	2nd Fall Persistence			3rd Fall Persistence			4-Year Graduation			6-Year Graduation		
	AAC N = 187	Not AAC N = 3041	p-value	AAC N = 166	Not AAC N = 3217	p-value	AAC N = 115	Not AAC N = 3343	p-value	AAC N = 89	Not AAC N = 3168	p-value
Male	43%	49%	0.15	45%	50%	0.15	50%	51%	0.75	49%	52%	0.69
First Generation	88%	64%	<0.001	85%	63%	<0.001	85%	65%	<0.001	79%	65%	0.007
Limited Income ¹	88%	72%	<0.001	86%	72%	<0.001	86%	70%	<0.001	87%	70%	<0.001
Nonresident	5.3%	25%	<0.001	3.0%	24%	<0.001	1.7%	24%	<0.001	2.2%	20%	<0.001
Asian ²	3.2%	5.9%	0.13	4.2%	6.1%	0.31	6.1%	5.3%	0.70	5.6%	4.0%	0.41
Black	7.5%	5.7%	0.30	7.8%	5.4%	0.19	7.8%	4.4%	0.078	9.0%	3.5%	0.014
Hawaiian/Pac. Islander	2.1%	1.1%	0.28	1.8%	1.0%	0.26	0.9%	0.8%	>0.99	1.1%	0.5%	0.38
Hispanic	51%	20%	<0.001	49%	19%	<0.001	33%	17%	<0.001	26%	14%	0.002
Multi-Racial	5.9%	6.2%	0.84	7.2%	5.9%	0.48	6.1%	4.2%	0.34	4.5%	3.5%	0.55
Native American	7.0%	4.3%	0.094	6.0%	4.2%	0.25	4.3%	3.4%	0.60	3.4%	3.3%	0.77
White	80%	86%	0.029	81%	84%	0.33	76%	81%	0.18	65%	81%	<0.001
International	0%	3.7%	0.007	0%	4.2%	0.007	0%	4.6%	0.019	0%	2.7%	0.17
HS/Transfer GPA (m) ³	3.26	3.16	0.010	3.23	3.14	0.033	3.08	3.01	0.26	3.06	3.01	0.45
HS/Trans GPA Missing	0%	<0.1%	>0.99	0%	0.2%	>0.99	3.5%	4.6%	0.58	4.5%	4.9%	>0.99
Cohort STEM	47%	42%	0.22	49%	41%	0.040	48%	40%	0.086	45%	36%	0.089
Cohort Exp Studies	8.0%	14%	0.022	9.0%	14%	0.072	8.7%	16%	0.040	15%	18%	0.42
Cohort Key	0%	0.2%	>0.99	0%	0.2%	>0.99	0%	0.2%	>0.99	0%	0.1%	>0.99
Cohort C4E	75%	5.6%	<0.001	77%	5.8%	<0.001	55%	3.7%	<0.001	17%	1.1%	<0.001

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

³Students with missing HS/transfer GPAs have a value of 0 for their GPA and a value of 1 for the variable HS/Trans GPA Missing.

Table A7. Covariate balance post-matching by outcome group among new students

Characteristic	2nd Fall Persistence			3rd Fall Persistence			4-Year Graduation			6-Year Graduation		
	AAC N = 308	Not AAC N = 308	p-value	AAC N = 270	Not AAC N = 270	p-value	AAC N = 207	Not AAC N = 207	p-value	AAC N = 231	Not AAC N = 231	p-value
Male	29%	31%	0.54	29%	29%	0.85	43%	47%	0.37	37%	39%	0.70
First Generation	89%	90%	0.90	87%	88%	0.70	86%	86%	>0.99	86%	89%	0.33
Limited Income ¹	84%	86%	0.43	83%	85%	0.55	82%	86%	0.18	79%	84%	0.23
Nonresident	9.7%	10%	0.79	10%	9.6%	0.77	9.2%	11%	0.51	9.1%	9.1%	>0.99
Asian ²	7.8%	5.8%	0.34	9.6%	8.9%	0.77	6.8%	4.8%	0.40	4.3%	4.3%	>0.99
Black	9.4%	12%	0.24	11%	8.1%	0.24	11%	12%	0.64	9.5%	12%	0.45
Hawaiian/Pac. Islander	0.6%	1.3%	0.69	0.4%	0.4%	>0.99	0.5%	1.0%	>0.99	0%	0%	
Hispanic	60%	60%	0.93	57%	60%	0.48	51%	52%	0.77	48%	48%	0.93
Multi-Racial	5.5%	4.5%	0.58	6.3%	3.3%	0.11	5.3%	4.8%	0.82	2.6%	4.3%	0.31
Native American	5.8%	2.9%	0.077	4.8%	3.0%	0.27	4.8%	5.8%	0.66	4.3%	2.2%	0.19
White	70%	70%	>0.99	72%	75%	0.49	70%	68%	0.75	57%	61%	0.34
HS/Transfer GPA (m) ³	3.67	3.70	0.84	3.71	3.69	0.56	3.65	3.62	0.52	3.59	3.56	0.53
HS/Trans GPA Missing	0.3%	0%	>0.99	0%	0%		0%	0%		0%	0%	
Cohort STEM	35%	33%	0.67	36%	31%	0.27	43%	41%	0.69	38%	34%	0.44
Cohort Exp Studies	30%	29%	0.86	33%	32%	0.85	30%	29%	0.83	26%	29%	0.47
Cohort Key	55%	54%	0.75	56%	52%	0.30	34%	34%	0.92	30%	30%	0.92
Cohort C4E	64%	66%	0.61	65%	66%	0.79	42%	42%	0.92	10%	8.7%	0.53

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

³Students with missing HS/transfer GPAs have a value of 0 for their GPA and a value of 1 for the variable HS/Trans GPA Missing.

Table A8. Covariate balance post-matching by outcome group among transfer students

Characteristic	2nd Fall Persistence			3rd Fall Persistence			4-Year Graduation			6-Year Graduation		
	AAC N = 187	Not AAC N = 187	p-value	AAC N = 166	Not AAC N = 166	p-value	AAC N = 115	Not AAC N = 115	p-value	AAC N = 89	Not AAC N = 89	p-value
Male	43%	45%	0.68	45%	44%	0.91	50%	43%	0.35	49%	47%	0.76
First Generation	88%	90%	0.41	85%	86%	0.75	85%	88%	0.56	79%	85%	0.24
Limited Income ¹	88%	90%	0.62	86%	88%	0.62	86%	88%	0.70	87%	90%	0.49
Nonresident	5.3%	5.3%	>0.99	3.0%	1.8%	0.72	1.7%	2.6%	>0.99	2.2%	5.6%	0.44
Asian ²	3.2%	4.3%	0.59	4.2%	5.4%	0.61	6.1%	5.2%	0.78	5.6%	9.0%	0.39
Black	7.5%	7.5%	>0.99	7.8%	6.6%	0.67	7.8%	6.1%	0.60	9.0%	11%	0.62
Hawaiian/Pac. Islander	2.1%	0.5%	0.37	1.8%	0%	0.25	0.9%	0.9%	>0.99	1.1%	4.5%	0.37
Hispanic	51%	48%	0.53	49%	49%	0.91	33%	27%	0.31	26%	19%	0.28
Multi-Racial	5.9%	5.3%	0.82	7.2%	6.0%	0.66	6.1%	5.2%	0.78	4.5%	11%	0.095
Native American	7.0%	7.5%	0.84	6.0%	4.8%	0.63	4.3%	5.2%	0.76	3.4%	5.6%	0.72
White	80%	78%	0.61	81%	83%	0.78	76%	77%	0.88	65%	67%	0.75
HS/Transfer GPA (m) ³	3.26	3.29	0.66	3.23	3.34	0.063	3.08	3.20	0.16	3.06	3.08	0.83
HS/Trans GPA Missing	0%	0%		0%	0%		3.5%	3.5%	>0.99	4.5%	4.5%	>0.99
Cohort STEM	47%	43%	0.47	49%	46%	0.51	48%	43%	0.51	45%	47%	0.76
Cohort Exp Studies	8.0%	12%	0.23	9.0%	12%	0.37	8.7%	9.6%	0.82	15%	13%	0.83
Cohort Key	0%	0%		0%	0%		0%	0%		0%	0%	
Cohort C4E	75%	74%	0.91	77%	77%	>0.99	55%	55%	>0.99	17%	15%	0.68

¹Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

²Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

³Students with missing HS/transfer GPAs have a value of 0 for their GPA and a value of 1 for the variable HS/Trans GPA Missing.

PSM Logistic Regression Odds Ratios

Table A9. Post-matching odds ratios of persistence & graduation among new students

Characteristic	2nd Fall Persistence		3rd Fall Persistence		4-Year Graduation		6-Year Graduation	
	OR ¹	p-value	OR ¹	p-value	OR ¹	p-value	OR ¹	p-value
Cohort AAC Flag	2.36	<0.001	2.34	<0.001	1.62	0.027	3.00	<0.001
Male	1.36	0.3	1.23	0.4	0.52	0.004	0.91	0.7
First Generation	0.66	0.4	0.58	0.13	0.86	0.6	0.86	0.6
Limited Income ²	0.82	0.6	0.69	0.3	0.65	0.2	0.75	0.4
Nonresident	1.12	0.8	0.50	0.091	0.75	0.5	0.84	0.7
Asian ³	0.41	0.2	0.28	0.042	1.34	0.6	1.49	0.6
Black	0.65	0.4	0.46	0.2	1.09	0.9	0.80	0.6
Hawaiian/Pac. Islander	0.63	0.7	0.15	0.14	0.00	<0.001		
Hispanic	1.43	0.3	1.05	0.9	0.94	0.8	0.82	0.5
Multi-Racial	2.33	0.3	2.44	0.2	0.67	0.6	1.90	0.4
Native American	0.47	0.3	0.28	0.050	0.43	0.2	0.42	0.2
White	0.48	0.087	0.52	0.15	1.35	0.4	0.76	0.4
HS/Transfer GPA (m) ⁴	3.31	<0.001	3.42	<0.001	3.90	<0.001	2.74	<0.001
HS/Trans GPA Missing	5,678,778	<0.001						
Cohort STEM	0.65	0.2	0.80	0.5	0.37	<0.001	0.61	0.070
Cohort Exp Studies	0.91	0.8	0.95	0.8	0.88	0.7	0.89	0.7
Cohort Key	1.06	0.8	1.15	0.6	1.20	0.5	0.88	0.6
Cohort C4E	0.94	0.9	0.88	0.7	1.02	>0.9	1.05	>0.9
No. Obs.	616		540		414		462	

¹OR = Odds Ratio

²Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

³Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

⁴Students with missing HS/transfer GPAs have a value of 0 for their GPA and a value of 1 for the variable HS/Trans GPA Missing.

Table A10. Post-matching odds ratios of persistence & graduation among transfer students

Characteristic	2nd Fall Persistence		3rd Fall Persistence		4-Year Graduation		6-Year Graduation	
	OR ¹	p-value	OR ¹	p-value	OR ¹	p-value	OR ¹	p-value
Cohort AAC Flag	1.29	0.4	1.93	0.031	2.61	0.004	10.6	<0.001
Male	1.34	0.4	1.58	0.12	1.31	0.4	1.68	0.3
First Generation	0.50	0.2	1.20	0.7	0.90	0.8	0.42	0.2
Limited Income ²	2.35	0.056	0.92	0.9	0.15	0.024	0.27	0.2
Nonresident	0.40	0.14	0.18	0.044	1.51	0.7	94,475,586	<0.001
Asian ³	5,700,768	<0.001	3,612,419	<0.001	0.44	0.3	0.78	0.8
Black	0.27	0.13	0.17	0.032	0.31	0.069	0.36	0.2
Hawaiian/Pac. Islander	6,971,347	<0.001	0.07	0.055	2,333,934	<0.001	1.87	0.6
Hispanic	0.79	0.5	1.05	0.9	0.73	0.4	0.17	0.005
Multi-Racial	0.87	0.9	4.53	0.2	1.67	0.6	0.92	>0.9
Native American	0.35	0.2	0.15	0.059	1.18	0.9	0.73	0.8
White	0.53	0.4	0.26	0.064	0.72	0.5	0.87	0.8
HS/Transfer GPA (m) ⁴	1.30	0.4	2.21	0.004	2.32	0.008	2.41	0.077
Cohort STEM	0.85	0.7	0.79	0.5	0.50	0.054	1.01	>0.9
Cohort Exp Studies	0.80	0.7	0.64	0.4	0.53	0.4	6.98	0.018
Cohort C4E	1.13	0.8	0.63	0.2	1.89	0.10	5.27	0.024
HS/Trans GPA Missing					7.02	0.14	3.81	0.5
No. Obs.	374		332		230		178	

¹OR = Odds Ratio

²Limited income includes Pell students and those who earned institutional grant aid in their first cohort term at CSU.

³Race and ethnicity variables in this table are duplicated, meaning that students can identify across several categories (e.g., White and Native American and Hispanic). Summing race/ethnicity percentages by column will yield a value greater than 100%.

⁴Students with missing HS/transfer GPAs have a value of 0 for their GPA and a value of 1 for the variable HS/Trans GPA Missing.

Figures

Common Support

Figure A1. 2nd fall persistence among new students

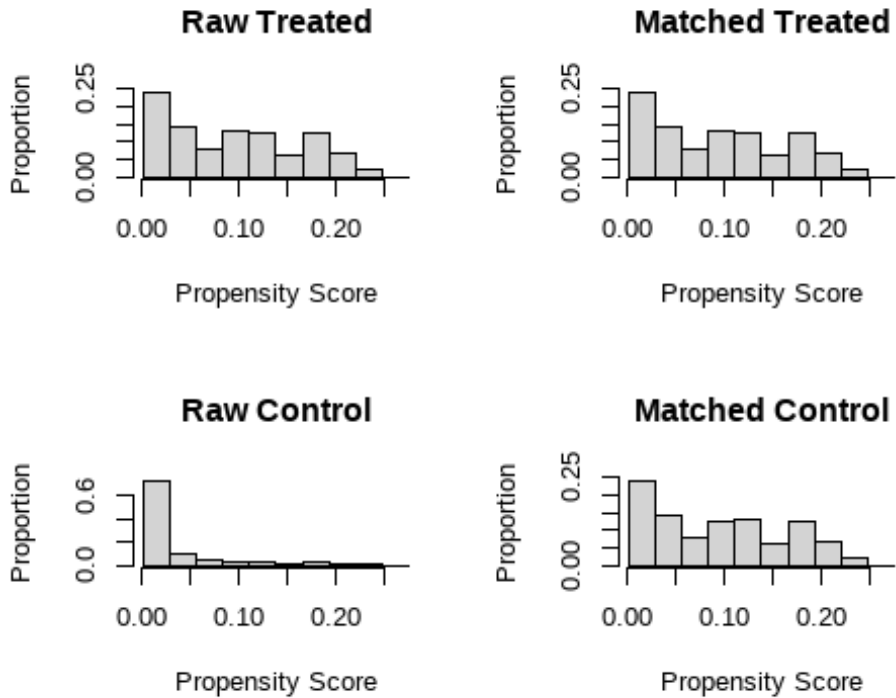


Figure A2. 3rd fall persistence among new students

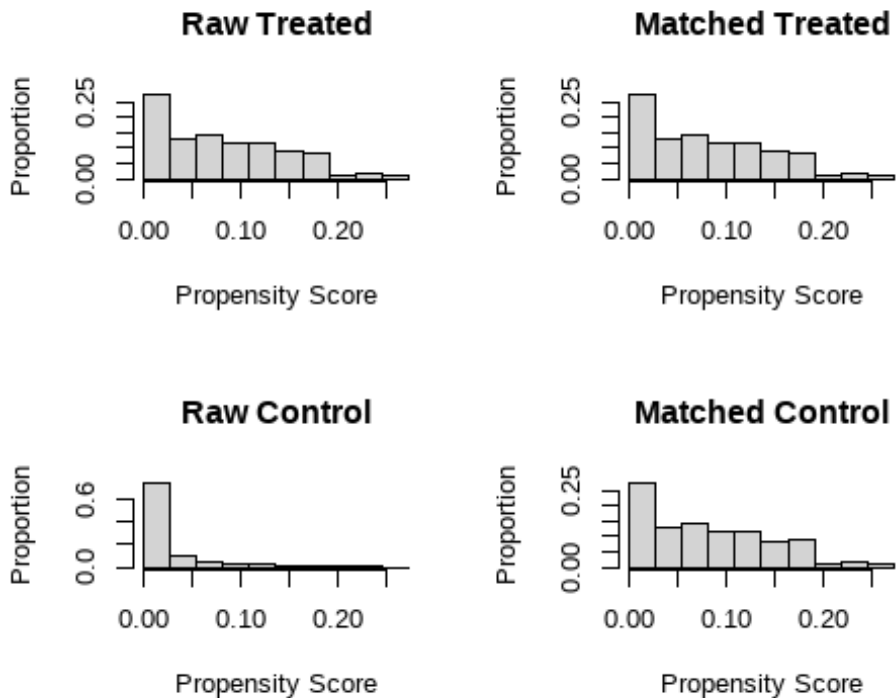


Figure A3. 4-year graduation among new students

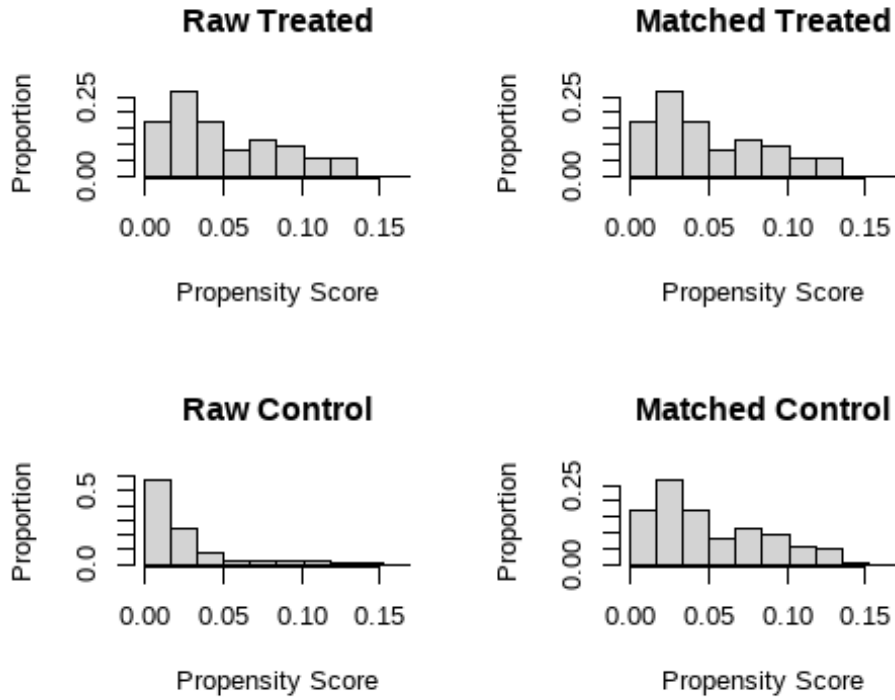


Figure A4. 6-year graduation among new students

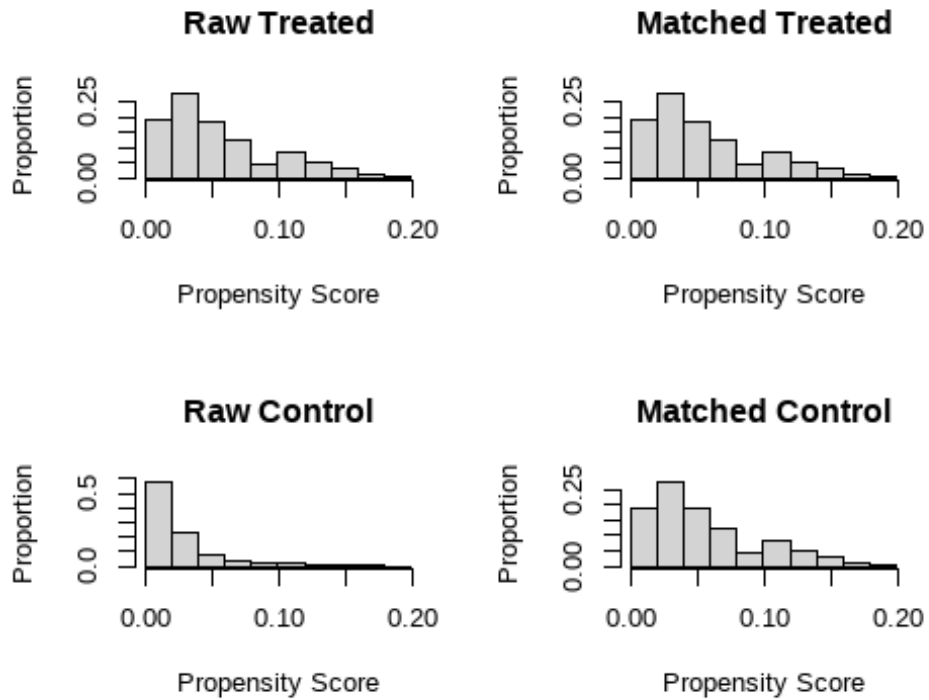


Figure A5. 2nd fall persistence among transfer students

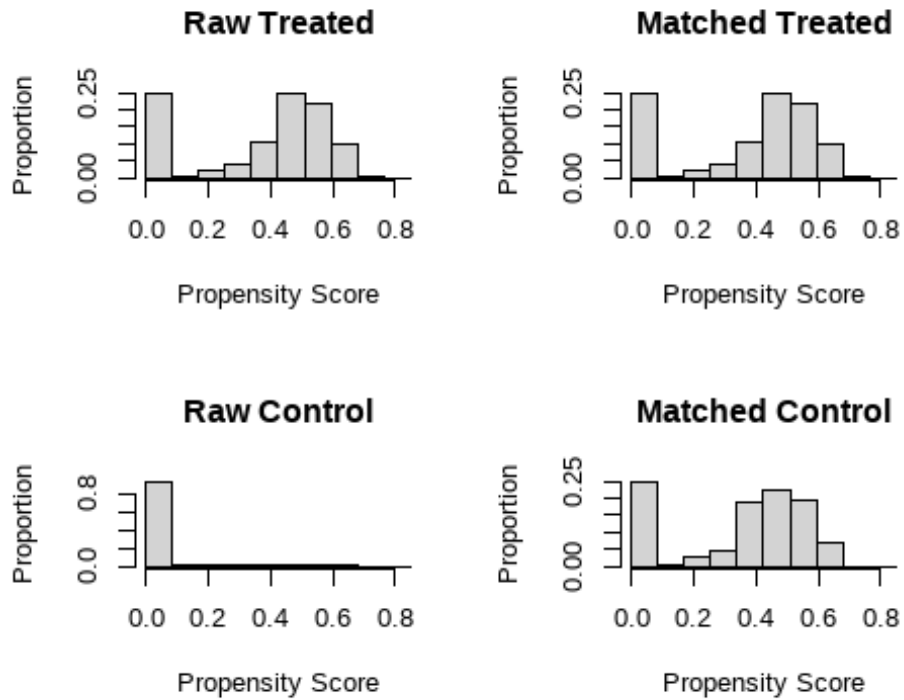


Figure A6. 3rd fall persistence among transfer students

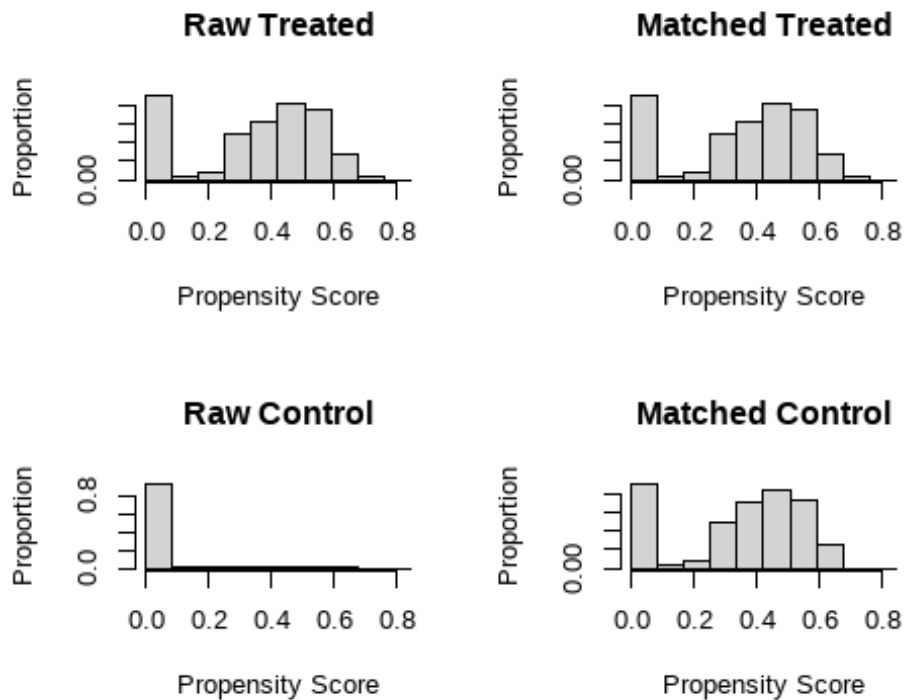


Figure A7. 4-year graduation among transfer students

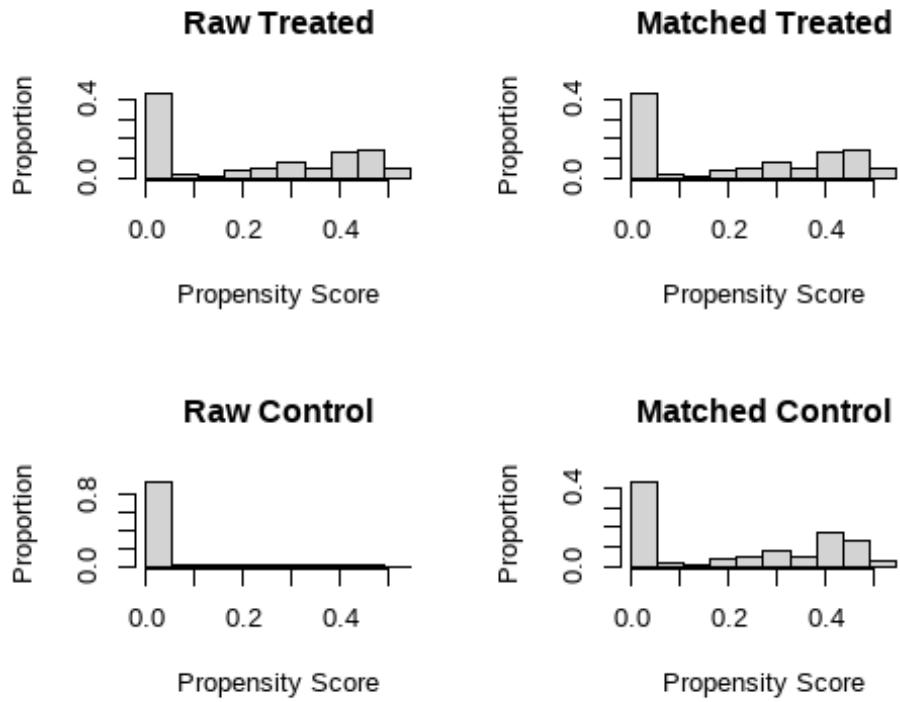


Figure A8. 6-year graduation among transfer students

