**Evaluating the Causal Impact of the Washington State’s Achievers Program on Student College Enrollment—A Comprehensive Look**

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1. **Introduction**

Low-income and underrepresented groups still face formidable challenges as they navigate through the education pipeline (Darling-Hammond [2003]). As a result, college attainment is still an elusive accomplishment for these student populations. In this analysis we evaluate the impact of a school grant program---the Washington State Achievers (WSA) Program, which is intended to support positive educational outcomes, particularly for low-income or otherwise marginalized students in the Washington state.

The Washington State Achievers Program, a major educational initiative by the Bill and Melinda Gates Foundation, was introduced in qualifying Washington State high schools in 2001. The aim of the WSA program is to encourage talented students from low-income families to attend college by financially alleviating their opportunity cost of going to college. The WSA scholarships alleviate and in some cases totally eliminate the direct costs associated with college attendance (Emeka and Hirschman [2005]). The specific criteria of eligibility of WSA schools are as follows:

* Candidates must attend and graduate from one of the 16 Achievers High Schools.
* Candidates must be actively working to prepare academically for college and must demonstrate academic potential through their commitment to classroom work and assignments.
* Candidates must plan to obtain a four-year college degree.
* Candidates must plan to attend an eligible public or independent Washington college or university for at least the first two years of college.
* Candidates must come from families who have and will continue to have an annual income that is in the lowest 35 percent of the State of Washington family incomes and have low or modest family assets. (Emeka and Hirschman [2005])

Recipients are selected on the basis of academic promise, teacher recommendations, and noncognitive skills that are predictive of academic success. Rather than choosing students from poor families based on GPA, the program focuses on selected low-income schools and hopes the program might create “an institutional as well as an individual effect”, aiming to create “a culture of college attendance” among low-income students (Emeka and Hirschman [2005]).

The primary goal of this study is to evaluate the causal impact of the WSA program on full time college attendance. In particular, this study aims to examine and/or answer the following questions:

1. Does full-time college attendance rate increase as the consequence of being a WSA school?
2. Does the program effect vary by school or by year, and if so, how?
3. In a given WSA achiever school, does the program increase the likelihood that enrolled students will attend college full time?

Our findings has shown that:

1. The full-time college attendance rate doesn’t increase as the consequence of being a WSA school.
2. The program effect does vary by school and by year.
3. WSA program has a positive effect on WSA recipients in each WSA school under analysis.

This paper consists of five sections. Section 2 describes the source of data and data collection procedures. Section 3 explains the model and techniques used. Section 4 exhibits the empirical results and discusses these results. Section 5 concludes. We will explore the above questions and explain our findings in more detail in the empirical results section.

1. **Data**

This study makes use of a large dataset generated by the University of Washington Beyond High School Project (UW BHS, 2012). The UW BHS project surveyed approximately 9,600 students in 14 high schools in the Pacific Northwest between 2000 and 2005 in an effort to explain the differences in the transition from high school to college by student race/ethnicity, socioeconomic origins and other characteristics. High school seniors were surveyed and answered approximately 200 questions on their academic ambitions, grades, family, perceptions of their school environment, and other factors believed to relate to their educational outcomes. Approximately one year after the first survey, a follow-up survey was administered to the same cohort. The second survey asked whether respondents had completed high school, whether they were enrolled in college, and whether they had a job. Surveys and follow up’s were given to five different senior classes, beginning in 2000 and ending in 2005 (there was no data collection in 2001).

**Sample**

We use several subsets of the UW BHS data to conduct our analyses. In our data 6 public high schools sampled are “Achiever Schools” (WSA schools); however our analysis will only include five of those six schools. In order to protect student confidentiality, schools will be referred to using anonymous ID numbers. In particular, we identify WSA schools and non WSA schools by their ids:

**WSA Schools**: 108, 109, 110, 102, 103, 106

**Non WSA Schools**: 101, 104, 105, 107, 111, 112

We are primarily interested in the schools that received WSA support for the years the support was provided. The WSA program was implemented in 2001 in three of the WSA schools in this analysis and in 2003 for the other three. Given that UW-BHS did not collect data in 2001, four years (2002, 2003, 2004, 2005) of WSA data are available for WSA schools 108,109 and 110. Three years (2003, 2004, 2005) of WSA data are available for WSA schools 102,103 and 106.

**Descriptive Statistics**

The following is a summary of descriptive statistics for all six WSA schools covering all years the support was provided for each school (the starting year the program was implemented might be different for different schools). A main purpose of WSA was to increase the number of underrepresented students enrolling in colleges. Here College Attend Full-Time is the dependent variable, which is a dummy variable indicating whether or not a student was enrolled in college full time. WSA Receive is the dummy variable indicating whether or not a student received WSA scholarship. WSA Apply is a dummy variable indicating whether or not a student applied WSA scholarship. Variables with \* are used as covariates in propensity score matching in following analysis.

Table 1 indicates that as many as around 60% students in WSA schools applied for the scholarships, and around 58.5% of applicants got the scholarships. This percentage is consistent with the finding from UW BHS survey that in the beginning years 2002 and 2003 the rate of selection is high (64%) and then the rate will decrease due to increasing number of applicants (Emeka and Hirschman [2005]). Table 1 also indicates that the college full-time attendance rate is around 69% for those WSA schools during the years the program has been implemented.

Among these variables, College Aspire is a dummy variable indicating whether or not a student wants to have a college degree plus. College Next is a dummy variable indicating whether or not a student plans to go to college. AP Course is a variable indicating whether a student has taken any advanced AP or Honors courses or not, or those courses are not offered. College Application Counselor is a variable indicating the frequency a student has resorted help from a counselor within the past 12 months on college applications.

**Table 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mean | Std. Dev . | Min | Max |
| WSA Receive | 0.358 | 0.480 | 0 | 1 |
| WSA Apply | 0.612 | 0.487 | 0 | 1 |
| \*Male | 0.451 | 0.498 | 0 | 1 |
| \*Self GPA | 3.100 | 0.672 | 0.5 | 3.9 |
| \*College Aspire | 0.913 | 0.282 | 0 | 1 |
| \*College Next | 0.802 | 0.398 | 0 | 1 |
| \*Parents Own Home | 0.574 | 0.495 | 0 | 1 |
| \*Dad Ed | 2.494 | 1.321 | 0 | 4 |
| \*Mom Ed | 2.593 | 1.195 | 0 | 4 |
| \*White | 0.411 | 0.492 | 0 | 1 |
| \*Black | 0.128 | 0.334 | 0 | 1 |
| \*Hispanic | 0.126 | 0.332 | 0 | 1 |
| \*Native American | 0.005 | 0.073 | 0 | 1 |
| \*Asian/Pacific Islander | 0.355 | 0.479 | 0 | 1 |
| \*Other Race | 0.017 | 0.131 | 0 | 1 |
| \*Multi Racial | 0.298 | 0.457 | 0 | 1 |
| College Attend Full-Time | 0.687 | 0.464 | 0 | 1 |
| \*AP Course | 1.497 | 0.506 | 1 | 3 |
| \*College Application Counselor | 1.406 | 1.222 | 0 | 3 |

In the following analysis, we drop school 103 due to missing data problem.

1. **The Model**

Throughout this study, the general technique is that we divide targeted population into treatment group and control group, and derive conclusions by examining the average treatment effect on treated (ATT). There are several cases to consider:

Case 1: Treated: WSA schools

Control: Non WSA schools

Case 2: In a given WSA school,

Treated: WSA receivers

Control: Non WSA receivers

Case 3: In a given WSA school, among all WSA applicants,

Treated: WSA receivers

Control: Non WSA receivers

Since the assignment of population to either treatment group or control group is not random, selection bias becomes a problem if we simply want to consider the difference between the means of treatment group and control group. To see this, assume is the treatment variable, is the outcome of individual from treatment group, is the outcome of individual from control group,then

however, we can only observe which is actually equal to



To fix this problem, propensity score matching technique was employed to match the treatment group to a non-treatment group selected from the population of schools. Students were matched using their propensity score in an effort to create treatment and control groups as if students had been randomly assigned to treatment. Covariates from our data that could introduce confounding between the treatment and the outcome were included in logistic regression functions estimating the propensity score for each school. Special attention was placed on making sure each covariate was balanced by comparing the distributions of each covariate in both the treatment and control groups.

Separate logistic models were fitted for each school to estimate students’ propensity score. Students were then matched based on their propensity score. The logistic functions used in three cases are:

Case 1&3:

Case 2:

Here WSAschool is the treatment variable indicating whether or not the student is from one of the six WSA schools. The above predictive probabilities are known as the propensity scores. Propensity score is the probability that a given student will receive the treatment (), conditional on the covariates selected for the matching.

Each respondent on the treatment group will then be matched with the closest non-treatment respondent based on their propensity score, and their differences will yield the average effect of the treatment on the treated (ATT).

However, to implement propensity score method, there are two assumptions needed to take into consideration.

***Assumption 1*** (*Conditional Independence Assumption or CIA*): there is a set of covariates, observable to the researcher, such that after controlling for these covariates, the potential outcomes are independent of the treatment status:

Assumption 1 means that after controlling for , the treatment assignment is “as good as random”. It ensures that the differences between treatment and control groups may be accounted for in order to reduce the selection bias. This allows the units from control group to be used to construct a counterfactual for the treatment group.

***Assumption 2*** (*Common Support Condition*): for each value of , there is a positive probability of being both treated and untreated:

Assumption 2 is also known as *overlap condition*, because it ensures there is enough overlap in the characteristics of the treatment and control groups so we can find adequate matches between these two groups.

1. **The Empirical Results**

In this section of the analysis we will first present a descriptive summary of the mean value of the outcome variable-full time college attendance within one year of high school graduation—by school and by year. We also want to know whether the fact of being a WSA school itself could lead to higher likelihood of students’ full-time college attendance from year 2003 to 2005.

Secondly, the results of propensity score models will be presented. These models estimate the causal impact of participation in WSA program. We do the propensity score matching procedures twice. First, we match students who received the support with the rest of students in a given WSA school. Second, we narrow down the population to the WSA scholarship applicants’ pool, and match students who received the support with those who didn’t receive but had applied for the scholarship.

Third, we do a casual impact analysis for each year (2003,2004 and 2005) using the same matching technique and examine whether there’s a program effect for all WSA schools each year.

Finally, the inquiry will focus on one WSA school (school 109) to examine the results of the propensity score matching process in more detail, using both nearest-neighbor and one-to-one matching techniques. We will also check the balancing between groups.

**a. Comparison of Full-time College Enrollment Means for WSA and non-WSA Schools**

Whether or not a student reported being enrolled in college as a full-time student within one year of their graduation from high school is the variable of interest. Though our primary focus is on the six schools who were recipients of the WSA program, the means of full-time college attendance for 12 schools—six WSA and six non-WSA—are displayed in figure one below. Figure 1 below displays each schools mean value for the outcome variable for all of the years data were collected by UW-BHS.

**Figure 1. Mean school-level values of full-time college enrollment for graduated students in WSA and Non WSA schools.**

WSA schools Non WSA schools

What may be first apparent is that the proportion of student’s from WSA schools attending college full-time within one year of high school graduation is on average less than non- WSA schools. This result likely reflects the targeted nature of the WSA program itself: public schools in low-income high-diversity communities are selected to participate—and research has shown that students who are attending low-income, high-diversity high schools may on average be less likely to enroll in college full time after graduation.

A visual inspection of the change in average full-time college enrollment over time in WSA schools does not necessarily reveal any overwhelming patterns. Levels of the dependent variable in WSA schools in 2005 are similar to those same schools’ values in 2001 —some slightly above, some slightly below. College enrollment outcomes for WSA schools 108, 109, and 110 are included for the year 2000—one year before the WSA program was implemented. Comparing those means to means for the same schools in year 2002—one year after WSA was implemented—does not reveal a uniform pattern. In WSA School 109 and 108 the mean value for full-time college enrollment is lower in 2002 (after implementation of WSA) than in 2000, in WSA School 110 it is higher.

Furthermore, considering the treatment variable WSAschool, we want to examine whether or not full-time college attendance will increase as a result of simply being a WSA school itself, through the use of propensity score matching. The following result shows the answer is no. T-stat for ATT is so small that we cannot reject the null hypothesis that the difference of full-time college attendance rate between treated (being in a WSA school) and control (being in a non WSA school) is zero. This implies that given the fact that WSA program has been implemented, a student who is enrolled in a WSA school does not have a higher likelihood of getting into college than if he had gone to a non WSA school. So at least it’s not obvious there is a positive spillover effect from the WSA program (for example, “the culture of college attendance”), when we take all five WSA schools as a cohort.

**Table 2**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Sample | Treated | Control | Difference | S.E. | T-Stat |
| College Attend Full-time | Unmatched | 0.699 | 0.781 | -0.082 | 0.013 | -6.45 |
| ATT | 0.699 | 0.699 | 0.000 | 0.023 | 0.02 |

**b. Fitting Propensity Score Models to Estimate Within-School Effects of WSA Treatment on the Treated in Five of Six WSA Schools**

Given that within WSA schools, students were not randomly assigned to receive the WSA program or not (students applied for WSA, and either received it or not), simply comparing WSA recipients to non-WSA recipients within WSA schools would be problematic in estimating the treatment effect of WSA. There could plausibly be something about WSA recipients themselves, e.g. higher motivation or academic preparedness that might lead to differences in full-time college enrollment, thus making it difficult to attribute rates of the college enrollment to the WSA program itself. To address this challenge, we use a propensity score approach to estimate the effects of the WSA program on program recipients within five of six WSA schools. Logistic models including a range of covariates, which for the purposes of this analysis are assumed to control for confounding between the treatment and the outcome, are fitted to calculate student-level propensity scores reflecting the likelihood of receiving treatment. Students who did and who did not receive WSA, but with similar likelihoods of receiving the treatment, are matched to create treatment and control groups to approximate random assignment.

In order to examine the causal impact of WSA scholarship in more detail, we do the propensity score matching procedures twice for each school. First, we match WSA recipients (treatment group) with non WSA recipients (control group). Second, we narrow down the population to applicants’ pool, thus matching WSA recipients (treatment group) with WSA applicants who didn’t receive the scholarship (control group). Within-school propensity score matching is conducted pooling across all school/years in which the WSA school was a WSA recipient.

Table 3 below presents the within-school ATT (effect of treatment on the treated) estimates for five WSA schools the UW-BHS sample that were generated using the propensity score matching approaches. The first row associated with each school id displays the estimation results given that the targeted population is the total student population of this school. The second row associated with each school id displays the estimation results given that the targeted population is a subset of the total population---the WSA applicants’ pool, i.e. all students who had applied for the WSA scholarship.

**Table 3. Causal estimates of within-school effects of WSA participation on WSA students.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Treated | Control | Difference (ATT) | S.E. | T-stat |
| School 108 | 0.926 | 0.861 | 0.065 | 0.077 | 0.84 |
| 0.935 | 0.925 | 0.009 | 0.087 | 0.11 |
| School 109 | 0.893 | 0.655 | 0.238 | 0.122 | ***1.94*** |
| 0.893 | 0.821 | 0.071 | 0.173 | 0.41 |
| School 110 | 0.901 | 0.637 | 0.264 | 0.117 | ***2.26*** |
| 0.9 | 0.8 | 0.1 | 0.122 | 0.82 |
| School 102 | 0.887 | 0.792 | 0.094 | 0.133 | 0.71 |
| 0.887 | 0.849 | 0.038 | 0.152 | 0.25 |
| School 106 | 0.933 | 0.789 | 0.144 | 0.097 | 1.48 |
| 0.933 | 0.811 | 0.122 | 0.090 | 1.35 |

We can observe from Table 3 that the WSA program has a overall positive impact on WSA recipients, since all the within-school ATT estimates attained from the propensity score matching are positive, indicating a higher likelihood of college enrollment for those WSA recipients than had they not receive the scholarship.

If the targeted population is the total student population, the WSA program has a significant effect on program recipients in two schools 109 and 110. The program effect is statistically significant at 10% significance level for school 109 and at 5% significance level for school 110. The effect is not statistically significant at 10% significance level for the rest of schools---school 108, 102 and 106. The ATT program effects range from 0.065 to 0.264. This suggests that the average percentage by which the full-time college attendance has increased as a result of receiving the WSA scholarship is from around 7 percent to 26 percent. This suggests that 7 to 26 percent more students are enrolling in college full-time within one year of graduation from high school than would have been the case if these students had not received the WSA scholarship.

If the targeted population is a subset of the total student population---the WSA applicants’ pool, the WSA program has a positive effect on the program recipients in all these five schools, but no the programs effects is statistically significant at 10% significance level. The ATT program effects range from 0.009 to 0.122. This suggests that 0.9 to 12 percent more students are enrolling in college full-time within one year of graduation from high school than would have been the case if these students had not received the WSA scholarship, the result of which comes from the matching procedure with a much smaller control group. This smaller control group, which is a subset of the first control group, requires that all the WSA recipients are matched to WSA applicants who hadn’t receive the scholarship. The result is interesting because it shows that the program effect is much less significant compared with the program effect attained from the first matching process---it seems WSA scholarship receivers didn’t have a significant advantage of getting into college compared with other WSA applicants who didn’t even receive the scholarship.

One way to think about this puzzle is that probably WSA applicants are more similar in nature in terms of the likelihood of getting into a college. Those who applied for WSA scholarships are more motivated to get into college, therefore WSA applicants are more likely to get into college than those who didn’t even try to apply for the WSA scholarship, despite that two groups of people may have similar other characteristics, e.g. family background, GPA, etc. Motivation is hard to measure among all the characteristics indicated by the covariates we used for propensity score matching, but it may has a larger impact on the outcome of getting into a college or not in real life situation than indicated in regressions, as motivated students are more willing to overcome hardships and difficulty in order to get into college. Another possible reason is that those WSA applicants who didn’t receive WSA scholarship may have applied for and received other scholarships or funding of similar type, which helped them financially in order to get into college. This is very plausible since they may resort to other resources given the fact that they had tried to get WSA scholarship but didn’t receive it; their motivation to get into college may lead them to other opportunities. Therefore, the effect of receiving the WSA scholarship alone is not that significant for increasing the likelihood of full-time college enrollment when the targeted population is the whole WSA applicants’ pool.

**Figure 2. The treatment effect estimates (ATT) for each WSA school (control group being all the non WSA students)**

**c. Fitting Propensity Score Models to Estimate WSA Treatment on the Treated in Five of Six WSA Schools By Each Year**

In this analysis, we examine whether there’s a program effect for all WSA schools in 2003, 2004 and 2005, the years of which the WSA program has already been implemented in all five WSA schools.

Table 4 contains ATT estimates for each year, taking together all five WSA schools as a cohort.

**Table 4. Causal estimates of effects of WSA participation on WSA students by each year.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | Treated | Control | Difference | S.E. | T-stat |
| 2003 | 0.914 | 0.8 | 0.114 | 0.070 | 1.63 |
| 2004 | 0.947 | 0.833 | 0.114 | 0.068 | 1.67 |
| 2005 | 0.929 | 0.876 | 0.044 | 0.072 | 0.61 |

Table 4 shows that there’s a positive impact of WSA program overall each year for five WSA schools taken together. The program effect is statistically significant at almost 10% significance level for year 2003 and statistically significant at 10% significance level for year 2004, while it’s not statistically significant at 10% significance level for year 2005. The program effects are similar in 2003 and 2004, which increase the percentage of full-time college enrollment by 11%, but in 2005 the percentage drops to 4%.

**d. In-depth Analysis of School 109**

School 109 will be used to present in more detail on the nearest neighbor matching procedures that were used for all schools in subsection b. Further, this matching approach will be contrasted with a one-to-one approach comparing the ATT estimates resulting from both matching strategies.

Table 5 below presents the logistic regression predicting the probability of receiving the WSA scholarship, which is equivalent to the propensity score in this analysis.

**Table 5. The logistic regression results predicting the probability of receiving the WSA fellowship for school 109**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Coef. | Std. Dev . | z | P>|z| |
| Male | 0.476 | 0.406 | 1.17 | 0.241 |
| Self GPA | 0.624 | 0.352 | 1.77 | 0.076 |
| College Next | 0.874 | 0.587 | 1.49 | 0.136 |
| Parents Own Home | -0.287 | 0.382 | -0.75 | 0.452 |
| Dad Ed | -0.272 | 0.155 | -1.75 | 0.079 |
| Mom Ed | -0.015 | 0.167 | -0.09 | 0.927 |
| White | 2.462 | 1.458 | 1.69 | 0.091 |
| Black | 2.545 | 1.474 | 1.73 | 0.084 |
| Hispanic | 0.948 | 1.261 | 0.75 | 0.452 |
| Asian/Pacific Islander | 2.212 | 1.459 | 1.52 | 0.129 |
| Multi Racial | -0.614 | 0.858 | -0.72 | 0.474 |
| AP Course | -1.450 | 0.373 | -3.89 | 0.000 |
| College Application Counselor | 0.335 | 0.152 | 2.21 | 0.027 |

\* Variables College Aspire, Native American and Other Race were omitted.

The results from the logistic model are consistent with the targeted purpose of the WSA program. The negative logit coefficients show that students from higher SES backgrounds, as implied by parents’ education and home ownership, are on average less likely to receive WSA assistance than their low-SES peers, holding all other covariates in the model constant. White being the reference category, it doesn’t seem students from ethnic/racial minority backgrounds are more likely than white students on average to receive WSA support except black students, however, the logit coefficents for other ethnic/racial groups are all positive except multi racial. Student self-reported academic achievement as measured by GPA and motivation to attend college after high school are positively associated with receipt of the WSA scholarship.

Table 6 displays the causal effects estimates of the WSA scholarship on recipients attained using nearest neighbor and one-to-one matching approaches. They yield quite different ATT estimates, 0.238 and 0.423 respectively. However, they are both statistically significant at 10% significance level (one-to-one estimate is significant at 5% significance level).

**Table 6. ATT estimates for school 109 using nearest neighbor and one to one matching approaches.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Method | Treated | Control | Difference | S.E. | T-Stat |
| Nearest Neighbor | 0.893 | 0.655 | 0.238 | 0.122 | 1.94 |
| One-to-One | 0.901 | 0.479 | 0.423 | 0.070 | 6.08 |

Figures 3 and 4 display the propensity score histograms for treatment and control groups using both methods. The histograms show that reasonable propensity score matches have been made. Given that propensity score histograms for treated and untreated groups are overlapping in most parts while the range of propensity scores is from 0.2 to 0.85 in both matching approaches, it was possible to match students with similar propensity scores to one another. This shows our matching procedures satisfy the common support assumption in model section.

**Figure 3 and Figure 4. Histogram of propensity scores for treatment and untreated groups for nearest-neighbor and one-to-one matching.**

**Nearest Neighbor Histogram** **One-to-One Histogram**

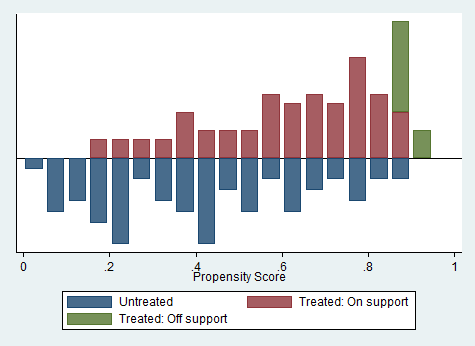
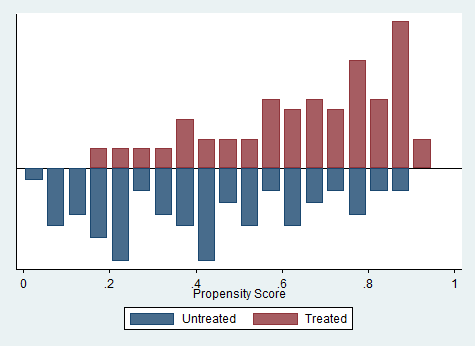


Table 7 below shows the post-matching covariate balances for both matching approaches.

**Table 7. Post-matching covariate balances for nearest neighbor and one-to-one matches in WSA School 110**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Nearest Neighbor | | | | | One-to-One | | | |
|  | Treated | Control | %bias | t | Treated | Control | %bias | t |
| Male | 0.345 | 0.452 | -22.2 | -1.42 | 0.352 | 0.380 | -5.8 | -0.35 |
| Self GPA | 3.323 | 3.3 | 4.0 | 0.32 | 3.278 | 3.025 | 44.5 | 2.63 |
| College Next | 0.929 | 0.940 | -3.5 | -0.31 | 0.915 | 0.803 | 33.4 | 1.94 |
| Own Home | 0.524 | 0.643 | -23.8 | -1.57 | 0.563 | 0.577 | -2.8 | -0.17 |
| Dad Ed | 2 | 2.107 | -8.6 | -0.57 | 2.225 | 2.239 | -1.1 | -0.07 |
| Mom Ed | 2.488 | 2.429 | 4.7 | 0.30 | 2.521 | 2.521 | 0.0 | -0.00 |
| White | 0.393 | 0.524 | -26.8 | -1.71 | 0.408 | 0.366 | 8.7 | 0.51 |
| Black | 0.25 | 0.190 | 13.5 | 0.93 | 0.253 | 0.268 | -3.2 | -0.19 |
| Hispanic | 0.060 | 0.048 | 4.2 | 0.34 | 0.070 | 0.113 | -15.0 | -0.87 |
| Asian Pacific | 0.321 | 0.238 | 18.2 | 1.20 | 0.300 | 0.268 | 6.2 | 0.37 |
| Multi Racial | 0.060 | 0 | 21.2 | 2.29 | 0.070 | 0.113 | -15.0 | -0.87 |
| AP Course | 1.238 | 1.214 | 4.9 | 0.37 | 1.282 | 1.634 | -72.2 | -4.21 |
| Counselor | 1.75 | 1.523 | 18.7 | 1.17 | 1.535 | 1.211 | 26.8 | 1.61 |

\* Variables College Aspire, Native American and Other Race were omitted.

Covariate balances for most covariates were reasonable using both matching approaches.

When nearest neighbor matching approach is used, after matching the differences in means for almost all variables are no longer statistically significant at 5% significant, except the variable Multi Racial. This suggests that the matching helps reduce the bias associated with observable characteristics.

When one-to-one matching approach is used, after matching the differences in means for almost all variables are no longer statistically significant at 5% significant, except the variables Self GPA, College Next and AP Course. The biases are also greater associated with these three variables.

1. **Conclusions**

The most significant finding from this analysis is a positive and in some schools statistically significant average causal effect of the WSA program on full-time college enrollment among students who participated in the program for all five WSA schools. The separate ATT estimates are 0.065, 0238,0.264,0.094 and 0.144. The program effect is also positive and in some years statistically significant during the year of which the WSA program has been implemented in all five WSA schools. However, the full-time college attendance doesn’t increase as a result of simply being a WSA school itself. Therefore it’s not obvious there is a spillover effect of this program like creating a “culture of college attendance” on other non WSA students in a WSA school, at least from this study. The analysis also revealed that WSA applicants are similar in terms of the likelihood of getting into college, perhaps attributed by motivation, availability of other scholarship/funding opportunities, etc.

This analysis also has several limitations. List-wise deletion procedures resulted in a reduction of the sample size and the possible inclusion of bias if the data were not missing at random. There was some attrition that was not adjusted for—not all students who completed the initial UW BHS survey completed the one year follow-up. These students were deleted from our sample, which possibly biased estimates. In addition to that, one of the key assumptions before we employ the propensity match technique—Conditional Independence Assumption, is not directly testable and still requires justification.

Future analyses could attempt to address these challenges and extend our work in several ways. The BHS data used for this study includes additional variables that could be considered for use as matching covariates. Alternative matching approaches could also be explored. We may also consider college completion as the outcome variable, when more compressive data is collected and becomes available.

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