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Interventions to Promote Postsecondary Attainment: *A Review of the Evidence and Benefit-Cost Analysis*

The Washington State Institute for Public Policy (WSIPP) Board of Directors authorized a collaborative project with the MacArthur Foundation and Pew Charitable Trusts Results First Initiative. This project extends WSIPP's benefit-cost analysis to a variety of new topics, including postsecondary education programs.

Postsecondary programs include interventions for students prior to and during college.[1] Program participants vary by school age (middle and secondary versus postsecondary students) and higher education institution type (baccalaureate degree-granting institutions versus community and technical colleges).[2] A common objective of the programs is to increase outcomes such as college readiness, enrollment, persistence, and degree completion.

In this report, we review the effectiveness of a set of higher education programs in the U.S. and, when possible, present benefit-cost results for these programs. Section I of this report outlines our research approach, while Section II discusses our findings.

Summary

WSIPP's Board of Directors authorized a collaborative project with the MacArthur Foundation and Pew Charitable Trusts to extend WSIPP's benefit-cost analysis to higher education programs. The goal is to determine whether higher education programs in the United States improve postsecondary outcomes and to estimate the benefits and costs of these programs.

This report reviews the evidence on four types of interventions: 1) financial aid, 2) student advising, 3) interventions in the summer before college, and 4) dual enrollment. Within each type, we reviewed specific interventions targeted at students in the K–12 system or already enrolled in college.

For each intervention, we gathered all the research we could locate from around the U.S. We screened the studies for methodological rigor and then computed an average effect of the programs on specific outcomes. When possible, we also independently calculated benefits and costs and conducted a risk analysis to determine which programs consistently have benefits that exceed costs.

We find evidence that most of the reviewed interventions achieve at least some desired outcomes and many have benefits that outweigh the costs. We describe these findings in this report and display them in Exhibits 1 and 2.

[1] We use postsecondary, higher education, and college interchangeably to refer to coursework beyond remedial education occurring at an institution of higher education. Unless otherwise noted, these terms refer to 4-year colleges and universities as well as community and technical colleges, which are typically 2-year programs.

[2] We use community and technical college (CTC) and 2-year institution interchangeably. Although CTC students may enroll in programs that take more or less than two years to complete, the literature often refers to CTCs as 2-year institutions. We also use baccalaureate degree-granting institution and 4-year institution interchangeably.

I. Research Methods

To assess the effectiveness of higher education programs, WSIPP reviewed existing studies of programs implemented since 1975. We restrict our review to evaluations of programs in the U.S. because of the relatively unique institutional and financial contexts surrounding higher education in this country. We also focus on programs for students attending college earlier in their career by excluding studies with an average participant age over 28.

To be included in our analysis, a study must contain an empirical evaluation of a program using a strong research design. Generally, this means we include studies that measure program effectiveness by comparing outcomes for a treatment and comparison group.[3] The comparison group must be similar to the treatment group on at least academic, demographic, and socioeconomic characteristics.

A study must also include one or more quantitative measures of an educational outcome, although we also report non-education outcomes from these studies. Postsecondary outcomes of interest included in this analysis are enrollment, college grade point average (GPA), student persistence in college, and degree receipt.

Many of the programs reviewed occur before college and are for K–12 students. In these cases, an included study may report K–12 outcomes such as high school graduation or high school GPA. To be included in this review, the primary intent of these programs must be to increase college readiness and/or enrollment. Additionally, studies must report outcomes for the whole study sample, meaning we exclude studies that report outcomes for only high school graduates or college enrollees when the intervention occurs at the K–12 level.[4]

We exclude studies that measure enrollment or graduation at a single university because these studies fail to capture outcomes for students who enroll elsewhere or transfer to other colleges. We also exclude studies that only use aggregate enrollment or graduation rates measured at the state level as these studies cannot explain individual-level student behavior.

Finally, we convert the relevant outcome measures from each individual study to an "effect size." An effect size measures the degree to which a program has been shown to change an outcome for program participants relative to a comparison group. To assess the overall weight of the evidence, we summarize the effect sizes of many studies using a meta-analytic framework. The result is a measure of average program effectiveness and the degree of precision of this estimate.[5]

[3] See WSIPP's Technical Documentation for more details on WSIPP's approach to meta-analysis. Washington State Institute for Public Policy. (December 2016). *Benefit-cost technical documentation.* Olympia, WA: Author. http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf.

[4] This review includes a partial list of higher education topics. Additional topics will be reviewed in 2017.

[5] Ibid, pp.18-19.

To assess the net benefits of higher education programs, we calculate the costs and benefits of their implementation in Washington State. We vary key factors in the benefit and cost calculations to estimate the degree of risk associated with our findings.

For higher education programs, we consider two types of costs: program costs and costs associated with attending college. First, we estimate the cost of the specific program, including costs associated with staff time, administration, or materials.

Second, we consider the costs of educating a student at an institution of higher education. Those in college incur costs related to tuition and fees as well as books and other related materials. If a program increases college enrollment or persistence, then the costs associated with attendance increase. We calculate the total expenditures per student attending a 4-year institution or CTC associated with greater educational attainment.

We also consider the opportunity cost of attending college. In our analysis, "opportunity cost" refers to the value of foregone earnings while attending college.

The primary economic benefit we consider in our model is the increased future earnings associated with greater postsecondary attainment.[6] Because earnings differ between those who enroll in college versus complete college and those with 2-year degrees versus 4-year degrees, we monetize 2-year and 4-year enrollment and graduation separately.[7] We also include societal benefits associated with greater educational attainment that accrue above and beyond the individual returns to education.

WSIPP's benefit-cost model estimates the value of these benefits on a per-program participant basis over time. WSIPP's model converts all future values into present discounted values. The model generates estimates of benefits and costs, net benefits (benefits minus costs) and the benefit/cost ratio. In addition, the model accounts for the inherent uncertainty in our estimates and calculates the probability that net benefits will exceed zero.[8]

[6] See Appendix II for more detail on how we monetize benefits associated with program participation.
[7] Enrollment and graduation outcomes must be disaggregated to be monetized in our model. We do not monetize enrollment at any college or any degree receipt.
[8] See WSIPP's Technical Documentation for more information.
http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf.

II. Research Findings

We present findings for four broad types of interventions:

1) Financial aid,
2) Student advising,
3) Summer interventions, and
4) Dual enrollment.

We compute meta-analytic findings for specific programs within each type. Results are reported in Exhibit 1. Findings are computed separately for high school and college populations. We conduct benefit-cost analyses when possible; available findings are displayed in Exhibit 2.[9]

1) Financial aid programs

Financial aid is money provided to students to reduce the recipient's cost of college attendance. Individual students may receive aid from local, state, and federal government sources as well as institutions and private organizations. Aid programs often target low-income students, although income eligibility requirements vary.

In this report, we present findings for three financial aid programs. Evaluations of these programs measured the effect of receiving any aid. Two programs—early commitment and performance-based scholarships—tend to target low-income students, while merit aid targets high-achieving students often without regard to income. Refer to Exhibits 1 and 2 for detailed findings for these programs.

Early commitment programs. Early commitment programs assure students postsecondary financial assistance early in their academic career conditional on meeting certain program requirements. The financial assistance goes toward tuition and other college costs. We focus on programs where students are assured assistance by 10th grade, and the academic standards are achievable by most students. We distinguish these programs from merit aid by excluding programs with a test score requirement and/or a minimum GPA requirement of 3.0 or higher.

We find that early commitment programs increase enrollment at 4-year institutions, but 4-year persistence rates were lower for the treatment group.[10]

Performance-based scholarships. Performance-based scholarships award aid directly to students in monthly or quarterly installments. Students can use these awards for schooling or other needs. To continue receiving aid, students must fulfill certain academic benchmarks, such as maintaining a 2.0 GPA or enrollment in additional years or terms of college. There are no initial academic requirements for the receipt of this type of aid.

[9] We do not conduct benefit-cost analyses when our meta-analyses do not contain monetizable outcomes.

[10] We do not report benefit-cost findings for early commitment and merit aid programs at this time because a large portion of the program cost is a transfer of college costs from the student to other sources. We do not yet have the capability to model this transfer. We report meta-analytic findings only in the current report and will report benefit-cost results when available.

We find that performance-based scholarships targeted at high school students improve enrollment in 2-year colleges and persistence into the 2nd and 4th year of college. The programs have benefits that exceed costs 74% of the time.

We find that performance-based scholarships for college students have a positive impact on the receipt of any college degree.

Merit aid. Undergraduate students can receive merit aid to cover part or all of tuition and other college costs. Aid receipt is based on prior academic achievement, such as SAT/ACT scores or high school GPA. Students may renew their merit aid awards each year if they continue to reach certain academic benchmarks. Merit aid rewards students for past achievements and encourages them to continue meeting high academic standards.

In our analysis, we find that merit aid improves academic performance and educational attainment. Among high school students, we find that the availability of merit aid increases enrollment at 4-year institutions. When applied to college students, we find that merit aid increases GPA, the likelihood of receiving a 4-year degree, and later earnings.

Exhibit 1

Higher Education Meta-Analytic Results

Intervention	High school graduation	# of effect sizes	Effect size	Standard error	P-value	# in treatment
Financial aid:						
Early commitment programs	**Enroll in 2-year college**	2	0.025	0.020	0.208	12,841
	Enroll in 4-year college	3	0.200	0.107	0.062	16,387
	Graduate with 2-year degree	1	0.056	0.130	0.669	855
	Graduate with 4-year degree	2	0.149	0.126	0.236	2,765
	Persistence into 4th year	1	-0.114	0.056	0.043	855
Performance-based scholarships (for high school students)[2]	**Enroll in 2-year college**	1	0.115	0.039	0.003	1,361
	Enroll in 4-year college	1	0.000	0.039	1.000	1,361
	Graduate with any degree	1	0.014	0.044	0.758	1,547
	Persistence into 2nd year	1	0.138	0.052	0.008	1,547
	Persistence into 3rd year	1	0.050	0.045	0.265	1,547
	Persistence into 4th year	1	0.088	0.042	0.038	1,547
Performance-based scholarships (for college students)	College grade point average	4	0.148	0.483	0.759	366
	Graduate with any degree	1	0.073	0.043	0.092	2,572
	Persistence into 2nd year	4	0.037	0.040	0.351	2,572
	Persistence into 3rd year	4	0.042	0.051	0.407	2,572
	Persistence into 4th year	2	0.030	0.051	0.562	1,287
	Persistence into 5th year	1	0.136	0.065	0.035	751
	Remedial credits earned	1	0.177	0.481	0.713	505
Merit aid (for high school students)	**Enroll in 2-year college**	6	-0.034	0.054	0.529	38,574
	Enroll in 4-year college	9	0.093	0.029	0.001	52,979
	Graduate with 2-year degree	4	-0.006	0.002	0.008	400,331
	Graduate with 4-year degree	5	-0.001	0.021	0.955	400,500
	Persistence into 2nd year	3	0.019	0.032	0.560	6,262
	Persistence into 3rd year	1	0.195	0.077	0.011	525
	Persistence into 4th year	2	0.061	0.138	0.657	21,146
Merit aid (for college students)	Employment	3	-0.007	0.018	0.711	12,122
	Earnings	3	0.040	0.021	0.056	12,122
	Graduate with 4-year degree	4	0.149	0.057	0.009	14,059
	College grade point average	5	0.029	0.014	0.040	21,120
	Graduate with 2-year degree[1]	1	0.077	0.280	0.783	9,519
	Transfer to 4-year college[1]	1	0.042	0.273	0.878	11,898
Student advising:						
College advising provided by counselors (for high school students)[2]	**Enroll in 2-year college**	2	0.039	0.027	0.147	7,520
	Enroll in 4-year college	3	0.123	0.036	<0.001	10,266
College advising provided by peer mentors (for high school students)[2]	**High school graduation**	1	-0.088	0.054	0.106	1,038
	Enroll in 4-year college	2	0.1052	0.043	0.015	1,552
	Enroll in 2-year college	2	-0.031	0.044	0.474	1,552
	Grade point average (high school)	1	-0.022	0.041	0.593	1,038
Opening Doors advising in community college	**Transfer to 4-year college**	1	-0.014	0.053	0.799	1,073
	Graduate with 2-year degree	1	-0.102	0.053	0.055	1,073
	Persistence into 2nd year	1	0.098	0.049	0.044	1,073
	Persistence into 3rd year	1	0.079	0.051	0.123	1,073

Notes:

[1] Outcomes measured in a single study that focused on merit aid at community colleges.

[2] Benefit-cost findings available and reported in Exhibit 2.

Bolded text identifies monetizable outcomes.

Exhibit 1 (Continued)

Higher Education Meta-Analytic Results

Intervention	Outcome	# of effect sizes	Effect size	Standard error	P-value	# in treatment
Summer interventions (for college-intending high school graduates):						
Summer bridge	Enrolled in any college	2	0.009	0.062	0.880	1,206
	Graduate with any degree	1	0.245	0.063	<0.001	413
	Remedial credits earned	1	-0.112	0.056	0.046	793
Summer outreach counseling[2]	**Enroll in 4-year college**	2	0.118	0.053	0.025	1,015
	Enroll in 2-year college	2	-0.026	0.072	0.721	1,015
Text message reminders (for high school graduates)[2]	**Enroll in 4-year college**	1	-0.046	0.035	0.186	2,524
	Enroll in 2-year college	1	0.107	0.041	0.010	2,524
Text message reminders (for college students)	College grade point average	1	0.029	0.095	0.761	407
	Persistence into 2nd year	2	0.070	0.250	0.780	413
Dual enrollment programs (for high school students)[2]						
	High school graduation	6	0.1459	0.115	0.206	17,094
	Enroll in 4-year college	4	-0.090	0.192	0.640	42,045
	Grade point average (high school)	1	0.262	0.040	0.001	631
	Graduate with 4-year degree	3	0.1812	0.093	0.051	33,462
	Graduate with 2-year degree	1	-0.270	0.035	0.001	1,700

Notes:

[1] Outcomes measured in a single study that focused on merit aid at community colleges.

[2] Benefit-cost findings available and reported in Exhibit 2.

Bolded text identifies monetizable outcomes.

Exhibit 2

Higher Education Benefit-Cost Results

Program name	Total benefits	Taxpayer benefits	Non-taxpayer benefits	Costs	Benefits minus costs (net present value)	Benefit to cost ratio	Chance benefits will exceed costs
College advising provided by counselors (for high school students)	$24,003	$5,505	$18,498	($325)	**$23,678**	$73.85	**100%**
Dual enrollment (for high school students)	$20,364	$6,144	$14,220	($1,493)	**$18,870**	$13.64	**87%**
Summer outreach counseling (for high school graduates)	$18,372	$4,285	$14,087	($95)	**$18,277**	$193.23	**90%**
Performance-based scholarships (for high school students)	$8,425	$1,920	$6,505	($1,493)	**$6,932**	$5.64	**74%**
Text message reminders (for high school graduates)	$702	($10)	$712	($7)	**$695**	$98.62	**52%**
College advising provided by peer mentors (for high school students)	$1,440	($382)	$1,822	($775)	**$665**	$1.86	**51%**
Opening Doors advising in community college	($1,401)	$296	($1,697)	($802)	**($2,203)**	($1.75)	**21%**

Notes:

These results are current as of December 2016. More recent results may be available on WSIPP's website http://www.wsipp.wa.gov/BenefitCost?topicId=11.

2) Student advising

Advising programs help students plan for college through visits with counselors, advisors, and peer mentors.

We review research on three different college advising scenarios: in high school provided by school counselors, in high school provided by peer mentors, and Opening Doors in community college. For detailed findings, refer to Exhibits 1 and 2.

College advising provided by counselors. Students in the 10th-12th grades meet with advisors at the high school for college-focused advising sessions. The advisors provide guidance on the application and enrollment process and career path readiness.

We find that college advising in high school provided by school counselors increases enrollment into 4-year colleges. In our analysis, benefits outweigh the costs of the program 100% of the time.

College advising provided by peer mentors. Students in the 11th and 12th grades receive support from a peer mentor, defined in the included studies as an undergraduate or graduate student. The peer mentor helps students apply to college and gives advice and encouragement on postsecondary plans. Students meet with their peer mentor in person, but interactions also take place via text message, email, or over the phone.

On average, we find that college advising provided by a peer mentor increases enrollment into 4-year colleges. Benefits outweigh the costs of the program 51% of the time.

Opening Doors advising in community college. We identified one rigorous multi-site evaluation of advising for first-year students at community colleges. This evaluation examined the advising component of the Opening Doors program at two community colleges.[11] The community college counselors worked with fewer students than in a traditional college setting, allowing for more intensive, personalized, and comprehensive advising sessions.[12] Students in this intervention were low income (with a family income below 250% of the federal poverty level) and, at an average age of 24 at initial enrollment, were slightly older than traditional college students.

Opening Doors advising in community college produces mixed results. We find the program increases student persistence into the 2nd year and find some evidence that persistence into the 3rd year also increases, although we do not currently monetize persistence. However, we also find that 2-year graduation rates, measured three years after the start of treatment, are lower for participants than nonparticipants. In our analysis, costs exceed benefits, on average. Positive net benefits can be expected about 21% of the time.

[11] The Opening Doors program designed by MDRC works with community colleges to implement one or more of the following strategies: new types of financial aid, enhanced student services, and curricular and instructional innovations http://www.mdrc.org/project/opening-doors#overview.

[12] Scrivener, S., & Weiss, M.J. (2009). *More guidance, better results? Three-year effects of an enhanced student services program at two community colleges.* New York, NY: Manpower Demonstration Research Corporation.

3) Summer interventions

We examine a variety of interventions that aim to reduce "summer melt," a term used to describe when high school graduates who planned to go to college fail to attend in the year following high school.[13] Interventions to address summer melt occur during the summer between high school graduation and college attendance the following fall. Detailed findings are reported in Exhibits 1 and 2.

Summer bridge. During summer bridge programs, students take academic, remedial, or introductory courses at the college they plan to attend. They also participate in academic and college skills workshops focused on academic preparation and integrating students into the college environment. These programs often target low-income, minority, and/or low-performing students.

We identified only two rigorous studies that measured the effect of summer bridge programs on remedial credits earned and enrollment at any college and another that measured the effect on any degree receipt. We find that summer bridge programs reduce the number of remedial credits a student earns and increase degree receipt.

Summer outreach counseling. Throughout the summer, counselors provide support and outreach on financial aid tasks, informational barriers, and social or emotional challenges related to the college transition. Counselors may reach out via in-person consultation, email, phone, text, or instant messages.

On average, we find that summer outreach counseling increases enrollment at 4-year colleges and has benefits that outweigh costs about 90% of the time.

Text message reminders. Text message reminder interventions can occur during the summer after high school or in college. We estimate the effects in these two settings separately.

In high school, students are sent automated text message reminders about financial aid and college enrollment tasks as well as prompts to reach out for help from a designated organization or advisor if needed. When targeted at college students, these automated text reminders encourage college students to seek out academic and financial aid resources at their schools and to reapply for financial aid.

Although reminders targeting college students are not designed to combat summer melt, we report findings under the summer intervention section in Exhibit 1 given the similarity among text message interventions.

We find some evidence that text message reminders for students in the summer after high school graduation can reduce summer melt by increasing enrollment rates at 2-year colleges. Benefit-cost results indicate this intervention has benefits that outweigh costs 52% of the time.

[13] Castleman, B.L., & Page, L.C. (2015). Summer nudging: Can personalized text messages and peer mentor outreach increase college going among low-income high school graduates? *Journal of Economic Behavior & Organization, 115*(3), 144-160.

4) Dual enrollment

There are various concurrent enrollment programs. For this report, we review dual enrollment, which in Washington State is referred to as Running Start. Dual enrollment allows high school juniors and seniors to enroll in post-secondary classes at CTCs or certain 4-year colleges. Dual enrollment students simultaneously earn transferrable college credit while still enrolled in high school. The cost of tuition is usually paid by the school district and the college. Refer to Exhibits 1 and 2 for detailed findings.

We find that dual enrollment programs increase 4-year degree attainment and improve grades in high school but have negative effects on graduating with a 2-year degree. Benefits outweigh the costs of the program 87% of the time.

III. Next Steps

This report presents findings on an initial set of higher education interventions. WSIPP will analyze additional interventions in 2017.

Appendices

Interventions to Promote Postsecondary Attainment: *A Review of the Evidence and Benefit-Cost Analysis*

Appendix

In Appendix I and II, we describe the methods used to arrive at the effect size estimates reported in Exhibit 1 and the benefit-cost findings in Exhibit 2. Appendix III lists the studies used in our analysis.

I. Discussion of Meta-Analysis Methodology and Results

When conducting meta-analysis, we must first determine what studies to include. We limit this report to programs in the U.S. because institutional context and financial costs of higher education differ across countries in ways likely to affect the final outcomes for students. We exclude studies published prior to 1975 because college enrollment rates have increased over time, potentially changing the expectations and value of a college degree.

We also focus on programs designed primarily for high school students and young college students (age 28 or younger). To be included in this review, interventions occurring prior to college must intend to increase college readiness, enrollment, persistence, or graduation. These interventions may have K–12 outcomes that we will report along with college-level outcomes. Some programs employ broad strategies to target multiple factors related to college outcomes.

We consider numerous study characteristics when determining whether to include an evaluation in a meta-analysis including research design, study sample, and measured outcomes.

Research design

The gold standard research design is a random assignment study in which program participants are randomly assigned to receive services (the treatment group) or not (the control group). Under these circumstances, the researcher can be relatively confident that treatment and control group participants have similar background characteristics and any differences between the treatment and control group occur randomly. However, many treatments intended to improve postsecondary outcomes are not randomly assigned, and strong research design has the potential to reduce the selection bias inherent in non-random assignments. Thus, we also include rigorous non-randomized studies in our analysis.

When including non-randomized studies, we generally prefer evaluations using quasi-experimental methods such as difference-in-differences, regression discontinuity, or instrumental variable analysis. Other types of non-randomized studies—those using multivariate regression or propensity score matching—must have a comparison group which has similar characteristics to the treatment group. Studies using multivariate regression or propensity score matching must include, or demonstrate balance

on, a rich set of covariates including, at a minimum, demographic (race, gender, and age), academic (standardized test scores and/or grade point average prior to treatment), and socioeconomic (primarily income or financial need or parental education) characteristics. Additionally, when a study uses multivariate regression or propensity score matching, the comparison group should be eligible for the treatment, unless they are ineligible for reasons specific to the research design, for example, because they live in an area that does not offer the intervention.

Study sample

The study sample refers to the data used within each study to evaluate a program. When we identify multiple studies based on the same underlying data, we first attempt to select one study for inclusion based on the completeness of the dataset at the time of analysis, the quality of the research design, and the sophistication and appropriateness of the statistical analysis. When more than one study satisfies these conditions, we include all studies but adjust the sample size of the studies to account for the overlapping sample.

When the treatment occurs during high school or before, we often exclude studies that report outcomes for samples of high school graduates or college enrollees only. Because the treatment may impact high school graduation or college enrollment, studies that limit the samples to only graduates or enrollees introduce the possibility of post-treatment bias. That is, the sample of students on which the analysis is performed may differ systematically from the initial sample of treated participants.

We exclude all studies that only examine outcomes at a single university. For example, we excluded studies that measured the effects of a specific university's merit aid program on enrolling at or graduating from that particular university. Although these studies may provide useful information for institutions of higher education that wish to use aid to boost their enrollment or graduation rates, the state's interest in higher education usually relates to increasing overall enrollment or graduation rates for all students at all colleges or universities. When results are limited to students at a single university, students who have chosen to attend or transfer to other universities will often be considered non-enrollees, dropouts, or missing cases, biasing the effects of the meta-analysis.

Measured outcomes

We generally exclude studies that report no relevant academic outcomes. Relevant academic outcomes include GPA (high school or college), *test scores* (middle or high school), *high school graduation*, *college enrollment* (any, *2-year*, or *4-year*), *college graduation* (any, *2-year,* or *4-year*), and college persistence into years 2-5 (defined as any enrollment during 2-5).[14]

When presented with multiple follow-up periods, we use the reported measure of college enrollment that falls closest to within 12 months of high school graduation. We prefer to use measures of the "highest" level of enrollment to avoid including measures that may double count students that enroll in both 2- and 4-year institutions. For college graduation, we use the measure nearest 150% on-time graduation for the highest degree attained—six years for Bachelor's degree receipt and three years for Associate's degree receipt. If a study reports any graduation, we generally use the measure closest to six years. Because 2-year and 4-year institutions have different enrollment and graduation patterns, we only monetize

[14] Italicized outcomes are monetizable in WSIPP's benefit-cost model. We do not monetize enrollment at any institution or any degree receipt.

enrollment and graduation outcomes when they are measured separately for 2-year and/or 4-year institutions. When a meta-analysis includes 2-year, 4-year, and any enrollment or graduation, we report the disaggregated 2-year and 4-year outcomes; in other situations, we will often report any enrollment or degree receipt.

After identifying and coding the studies that fit the above criteria, we calculate the standardized mean difference as our effect size metric.[15] In the meta-analytic framework, the overall measure of program effectiveness is a weighted average of the effect sizes derived from individual studies included in the analysis. Weights are assigned to individual studies based on the number of program participants in the study and the precision of the effect size estimates.[16]

[15] When possible, we correct for clustering as described in WSIPP's Technical Documentation. We calculate intraclass correlations (ICCs) using the Education Longitudinal Study, a national survey of 10th graders in 2002 and 12th graders in 2004. We estimate mixed effects models predicting college enrollment and graduation conditional on demographic and academic characteristics. For college enrollment, we cluster by high school; for college graduation, we cluster by college. The ICC is then the proportion of the variation in the outcome attributed to the cluster.

[16] WSIPP also adjusts for study characteristics and decay in effect sizes over time. For more information on these adjustments, see WSIPP's Technical Documentation:
http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf. As we continue to review higher education programs, we will perform analyses to determine whether these adjustments are warranted for postsecondary programs. In this initial report, we do not perform any adjustments for study characteristics or decay over time.

II. Methodology to Estimate Increased Earnings from Postsecondary Attainment

Estimating the benefits of higher education programs requires estimating 1) the change in the number of students attending and/or graduating from college, and 2) the economic value of that change as measured by the earnings associated with postsecondary attainment.

To calculate the change in the number of students at each educational attainment level, we first estimate a baseline distribution of students in Washington with some college attainment, an Associate's (2-year) degree, and a Bachelor's (4-year) degree.[17] We then apply our effect size estimates to the baseline distribution to predict the change in the baseline distribution of students as a result of program participation.

After estimating the change in the number of students at each education level, we then estimate the economic returns to that change in educational attainment. WSIPP values additional education in the form of increased future earnings. Because we observe differences in earnings associated with different educational attainment levels (see Exhibit A3), we can estimate the change in earnings that we would expect from a change in the distribution of final degree and college attainment.

Finally, we moderate our estimates of the economic returns to the changes in educational attainment by considering the financial costs (tuition, books etc.) and opportunity costs (forgone earnings) of college attendance. To monetize changes in postsecondary attainment due to program participation, we then calculate the change in earnings and the change in college tuition and opportunity costs due to the change in the number of students at each educational attainment level. This section describes these steps in greater detail.

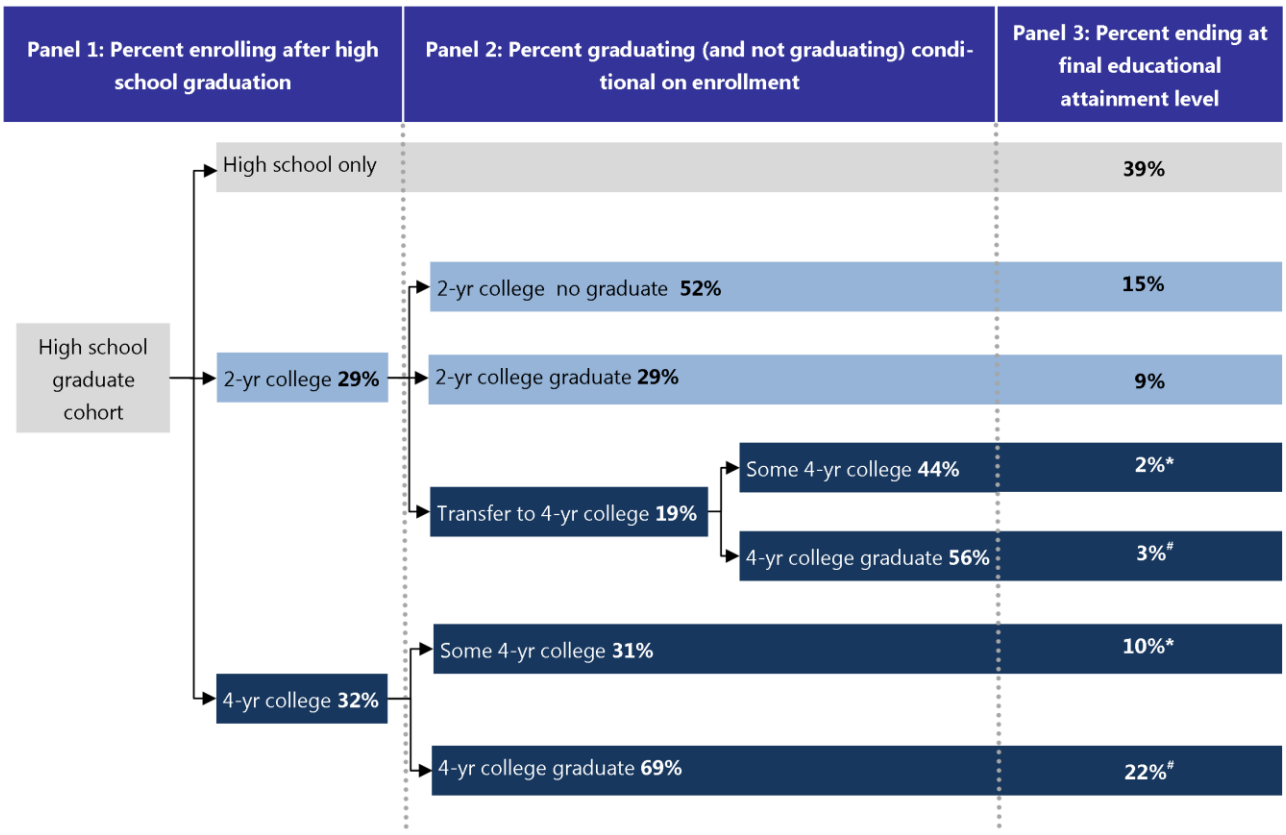
Estimating the baseline distribution of educational attainment

Our baseline distribution represents our estimates of the highest level of education attained for a cohort of high school graduates in Washington without any intervention. To arrive at the baseline distribution, we combine data from different sources to determine the proportion of high school graduates that attain some college or receive a college degree. Exhibit A1 illustrates a typical Washington high school graduate's projected educational pathways for the baseline distribution. The first panel of the tree illustrates the percent of high school graduates we estimate will enroll in 2-year or 4-year colleges. The second panel of the tree shows the proportion of students that will graduate and/or transfer conditional on their initial enrollment decision. The final panel of the tree represents the final baseline distribution of high school graduates that we estimate will obtain some college attainment (2- and 4-year), an Associate's degree, or a Bachelor's degree approximately six years after graduating high school. The baseline distribution is reported in the table at the bottom of Exhibit A1.

[17] We define some college attainment as enrollment in either a 2-year or 4-year institution without obtaining any degree.

Exhibit A1

Potential Educational Pathways



Final baseline distribution: Percent of students at each educational attainment level				
High school graduate only	Some college attainment		2-year degree	4-year degree
	2-year	4-year		
39%	15%	12%	9%	25%

Notes:

* Some college (either 2-year or 4-year) are summed together to arrive at the total percent of individuals receiving some college but not graduating.

4-year college graduates, regardless of path, are summed together to arrive at the total percent of individuals who receive a 4-year degree.

We calculate degree attainment by multiplying the percent enrolling by the probability of graduating conditional on enrollment. We multiply enrollment by the percent not graduating conditional on enrollment to estimate some college attainment. When a student can arrive at a final education level through more than one path, we sum the percent at a final education level across all possible paths. For example, to arrive at the percent of students with a Bachelor's degree we calculate the percent with a Bachelor's through the direct path as percent enrolling in a 4-year institution (32%) multiplied by the percent graduating conditional on enrolling in a 4-year institution (32% x 69% = 22%). We also calculate the percent graduating with a BA for those that start at a 2-year institution as the percent enrolling in a 2-year institution multiplied by the percent of 2-year enrollees that transfer to 4-year institutions multiplied by the percent of transfer students that graduate (29% x 19% x 56% = 3%). We then calculate the percentage of students with a BA as the sum of these two paths (22% + 3% = 25%).

We use data from the State of Washington Education Research & Data Center (ERDC) to estimate the baseline proportion of high school graduates enrolling in a 2-year program, enrolling in a 4-year program, or not enrolling in higher education. Calculations are based on the 2014 enrollment percentages in ERDC's High School Feedback Reports, which measures college enrollment in the 12 months following high school graduation.[18]

We next estimate the proportion graduating given enrollment to arrive at the total proportion of high school graduates who will obtain a degree. The proportion of 2-year enrollees who graduate with an Associate's degree in three years comes from data from the Integrated Postsecondary Education Data System (IPEDS) as reported by the Washington State Board for Community and Technical Colleges (SBCTC).[19] We also consider the proportion of students enrolled in a 2-year college transferring to a 4-year college. Transferring from a 2- to 4-year college increases the student's expected earnings by increasing the probability students receive a BA. The probability of transfer also comes from IPEDS data reported by the Washington SBCTC.[20] We then use data from the National Student Clearinghouse Research Center to determine the proportion of transfer students that graduate with a Bachelor's degree.[21]

The conditional probability of earning a BA within six years given enrollment in a 4-year institution is from Washington's Office of Financial Management.[22] This number reflects the graduation rate for students enrolling in a public Washington university directly from high school in the 2010-11 academic year.

Estimating the change in the distribution of educational attainment

Our ultimate goal is to estimate the change in the distribution of education due to program participation. We allow higher education programs to affect the distributional attainment in one of four ways. First, a program may change the percent of high school graduates that attain a BA or Associate's degree. Second, a program can change the percent of high school graduates that enroll at 2-year or 4-year institutions. Third, for those who are already enrolled at a 2-year or 4-year institution, the program can change the percent of enrolled students who graduate. Finally, a program for 2-year students can change the rates at which they transfer to or graduate from a 4-year institution.

We apply the effect sizes estimated by our meta-analysis to the affected outcomes to determine the expected change in the baseline distribution associated with program participation.[23] For example, suppose that a program reports an increase in 4-year college enrollment by five percentage points but does not measure changes in college enrollment in 2-year institutions or overall college graduation rates. We would predict that the new rate of 4-year college enrollment for high school graduates would be 37%

[18] We use 2014 as it is the most current enrollment data at the time of the calculation; http://www.erdcdata.wa.gov/hsfb.aspx.
[19] Washington State Board of Community and Technical Colleges (2011). Accelerate and complete. Retrieved from https://www.sbctc.edu/resources/documents/about/facts-pubs/completions.pdf.
[20] Ibid.
[21] Shapiro, D., Dundar, A., Ziskin, M., Chiang, Y., Chen, J., Harrell, A., & Torres, V. (2013). *Baccalaureate attainment: A national view of the postsecondary outcomes of students who transfer from two-year to four-year institutions.* National Student Clearinghouse Research Center.
[22] http://www.ofm.wa.gov/hied/dashboard/progress.html.
[23] If the increase in the probability of the affected outcome(s) is greater than the probability of the lowest educational attainment outcome, then the probability of all outcomes will be divided by the new base rate. For example, if a program predicts that students will have a 50% chance of enrolling in a 2-year college and a 60% chance of enrolling in a 4-year college, the model will assume that students have a 45.45% chance of enrolling in a 2-year college (50/110 x 100%), a 54.55% chance of enrolling in a 4-year college (60/110 x 100%), and a 0% chance of having a high school degree only.

(32% in the baseline distribution plus the five percentage point increase). The rate of 2-year college enrollment would remain constant at 29%, the percent of students with an Associate's degree would stay at 9%, and the new percent of students who terminate with a high school degree would decrease by five percentage points to 34%. The conditional probabilities on the branches would remain unchanged. The rates of educational attainment for students directly enrolling in 2-year institutions remain the same (15% obtain some college attainment at a 2-year institution; 9% receive an Associate's degree; 2% transfer and attain some college attainment at a 4-year institution; and 3% transfer and attain Bachelor's degree, respectively). The percent of students who attain Bachelor's degree after directly enrolling in a 4-year institution would increase to 26% (the new 4-year enrollment of 37% x 69%). Finally, the percent of students with some college attainment that enroll directly at a 4-year institution would increase to 11% (37% x 31%).[24] We are ultimately interested in the change from the baseline to the new distribution as illustrated in Exhibit A2 which summarizes the above example.

Exhibit A2

Hypothetical Change in Educational Attainment Distribution

	High school graduate only	Some college attainment		2-year degree	4-year degree
		2-year	4-year		
Baseline distribution	39%	15%	12%	9%	25%
New hypothetical distribution	34%	15%	13%	9%	29%
Percentage point change (Baseline - new)	**-5**	**-**	**+1**	**-**	**+4**

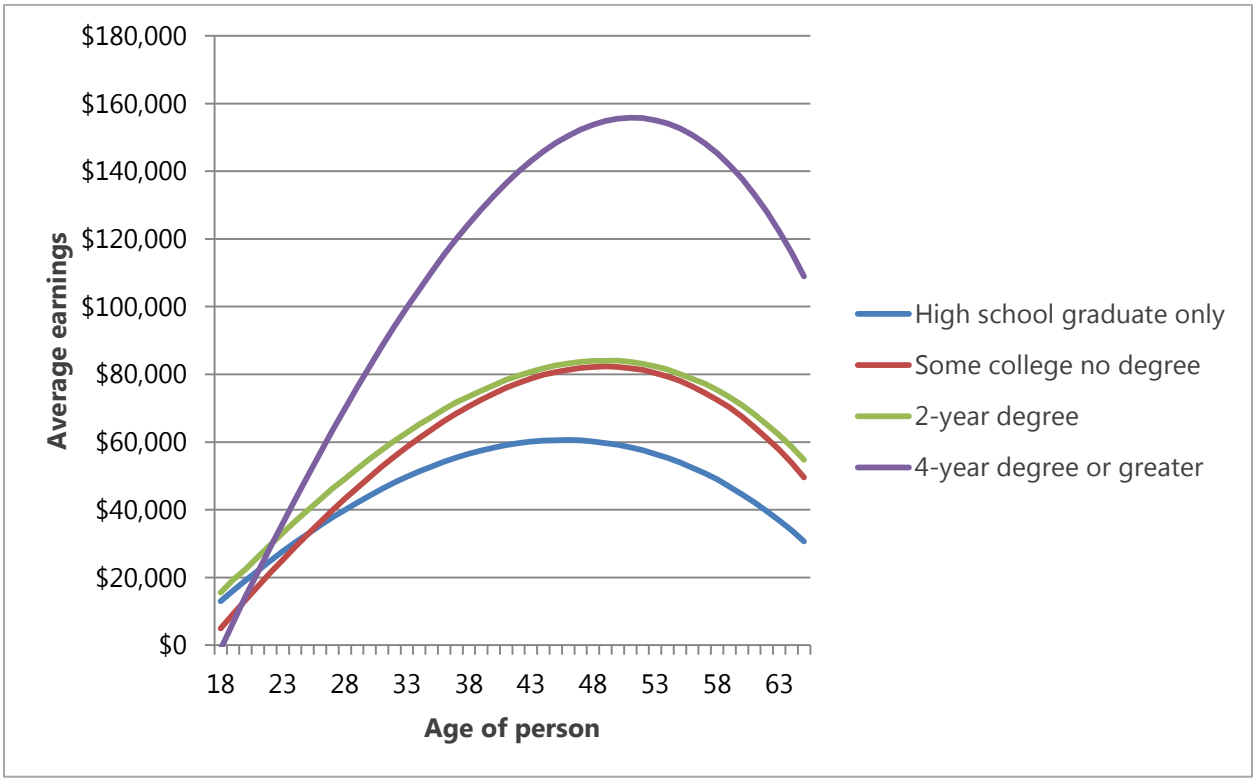
Estimating returns to labor market earnings from changes in postsecondary attainment

In this section, we provide a brief summary of our methodology to estimate the returns to changes in postsecondary attainment. For more detail, see WSIPP's Technical Documentation.[25] We first predict the observed total compensation (salary + benefits) over one's lifetime for each level of educational attainment using data from the Current Population Survey (CPS). Exhibit A3 illustrates the predicted compensation at different levels of educational attainment.[26]

[24] For programs that measure enrollment *and* graduation, we estimate the new degree attainment based on the measured changes in graduation. Changes in enrollment are used to calculate the new percentage of students that obtain some college.
[25] http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf.
[26] Earnings include both salary and benefits. Thus, we use earnings and total compensation interchangeably.

Exhibit A3

WSIPP Projected Compensation, 2015 Dollars,
(Adjusted Earnings Starting at 18) for Four Educational Groupings



We then generate a causal factor for each education level reported in Exhibit A4, which estimates the degree to which the observed difference in earnings at each level of education is causal.[27] We estimate the causal earnings gain associated with an additional level of education as the observed difference in earnings for each year, multiplied by the causal factor. For example, using CPS data, we estimate $53,000 in earnings for a 35-year old high school graduate and about $111,000 in earnings for someone with a BA or greater. The observed difference is $58,000. Because we estimate about 52% of the observed difference is causal, we estimate that $30,160 ($58,000 x 0.52) of the observed difference at age 35 is caused by the attainment of a Bachelor's degree. These calculations give us the causal earnings stream associated with each level of attainment.

[27] We derive these estimates from Heckman, J.J., Humphries, J.E., & Veramendi, G. (2016). *Returns to education: The causal effects of education on earnings, health and smoking.* Washington, DC: National Bureau of Economic Research. For more detail, please see WSIPP's Technical Documentation.
http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf.

Exhibit A4

Estimates of the Causal Effect of High School Graduation on Earnings

Starting attainment level	Final educational attainment level		
	Some college (2-year or 4-year)	Associate's degree	Bachelor's degree
All high school graduates	0.75	0.75	0.52
2-year college enrollees	-	1	0.42
4-year college enrollees	-	-	0.42

Notes:
The values in the cells represent the proportion of the difference in the observed earnings between starting and final educational attainment levels that we estimate to be causally related to attaining that final level of education.

We assume a student has no earnings while in college, meaning we assume that the opportunity cost of college is equivalent to the total earnings for a high school graduate during the expected years in college. Exhibit A5 shows the parameters we use for the expected time spent in postsecondary education.

Finally, as detailed in WSIPP's Technical Documentation, we apply a positive externality multiplier to the causal difference in earnings to reflect the benefits to society of an educated population.[28] We then calculate the net present value of the earnings streams for each educational attainment level.

Estimating costs of education due to postsecondary attainment

Students who continue on to college incur the cost of a college education. In our model, we consider the costs of tuition, fees, and books. We estimate the yearly cost of attending 2-year and 4-year institutions using data from IPEDS as described in WSIPP's Technical Documentation.[29]

We then use data from the Education Longitudinal Study (ELS), which is a national survey of 10th graders in 2002 and 12th graders in 2004, to estimate the average time in school used to calculate the total cost incurred. We calculate the average number of months enrolled for each relevant group of students; for example, the average months enrolled for 2-year enrollees that receive no degree and do not transfer to a 4-year institution. We use the third follow-up from 2012 and limit the analysis to students that were in 12th grade in spring 2004. Survey weights are applied to account for the complex survey design. Our estimates for time spent in school under various educational pathways are reported in Exhibit A5.

[28] We do not apply the externality multiplier to the opportunity cost for the full years a student is in school.
[29] http://www.wsipp.wa.gov/TechnicalDocumentation/WsippBenefitCostTechnicalDocumentation.pdf.

Exhibit A5

Time spent in school

Educational pathway	Years
2-year enrollee, no transfer, no degree	1.80
2-year enrollee, transfer to 4-year, no degree	2.89
2-year enrollee, Associate's degree	3.39
2-year enrollee, transfer to 4-year, Bachelor's degree	4.43
4-year enrollee, no degree	2.41
4-year enrollee, Bachelor's degree	4.07

Notes:
Years are measured in calendar years. To determine academic years spent in school, multiply calendar years by 1.33.

For each year or partial year that a person spends in higher education, we multiply the percent of the year in school by the cost of that type of attendance (2-year versus 4-year attendance) to arrive at a stream of costs for each predicted year in school. For students who transfer from 2- to 4-year institutions, we use the weighted average cost for all students to approximate the average yearly cost. We then estimate the net present value of the stream of costs associated with attending college.

Finally, to monetize the benefits of higher education programs we estimate the net present value of earnings under the baseline and new distribution of students across educational attainment levels. The difference in the net present value in earnings represents the expected change in earnings caused by a change in the number of students at each educational attainment level due to program participation. We perform the same calculations to derive the change in the net present value of the costs associated with postsecondary attainment, which we report as a negative benefit.

III. Studies Used in the Meta-Analyses

Merit aid

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Kane, T.J. (2003). *A quasi-experimental estimate of the impact of financial aid on college-going*. Cambridge, MA: National Bureau of Economic Research.

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St. John, E.P., Gross, J.P.K., Musoba, G.D., & Chung, A.S. (2005). *A step toward college success: Assessing attainment among Indiana's Twenty-First Century Scholars*. Indianapolis, IN: Lumina Foundation for Education.

Toutkoushian, R.K., Hossler, D., Desjardins, S.L., McCall, B.P., & Canche, M.G. (2015). The effect of participating in Indiana's Twenty-First Century Scholars program on college enrollments. *Review of Higher Education, 39*(1), 59-95.

Performance-based scholarships

Mayer, A.K., Patel, R., Rudd, T., & Ratledge, A. (2015). *Designing scholarships to improve college success: Final report on the Performance-Based Scholarship Demonstration.* New York, NY: Manpower Demonstration Research Corporation.

Richburg-Hayes, L., Brock, T., LeBlanc, A., Paxson, C., Rouse, C.E., & Barrow, L. (2009). *Rewarding persistence: Effects of a performance-based scholarship program for low-income parents.* New York, NY: Manpower Demonstration Research Corporation.

College advising provided by school counselors (for high school students)

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