# Does Aid Matter? A Systematic Review and Meta-Analysis of the Effects of Grant Aid on College Student Outcomes

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## Abstract

The College Board reported that, in 2019-20, approximately 60% of the more than $184 billion in financial assistance awarded to undergraduates through programs sponsored by the federal government, state governments, colleges and universities, philanthropic organizations, and other entities was in the form of grants. While researchers have examined the effects of individual grant aid programs on particular college student outcomes, results have indicated varied effects. Moreover, individual study findings have not been widely synthesized or examined to understand why some programs succeed where others do not. We conducted a comprehensive systematic review and meta-analysis to provide structure to this varied field and better understand programmatic effects. The results of the systematic searching and screening yielded 86 studies, across seven outcome domains, and the meta-analysis synthesized findings from 709 effect sizes from study samples representing 7,656,062 individuals. The meta-analytic results found small but meaningful positive average effects on college enrollment, credit accumulation, persistence, and completion. We cannot conclude from available studies that grant aid increases academic achievement or post-college labor market outcomes. We also found that grants had larger positive effects on credit accumulation for studies with samples of students at two-year institutions and that did not differentiate between two-year and four-year students than for studies with samples of students at four-year institutions only. Using a relatively new method called an evidence gap map, we illustrate where researchers should focus on producing new evidence.


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# Does Aid Matter? A Systematic Review and Meta-Analysis of the Effects of Grant Aid on College Student Outcomes

Each year, considerable resources are allocated to help students pay the costs of attending college. The College Board reports that, in 2019-20, undergraduate students received more than $184 billion in financial assistance from programs sponsored by the federal government, state governments, colleges and universities, philanthropic organizations, and other entities. About 60 percent of this assistance was in the form of grants (Ma, Pender & Libassi, 2020). We define grants as aid that does not need to be repaid or earned through employment or service and that reduces the sticker price of attending college or provides financial rewards for meeting measures of academic performance.

Grants vary in sponsor as well as other characteristics including eligibility requirements, amount of the award, and postsecondary institutions at which the award may be used (Delaney & Ness, 2016; Sjoquist & Winters, 2015; Perna, 2010). While all 50 states now have state-sponsored financial aid programs of some type, amounts and eligibility requirements vary. In 2018-19, 11 states (Arizona, Connecticut, Illinois, Iowa, Maine, Montana, New Jersey, North Carolina, Rhode Island, Vermont, and Wisconsin) awarded more than 90% of undergraduate student aid based on financial need, 3 states (Arkansas, Louisiana, and South Dakota) awarded more than 90% of undergraduate aid based on merit, and 3 states (California, Idaho, and South Carolina) awarded more than 90% of undergraduate aid based on a combination of need and merit (National Association of State Student Grant and Aid Programs [NASSGAP], 2020). Five states accounted for nearly half (48%) of state grant aid dollars in 2018-19: California, Florida, Georgia, New York, and Texas (Ma, Pender, & Libassi, 2020).

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Financial assistance that meets the definition of grants has various names. One emerging approach is the "promise program." Promise programs include place-based scholarship programs (Perna & Leigh, 2018), often modeled on the Kalamazoo Promise in Michigan, which are intended to promote college enrollment as well as local economic development and transformation of K-12 schools by offering an early commitment of college aid to students who attend designated schools or reside in specified communities (Miller–Adams, 2015). Other promise programs offer free tuition to attend a community college, as pioneered by the Tennessee Promise. Programs with a promise label or related characteristics have been established by philanthropic organizations, private corporations, cities, colleges and universities, and state governments (Perna & Leigh, 2018).

Researchers have examined the effects of individual grant aid programs on particular college student outcomes. While studies of individual programs have value, policymakers, practitioners, and researchers also benefit from knowing the conclusions that may be drawn across studies. Summary estimates of the effects of grants with different characteristics on different college student outcomes can help to inform decisions about resource allocation and program design.

By organizing and estimating pooled effects across studies, systematic reviews and meta-analyses address this knowledge need. A systematic review establishes *a priori* inclusion criteria based on rigorous design and adheres to a comprehensive, well-documented, and thorough search strategy, accompanied by a rigorous study screening process. A meta-analysis uses established statistical methods to quantify the findings from studies identified through the systematic review.

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Others have reviewed the effects of grants on college student outcomes. While offering useful insights, prior reviews typically cover only one category of grant aid program, examine a subset of relevant student outcomes, and/or have methodological limitations. For example, Nguyen and colleagues (2019) conducted a systematic review and meta-analysis but considered the effects of grants on only persistence and attainment. Swanson and colleagues (2020) conducted a systematic review but not a meta-analysis of the effects of promise programs on college enrollment and other outcomes.

This study builds on and extends prior reviews in three ways. First, our results establish what is known from studies released from January 2002 to January 2020 of the effects of a comprehensive set of grant aid programs on outcomes from initial college enrollment to post-college labor market. Using rigorous systematic review procedures (Pigott & Polanin, 2020), we identified 9,900 citations for abstract screening, 1,250 citations for full-text screening, and 86 studies with 709 effect sizes that met our inclusion criteria. Studies that used randomized–controlled trials, regression discontinuity designs, difference-in-differences analyses, and quasi-experimental studies with student-level data were eligible for inclusion. Included studies also have comparison groups that did not receive the specified grant aid that the intervention group was eligible to receive or received, present baseline information for treatment and control groups, and provide sufficient information to calculate effect sizes. The 86 studies that met our inclusion criteria examined 62 different grant aid programs.

Second, with the goal of informing the design of student grant programs, our meta-analyses examined whether the effects of grant aid vary based on program characteristics. We categorize the 62 grant aid programs in the included studies into the following seven types: federal grants, national scholarships, state-sponsored grants, institutional grants, student

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performance-based financial incentives, emergency financial assistance, and promise programs. We examined whether effects varied based on these categories as well as seven other program characteristics: whether the aid may be applied at two-year or four-year institutions, presence of need- or merit-based eligibility requirements, number of years of residence or participation (for example, in a locale or school) in advance of college enrollment required to be eligible for the maximum grant award, duration of aid measured as the maximum number of semesters students may receive the grant aid, average award amount, types of costs covered by the grant (e.g., tuition only), and presence of nonfinancial supports.

Third, to provide a clear and succinct presentation of the state of research knowledge on the effects of grant aid on college student outcomes, we present results in tables and evidence gap maps. Evidence gap maps have been used to summarize research on interventions in other fields (e.g., labor and economic policy; social, health, and behavioral interventions; neurotrauma; safety net programs; agriculture, Saran & White, 2018), but have less commonly been used to describe research on educational interventions. By offering a concise visual display of the number of studies that have been conducted and findings from those studies, evidence gap maps illustrate the strength of available evidence and areas for needed research (Authors, 2021).

## Prior Research and Guiding Perspectives

Policymakers may allocate funding for student grants to realize various goals, including increasing enrollment and degree completion for low-income students, improving college affordability for lower- and middle-income students, encouraging and rewarding academic achievement, advancing economic development, and raising overall educational attainment (Hearn, 2001; Perna, 2010; Perna, Rowan–Kenyon, Bell, Li, & Thomas, 2008).

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Different policy goals may result in different eligibility requirements. Grants that are intended to promote outcomes for low-income students may limit eligibility to students with financial need (e.g., Pell Grant, Illinois Monetary Assistance Program). To incentivize academic readiness, progress, persistence, and other outcomes, eligibility may be limited to students who meet specified academic criteria and other performance measures (e.g., Cash for College scholarship in California). To improve college enrollment and completion in particular places, grants may be limited to students who meet residence-based criteria or graduate from designated high schools (e.g., Kalamazoo Promise). Grants may also be targeted to promote college enrollment among students from other underserved groups, such as youth in foster care (e.g., John H. Chafee Scholarship) or high-achieving students from minoritized racial/ethnic groups (e.g., Gates Millennium Scholarship).

Grants also vary in other ways. The Pell Grant, the largest federal grant program for undergraduates, offers grant aid to students with financial need and is available for up to six years if students meet minimum academic progress requirements (2.0 college grade-point average [GPA]). Other grants provide one-time payments. Student performance-based financial incentives provide cash that students who meet performance measures may use as they chose (Mayer et al., 2015). Emergency financial assistance programs provide one-time, supplemental grants to address particular financial emergencies.

Whereas the federal government provides Pell Grants for students to attend postsecondary education institutions nationwide, state governments provide grants to attend designated institutions in their state. Broad-based state-sponsored merit aid programs (e.g., Georgia HOPE Scholarship) seek to reward or incentivize high academic achievement and encourage high-academic performers to attend in-state colleges and universities. Colleges and

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universities may offer grants to encourage students to attend their own institution. Such aid is more commonly awarded at private nonprofit four-year institutions than institutions in other sectors. More than half (57 percent) of undergraduates attending private nonprofit four-year institutions in 2015-16 received institutional aid, compared with 30 percent of undergraduates attending public four-year institutions and 7 percent of undergraduates attending public two-year institutions (NCES, 2019).

Grants also vary in costs covered. Grants may cover up to the cost of attendance, particular costs (e.g., tuition), a set dollar amount (e.g., student performance-based financial incentives), or some amount of emergency financial need. Some grants use a "first dollar" approach, whereby the grant is applied to costs before other grant aid is applied, whereas others use a "last dollar" approach, whereby the amount of the grant is reduced by grants received from other sources.

Some grants come with nonfinancial supports, such as tutoring and other academic support services, academic advising, mentoring, leadership and networking programs, student success seminars, and cohort-based learning communities. For example, the Accelerated Study in Associate Programs (ASAP) provides three years of tuition funding, as well as academic advising, tutoring services, career counseling, informational supports, cohort-based courses, and a college success seminar (Scrivener et al., 2015). These supplemental supports may reflect interest in reducing nonfinancial barriers that limit college access and success, especially for underserved students such as those from low-income families, minoritized racial/ethnic groups, and rural areas, or who are first in their families to attend college (e.g., Perna, 2006; Page & Scott-Clayton, 2016; Roderick et al., 2008; Morton et al., 2018).

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**Prior research reviews and syntheses**

Over the past three decades, scholars have recognized the value of synthesizing results of studies of the effects of college student grants (e.g., Heller, 1997; Leslie & Brinkman, 1988; Murdock, 1989). In a literature review, Liu (2020) reported inconsistent results from prior research on Pell Grants, with some studies finding no effects on enrollment, credit accumulation, or degree attainment, and other studies finding small effects on first-time enrollment and degree attainment (e.g., Denning et al., 2019) and modest effects on credit accumulation from year-round Pell Grants (e.g., Bannister & Kramer, 2014). In a synthesis of results from 17 experimental and quasi-experimental studies of federal and state grants, as well as student performance-based financial incentives, published between 1983 and 2009, Deming and Dynarski (2010) concluded that eligibility for $1,000 in grant aid (not adjusted to then-current dollars across studies) increased college enrollment by about 4 percentage points. Focusing on student performance-based scholarship programs, Mayer and colleagues (2015) synthesized the results of seven randomized-controlled trials and found modest positive effects on credit accumulation (an increase of 2.1 credits earned) and degree completion (a 3.3 percentage-point increase). Sjoquist and Winters (2015) synthesized the effects of 25 state merit aid programs and concluded that enrollment and degree completion were similar in states with and without merit aid programs.

A systematic review of the effects of place-based scholarship programs, a subset of the larger category of promise programs, concluded, but did not statistically test, that programs with different designs may improve college outcomes (Swanson et al., 2020). All six of the identified studies that examined enrollment found positive effects (although the effects were statistically insignificant in two of the six), both of the identified studies that examined persistence found

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positive but statistically insignificant effects, and the one identified study that examined completion found positive effects (Swanson et al., 2020). The identified studies examined programs with different eligibility criteria and different approaches to determining the financial award (such as first dollar and last dollar application of funds).

Although summarizing findings from across studies, conclusions from some prior reviews are limited by the absence of attention to methodological rigor of included studies or the use of meta-analytic procedures to standardize effects across studies. Moreover, the continued relevance of findings from reviews of older studies may be limited by growth in the costs of college attendance, changes in the demographic characteristics of college students, and other changes over time (Cahalan et al., 2021).

In the study most similar to ours, Nguyen et al. (2019) conducted a systematic review and meta-analysis of research on the effects of federal, state, and institutional grants, promise programs, and student performance-based financial incentives on persistence and completion. From 43 studies and 75 effect size estimates, they concluded that grant aid increased the "probability of student persistence and degree completion between 2 and 3 percentage points" (p. 831). Although the authors did not distinguish differences in effects on persistence and completion, they found generally larger effect sizes for programs that included nonfinancial supports, provided higher amounts of aid, and were offered by the institution or private sources. Studies that used a randomized–controlled trial or regression discontinuity design and were reported in a peer-reviewed journal also had larger effect size estimates (Nguyen et al., 2019).

This study builds on and extends reviews by Nguyen and colleagues (2019) and others both conceptually and methodologically. In our review, we consider a broad and comprehensive set of grant programs and include studies of effects on student outcomes from initial enrollment

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to post-college labor market. We conducted a wide-ranging search and screening process that resulted in double the number of studies included and a far greater number of estimated effect sizes relative to Nguyen and colleagues (2019). We conducted meta-analytic procedures considered state-of-the-art, including pre-planned confirmatory and exploratory moderator analyses, and we created evidence gap maps to concisely illustrate the quantity and magnitude of effects from existing research.

## Methods

This study uses rigorous and state-of-the-art systematic review and meta-analysis procedures to address the following research questions:

1. What are the effects of grant aid on each of the following categories of college student outcomes: college enrollment, academic achievement, credit accumulation, persistence, completion, and post-college labor market outcomes?
2. How do effects of grants vary for students in two-year and four-year institutions?
3. How do characteristics of grants (e.g., type of grant aid, eligibility requirements including need- or merit-based awards and early commitment, duration of aid, average award amount, costs covered, and inclusion of nonfinancial supports) explain differences in effects of grants?
4. What are the gaps in the evidence base about the effects of different categories of grant aid on different college student outcomes?

This systematic review and meta-analysis follows standards and reporting guidelines outlined by the Methods Group of the Campbell Collaboration (2019). To conform to modern and transparent research practices (Polanin, Hennessy, & Tsuji, 2020), before starting this project we drafted a review protocol that specified inclusion criteria, search and screening methods, and

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codebook, and we registered the study on our Open Science Framework (OSF) project page (Blinded page). Before analyzing the final dataset and writing the manuscript, we drafted a pre-analysis plan that specified our confirmatory and exploratory moderator variables. To conduct the analyses, we used the freely available R statistical software, relying on the *metafor* (Viechtbauer, 2010), *robumeta* (Fisher, Tipton, & Zhipeng, 2017), and *PRISMAStatement* (Wasey, 2019) packages. The analytical dataset and the statistical R code used to clean the data, identify the eligible effect sizes, conduct the missing data procedures, and estimate the overall analyses—as well as all supplemental meta-regression analyses—are available on our OSF project page.

**Inclusion Criteria**

When conducting a systematic review and meta-analysis, the types of studies that are included and excluded are identified *a priori* (Pigott & Polanin, 2020). To identify eligible studies, we applied multiple inclusion criteria. Eligible studies must have evaluated financial aid awarded to undergraduate students in the United States in the form of grants, defined here as money that is not repaid and either reduces the generally advertised sticker price of college enrollment or provides financial rewards for meeting measures of academic performance. Eligible for inclusion were studies of programs labeled as grants, scholarships, promise programs, "free tuition," tuition waivers, and subsidies. Studies of grants provided by any source (for example, federal or state government, college or university, philanthropic organization) and awarded based on financial need, academic achievement, place of residence, and/or other criteria were eligible for inclusion. We excluded studies that examined financial assistance that must be earned through employment (work-study) or service (e.g., military, teaching), athletic scholarships, and individual tax-preferred savings accounts. We also excluded studies of price-

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setting policies (including policies that determine characteristics of students who are eligible for in-state tuition) because these approaches change the generally advertised sticker price of attending college rather than the net price (the price after aid is considered). Because we were interested in identifying the effects of grants with different characteristics, we also excluded studies that combined different grants and did not analyze the effect of one specified grant aid program (e.g., Kim, 2004; Li, 2008; Sjoquist & Winters, 2016). Studies that evaluated the loss of grant aid, either through changes to the aid program or because students did not meet aid renewal requirements, were excluded from this meta-analysis but analyzed separately (LaSota et al., 2021).

Our inclusion criteria allowed for studies of other programs that met our definition of grants, including programs that encourage saving for college if the program includes an allocation of funds from a community-based, government, or other organization (e.g., community-based college savings accounts). Like college promise programs, community-based college savings accounts may encourage students and families to believe, early in the educational pipeline, that college is affordable by providing financial resources to a student/family that do not have to be repaid. We also included tax credits in our definition of grant aid, as they provide a financial award that does not need to be repaid. However, we found no studies of community-based college savings accounts or tax credits that met all other inclusion criteria.

We applied the following additional inclusion criteria related to study design. Studies must have included a comparison group that did not receive the aid being evaluated. Any between-group design was eligible for inclusion—including randomized-controlled trials, nonrandomized (i.e., quasi-experimental) designs with appropriate baseline data or analyses, regression discontinuity designs, and difference-in-difference designs. For difference-in-

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difference designs, the impact estimate must have compared a pre-intervention time period where all eligible students did not receive a grant with a post-intervention period during which all eligible students could have received the grant. Depending on the study, study samples were students who could potentially attend college or were enrolled in college.

We also applied criteria that pertained to baseline and outcome measures. Having baseline data that measured the difference between the intervention and comparison groups before receiving the grant was an eligibility requirement for nonrandom designs, and the eligibility requirements related to outcomes varied by the outcome type. Outcomes with an applicable and available direct pretest needed only the direct pretest. Outcomes without an applicable direct pretest (that is, the same measurement used in posttest assessed before the intervention's start) required a measure of prior academic achievement and a measure of socioeconomic status. When neither of these measures was available, we considered only studies with at least two measures of student demographics, such as gender and race. We did not apply these requirements to studies that used a random design, although we did collect the baseline information when available. When the authors conducted multiple impact analyses using the same outcome measure, we selected the model that controlled for the most covariates without including interaction terms. See Supplemental Table S1 for a summary of inclusion criteria.

**Search and Screening Procedures**

We systematically searched for extant research written in English and released between January 2002 and January 2020 following best practice guidelines (Polanin, Pigott, Espelage, & Grotpeter, 2019). All publication types, regardless of peer review status, were eligible for inclusion (Polanin, Tanner-Smith, & Hennessy, 2016).

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We began with a search of academic databases using a curated but expansive list of terms, building on terms used by others (Nguyen, Kramer & Evans, 2018) and organized with a Boolean search string. We searched the following online databases: *EBSCO, Education Resources Information Center (ERIC), Education Source, JSTOR, Academic Search Complete, PsycINFO, EconLit* with full text, *Sociology Source Ultimate, Humanities Source,* and *ProQuest Dissertations and Theses.* We concluded an initial search of databases in October 2018 and conducted a supplementary search that captured studies released from October 2018 through January 2020. Online Supplemental Appendix 1 provides database search strings used for our EBSCO and Proquest searches.

We located additional studies through supplemental searches of websites. Using a list published by the WWC (IES, 2019), we reviewed the websites of various institutional and research organizations, including but not limited to Abt Associates, Inc., American Institutes for Research, Community College Research Center, MDRC, Mathematica Policy Research, National Bureau of Economic Research, RAND Corp., Social Science Research Network, Urban Institute, and W.E. Upjohn Institute for Employment Research. We also engaged in forward and backward reference harvesting using Google Scholar and reference lists of included studies and previously published systematic reviews on similar topics. We contacted authors of identified studies and asked them to suggest additional studies to evaluate for inclusion in our project.

Our abstract and full-text screening procedures followed established best practices for systematic reviews (Polanin et al., 2019). We organized and de-duplicated citations identified through the systematic search using Zotero and created an abstract screening protocol to guide screening decisions. Two screeners independently screened each abstract using the free, online, machine-learning software Abstrackr (Wallace et al., 2012). Screening disagreements were

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resolved by the two screeners and, in cases of difficult decisions, by a third member of the research team. Following abstract screening, we obtained full-text PDFs of the citations deemed eligible and created a full-text screening protocol. One researcher screened each article using the protocol as a guide and a senior member of the research team checked every screening decision. The entire research team met weekly throughout the screening process to discuss difficult decisions and ensure accuracy.

**Study Coding**

To describe the diversity of characteristics of examined grant programs and samples and explain variation in program effects, our team sought to capture a wide range of information from included studies. We constructed a coding manual (codebook) that informed the research team on the information to collect. We updated the coding manual regularly with descriptions of the codes, examples from previously coded studies, and decisions about difficult-to-code studies or elements within studies. We also created a coding form using FileMaker Pro (Apple, 2018) that efficiently captured information using a relational database structure. This structure allowed the research team to capture the multitude of research design possibilities nested in a particular study or study sample. To ensure each piece of information was captured correctly, we held weekly research team meetings. One researcher coded each study and at least one senior member of the research team checked each piece of information coded. For particularly difficult studies or decisions, multiple researchers reviewed the study before coming to consensus.

We designed the coding manual and database coding form to capture five categories of information: study characteristics, sample characteristics, baseline and outcome measure descriptions, effect sizes, and intervention and comparison group descriptions, which included descriptions of the research design. For study characteristics, we captured peer-review status,

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funding status, conflict of interest, and other basic citation data. For sample characteristics, we captured state of origin of the sample within the United States, percentage of males, socioeconomic status, age, race/ethnicity, academic readiness, and total sample size. Baseline and outcome measures included the outcome domain (e.g., enrollment, completion), the scale's direction, reporting timeframe, and other measurement information specific to particular outcome categories. The effect size section captured information necessary to estimate effects, as described more completely below. The full coding manual is available on our OSF project page (LaSota, Polanin, Perna et al., 2018).

The most complex and detailed information collected was on the characteristics of the intervention and comparison groups. For the intervention group, we extracted program characteristics, initial eligibility criteria, criteria to continue to receive or renew the grant aid, institution types at which the grant could be used, and requirements regarding years of residence or preregistration (in a promise program, for example) required to receive the maximum grant award. Program characteristics included whether the program offered nonfinancial supports (e.g., tutoring, advising), award amounts (e.g., average dollars by time period, minimum and maximum award amounts), costs that could be covered by the grant aid, maximum number of semesters aid could be received, and whether the program required full-time enrollment or allowed part-time enrollment. For the comparison condition, we sought to capture how the comparison group was formed (e.g., from an eligibility cutoff value or pre-aid program period), whether the comparison group received other aid, and average aid award received, but few studies provided this information.

We also collected information on research design. For studies that were randomized-controlled trials, we extracted information about attrition from the sample and the process of

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conducting random assignment. For quasi-experimental designs, we collected baseline comparison data and noted whether matching was used and, if so, how matching was conducted. For regression discontinuity designs, we captured the eligibility cutoff, evidence of forcing variable manipulation, baseline comparisons, and bandwidth justification.

**Meta-Analysis Procedures**

The unit of analysis in the effect size estimation detailed below is an intervention-comparison contrast, defined as the comparison of two conditions within a study. To be included in our analysis, a study must have a sample of participants who received an intervention and a nonoverlapping sample of participants in a comparison group. A study that has a single comparison group, but multiple intervention groups would have multiple contrasts. A report is a single full-text document that describes one or more eligible evaluations of an intervention-comparison contrast. One report may include multiple studies (e.g., Andrews, Imberman, and Lovenheim [2016] evaluated the effects of the Century Scholars program at Texas A&M University and the Longhorn Opportunity Scholarship program at University of Texas Austin).

Following our pre-analysis plan and informed by What Works Clearinghouse's (WWC's) Support Postsecondary Success protocol (IES, 2019), we categorized outcome measures and subsequent meta-analyses into six outcome domains: enrollment, academic achievement, credit accumulation, persistence, degree completion, and post-college labor market outcomes. Enrollment includes studies of any postsecondary enrollment, enrollment in a two-year institution, and enrollment in a four-year institution. Academic achievement is measured by GPA either in an academic term or cumulative through a certain period (e.g., two, three, or four years). Credit accumulation typically is measured as an average number of college-level credits earned per term, but also includes cumulative number of credits earned through particular periods (e.g.,

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two, three, or four years). Persistence outcomes measure whether a student re-enrolls for a subsequent semester as well as total terms enrolled over multiple years (e.g., two, three, or four years). Persistence also includes measures of stopout and dropout (effect sizes reverse coded) and transfer from two-year to four-year institutions. Completion is measured by whether a student earned any degree, an associate degree, or a bachelor's degree. Post-college labor market outcomes include average earnings through a particular period (e.g., 5, 8, or 12 years after high school graduation), as well as whether a student is employed and has year-round employment in year 10. Given variation in included measures, we conducted subgroup analyses to examine the effects on outcomes in the enrollment and completion domains. We also conducted subgroup analyses to examine whether the effects in each outcome domain varied for samples of students at two-year institutions, samples of students at four-year institutions, and samples that included students at both two- and four-year institutions (including samples of students whose enrollment was not differentiated by institution type).

**Effect size estimation.** For all outcome measures in each of the six outcome domains, and within each eligible study for each eligible intervention-comparison contrast, we sought to estimate a standardized mean difference in the form of Hedges' *g* (Hedges, 1981), and the effect size variance. Hedges' *g* includes the small sample size correction, using the effective sample size for studies with a clustered design (Hedges, 1981). When the outcome measure was dichotomous or from a logistic regression, we used the WWC's (2020b) approach and transformed the odds ratio into Hedges' *g* using the Cox transformation (Sanchez–Meca, Marin–Martinez, & Chacon–Moscoso, 2003). When a study reported an unstandardized regression coefficient, we used the WWC's effect size and variance estimation procedures that account for clustering and multiple covariates within the estimation model (WWC, 2020a).

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Regardless of outcome or study design, we sought to account for differences in baseline measures between the intervention and control groups. For studies that met our inclusion criteria but did not provide sufficient information to calculate effect sizes for baseline covariates or outcome measures, we sent queries to study authors. We also queried authors to obtain missing effect size information and address additional questions regarding the aid program. For the 35 studies that were missing information to calculate baseline or outcome effect sizes, 19 authors (54%) provided the requested information. Compared with previous analyses of author query responses, this is a high response rate (Polanin et al., 2020).

When available, we used study authors' adjustments for baseline differences. When study authors adjusted for baseline differences using a regression model or ANCOVA design, we prioritized the models with the most covariates included. For continuous outcomes, whether adjusted means or a regression coefficient was provided, we standardized the effect with the unadjusted standard deviation. When study authors did not adjust for baseline differences, we estimated a difference-in-difference effect size following the WWC's *Procedures Handbook*, version 4.1 (WWC, 2020a). In such cases, the effect size estimates baseline and outcome differences using Hedges' *g*, then subtracts the baseline effect from the outcome effect, accounting for the correlation between the two measures. We estimated a baseline difference effect when the authors measured a direct pretest. For example, high school GPA is a direct pretest for college GPA posttest. For all other outcomes, we used effect size estimates from the authors that adjusted for baseline covariates or conducted the adjustment based on information on prior academic achievement and socioeconomic status provided for both groups. When students' prior academic achievement and/or socioeconomic status was not available (43 effect sizes in 5 studies or 5.8% of all effect sizes), we adjusted for differences using gender and

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race/ethnicity information. When multiple baseline effects could be estimated for a study, we estimated each baseline effect and then combined them into one average baseline difference effect. When a pretest-posttest correlation was unavailable, we used the WWC's suggested correlation values for the effect size ($r = 1.0$) and effect size's variance calculations ($r = 0.5$).

**Meta-analytic estimation.** To estimate the meta-analytic models, we used a random-effects model with robust variance estimation (Hedges, Tipton, & Johnson, 2010) to produce a weighted average of the effect sizes. Effect sizes were weighted inversely according to their variances and covariances as implied by the sandwich estimator, assuming a correlated effects working model (Hedges, Tipton & Johnson, 2010). We used this specification to account for non-independent sampling errors attributable to the inclusion of multiple effect sizes from the same study (Moeyaert et al., 2017). We assumed the majority of dependent effects had correlated errors and set the correlation to 0.80. Sensitivity analyses around other reasonable values of this correlation suggested that our results were not sensitive to this choice. We also used the default small sample correction suggested by Tipton and Pustejovsky (2015), so that the variance-covariance estimator is approximately unbiased when the number of studies is small or moderate. To improve the interpretability of effects, we back-transformed the average effects for each outcome domain to more meaningful metrics (see Supplemental Appendix 2 for more details).

To address extreme effect size values in our dataset, we Winsorized the effect sizes (Lipsey & Wilson, 2001. We defined an outlier as an observation that is more than 3 standard deviations above or below the mean. We replaced those values with the value just inside the 1st and 99th percentiles of the distribution of effect sizes. We did not recompute the weights for the effect sizes that we Winsorized, as this would have produced larger weights for these effect sizes.

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**Heterogeneity analysis.** For each outcome domain, we estimated the heterogeneity of effects across studies using $\tau^2$, which represented the absolute magnitude of effect heterogeneity, and $I^2$, which represented the percentage of heterogeneity assumed to be from the true effects (Borenstein, Higgins, Hedges, & Rothstein, 2015). The value of $I^2$ does not necessarily indicate how much heterogeneity is observed; it indicates the proportion of heterogeneity that is not due to sampling error. We assumed that, given the range of studies and effects included, significant heterogeneity would be found. In our pre-analysis plan, we designed two sets of moderator analyses: confirmatory and exploratory. Confirmatory moderator analyses tested specific, policy-relevant hypotheses. We used an ANOVA-like moderator analysis, computing a *Q*-statistic, which allowed us to evaluate whether differences between moderator levels were statistically significant. To conduct these tests within a robust variance estimation approach, we followed the guidance of Tipton and Pustejovsky (2015) and used a Wald-type test statistic for multiple contrasts, specifically using the approximate Hotelling's $T^2$ method for small sample corrections.

**Confirmatory moderator analyses.** The eight confirmatory moderators we tested were: grant program type, institutional sample type, eligibility criteria, early commitment requirement, duration, average annual award amount, costs covered, and presence of nonfinancial supports.

***Grant program type.*** We organized the grant programs that were evaluated in studies that met our inclusion criteria into seven types: federal grants, national scholarships, state-sponsored grants, institutional grants, student performance-based financial incentives, emergency financial assistance, and promise programs. See Supplemental Table S2 for definitions. We further divided the promise program category based on the range of institutions at which the award could be used. Some promise programs are expansive, allowing use of the scholarship at an array of postsecondary institutions, similar to Pell grants, national scholarships, and many state-

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sponsored grants. Other promise programs are restrictive, limiting use of the award to a specific institution or set of institutions, similar to institutional grants and emergency financial assistance (Miller-Adams, 2015). Illustrating the difference, the El Dorado Promise permits use of the award at any U.S. accredited institution of higher education, whereas Knox Achieves applies only to Tennessee community colleges.

***Institutional sample type.*** Even though a grant aid program may provide funds for students at both two- and four-year institutions, some of the study samples examined the effects of an aid program on outcomes for students at only one of these institution types. We examined differences in grant program effects for studies of students intending to enroll (based on intent-to-treat samples defined by eligibility) or enrolled in two-year institutions only, four-year institutions only, or both types of institutions.

***Eligibility criteria.*** Some programs have academic achievement requirements (e.g., minimum GPA, passing grades in a college preparatory course sequence), some limit awards to students with financial need, and some are universal, requiring neither need nor merit for eligibility (Miller-Adams, 2015; Perna & Leigh, 2018). We coded initial eligibility criteria into four categories: need-based, merit-based, both need- and merit-based, and neither need- nor merit-based.

***Early commitment requirement.*** Aid programs vary in the length of time recipients must do something to receive a program or be eligible for the maximum grant award. For example, Kalamazoo Promise provides maximum benefits for students enrolling in a specific public school system beginning in kindergarten. Other programs require students to sign a pledge in middle school (for example, to achieve a certain GPA or avoid criminal behavior) to be eligible for the grant (e.g., Indiana 21st Century Scholars). Other programs (e.g., Pell Grants, performance-based

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financial incentives) do not have residency or early registration requirements. While residency requirements may reflect policy interest in improving the economic, educational, and social well-being of a particular community, both residency and early registration requirements may also build early awareness of the availability of the grant aid (Perna & Leigh, 2018). Drawing from the distribution of early commitment requirements for programs in the included studies, our analyses consider four categories of early commitment: zero years required, one to two years required, three to five years required, and more than five years required.

***Duration.*** Nearly all aid programs examined in the included studies specify renewal criteria and a maximum number of academic terms for which grant aid may be provided to students, conditional on their meeting renewal requirements. Programs that do not have renewal criteria include one-time awards, like the National Merit Scholarship. Some student performance-based financial incentives are available for one term or one year only. In some cases, studies analyze the effects of multi-year grant awards for a one-year period only (e.g., Starke, 2019). We coded aid duration into the following categories: one to two semesters, three to four semesters, five to six semesters, seven to eight semesters, and nine or more semesters.

***Average annual award amount.*** In their systematic review and meta-analysis of 43 studies of grant aid, Nguyen and colleagues (2019) found larger effects on student persistence and degree completion for programs with higher award amounts. To test variations in effects based on award amount, we adjusted the average amount of aid grants awarded per year using the 2020 Consumer Price Index average annual inflation rate from the Bureau of Labor Statistics (https://www.bls.gov/data/inflation_calculator.htm). During study coding, we extracted the year for which the annual amount applied. When the award applied to a range of years, we used the middle year. When the middle of the range fell between two years, we rounded down to the

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earlier year (e.g., for 2002 to 2005 we used 2003). Drawing from the distribution of aid award amounts and effect sizes for studies in our dataset, we categorized average annual award amounts into six groups: less than $1,500, $1,501 to $3,000, $3,001 to $4,500, $4,501 to $6,000, more than $6,000, and not reported/unavailable.

***Costs covered***. This composite categorical variable simultaneously considers the type of costs covered (e.g., any cost of attendance, tuition and/or fees, other costs) and whether the grant award is reduced by other financial aid (that is, whether it is "last dollar" rather than "first dollar"). First-dollar programs that cover any costs of attendance provide the largest awards for low-income students, since low-income students typically are eligible for other need-based aid and will have last-dollar awards reduced by these grant amounts (Perna & Smith, 2020). We coded the composite measure of costs covered into five categories: first-dollar award for any costs of attendance (e.g., Pell and other federal targeted aid, Dell Scholars), first-dollar award for tuition only (e.g., Oklahoma Promise, Kalamazoo Promise), last-dollar award for any costs of attendance (e.g., Pittsburgh Promise, The Degree Project), last-dollar award for tuition only (e.g., Indiana 21st Century Scholars, New Haven Promise), and extra financial incentive to cover any cost (e.g., student performance based incentives, emergency financial assistance).

***Presence of nonfinancial supports.*** Some of the studied grant aid programs included student supports in addition to the grant award. The Dell Scholars program provides individualized advising to Pell-eligible students who have at least a 2.4 GPA (Page et al., 2016). The Gates Millennium Scholars program provides mentoring support (Boatman & Long, 2016). The Indiana 21st Century Scholars program offers college counseling at regional centers in addition to need-based aid for academically college-qualified students (Toutkoushian et al.,

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2015). Some supports are also eligibility criteria. For instance, the Tennessee Promise requires students to complete the FAFSA and participate in mentoring to receive the financial award.

**Exploratory moderator analyses.** Exploratory moderator analyses tested the significance of multiple moderators simultaneously with a series of meta-regression analyses. We did not create *a priori* hypotheses for the exploratory models, but rather sought to include any variable that might help to explain effect size variation.

We grouped potential moderators into five groups, then used a stepwise process to select statistically significant moderators for a final, full model. More specifically, we conducted separate meta-regression models for each of following groups of moderators: study-level characteristics, sample characteristics, program details, award and funding characteristics, and study design and analysis characteristics. Study characteristics included whether the study was published in a peer-reviewed journal, whether the study received external funding, and the date of release. Sample characteristics included the percentage of males, percentage of students who identify as non-White, characterization of the sample's socioeconomic status, characterization of the sample's academic readiness, and whether the sample included students who enrolled or intended to enroll in two-year, four-year, or either type of institution (both 2-year and 4-year). Program details included the grant program type, eligibility requirements, early commitment requirements, and aid duration. Award and support characteristics included average annual award amount, first-/last-dollar approach relative to costs covered, and presence or absence of nonfinancial supports. Design and analysis characteristics included research design, whether the authors provided effect sizes adjusted for baseline differences, and effect size type. Each of the five meta-regression models also included controls for the categories of outcome domains, since

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all effect sizes were included together as the outcome variable in the regression. We included statistically significant covariates from any of the five models in a final meta-regression model.

**Evidence Gap Maps**

An evidence gap map (EGM, White et al., 2020) is a data visualization tool that "provides a structured framework allowing readers to see where research has—and has not—been conducted" (Authors, 2021, p. 1). We constructed two EGMs. The first presents effect sizes across included studies based on categories of grant aid programs and the second EGM presents effect sizes based on program eligibility criteria. Crossing each category or eligibility criterion with each outcome domain, we estimated separate meta-analytic models using the random-effects meta-analytic model with robust variance estimation described above. Each cell (the intersection of grant category or eligibility criterion and outcome) represents a meta-analysis, where the size of the bubble is proportional to the number of studies found, the color is the magnitude of the effect, and the values represent the meta-analytic average effect size.

**Sensitivity and Publication Bias Analyses**

To ensure the robustness of the results, we conducted several sensitivity and publication bias analyses. Sensitivity analyses aim to ensure that decisions about effect size estimation do not change the interpretation of the results. We tested differences in average effect size estimates when extreme Winsorized values are and are not included. We also tested whether publication bias influenced the reporting of effect sizes. Publication bias occurs when findings of small, non-statistically significant effect sizes are less likely to be published in peer-reviewed journals and therefore less likely to be included in the meta-analytic sample. Our comprehensive and systematic search was designed to eliminate the possibility of missing studies or effects because of publication status, but the possibility of publication bias remains. To address these concerns,

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we conducted the Egger Sandwich test (Rodgers & Pustejovsky, 2020), a variant of the classic Egger's regression that accounts for dependent effect sizes using the robust variance estimation technique. The test detects funnel plot asymmetry by examining the relationship between magnitude and the related precision of the effect sizes included in the meta-analysis. A significant coefficient related to the measure of precision indicates evidence of small-study effects, which includes publication bias as well as true heterogeneity among the studies included in the meta-analysis.

## Results

Our database search yielded 11,355 citations, and we located an additional 247 citations through supplemental searches (Figure 1). After de-duplication efforts, the number of citations was reduced to 9,919. Abstract screening eliminated 8,500 citations and we could not find 286 full-text reports, resulting in 1,188 reports for full-text screening. After applying our inclusion criteria, we found 97 reports linked to 86 studies. The 86 studies that met our inclusion criteria analyzed the effects of 62 individual grant aid programs. Within the 86 studies, we identified 107 intervention-comparison contrasts and 709 effect sizes (average per study = 8.24, median = 4). The included studies together examined 7,656,000 unique students (see Supplemental Table S3).

### Characteristics of Studies That Met Our Criteria for Meta-Analysis

About 44% of the 86 studies were reported in a peer-reviewed journal and 55% were supported by external funding (Supplemental Table S4). Reporting dates ranged from 2004 to 2019, but the majority (71%) were reported in 2013 or later. Of the 107 contrasts in our meta-analytic sample, nearly one third (31%) came from randomized-controlled trials. The remainder came from studies using quasi-experimental designs including regression discontinuity (28%),

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difference-in-differences (8%), and other quasi-experimental analyses on the effects of receiving aid (e.g., "treatment on the treated" results, 34%).

The identified studies most commonly examined outcomes in three domains: enrollment (number of studies k = 41, number of effects m = 153), persistence (k = 39, m = 135), and completion (k = 43, m = 119). The credit accumulation domain had the highest number of effect size estimates (k = 32, m = 171). College academic achievement was examined in relatively fewer effect size estimates (k = 37, m = 109). Only eight studies that met our inclusion criteria examined post-college labor market outcomes (k = 8, m = 22).

The average sample size for contrasts in the identified samples was about 17,500 students; the median was about 4,200. On average, 55% of students identified as White and 45% identified as Black, Latin(x), Asian, Native American, or multi-racial. We could not further disaggregate racial backgrounds because the underlying studies did not disaggregate consistently. Most students in study samples identified as female (60%) and were from low- or low-middle-income families (70%). Included studies most commonly examined middle-achieving students (41%), with 20% examining low-achieving students and 28% examining high-achieving students. About one fourth of the samples were in two-year institutions (28%), a fourth were in four-year institutions (27%), and nearly half were combined two-year and four-year samples (45%).

**Categories of Grant Aid Examined in Included Studies**

Drawing on descriptions of the grants provided by study authors, we organized the 62 programs into the following seven categories: federal grants, national scholarships, state-sponsored grants, institutional grants, student performance-based financial incentives, emergency

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financial assistance, and promise programs. See Supplemental Table S5 for a listing of grant aid programs by category among the studies included in the meta-analysis.

**Federal targeted grants**. Of the 86 included studies, four evaluated the federal Pell Grant and two examined smaller federally funded grant aid programs: the John H. Chafee Foster Care Independence program and the Scholarships for Disadvantaged Students program of the Health Resources and Services Administration.

Many studies of the effects of Pell Grants did not meet our inclusion requirements including having baseline information for intervention and comparison groups (e.g., Armstrong, 2015; Bannister & Kramer, 2014; Bettinger, 2004; Evans & Nguyen, 2018; Filerino, 2013; Ho, 2016; Ramsey, 2013; Waters, 2016). Other studies were excluded because they modeled the effects of receiving a higher amount of Pell Grant aid versus a smaller amount rather than having a comparison group that did not receive the aid (e.g., Chen & Hossler, 2017; Denning et al., 2019; Marx & Turner, 2015).

**State-sponsored grants.** Of the 86 included studies, 27 examined state-sponsored grants. Of the 27 included studies of state grants, eight analyzed the effects of six different state need-based programs, 18 examined the effects of 10 different state merit-based programs, and one examined the effects of a state program with both need- and merit-based criteria (California's Cal Grant).

**Promise programs.** Of 86 included studies, 11 analyzed the effects of nine promise programs. While acknowledging that program features differ, Miller-Adams (2015) defined place-based promise programs as those that provide scholarship awards based on residence in a specific community or enrollment in particular school or school district in order to encourage a college-going culture in targeted schools and communities, increase college-going, and transform

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communities by encouraging community and economic development. Perna and Leigh (2018) took a broader approach, defining college promise programs as meeting three criteria: having a goal of increasing higher education attainment; providing a financial award beyond existing federal and state aid; and targeting individuals in a particular place; including living in a designated state, county, or city, or attending designated K–12 schools. In this review, we define promise programs as programs that make grant aid available to students who attend particular high schools or live in a designated substate community, and/or provide an early commitment (that is, before, or at the start of, high school senior year) or clear early message about the availability of student grant aid for students meeting program requirements.

**Institutional grants.** Of the 86 included studies, 20 evaluated the effects of institutional grants. This category includes grant aid from a college or university that is included in a student's financial aid package, but not supplemental, one-time grant aid that may be received for emergencies or for meeting specific performance benchmarks after enrollment. Colleges and universities vary in their approaches to awarding institutional grant aid. On average, institutional grant awards are higher at private, not-for-profit four-year institutions ($17,250 for first-time, full-time students in 2017-18) than public four-year institutions ($3,370) and public two-year institutions ($330; Ma, Pender, & Libassi, 2020), reflecting differences in sticker prices across sectors.

**National scholarships.** Of the 86 included studies, six examined three national scholarship programs: Dell Scholars, Gates Millennium Scholarship, and National Merit Scholarship. We define national scholarships as grant aid funded by a national philanthropic or nonprofit organization and awarded to students who meet specified eligibility criteria (e.g., academic, noncognitive) to attend a college or university across the nation. These programs vary

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in eligibility criteria, award amounts, and maximum number of semesters for which aid is provided (if students meet renewal criteria). While the National Merit Scholarship has academic merit eligibility criteria, both Gates and Dell have need- and merit-based eligibility criteria. The Gates Millennium Scholarship also requires students to be from a historically underrepresented racial/ethnic minoritized group. The average annual award was $12,785 for the Gates Millennium Scholarship between the 2000 and 2014 academic years (Gates Millennium Scholars, n.d.). The average annual award for Dell Scholars was $5,000 between 2009 and 2012 and is now $20,000 (Dell Scholars, n.d.). Whereas National Merit Scholarships provide a one-time award of $2,500, Gates and Dell scholarships are renewable for four to five years.

**Student performance-based financial incentives.** Nine included studies evaluated the effects of nine student performance-based incentive programs. All nine studies were completed by MDRC and used random assignment. In 2008, MDRC launched the Performance-Based Scholarship Demonstration to evaluate the effects of providing low-income students with financial incentives to meet performance milestones associated with college success, such as attending advising sessions and/or completing a certain number of credits with a "C" or better average. The maximum amount that may be earned by students who achieve performance objectives varies from $1,000 to $4,000 in the studied performance-based financial incentive programs (Mayer et al., 2015).

Performance-based financial incentives may be targeted to students who placed into developmental education courses in reading or mathematics (Patel & Rudd, 2012; Sommo et al., 2014), or students meeting other criteria, such as being low-income or a single parent (Richburg-Hayes et al., 2015), or a Latino male student (Patel & Valenzuela, 2013). Compared with state and institutional aid, student performance-based incentive programs are shorter in duration. For

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the studies in our dataset, student performance-based incentive programs have a maximum duration between one term and two years, whereas state merit aid programs are available for up to 10 semesters and institutional merit aid programs are available for an average of 7 semesters.

**Emergency financial assistance.** One study of the effects of emergency financial assistance met our inclusion criteria (Evans et al., 2019). Emergency financial assistance is typically funded by institutions or private dollars funneled through institutions to help students address a temporary financial emergency that poses a barrier to continued enrollment (e.g., loss of job, unexpected increase in rent, car repairs). Some programs give the aid to the student; others make payments directly to providers (e.g., landlord, car repair shop). Federal relief funding to higher education during the COVID-19 pandemic (e.g., CARES Act of 2020) increased the availability of emergency financial assistance programs, providing an opportunity for future research on these types of programs.

**Other Moderators Examined in Included Studies**

Among the 107 contrasts in our meta-analytic sample, nearly half (45%) of the grant aid programs had need-based eligibility criteria, 33% had merit criteria, 17% had both need and merit criteria, and 6% had neither. Most programs (57%) allowed use of the grant at an expansive set of institutions such as public and private institutions within a state or both in-state and out-of-state institutions. About half (53%) required full-time enrollment. Most programs required some type of early commitment (including residency in a particular locale) to be eligible for or receive the maximum grant award. Four programs (6%) required participation beginning in kindergarten or first grade for full benefits (Kalamazoo Promise, New Haven Promise, Pittsburgh Promise, Say Yes Buffalo), while 27% (including the Pell Grant) had no length of residency requirement.

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Most of the grant programs represented in our study contrasts (71%) had a maximum duration of eight semesters or more; 12% provided aid for one to two semesters. Of the 62 grant programs analyzed in studies meeting our criteria, five had a maximum duration of 12 semesters (six-year equivalent), including the Pell Grant program. Nine programs had a maximum of 10 semesters. Several programs focused on community college student populations had maximum durations of six semesters (three-year equivalent), including one promise program (Knox Achieves). While one student-performance based incentive program (Detroit Promise Path) had a maximum duration of six semesters, the other student performance-based financial incentive programs had maximum durations of four semesters or fewer. In 2020 U.S. dollars, the average award amount received by students in our meta-analytic sample was $4,182 annually (SD = $3,881; median = $2,587). Nearly one in five (18%) study contrasts did not report the amount of the grant award. Average award amounts ranged from $66 (for a student performance-based incentive) to $20,510 (for a first-dollar institutional aid program at New York University).

Most of the 62 grant programs examined in the included studies were last-dollar (60%), but a fourth (24%) were first-dollar programs and 15% were in the form of additional funding that was not applied to the students' financial aid package. The two thirds of programs (61%, n=30) offered nonfinancial supports: four promise programs, 16 institutional aid programs, one federal aid program (Chafee Scholarship), two national scholarship programs (Gates Millennium Scholars and Dell Scholars), six student performance-based financial incentive programs, and one emergency financial assistance program (Stay the Course at Tarrant Community College).

**Meta-Analysis Results**

The meta-analysis results for the effects of postsecondary grant aid on initial college enrollment, college academic achievement, credit accumulation, persistence, degree completion,

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and post-college labor market outcomes are summarized in Tables 1-4. Table 1 reports the effects of grant aid across outcome domains. Table 2 provides a subgroup analysis of effects on outcomes in the enrollment and completion domains. Table 3 provides effect sizes that we translated into commonly used metrics such as enrollment and completion rates. Table 4 provides a subgroup analysis of differences in effects for samples of students enrolled in or intending to enroll in two-year institutions, four-year institutions, and two- and four-year institutions undifferentiated.

**Enrollment**. About half (n=41; 48%) of included studies evaluated one or more enrollment outcomes. The analyses show a statistically significant positive effect size (*g*) across studies (*g* = 0.07, *SE* = 0.03, *p* = .03, 95% CI[0.01, 0.13]). (See Table 1). This effect translates into a 2.8 percentage-point increase in enrollment rate for the intervention group (46%), compared with the comparison group (43%) of prospective students (Table 3). These findings are consistent with Deming and Dynarski (2010), who reported a 3 to 4 percentage-point increase in college enrollment rates from grant aid. Regarding the effects of grants by institution type, we found a 4 percentage-point increase in enrollment in any collegiate institution (that is, in studies where sector of enrollment was not differentiated), a 0.6 percentage-point increase for enrollment in two-year institutions, and a 1.1 percentage-point increase in enrollment in four-year institutions. These differences in enrollment effects across institution types were not statistically significant (*Q* = 0.72, *p* = .77, Table 8).

Subgroup analyses reveal no statistically significant differences in effects for different enrollment measures (*Q* = 0.53, *p* = .75; Table 2). However, the analyses do indicate a small, statistically significant effect of grant aid on enrollment in a within-state institution (*g* = 0.03, *SE*

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= 0.01, $p$ = .01, 95% CI[0.01, 0.04]). Although the $I^2$ was large (95.43), a large $I^2$ does not necessarily indicate heterogeneity.

**Academic Achievement.** Of the 86 eligible studies, 37 studies analyzed effects on academic achievement. Table 1 shows a small, statistically insignificant effect of grant aid on this outcome from the 109 effect sizes in the included studies ($g$ = 0.03, $SE$ = 0.03, $p$ = .21, 95% CI[–.02, .09]) and a small amount of effect heterogeneity ($I^2$ = 79.45, $\tau^2$ = 0.004). Translated to the WWC's improvement index, we conclude that an average student from the comparison group would experience an increase in their academic achievement percentile ranking by 1.3 points, were they to become eligible for, or receive, grant aid (Table 3). The subgroup analyses did not yield statistically significant differences in effects for samples of students at two-year and four-year institutions ($Q$ = 0.79, $p$ = .48) (Table 4).

**Credit Accumulation.** Our meta-analysis of the 171 effects sizes in the 32 studies that examined credit accumulation revealed a moderate, statistically significant positive effect of grant aid ($g$ = 0.12, $SE$ = 0.03, $p$ = .001, 95% CI[.05, .18]) (Table 1). We translated the average effect size into the expected number of credits earned in a single semester and over the course of four semesters. Assuming an average individual from the comparison group earned 8.8 credits per semester, a student receiving grant aid would be expected to earn 9.02 credits per semester, a 1.6% increase (Table 3).

Subgroup analyses showed the effects of grants on credit accumulation were smaller for studies of students in four-year institutions than for studies of students in two-year institutions and studies that included students in both two- and four-year institutions (Table 4). Specifically, we found statistically significant differences based on the institution type of the sample ($Q$ = 4.99, $p$ < .05), whereby two-year ($g$ = 0.15, SE = 0.07, $p$ = .05, 95% CI[.01, .30]) and combined

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two- and four-year samples ($g$ = 0.12, SE = 0.03, $p$ = .01, 95% CI [.06, .19]) had larger effects relative to four-year samples ($g$ = 0.02, SE = 0.02, $p$ = .33, 95% CI [–.04, .08]). Effects in the four-year samples were not statistically different from zero.

**Persistence.** Of the 86 included studies, 39 studies reported 135 effect sizes for persistence outcomes. The meta-analysis revealed a statistically significant positive effect of grant aid on persistence ($g$ = 0.05, SE = 0.02, $p$ = .01, 95% CI[.02, .08]), and only a small amount of effect heterogeneity ($I^2$ = 70.09, $\tau^2$ = 0.006) (Table 1). Based on our estimation of control group outcome data, we estimated that 53.7% of comparison group students persisted semester to semester; using this value, we converted the effect size, and estimated that 55.7% of intervention group students would persist semester to semester, representing a 2 percentage-point increase (Table 3). Subgroup analyses found no statistically significant differences in the effect of grant aid on persistence for samples based on institutional type ($Q$ = 2.68, $p$ = .13) (Table 4).

**Degree Completion**. The 43 included studies of completion reported 119 effect sizes. The meta-analysis revealed a small, positive, statistically significant effect of grant aid ($g$ = 0.01, SE = 0.01, $p$ = .01, 95% CI[.01, .02]) (Table 1). Examining the heterogeneity of the effects, we again find only a small amount ($I^2$ = 70.21, $\tau^2$ = 0.001). We find no statistically significant differences in effects for samples by institutional type ($Q$ = 0.93, $p$ = 0.45). (Table 4)

Although an effect size of 0.01 is small, when translated it represents a 0.4 percentage-point increase in graduation rate for the intervention group relative to the control group (33.4% versus 32.9%) (Table 3). The magnitude of this effect is lower than reported by Nguyen and colleagues (2019). From analyses of a smaller number of studies and without differentiating between persistence and completion, Nguyen and colleagues reported that grant aid resulted in a two to three percentage-point increase in persistence and completion.

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Even a 0.4 percentage-point increase in degree completion may translate into improved completion rates for a large number of students. Applied to the approximately 484,900 students across our studies with degree completion outcomes, a 0.4 percentage-point increase would translate to an additional 1,940 students earning degrees. The included studies in our meta-analyses examined more than 7.6 million students across all outcomes. Applying the 0.4 percentage-point increase to this group suggests that, if all of the control students in the studies in our review had received grant aid, an additional 30,600 would have earned a degree. If this anticipated effect of grant aid were applied to the total number of undergraduates in the United States, calculated based on fall 2019 enrollment (15.5 million students), nearly 62,000 additional students would be estimated to earn degrees with provision of grant aid. Because the grant aid programs in our dataset are not representative of all U.S. grant aid programs, these results may not directly translate to the national population receiving grant aid. This example gives a sense of the hypothetical national impact if all students and grant aid programs closely resembled those in the studies.

**Post-College Labor Market Outcomes.** Our systematic review identified only 8 studies and 22 effect size estimates examining post-college labor market outcomes. The meta-analysis revealed a small, statistically insignificant positive effect ($g$ = 0.05, SE = 0.03, $p$ = .14, 95% CI[–.02, .12]) (Table 1). This effect translates into a 1.4 percentage-point increase in employment rate for the intervention group (77.4%), compared with the control group (estimated to be 76% based on the 2019 employment rate among 20 to 29 year olds with a bachelor's degree; Table 3; BLS, 2021). Heterogeneity analyses revealed small amounts, as with other domains ($I^2$ = 81.62, $\tau^2$ = 0.002). Subgroup analyses also revealed no statistically significant differences for the two-year, four-year, and combined two- and four-year samples ($Q$ = 0.37, $p$ = .58) (Table 4).

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**Evidence Gap Maps**

We produced one EGM that illustrates the effects of different categories of grant aid and one EGM that illustrates the effects of different eligibility criteria on each outcome domain. Each cell (i.e., the intersection of grant program type or eligibility criterion and outcome) represents a single meta-analysis, where the size of the bubble is proportional to the number of studies included, the color is the magnitude of the effect, and the values represent the meta-analytic average effect size.

For grant program type (Figure 2), the strongest bodies of evidence are for state and institutional grants. Some of the strongest evidence is for the effect of institutional grants on enrollment ($g = 0.17$, $p \geq .05$) and persistence ($g = 0.15$, $p < .01$). The state-sponsored grant category has the largest number of studies, with examinations of the effects of state-sponsored grants on degree completion representing the single largest cell in this EGM. Studies of federal targeted aid have large effect sizes on enrollment, academic achievement, and credit accumulation (as indicated by the blue coloring) but relatively few studies that met our inclusion criteria examined these and other outcomes.

Few studies examined the effects of promise programs and national scholarships. While the number of promise programs has increased over the last decade (Perna & Leigh, 2018), these programs are relatively new compared with other types of aid programs, and fewer studies of them have been conducted to date. Among the included studies of promise programs, none evaluated effects on credit accumulation. Across all grant program types, few studies evaluated effects on post-college labor market outcomes.

With regard to eligibility requirements (Figure 3), included studies most commonly examined need-based programs, followed by merit-based programs. Need-based programs have

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relatively strong positive effects on enrollment (g = 0.13, p ≥ .05), academic achievement (g = 0.08, p ≥ .05), and credit accumulation (g = 0.13, p < .05). Merit-based programs also have relatively strong positive effects on enrollment (*g* = 0.13, *p* < .05) and credit accumulation (*g* = 0.10, *p* < .01). The EGM shows fewer studies examining programs that require both need and merit, or that require neither need nor merit. None of the included studies examined the effects of programs that require neither need nor merit on academic achievement, credit accumulation, or labor market outcomes.

**Confirmatory and Exploratory Moderator Analyses**

Following our pre-analysis plan, we conducted confirmatory moderator analyses for all six outcome domains with our eight moderators—grant program type plus seven program characteristics (Supplemental Tables S6–S13). These analyses revealed no single statistically significant difference between the tested moderator levels for any of the variables (*p* > .05). We do not discuss the individual moderator level estimates and tests of statistical significance given this overall finding and the number of tests conducted. Nonetheless, the results could be meaningful for particular policy questions. One such question is whether a greater amount of grant aid has a larger effect on student outcomes. While the moderator analysis indicated no statistically significant differences across the tested levels, we observed an upward trend in the average effect size as the amount of the award rises. For example, findings from studies where students received less than $1,500 US dollars (expressed in 2020 dollars) annually had small effects (*g* = 0.01, *SE* = 0.04, *p* = .83, 95% CI[-0.12, 0.14]), while findings from studies of larger grant aid awards produced larger effects (*g* = 0.14, *SE* = 0.12, *p* = .30, 95% CI[-0.18, 0.46]). This upward trend for the effect of award amount holds for all of the outcome domains except post-college labor market outcomes.

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As outlined in the methods section, we also conducted a series of exploratory regression models within a multiple predictor, meta-regression framework (Supplemental Table S14). As with the confirmatory moderator analyses, none of the variables in the initial models were statistically significant. When program characteristics were analyzed together with characteristics of studies, samples, and outcomes, we found that none of these characteristics were statistically significant. The effects of grant aid are relatively stable and similar when effects on all outcomes are considered together. The lack of significant findings may be due to the small amount of heterogeneity observed within the overall models. The small amount of between-study heterogeneity results in less power to detect significant relationships. It also means that program effectiveness does not vary from study to study, regardless of program or sample characteristics. As a result, it is not surprising that the moderator analyses did not reveal statistically significant findings.

**Publication Bias and Sensitivity Analysis**

Applying the Egger Sandwich method for each of the outcome domains (Supplemental Table S15) revealed no evidence of publication bias ($p > .05$). Our exploratory moderator analyses indicated that the absolute difference between published and unpublished studies was small and not statistically significant ($b = 0.01$, $SE = 0.04$, $p > .05$). Comparing results of the Winsorized with the nonwinsorized data, we did not find any evidence that the procedure changed the findings or the meaning of our overall results (Supplemental Table S16).

## Discussion

Drawing from experimental and quasi-experimental literature over the past 20 years, our meta-analyses provide estimates, standardized across studies that met specified inclusion criteria, of the effects of grants on college enrollment, academic achievement, credit accumulation,

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persistence, degree completion, and post-college labor market outcomes. Establishing estimated effects across recent studies is important, as the transferability of findings from older studies may be limited by increases over time in the cost of attendance and changes in the demographic characteristics of college students (Cahalan et al., 2021). Although many studies have considered the effects of particular grant aid programs on various college student outcomes, policymakers, practitioners, and researchers also need to know what conclusions can be drawn across studies. We used rigorous systematic review and meta-analysis procedures (Pigott & Polanin, 2020) to organize information from the 86 studies that met our inclusion criteria and estimate pooled effects across studies.

Three conclusions may be drawn from this study. First, findings from this review of studies reported from January 2002 to January 2020 confirm that grants had positive effects on college student outcomes. Our analyses showed positive effects of grant aid on college enrollment, credit accumulation, persistence, and degree completion. The estimated pooled effect for academic achievement was small and not statistically significant. For enrollment, our translated effect estimates suggest that grants increased the enrollment rate among prospective college students by 2.8 percentage points, a finding that is consistent in direction and magnitude with prior research (Deming & Dynarski, 2010). Whereas Nguyen and colleagues (2019) found grants to be associated with a 2 to 3 percentage-point increase in persistence and completion (aggregated), we found grants to increase persistence rates by 2 percentage points and increase completion rates by 0.4 percentage points.

Second, the positive effects of grant aid are generally comparable for studies of students at two-year and four-year institutions. The one exception was for effects on credit accumulation. We found that grant aid had a larger positive effect on credit accumulation for samples of

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students at two-year institutions and samples of students at two-year and four-year institutions than for students at four-year institutions.

Third, our moderator analyses showed that the positive effects of grants did not vary based on eligibility criteria, grant program type, early commitment or residence requirements, presence of non-financial supports, award duration, average annual award amount, or type of costs covered by the grant. Although the differences were not statistically significant, a review of the pattern of coefficients suggests that the positive effects of grants increase with the average annual amount of the grant aid award. This pattern held for all outcome domains except post-college labor market outcomes (where there were few studies).

## Implications for Future Research

Our findings have numerous implications for future research. First, future researchers should consistently and completely report study characteristics and other information needed for meta-analyses. Our meta-analysis is limited by the level of reporting in individual studies. Even with our best efforts to estimate baseline information and obtain needed unpublished information from study authors, we still had to exclude 321 studies because of missing information (See Figure 1). We also found inconsistent reporting of key descriptive information about the studied grant program (e.g., dollar amount of grants received). Some studies did not describe characteristics of the student sample, including students' prior academic achievement, socioeconomic status, racial/ethnic identity, and age. Consistent reporting of these characteristics will help expand the conclusions that may be drawn from future meta-analyses.

Second, to further improve knowledge of conclusions that may be drawn across studies, we encourage future researchers to more closely consider how and why their approach aligns with the approaches used in prior research. For example, within each of the outcome domains,

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we found many distinct outcome measures. Authors also varied in the number and type of student characteristics they included as control variables. The mean number of covariates in the included studies was 9.8 (median=9) but ranged from 1 to 44. These and other variations challenge efforts to estimate the magnitude of the effect of grants across studies.

Third, future meta-analyses should identify how the effects of grant aid on student outcomes vary based on the demographic characteristics of students who were eligible for, or received, grant aid (Perna, 2010). Some of the studies that met our inclusion criteria reported subgroup analyses by gender (n=24), race/ethnic groups (n=24), socioeconomic status (n=22), and academic achievement (n=18). Smaller numbers of studies analyzed differences in effects for other student groups, including students who were and were not the first in their families to attend college. Determining the effects of grant aid on college outcomes for students from low-income families and other underserved groups is essential, given the many benefits that come with higher education and persistent gaps across groups in college outcomes (Cahalan et al., 2021). Some observers suggest that grants have larger effects for students from lower-income families than higher-income families, and for Black and Hispanic students than for White students (e.g., Avery & Hoxby, 2004; Heller, 1997; Mundel, 2008). By meta-analyzing studies that analyze the effects of grants across groups, researchers can further inform policymakers and practitioners of the equity-related implications of providing grant aid and the effects of grants on closing gaps in college outcomes.

Fourth, the evidence gap maps demonstrate that we know more about the effects of some types of grants than others. Included studies more frequently examined the effects of grants on enrollment and completion, and less frequently examined the effects on post-college labor market outcomes. More studies have examined the effects of state and institutional grants, while

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fewer studies have examined the effects of national scholarships, federal targeted grant aid, and promise programs. The relatively low number of studies examining promise programs is not surprising given their relatively recent emergence (Perna & Leigh, 2018). More is known about the effects of programs that award grants based on need or merit, whereas fewer studies have examined the effects of programs that consider both need and merit or neither need nor merit.

Future research should address the gaps identified in these evidence gap maps as well as gaps not included in the maps. For example, the enrollment domain aggregates findings from studies that examined any enrollment, enrollment in a two-year institution, and enrollment in a four-year institution. While we conducted separate meta-analyses on each of the outcomes in the enrollment domain (and other outcome domains), the numbers of studies that met our inclusion criteria and examined these and other potentially important outcomes were small.

Fifth, in an effort to bring order to the 62 grant aid programs examined in the 86 studies that met our criteria, we created our own categories of programs (federal targeted grants, national scholarships, state grants, institutional grants, performance-based aid, emergency financial assistance, and promise programs) and program characteristics (e.g., eligibility criteria, duration, costs covered). We found some differences in effects across categories, but few differences based on other characteristics. To further inform resource allocation and program design, future research should consider the utility and validity of these program categories and characteristics and perhaps consider alternatives. Future meta-analyses might also consider categories of support that did not meet our definition of grants, including tuition price-setting interventions, work study programs, and programs with service-related eligibility criteria (e.g., military, teaching, social services).

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Finally, future meta-analyses should compare effects of grant eligibility with effects of actually receiving grant aid. The studies included in this meta-analysis were a combination of intent-to-treat analyses (i.e., comparisons between students eligible for grants and similar students ineligible for grants because of randomization or not meeting the eligibility cutoff) and treatment-on-the-treated analyses (i.e., comparisons between students who received grants and similar students who did not). We used intent-to-treat analyses if treatment-on-the-treated analyses were also reported. Although we found no difference in effects based on type of research design, we did not produce separate effect estimates for different types of analyses.

## Concluding Note

Given the likelihood of continued increases in the costs of attending college, research on the effects of grants on college student outcomes will be needed into the future. While studies of individual grant aid programs have value, systematic reviews and meta-analyses of results across studies are critical to understanding the conclusions that may be drawn across studies. We hope that this study provides a useful foundation for future systematic review and meta-analyses of college grant programs, as well as other interventions intended to improve students' educational outcomes.

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of student grant aid programs, even if their studies did not meet our inclusion criteria. Much is still left to be understood about the effects of college aid programs, and we are eager to see future contributions from individuals who have conducted previous studies, as well as researchers conducting studies of this type for the first time.

**Funding:** This research was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A180102 to Development Services Group, Inc. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

Under Review

**Table 1. Effects of College Grant Aid across Outcome Domains**

| **Outcome Domain** | **k (m)** | **ES (SE)** | **95% CI** | ***p*-value** | $I^2$, $\tau^2$ |
|---|---|---|---|---|---|
| Enrollment | 41 (153) | .07 (.03) | .01, .13 | .024 | 95.43, 0.009 |
| Academic Achievement | 37 (109) | .03 (.03) | -.02, .09 | .208 | 79.45, 0.004 |
| Credit Accumulation | 32 (171) | .12 (.03) | .05, .18 | .001 | 91.64, 0.011 |
| Persistence | 39 (135) | .05 (.02) | .02, .08 | .006 | 70.09, 0.002 |
| Degree Completion | 43 (119) | .01 (.01) | .01, .02 | .007 | 70.21, 0.001 |
| Post-College Labor Market | 8 (22) | .05 (.03) | -.02, .12 | .139 | 81.62, 0.002 |

*Notes*: k = number of studies, m = number of effect sizes, ES = average effect size, SE = standard error, 95% CI = confidence interval. $I^2$ = inconsistency index, $\tau^2$ = tau-squared.

**Table 2. Subgroup Analysis of Enrollment and Degree Completion Outcome Measures**

| Outcome Domain | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|
| Enrollment | | | | | 0.53, 0.75 |
| Enrollment in 2-year college | 22 (47) | 0.02 (0.01) | -0.01, 0.05 | 0.25 | |
| Enrollment in 4-year college | 24 (40) | 0.03 (0.04) | -0.05, 0.11 | 0.42 | |
| Any enrollment | 22 (40) | 0.13 (0.07) | -0.02, 0.28 | 0.08 | |
| Enrollment in a specific institution | 6 (7) | 0.22 (0.21) | -0.44, 0.88 | 0.36 | |
| Enrollment in a state institution | 7 (13) | 0.03 (0.01) | 0.01, 0.04 | 0.01 | |
| Enrollment in a highly selective institution | 5 (6) | 0.05 (0.05) | -0.17, 0.27 | 0.42 | |
| Degree Completion | | | | | 0.53, 0.62 |
| Associate degree completion | 14 (28) | 0.01 (0.01) | -0.01, 0.04 | 0.18 | |
| Baccalaureate degree completion | 33 (68) | 0.02 (0.01) | 0, 0.03 | 0.03 | |
| Any degree completion | 8 (23) | 0.01 (0.01) | -0.01, 0.03 | 0.43 | |

*Note*: k = number of studies, m = number of effect sizes, ES = meta-analytic average effect size, SE = standard error, 95% CI = 95% confidence interval, $I^2$ = inconsistency index, $\tau^2$ = tau-squared

**Table 3. Translated Effect Sizes**

| Outcome Domain | Translation Type | Control Group Base Rate (If applicable) | Translated Effect Size | % Point Difference (If applicable) |
|---|---|---|---|---|
| Enrollment - Combined | Percentage | 43.4% | 46.2% | +2.8 |
| Enrollment - 2 year | Percentage | 35.0% | 35.6% | +0.6 |
| Enrollment - 4 year | Percentage | 31.0% | 32.1% | +1.1 |
| Enrollment - Any | Percentage | 73.0% | 77.0% | +4% |
| Academic Achievement | WWC Improvement Index | NA | +1.3 | NA |
| Credit Accumulation | Number of Credits Earned Per Semester | 8.88 | 9.02 | 1.5% increase, or +0.14 credits per term |
| Persistence | Percentage | 53.7% | 55.7% | +2.0 |
| Degree Completion | Percentage | 32.9% | 33.4% | +0.5 |
| Completion - 2 year | Percentage | 20.0% | 20.3% | +0.3 |
| Completion - 4 year | Percentage | 36.0% | 36.6% | +0.6 |
| Completion - Any | Percentage | 31.0% | 31.2% | +0.2 |
| Post-College Labor Market | Percentage | 76.0% | 77.4% | +1.4 |

**Table 4. Subgroup Analysis of 2-Year Samples, 4-Year Samples, or 2- and 4-Years Combined Samples**

| Outcome Domain | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|
| Enrollment | | | | | 0.27, 0.77 |
| 2-Year | 12 (46) | 0.04 (0.04) | -0.07, 0.14 | 0.39 | |
| 4-Year | 7 (20) | 0.13 (0.14) | -0.27, 0.52 | 0.41 | |
| 2- and 4-Year Combined | 22 (87) | 0.07 (0.03) | 0.01, 0.13 | 0.04 | |
| Academic Achievement | | | | | 0.79, 0.48 |
| 2-Year | 13 (48) | 0.03 (0.02) | -0.02, 0.08 | 0.15 | |
| 4-Year | 12 (35) | -0.01 (0.09) | -0.23, 0.2 | 0.88 | |
| 2- and 4-Year Combined | 13 (26) | 0.06 (0.02) | 0.02, 0.11 | 0.01 | |
| Credit Accumulation | | | | | 4.99, 0.05 |
| 2-Year | 17 (112) | 0.15 (0.07) | 0.01, 0.30 | 0.05 | |
| 4-Year | 5 (36) | 0.02 (0.02) | -0.04, 0.08 | 0.33 | |
| 2- and 4-Year Combined | 10 (23) | 0.12 (0.03) | 0.06, 0.19 | 0.01 | |
| Persistence | | | | | 2.68, 0.13 |
| 2-Year | 15 (71) | 0.08 (0.03) | -0.01, 0.17 | 0.07 | |
| 4-Year | 12 (31) | 0.01 (0.02) | -0.05, 0.06 | 0.85 | |
| 2- and 4-Year Combined | 13 (33) | 0.07 (0.03) | 0, 0.14 | 0.06 | |
| Degree Completion | | | | | 0.93, 0.45 |
| 2-Year | 11 (31) | 0.01 (0.01) | -0.02, 0.04 | 0.20 | |
| 4-Year | 12 (34) | 0.01 (0.01) | -0.01, 0.02 | 0.39 | |
| 2- and 4-Year Combined | 20 (54) | 0.02 (0.01) | 0, 0.04 | 0.05 | |
| Post-College Labor Market | | | | | 0.37, 0.58 |
| 4-Year | 4 (15) | 0.05 (0.01) | -0.01, 0.1 | 0.06 | |
| 2- and 4-Year Combined | 3 (5) | 0.13 (0.14) | -0.61, 0.87 | 0.46 | |

*Note*: k = number of studies, m = number of effect sizes, ES = meta-analytic average effect size, SE = standard error, 95% CI = 95% confidence interval

**Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart**

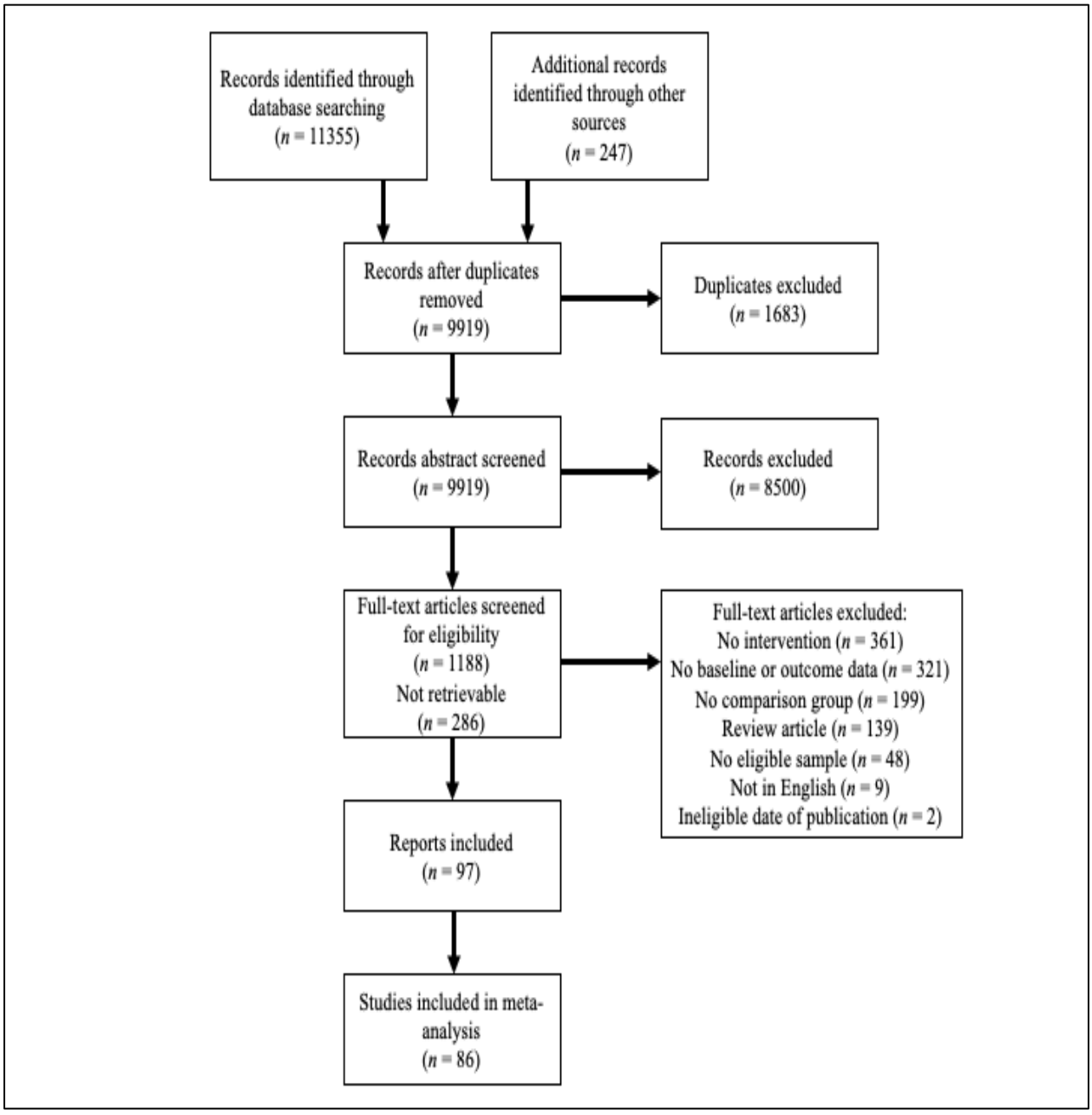


**Figure 2. Evidence Gap Maps of Aid Program Type by Outcome Domain**

**Note:** The size of the bubble indicates the number of studies included. Note: p<.05=*, p<.01=**, p<.001***

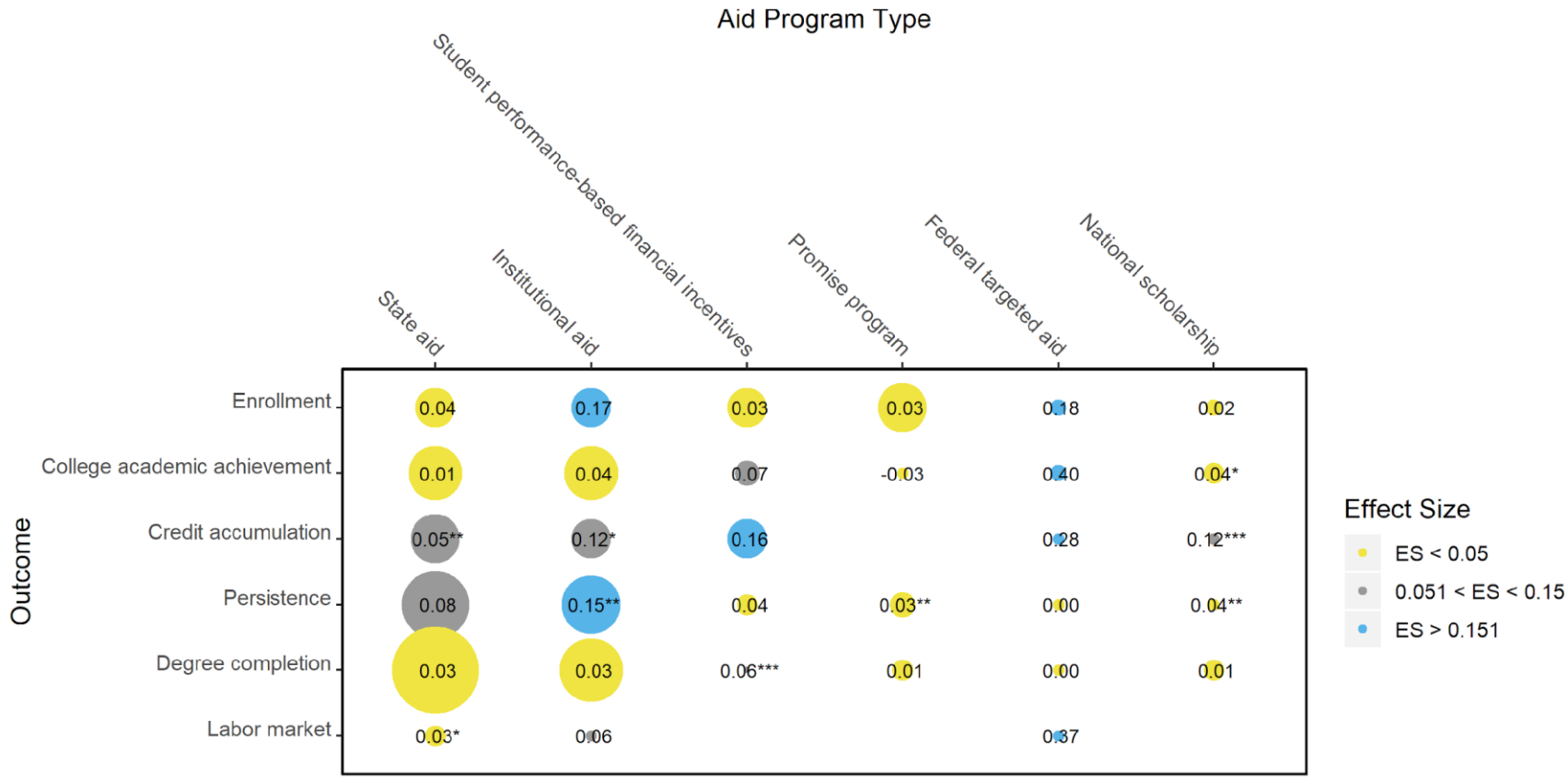
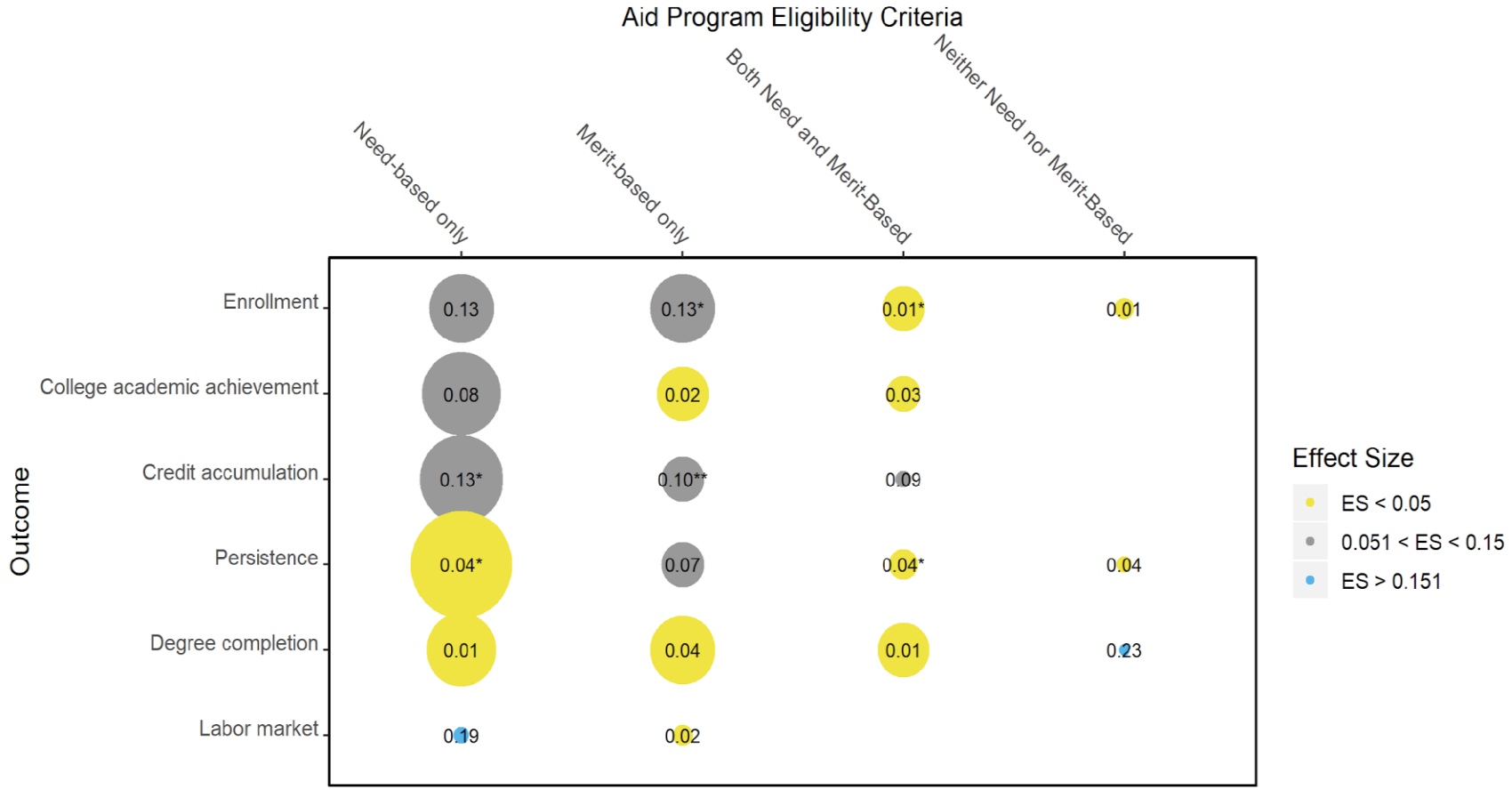


**Figure 3. Evidence Gap Maps of Aid Program Eligibility Criteria by Outcome Domain**

**Note:** The size of the bubble indicates the number of studies included. Note: p<.05=*, p<.01=**, p<.001***



**Online Supplemental Appendix**

# Contents

# S1. Final Boolean Search Terms for Academic Databases

## Final Boolean Database Search Terms for 2002–2017 - With Outcomes (with Promise Terms)

*We did not need to duplicate the Nguyen et al. (2018) search (searched impact of grant aid on persistence and degree attainment[1] up to January 2018) or the Swanson et al. (2016) search (searched the effect of Promise programs on K-12 academic outcomes, postsecondary outcomes, and community development outcomes until 2016). So we added the outcomes that Nguyen (2018) did not prioritize, focusing specifically on postsecondary outcomes such as* ***enrollment, achievement, credit accumulation****, and* ***attendance,*** *as well as* ***labor market*** *outcomes. We anticipated some duplication with the Swanson study, finding studies of the effect of promise programs on enrollment and achievement. But the other option would be to use NOT terms for all promise programs, and the problem with that would be that we would miss studies examining the effect of promise programs on labor market outcomes. Also, removed "degree completion" from college terms. We completed four searches itemized below.*

((((“promise zone*” OR “free college” OR “tuition-free” OR “tuition free” OR “free tuition” OR “tuition waiver” OR “cash for college” OR “post-secondary aid” OR “student aid” OR “tuition assistance” OR scholarship* OR “grant program*” OR “financial aid” OR “work study” OR “work-study” OR “Federal Supplemental Educational Opportunity” OR FSEOG OR “grant aid” OR “financial assistance” OR “financial incentive” OR “university grant*”) OR ((“need-based” OR “place-based” OR merit OR “performance-based” OR financial OR promise OR “last dollar” or “last-dollar” OR Pell OR “no-loan” OR tuition) n2 (aid OR grant* OR incentive* OR program* OR lotter* OR subsid* or discount*)) OR ((AFDC OR “Aid to Families with Dependent Children” OR “Social Security”) N4 (college)) OR ((“minimum threshold”) and (“high school Grade Point Average” or “high school GPA”))) **AND** (college* OR universit* OR postsecondary OR post-secondary OR undergrad* OR “two-year institut*” or “2-year institut*” or “four-year institution*” or “4-year institution*” or “institution* of higher learning” or “higher education”)) **OR (**(“CORE Promise” and Philadelphia) OR (“Eminent Scholar*” n4 Mississippi) OR “13th year promise” OR “13th Year Promise” OR “21st Century Scholar*” OR “50th anniversary scholar*” OR “50th Anniversary Scholar*” OR “Accelerated Study in Associate Program*” OR “Adams Scholarship” OR “Adelante Promise” OR “Advantage Shelby” OR “Aims College Promise” OR “American Dream Scholarship” OR (Arizona* and “Instrument to Measure Standards”) OR “Arkadelphia Promise” OR “Baldwin Promise” OR “Bay Commitment” OR “Beacon of Hope” OR (“Bright Flight” and Missouri*) OR (“Bright Futures” and Florida) OR “Cal Grant” OR “Century Scholar*” OR “Challenge Scholars*” OR “Champion City Scholar*” OR “Chicago Star Scholarship*” OR “Cleveland County Promise*” OR “College Bound Scholarship* Program*” OR “Community Scholarship* Program*” OR “Dell Scholar*” OR “Denver Scholarship* Program*” OR “Detroit College Promise” OR “Detroit Promise” OR “Dyer County Promise” OR “Educate and Grow” OR “El Dorado Promise” OR “Florida Student Access Grant” OR “Galesburg Promise” OR “Garret County Scholarship Program” OR “Gates Millennium Scholar*” OR (Georgia and Hope) OR “Helping Outstanding Pupils Educationally” OR “Higher Education Legislative Plan” OR “Illinois Promise” OR (Kalamazoo AND Promise) OR “Kentucky College Access Program grant” OR “Knox Achieves” OR “Legacy Scholars” OR “Leopard Challenge” OR “Long Beach College Promise” OR “Longhorn Opportunity Scholar*” OR “Lottery Scholarship” OR “Madison Promise” OR “Milwaukee Area Technical College Promise” OR “Montgomery County Ohio College Promise” OR “Muskegon Promise” OR “National Merit Scholar*” OR (“National Scholar*” and Iowa*) OR “New Haven Promise” OR “Newark College Promise” OR “Northport Promise” OR “Oakland Promise” OR “Ohio College Opportunity Grant” OR “PACE Promise” OR “Pell grant” OR “Pensacola Pledge Scholars” OR “Peoria Promise” OR “Philadelphia Education Fund” OR “Pittsburg Promise” OR “Pittsburgh Promise” OR “Power of YOU” OR “Project Excel” OR “Promise for the Future” OR “Quincy Promise” OR “Tuition Assistance Grant” OR “Richmond CC Guarantee” OR “Richmond Promise” OR “Robert and Joyce Corrigan SF Promise Endowed Scholarship” OR “Rochester Promise” OR “Rockford Promise” OR “Rosen Foundation Scholarship” OR “Rotary Promise” OR “Rusk TJC Citizens Promise” OR “Santa Barbara Community College Promise” OR “Say Yes to Education” OR “School Counts” OR “Seattle Promise” OR “Shoreline Scholars” OR “Siskiyou Promise” OR “Skyline College Promise” OR “Sparkman Promise” OR “Spartan East Side Promise” OR “Sponsor a Scholar” OR “Tangelo Park Program” OR “Tennessee Promise” OR “The Cuesta Promise” OR “tnAchieves” OR “Tulsa Achieves” OR “Uchicago Pledge Scholars” OR “Ventura College Promise” OR “Wisconsin Scholars Grant”)) **AND** ("control group*" OR random* OR "comparison group*" OR "regression" OR "matched group*" OR baseline OR treatment OR experiment* OR intervention* OR evaluat* OR impact* OR effect* OR causal* OR posttest OR post-test OR pretest OR pre-test OR QED OR RCT OR "propensity score matching" OR "quasi-experimental" OR outcome* OR result* OR predict* OR affect* OR “difference-in-difference” OR “regression discontinuity” OR "literature review" OR "systemat* review" OR "meta-analys*” OR quantitative OR quantif* OR trend*) **AND** (admission* OR admit* OR enroll* OR achievement OR “labor market*” or employ* OR job* OR career* OR workforce OR income* OR salary OR salaries OR wealth OR grade* OR GPA OR test* OR score* OR credit* OR (attend* and (college or course* or class*)))

[1] *(persist* OR retention OR attrition OR graduat* OR attain* OR degree)*

**Searching** Abstracts OR Titles
**Databases in EBSCO**: Academic Search Premier, EconLit, ERIC, OpenDissertations, Professional Development Collection, PsycARTICLES, PsycINFO, SocINDEX with Full Text, Teacher Reference Center
**Proquest:** ProQuest Dissertations and Theses database

# Final Boolean Database Search Terms for 2018 through January 15, 2020)

((((“promise zone” OR “free college” OR “tuition-free” OR “tuition free” OR “free tuition” OR “tuition waiver” OR “cash for college” OR “post-secondary aid” OR “student aid” OR “tuition assistance” OR scholarship* OR “grant program*” OR “financial aid” OR “work study” OR “work-study” OR “Federal Supplemental Educational Opportunity” OR FSEOG OR “grant aid” OR “financial assistance” OR “financial incentive” OR “university grant*”) OR ((“need-based” OR “place-based” OR merit OR “performance-based” OR financial OR promise OR “last dollar” or “last-dollar” OR Pell OR “no-loan” OR tuition) n2 (aid OR grant* OR incentive* OR program* OR lotter* OR subsid* or discount*)) OR ((AFDC OR “Aid to Families with Dependent Children” OR “Social Security”) N4 (college)) OR ((“minimum threshold”) and (“high school Grade Point Average” or “high school GPA”))) **AND** (college* OR universit* OR postsecondary OR post-secondary OR undergrad* OR “two-year institut*” or “2-year institut*” or “four-year institution*” or “4-year institution*” or “institution* of higher learning” or “higher education” or “degree completion”)) OR **(**(“CORE Promise” and Philadelphia) OR (“Eminent Scholar*” n4 Mississippi) OR “13th year promise” OR “13th Year Promise” OR “21st Century Scholar*” OR “50th anniversary scholar*” OR “50th Anniversary Scholar*” OR “Accelerated Study in Associate Program*” OR “Adams Scholarship” OR “Adelante Promise” OR “Advantage Shelby” OR “Aims College Promise” OR “American Dream Scholarship” OR (Arizona* and “Instrument to Measure Standards”) OR “Arkadelphia Promise” OR “Baldwin Promise” OR “Bay Commitment” OR “Beacon of Hope” OR (“Bright Flight” and Missouri*) OR (“Bright Futures” and Florida) OR “Cal Grant” OR “Century Scholar*” OR “Challenge Scholars*” OR “Champion City Scholar*” OR “Chicago Star Scholarship*” OR “Cleveland County Promise*” OR “College Bound Scholarship* Program*” OR “Community Scholarship* Program*” OR “Dell Scholar*” OR “Denver Scholarship* Program*” OR “Detroit College Promise” OR “Detroit Promise” OR “Dyer County Promise” OR “Educate and Grow” OR “El Dorado Promise” OR “Florida Student Access Grant” OR “Galesburg Promise” OR “Garret County Scholarship Program” OR “Gates Millennium Scholar*” OR (Georgia and Hope) OR “Helping Outstanding Pupils Educationally” OR “Higher Education Legislative Plan” OR “Illinois Promise” OR (Kalamazoo AND Promise) OR “Kentucky College Access Program grant” OR “Knox Achieves” OR “Legacy Scholars” OR “Leopard Challenge” OR “Long Beach College Promise” OR “Longhorn Opportunity Scholar*” OR “Lottery Scholarship” OR “Madison Promise” OR “Milwaukee Area Technical College Promise” OR “Montgomery County Ohio College Promise” OR “Muskegon Promise” OR “National Merit Scholar*” OR (“National Scholar*” and Iowa*) OR “New Haven Promise” OR “Newark College Promise” OR “Northport Promise” OR “Oakland Promise” OR “Ohio College Opportunity Grant” OR “PACE Promise” OR “Pell grant” OR “Pensacola Pledge Scholars” OR “Peoria Promise” OR “Philadelphia Education Fund” OR “Pittsburg Promise” OR “Pittsburgh Promise” OR “Power of YOU” OR “Project Excel” OR “Promise for the Future” OR “Quincy Promise” OR “Richmond CC Guarantee” OR “Richmond Promise” OR “Robert and Joyce Corrigan SF Promise Endowed Scholarship” OR “Rochester Promise” OR “Rockford Promise” OR “Rosen Foundation Scholarship” OR “Rotary Promise” OR “Rusk TJC Citizens Promise” OR “Santa Barbara Community College Promise” OR “Say Yes to Education” OR “School Counts” OR “Seattle Promise” OR “Shoreline Scholars” OR “Siskiyou Promise” OR “Skyline College Promise” OR “Sparkman Promise” OR “Spartan East Side Promise” OR “Sponsor a Scholar” OR “Tangelo Park Program” OR “Tennessee Promise” OR “The Cuesta Promise” OR “tnAchieves” OR “Tuition Assistance Grant” OR “Tulsa Achieves” OR “Uchicago Pledge Scholars” OR “Ventura College Promise” OR “Wisconsin Scholars Grant”)) **AND** ("control group*" OR random* OR "comparison group*" OR "regression" OR "matched group*" OR baseline OR treatment OR experiment* OR intervention* OR evaluat* OR impact* OR effect* OR causal* OR posttest OR post-test OR pretest OR pre-test OR QED OR RCT OR "propensity score matching" OR "quasi-experimental" OR outcome* OR result* OR predict* OR affect* OR “difference-in-difference” OR “regression discontinuity” OR "literature review" OR "systemat* review" OR "meta-analys*” OR quantitative OR quantif* OR trend*)

**Searching** Abstracts OR Titles
**Databases in EBSCO**: Academic Search Premier, EconLit, ERIC, OpenDissertations, Professional Development Collection, PsycARTICLES, PsycINFO, SocINDEX with Full Text, Teacher Reference Center
**Proquest:** ProQuest Dissertations and Theses database

# Final Boolean Search Terms for Federal Work Study Programs 2002–2018

(federal and ("work study" or "work-study")) **AND** ("control group*" OR random* OR "comparison group*" OR "regression" OR "matched group*" OR baseline OR treatment OR experiment* OR intervention* OR evaluat* OR impact* OR effect* OR causal* OR posttest OR post-test OR pretest OR pre-test OR QED OR RCT OR "propensity score matching" OR "quasi-experimental" OR outcome* OR result* OR predict* OR affect* OR "difference-in-difference" OR "regression discontinuity" OR "literature review" OR "systemat* review" OR "meta-analys*" OR quantitative OR quantif* OR trend*) **NOT** (college* OR universit* OR postsecondary OR post-secondary OR undergrad* OR "two-year institut*" or "2-year institut*" or "four-year institution*" or "4-year institution*" or "institution* of higher learning" or "higher education")

**Searching** Abstracts and Titles separately
**Databases in EBSCO**: Academic Search Premier, EconLit, ERIC, OpenDissertations, Professional Development Collection, PsycARTICLES, PsycINFO, SocINDEX with Full Text, Teacher Reference Center
**Proquest:** ProQuest Dissertations and Theses database

# Final Boolean Search Terms for Promise Programs Only Search String for 2016-2017

(("13th year promise" OR "50th anniversary scholar*" OR "50th Anniversary Scholar*" OR "13th Year Promise" OR "Adelante Promise" OR "Advantage Shelby" OR "Aims College Promise" OR "American Dream Scholarship" OR "Arkadelphia Promise" OR "Baldwin Promise" OR "Bay Commitment" OR "Beacon of Hope" OR "Challenge Scholars*" OR "Champion City Scholar*" OR "Chicago Star Scholarship*" OR "Cleveland County Promise*" OR "College Bound Scholarship* Program*" OR "Community Scholarship* Program*" OR "Denver Scholarship* Program*" OR "Detroit College Promise" OR "Detroit Promise" OR "Dyer County Promise" OR "Educate and Grow" OR "El Dorado Promise" OR "Galesburg Promise" OR "Garret County Scholarship Program" OR "Illinois Promise" OR "Kalamazoo Promise" OR "Knox Achieves" OR "Legacy Scholars" OR "Leopard Challenge" OR "Long Beach College Promise" OR "Madison Promise" OR "Milwaukee Area Technical College Promise" OR "Montgomery County Ohio College Promise" OR "Muskegon Promise" OR "New Haven Promise" OR "Newark College Promise" OR "Northport Promise" OR "Oakland Promise" OR "PACE Promise" OR "Pensacola Pledge Scholars" OR "Peoria Promise" OR "Philadelphia Education Fund" OR "Pittsburg Promise" OR "Pittsburgh Promise" OR "Power of YOU" OR "Project Excel" OR "Promise for the Future" OR "Quincy Promise" OR "Richmond CC Guarantee" OR "Richmond Promise" OR "Robert and Joyce Corrigan SF Promise Endowed Scholarship" OR "Rochester Promise" OR "Rockford Promise" OR "Rosen Foundation Scholarship" OR "Rotary Promise" OR "Rusk TJC Citizens Promise" OR "Santa Barbara Community College Promise" OR "Say Yes to Education" OR "School Counts" OR "Seattle Promise" OR "Shoreline Scholars" OR "Siskiyou Promise" OR "Skyline College Promise" OR "Sparkman Promise" OR "Spartan East Side Promise" OR "Tangelo Park Program" OR "Tennessee Promise" OR "The Cuesta Promise" OR "tnAchieves" OR "Tulsa Achieves" OR "Uchicago Pledge Scholars" OR "Ventura College Promise" OR **(**"CORE Promise" and Philadelphia)) **OR** ((promise OR place-based OR Last-dollar) **AND** (college* OR universit* OR postsecondary OR post-secondary OR undergrad* OR "two-year institut*" or "2-year institut*" or "four-year institution*" or "4-year institution*" or "institution* of higher learning" or "higher education" or "degree completion"))) **AND** ("control group*" OR random* OR "comparison group*" OR "regression" OR "matched group*" OR baseline OR treatment OR experiment* OR intervention* OR evaluat* OR impact* OR effect* OR causal* OR posttest OR post-test OR pretest OR pre-test OR QED OR RCT OR "propensity score matching" OR "quasi-experimental" OR outcome* OR result* OR predict* OR affect* OR "difference-in-difference" OR "regression discontinuity" OR "literature review" OR "systemat* review" OR "meta-analys*" OR quantitative OR quantif* OR trend*)

**Searching** Abstracts and Titles separately
**Databases in EBSCO**: Academic Search Premier, EconLit, ERIC, OpenDissertations, Professional Development Collection, PsycARTICLES, PsycINFO, SocINDEX with Full Text, Teacher Reference Center
**Proquest:** ProQuest Dissertations and Theses database

## S2. Information Regarding Back-Transformation of Effect Sizes

To improve the interpretability of effects, we back-transformed the average effects for each outcome domain to more meaningful metrics. To calculate translated effect sizes, we estimated outcomes for the control group using information available in the included studies. These estimated outcomes for the control group reflect the studies that reported this information and may not be representative of outcomes for all students and institutions across the United States. For three outcome domains—enrollment, persistence, and completion—we transformed the effect into proportions and calculated a percentage-point difference between intervention and control groups. The enrollment domain includes three enrollment outcomes: enrollment in any postsecondary institution, enrollment in a two-year institution, and enrollment in a four-year institution. Using information reported by studies included in this meta-analysis, we calculated an average comparison group enrollment rate for each of these three enrollment outcomes. We calculated a within study average at the contrast level, and then a weighted average by the total number of study participants across all studies.

We estimated that 73% of the control groups enrolled in any postsecondary institution, 35% enrolled in a two-year institution, and 31% enrolled in a four-year institution. The weighted average college enrollment rate for the control group across all enrollment outcomes was 43.4%. Using a similar approach, from available information in included studies, we estimate that the weighted average persistence rate for the control group was 53.7%. Across studies of completion with available information, 31% of the control group earned any degree, 20% earned an associate degree, and 36% earned a bachelor's degree. The weighted average degree-completion rate for the control groups across all degree completion outcomes in our dataset was 32.9%.

For academic achievement, we converted the average effects into the WWC's Improvement Index metric (WWC, 2020a), which is the expected percentile gain in the typical student in the control distribution had received the intervention. For credit accumulation, the average control group rate derived across studies in our dataset that reported credits earned (within individual academic semesters/terms) is a

mean of 8.88 credits per semester (SD 1.24). For the post-college labor market outcome domain, we elected to use the Bureau of Labor Statistics base rate of 76% employment to translate this effect size (BLU, 2021). Given the limited number effect sizes and diversity of these outcomes (*n*=8), we chose not to use summary statistics from our meta-analytic dataset.

# S3. Descriptive Tables

## Table S1. Study Inclusion Criteria for Systematic Review and Meta-Analysis on the Effects of College Aid Programs

| Criteria | Requirements of Included Studies |
|---|---|
| Population | K–12 students meeting college aid program criteria, high school students, recent high school graduates, and adult learners. |
| Intervention types | Grant aid to undergraduates that reduces college costs (does not have to be repaid). Aid may be awarded based on financial need and/or academic merit, place of residence, or other criteria. Aid includes grants, scholarships, "free tuition," tuition waivers, and subsidies. Tuition-price setting, athletic scholarships, individual tax savings accounts, work study, and aid programs requiring service are excluded. Aid programs that are bundled together and do not analyze the effect of one specified aid program are also excluded. Studies of the elimination or loss of grant aid meeting these intervention criteria were included and analyzed separately from the studies evaluating effects of the presence of grant aid. |
| Location | United States, U.S. territories, or U.S. tribal communities. |
| Study design | Randomized controlled trials, regression discontinuity designs, difference-in-differences analyses, and quasi-experimental studies analyzed with student-level data are included. Studies reporting only institution-level analyses were excluded. |
| Comparison groups | 1) "no-treatment" or inactive comparison group; or 2) cohorts of students before program promotion or availability; or 3) students who did not meet but were near the cutoff of program eligibility criteria. |
| Baseline data requirements for non-RCTs | **Option 1**: For college GPA measures with HS GPA baseline (considered "direct pretest"), no additional baseline needed. For all other outcomes without "direct pretest" Options 2 and 3 apply. **Option 2**: Study provides measure of prior academic achievement or measure of socioeconomic status of students at baseline. **Option 3**: Study provides two or more measures of baseline demographics (e.g., gender, race, age). |
| Outcome | College enrollment, college enrollment type (2-year or 4-year), college academic achievement (e.g., GPA), college credit accumulation, persistence, degree completion, and post-college labor market outcomes. |
| Publication status | No restrictions, published or unpublished. |

## Table S2. Types of College Grant Aid Programs Represented from the Systematic Search

| **Type of Grant Aid Program** | **Description** (Note: See definition of Intervention type in Table S1.) |
|---|---|
| Federal grants | Authorized and appropriated by the U.S. Congress to provide grant aid to college students with financial need (e.g., Pell Grant) or other designated populations. The latter include the John H. Chafee Independent Living Program for youth in foster care under age 19, Education and Training Vouchers for students formerly in foster care under the age of 26 (formerly age 22), and the Health Resources and Services Administration (HRSA) program, Scholarships for Disadvantaged Students, targeted to students enrolled in health sciences programs at 4-year institutions. |
| National scholarships | Grant aid funded by a national philanthropic or nonprofit organization and awarded to students who meet specified eligibility criteria (e.g., academic, non-cognitive) to attend a college or university across the nation. Programs may include mentoring and other supports. Examples include Gates Millennium Scholarship, National Merit Scholarship, and Dell Scholars. |
| State-sponsored grants, based on merit criteria | Grant aid (covering some portion of the costs of attendance) to college students meeting academic criteria who enroll in in-state public and/or private postsecondary institutions. The amount of grant aid may vary by type of institution and level of academic merit of students, using established criteria (e.g., ACT/SAT total score, high school GPA of at least 2.5 or higher, top 10% HS class rank, exceptional achievement on state standardized tests). Some programs have tiered funding for students meeting higher thresholds of academic merit (e.g., higher than 3.0 HS GPA vs. lower than 3.0 GPA). |
| State-sponsored grants, based on need criteria | Provide grant aid (covering some portion of the costs of attendance) to college students meeting need-based criteria who enroll in in-state public and/or private postsecondary institutions. Programs typically require students to complete the Federal Application for Financial Student Assistance (FAFSA) and define financial need based on a maximum threshold for Expected Family Contribution (EFC). These programs may require that federal Pell grant dollars be applied first to the students' costs of attendance. |
| State-sponsored grants, based on both merit and need criteria | Have both need-based and academic merit-based eligibility criteria. |
| Institutional grants | Grant aid awarded from the institution of attendance that has institution-developed eligibility requirements that may be based on financial need, academic or non-cognitive merit (e.g. leadership), or a combination of need and non-need criteria. This aid may only be used at the particular institution(s) awarding the grant. Note: Institutional athletic scholarships are excluded from this systematic review. |

| | |
|---|---|
| Student performance-based financial incentives | Grant aid awarded to students who achieve specified performance measures, including earning a minimum GPA, registering for a specified number of credits or specific courses, attending advising sessions, and participating in support programs (tutoring, advising, etc.). The duration of the student performance-based aid available varies by program (e.g., 1 term, 2 terms, up to 6 terms). Unlike most other aid programs, the monetary award is provided directly to the student and may be applied to costs of college attendance at the discretion of the student. |
| Emergency financial assistance | Grant aid to students to address a temporary financial emergency that poses a substantial barrier to continued enrollment (e.g., loss of job, unexpected increase in rent, car repairs). Some programs give the aid to the student directly; others make payments directly to providers (e.g., landlord, car repair shop). |
| Promise program | Grant aid available to students who attend particular high schools or live in a designated sub-state community and/or provide an early commitment (that is, before HS senior year) or clear message of availability of student grant aid for eligible students meeting program requirements. |
| Expansive promise program | A subtype of promise program that allows students to apply aid to an expansive set of institutions (e.g., both public and private institutions, both in-state or out-of-state institutions). |
| Restrictive promise program | A subtype of promise program that limits the set of institutions at which an award may be used. For example, the grant aid may only be available to students who attend two-year institutions or public institutions in a particular geographic region (Miller-Adams, 2015). |

Table S3. Average sample sizes of students represented in studies of different types of aid programs, and overall total of students represented (n=86 studies)

| **Aid Program Types (represented in our sample)** | **Average Sample Size (SD) (for 107 Contrasts in 86 studies)** |
|---|---|
| Promise Program - Expansive | 23,192 (27,376) |
| Promise Program - Restrictive | 3,775 (4,333) |
| Institutional Grants | 6,910 (9,707) |
| Federal Grants - Non-Pell | 2,921 (2,226) |
| Federal Grants – Pell | 16,518 (10,568) |
| National Scholarship | 22,130 (82,359) |
| Student Performance-Based Financial Incentives | 1,806 (1,043) |
| Emergency Financial Assistance | 840 (56) |
| State-Sponsored Grants | 17,565 (21,929) |
| **Mean (SD) of Sample Size** | **10,798 (25,895)** |
| **Total number of unique students across all study analyses** | **7,656,062** |

## Table S4. Overview of Study, Sample, and Program Characteristics (n=107 contrasts from n=86 studies)

*Note*: A contrast is defined as the comparison between a specified intervention group with unique characteristics vs. a no-aid comparison group that does not have an overlapping sample within a particular study, that met all other inclusion criteria for effect size calculation.

| Characteristic | Categories | # (%) of contrasts |
|---|---|---|
| Has a publication in a peer-reviewed journal | Yes, at least one peer reviewed report | 45 (42.1) |
| | No, does not include one peer reviewed report | 62 (57.9) |
| Received external funding | Yes | 59 (55.1) |
| | No | 48 (44.9) |
| Study design type | Non-random assignment/quasi-experimental design (treatment on treated, TOT) | 36 (33.6) |
| | Difference-in-difference quasi-experimental design (DND, intent-to-treat, ITT) | 8 (7.5) |
| | Randomized controlled trial (RCT, ITT) | 33 (30.8) |
| | Regression discontinuity design (RDD, ITT) | 30 (28.0) |
| Location of the sample | a mid-Atlantic state | 2 (1.9) |
| | Arizona | 1 (0.9) |
| | California | 9 (8.4) |
| | California, Washington | 1 (0.9) |
| | Colorado | 1 (0.9) |
| | Connecticut | 1 (0.9) |
| | Florida | 6 (5.6) |
| | Georgia | 2 (1.9) |
| | Illinois | 2 (1.9) |
| | Indiana | 2 (1.9) |
| | Kentucky | 1 (0.9) |
| | Louisiana | 1 (0.9) |
| | Maryland | 1 (0.9) |
| | Massachusetts | 1 (0.9) |
| | Michigan | 4 (3.7) |
| | Mississippi | 1 (0.9) |
| | Missouri | 2 (1.9) |
| | ***National*** | 11 (10.3) |
| | Nebraska | 3 (2.8) |
| | New Mexico | 2 (1.9) |
| | New York | 6 (5.6) |
| | North Carolina | 2 (1.9) |
| | Ohio | 6 (5.6) |
| | Oklahoma | 1 (0.9) |
| | Pennsylvania | 3 (2.8) |

| Characteristic | Categories | # (%) of contrasts |
|---|---|---|
| | Tennessee | 14 (13.1) |
| | Texas | 5 (4.7) |
| | Utah | 1 (0.9) |
| | Washington | 2 (1.9) |
| | West Virginia | 3 (2.8) |
| | Wisconsin | 7 (6.5) |
| | *Location Not Specified* | 3 (2.8) |
| Publication Date | 2004 | 2 (1.9) |
| | 2006 | 5 (4.7) |
| | 2007 | 3 (2.8) |
| | 2008 | 0 |
| | 2009 | 6 (5.6) |
| | 2010 | 5 (4.7) |
| | 2011 | 9 (8.4) |
| | 2012 | 1 (0.9) |
| | 2013 | 12 (11.2) |
| | 2014 | 9 (8.4) |
| | 2015 | 7 (6.5) |
| | 2016 | 18 (16.8) |
| | 2017 | 14 (13.1) |
| | 2018 | 9 (8.4) |
| | 2019 | 7 (6.5) |
| ***Sample Characteristics*** | | |
| Sample size | Mean: 17,581.80<br>SD: (54,076.46) | Median: 4,206<br>Range: (83 to 368,011) |
| Proportion of non-White students | Mean: 0.45<br>SD: (0.33) | Median: 0.39<br>Range: (0 to 1) |
| Proportion of males | Less than 33% | 17 (15.9) |
| | Between 33 and 44% | 49 (45.8) |
| | Greater than 44% | 34 (31.8) |
| | *Missing* | 7 (6.5) |
| Socioeconomic status | Low SES | 49 (45.8) |
| | Low-middle SES | 26 (24.3) |
| | Middle SES | 20 (18.7) |
| | Middle-upper SES | 6 (5.6) |
| | *Missing* | 6 (5.6) |
| Academic readiness | Low achieving | 21 (19.6) |
| | Middle achieving | 44 (41.1) |
| | High achieving | 30 (28.0) |
| | *Missing* | 12 (11.2) |

| Characteristic | Categories | # (%) of contrasts |
|---|---|---|
| Institutional type | 2-Year only | 30 (28.0) |
| | 4-Year only | 29 (27.1) |
| | Both 2- and 4-Year | 48 (44.9) |
| Expansive or restrictive range of institutions to which aid may apply | Restrictive | 46 (43.0) |
| | Expansive | 61 (57.0) |
| ***Grant Program Characteristics*** | | |
| Grant aid program type | Federal grants (Expansive) | 7 (6.5) |
| | State-sponsored grants (Expansive) | 37 (34.6) |
| | Promise programs | 13 (12.1) |
| | *Promise programs (Expansive) | *9 (8.4) |
| | *Promise programs (Restrictive) | *4 (3.7) |
| | Institutional grants (Restrictive) | 26 (24.3) |
| | National scholarships (Expansive) | 8 (7.5) |
| | Student performance-based financial incentives (Restrictive) | 14 (13.1) |
| | Emergency financial assistance (Restrictive) | 2 (1.9) |
| Program eligibility criteria by need/merit (%) | Need-based only | 48 (44.9) |
| | Merit-based only | 35 (32.7) |
| | Both Need and Merit-Based | 18 (16.8) |
| | Neither Need nor Merit-Based | 6 (5.6) |
| Mean unadjusted annual award amount | Mean: $3,323.99<br>SD: ($3,121.53) | Median: $2,071.50<br>Range: ($62.21 to $16,950.00) |
| Mean annual award amount (adjusted to 2020 dollars) | Mean: $4,182.30<br>SD: ($3,880.51) | Median: $2,586.99<br>Range: ($66.37 to $20,509.50) |
| Mean annual award amount (adjusted to 2020 dollars) | Less than $1,500 per year | 15 (14) |
| | $1,501 to $3,000 per year | 32 (29.9) |
| | $3,001 to $4,500 per year | 13 (12.1) |
| | $4,501 to $6,000 per year | 10 (9.3) |
| | $6,001 or more per year | 18 (16.8) |
| | Not Reported | 19 (17.8) |
| Program duration (maximum # of terms) | 1 to 2 semesters | 13 (12.1) |
| | 3 to 4 semesters | 7 (6.5) |
| | 5 to 6 semesters | 11 (10.3) |
| | 7 to 8 semesters | 37 (34.6) |
| | 9 or more semesters | 39 (36.4) |
| Grant program funding source | Federal | 8 (7.5) |
| | State | 34 (31.8) |
| | Institution | 17 (15.9) |
| | Philanthropic organization | 32 (29.9) |
| | Multiple funders | 13 (12.1) |

| Characteristic | Categories | # (%) of contrasts |
|---|---|---|
| | Missing | 3 (2.8) |
| Non-financial supports provided | No Additional Support Specified | 65 (60.7) |
| | Other Supports Available/Provided | 42 (39.3) |
| Costs covered through first-dollar, last-dollar, or other approach | First Dollar Any Costs | 13 (12.1) |
| | First Dollar Tuition/Book Fees Only | 13 (12.1) |
| | Last Dollar Any Costs | 43 (40.2) |
| | Last Dollar Tuition/Book Fees Only | 21 (19.6) |
| | Extra Financial Award | 16 (15.0) |
| | *Missing* | 1 (0.9) |
| Timing of program enrollment | Before high school | 7 (6.5) |
| | In high school | 21 (19.6) |
| | After high school graduation | 35 (32.7) |
| | While enrolled in college | 44 (41.1) |
| Institution type(s) to which the funding applies | In-state - Private - Four-year | 1 (0.9) |
| | In-state - Public - Four-year | 16 (15.0) |
| | In-state - Public - Two-year | 23 (21.5) |
| | In-state - Public - Two & Four year | 12 (11.2) |
| | In-state - Public & Private - Four-year | 3 (2.8) |
| | In-state - Public & Private - Two & Four year | 24 (22.4) |
| | In & Out of State - Private - Four-year | 1 (0.9) |
| | In & Out of State - Public - Two-year | 3 (2.8) |
| | In & Out of State - Public - Two & Four year | 2 (1.9) |
| | In & Out of State - Public & Private - Four-year | 1 (0.9) |
| | In & Out of State - Public & Private - Two & Four year | 19 (17.8) |
| | Not reported - Public - Four-year | 2 (1.9) |
| *Sector(s) of institutions to which aid may apply | Private institution(s) only | 2 (1.9) |
| | Public institution(s) only | 58 (54.2) |
| | Public & Private institutions | 47 (43.9) |
| *Range of institutions to which aid may apply | In-state institution(s) only | 79 (73.8) |
| | In & Out of State institutions | 26 (24.3) |
| | Not reported | 2 (1.9) |
| Enrollment intensity required | Full-time | 57 (53.3) |
| | Either full-time or part-time | 42 (39.3) |
| | Not reported | 8 (7.5) |
| Number of years of residency required for eligibility or full benefits | Mean: 1.69<br>SD: (2.92) | Median: 1.0<br>Range: (0 to 13) |
| Number of years required for eligibility or full benefits | 0 Years residency required | 29 (27.1) |
| | 1-2 Years residency required | 64 (59.8) |
| | 3-5 Years residency required | 8 (7.5) |
| | 12-13 Years residency required | 6 (5.6) |

## Table S5. Postsecondary Grant Aid Programs Included in the Meta-Analysis

| Program Type | # of Programs/ # of Contrasts | Programs Included in Studies |
|---|---|---|
| **Promise program** | 9 Programs; 13 Contrasts in 11 Studies | 1.Indiana 21st Century Scholars (2 studies), 2. Kalamazoo Promise, 3. Knox Achieves (TN), 4. The Degree Project, 5. OKPromise, 6. New Haven Promise, 7. Pittsburgh Promise, 8. Say Yes to Education, 9. Washington State Achievers (2 studies) |
| **Institutional grants** | 19 Programs; 24 Contrasts in 20 Studies | 1.Academic Excellence Award @ Univ. of Southern MS, 2. ASAP (New York) (2 studies), 3. ASAP (Ohio), 4. AAPI program (CA), 5. Buffett Scholarship (NE), 6. CARE Grant (FL), 7. Century Scholars (TX), 8. EXCEL (OH), 9. Flying Solo (CO), 10. I-Promise (IL), 11. Longhorn Scholars (TX), 12. Machen Scholars (FL), 13. New York Univ. CCTOP, 14. North Carolina Covenant Program (1 study; 2 contrasts), 15. Salt Lake Community College Promise, 16. Summer Scholar Grant (1 study; 2 contrasts), 17. Wayne State Transition to Independence (1 study, 2 contrasts), 18. (unnamed) Academic Recognition award at a private, selective liberal arts college, 19. (unnamed) institution merit aid program. |
| **Federal grants** | 3 Programs; 7 Contrasts in 6 Studies | 1.Pell Grant (5 contrasts; 4 studies), 2. Health Resources and Services Administration (HRSA) Scholarships for Disadvantaged Students Program, 3. Tuition Support in Chafee Foster Care Independence Program |
| **National scholarship** | 3 Programs; 7 Contrasts in 6 Studies | 1.Dell Scholars program (2 contrasts, 2 studies), 2. Gates Millennium Scholars Program (3 studies, 3 contrasts), 3) National Merit Scholarship Program (2 contrasts, 1 study) |
| **Student performance-based financial incentives** | 9 Programs; 14 Contrasts in 9 Studies | 1.Adelante Performance-Based Scholarship (PBS) (AZ), 2. Cash for College Scholarship (CA) (5 contrasts in 1 study), 3. Detroit Promise Path (advising incentives), 4. Ohio PBS Program, 5. Ohio Opening Doors Program, 6. Louisiana Opening Doors PBS Program, 7. PBS at Hillsborough Community College (FL), 8. PBS at NY Community Colleges (2 contrasts, 1 study), 9. VISTA PBS (NM) |

| | | |
|---|---|---|
| **Emergency financial assistance** | 2 Programs; 2 Contrasts in 1 Study | 1.Stay the Course Emergency Financial Assistance Program @ Tarrant Community College, 2. Emergency Financial Assistance (only) @ Tarrant Community College |
| **State-sponsored grants with need & merit criteria** | 1 Program; 2 Contrasts in 1 Study | 1.Cal Grant (1 study; 2 contrasts) |
| **State-sponsored grants with need criteria** | 6 Programs; 13 Contrasts in 8 Studies | 1.California Board of Governors Fee (Tuition) Waiver, 2. Florida Student Access Grant, 3. Howard P. Rawlings Educational Assistance Grant (MD), 4. Tennessee Student Assistance Award (3 contrasts, 1 study), 5. TEXAS Grant, 6. Wisconsin Scholars Grant (6 contrasts, 3 studies) |
| **State-sponsored grants with merit criteria** | 10 Programs; 20 Contrasts in 18 Studies | 1.Georgia HOPE (2 studies), 2. Florida Bright Futures (2 contrasts, 1 study), 3. Kentucky Educational Excellence Scholarship, 4. Massachusetts John & Abigail Adams Scholarship, 5. Missouri A+ Schools Program, 6. Missouri Bright Flight Program, 7. New Mexico Legislative Lottery Scholarship, 8. Tennessee Education Lottery Scholarship (5 studies), 9. Tennessee HOPE Scholarship (3 contrasts in 2 studies), 10. West Virginia Promise Scholarship (3 studies) |

# S4. Moderator Analysis Tables

## Table S6. Confirmatory Moderator Analysis – Average Annual Aid Award Amount

| Outcome Domain | Level (per year) | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 0.71, 0.63 |
| | < $1500 | 6 (22) | 0.01 (0.04) | -0.12, 0.14 | 0.83 | |
| | $1501 - $3000 | 14 (38) | 0.13 (0.07) | -0.03, 0.28 | 0.09 | |
| | $3001 - $4500 | 5 (25) | 0.03 (0.02) | -0.02, 0.08 | 0.13 | |
| | $4501 - $6000 | 6 (21) | 0.11 (0.1) | -0.15, 0.37 | 0.32 | |
| | > $6001 | 8 (21) | 0.14 (0.12) | -0.18, 0.46 | 0.30 | |
| | Not reported | 6 (26) | 0.02 (0.01) | -0.01, 0.05 | 0.17 | |
| Academic Achievement | | | | | | 0.31, 0.90 |
| | < $1500 | 4 (11) | 0.02 (0.02) | -0.09, 0.13 | 0.51 | |
| | $1501 - $3000 | 10 (35) | 0.04 (0.04) | -0.07, 0.15 | 0.40 | |
| | $3001 - $4500 | 7 (11) | 0.04 (0.05) | -0.11, 0.19 | 0.44 | |
| | $4501 - $6000 | 4 (10) | 0.06 (0.04) | -0.07, 0.19 | 0.22 | |
| | > $6001 | 5 (7) | 0.12 (0.09) | -0.15, 0.39 | 0.26 | |
| | Not reported | 10 (35) | -0.02 (0.07) | -0.2, 0.16 | 0.80 | |
| Credit Accumulation | | | | | | 1.07, 0.49 |
| | < $1500 | 6 (31) | 0.24 (0.12) | -0.09, 0.57 | 0.12 | |
| | $1501 - $3000 | 12 (75) | 0.05 (0.02) | 0.01, 0.09 | 0.02* | |
| | $3001 - $4500 | 4 (10) | 0.17 (0.14) | -0.48, 0.82 | 0.34 | |
| | $4501 - $6000 | 3 (8) | 0.17 (0.05) | -0.45, 0.8 | 0.18 | |
| | Not reported | 7 (44) | 0.08 (0.04) | -0.02, 0.18 | 0.09 | |
| Persistence | | | | | | 0.42, 0.82 |
| | < $1500 | 7 (36) | 0.1 (0.05) | -0.13, 0.32 | 0.19 | |
| | $1501 - $3000 | 13 (36) | 0.02 (0.01) | 0, 0.04 | 0.06 | |
| | $3001 - $4500 | 9 (22) | 0.05 (0.02) | -0.02, 0.11 | 0.09 | |
| | $4501 - $6000 | 4 (9) | 0.03 (0.01) | -0.05, 0.11 | 0.18 | |
| | > $6001 | 3 (3) | 0.38 (0.29) | -2.07, 2.82 | 0.39 | |
| | Not reported | 8 (31) | 0.02 (0.02) | -0.06, 0.11 | 0.40 | |
| Degree Completion | | | | | | 0.29, 0.89 |
| | < $1500 | 5 (11) | 0.01 (0.01) | -0.03, 0.05 | 0.27 | |
| | $1501 - $3000 | 12 (30) | 0.01 (0.01) | -0.01, 0.04 | 0.19 | |
| | $3001 - $4500 | 7 (22) | 0.05 (0.02) | -0.14, 0.24 | 0.25 | |
| | $4501 - $6000 | 5 (16) | 0.01 (0.01) | -0.03, 0.05 | 0.35 | |
| | > $6001 | 7 (9) | 0 (0.02) | -0.08, 0.07 | 0.86 | |
| | Not reported | 8 (31) | 0.03 (0.03) | -0.07, 0.14 | 0.38 | |
| Post-College Labor Market | | | | | | 0.78, 0.52 |
| | $1501 - $3000 | 3 (6) | 0.02 (0.01) | 0, 0.05 | 0.05* | |
| | $4501 - $6000 | 2 (5) | 0.31 (0.33) | -3.81, 4.43 | 0.52 | |

## Table S7. Confirmatory Moderator Analysis – Maximum Program Duration (provided students meet renewal criteria)

| Outcome Domain | Level | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 0.91, 0.54 |
| | 1-2 semesters | 6 (17) | 0.38 (0.18) | -0.41, 1.17 | 0.17 | |
| | 3-4 semesters | 4 (12) | -0.13 (0.16) | -0.75, 0.5 | 0.50 | |
| | 5-6 semesters | 6 (19) | 0.03 (0.07) | -0.36, 0.43 | 0.70 | |
| | 7-8 semesters | 13 (64) | 0.02 (0.01) | 0.01, 0.04 | 0.03* | |
| | 9+ semesters | 14 (41) | 0.09 (0.05) | -0.02, 0.2 | 0.11 | |
| Academic Achievement | | | | | | 1.12, 0.46 |
| | 1-2 semesters | 5 (19) | -0.02 (0.03) | -0.15, 0.11 | 0.59 | |
| | 3-4 semesters | 3 (12) | 0.04 (0.08) | -0.35, 0.42 | 0.68 | |
| | 5-6 semesters | 5 (9) | 0.01 (0.01) | -0.05, 0.07 | 0.51 | |
| | 7-8 semesters | 13 (35) | 0.1 (0.04) | 0.02, 0.18 | 0.02* | |
| | 9+ semesters | 12 (34) | -0.02 (0.06) | -0.15, 0.11 | 0.72 | |
| Credit Accumulation | | | | | | 0.54, 0.72 |
| | 1-2 semesters | 5 (45) | 0.11 (0.03) | -0.01, 0.24 | 0.06 | |
| | 3-4 semesters | 5 (29) | 0.32 (0.26) | -0.72, 1.36 | 0.34 | |
| | 5-6 semesters | 5 (31) | 0.11 (0.04) | -0.03, 0.26 | 0.09 | |
| | 7-8 semesters | 9 (30) | 0.11 (0.03) | 0.04, 0.18 | 0.01** | |
| | 9+ semesters | 9 (36) | 0.06 (0.03) | -0.02, 0.13 | 0.11 | |
| Persistence | | | | | | 7.86, 0.15 |
| | 1-2 semesters | 5 (34) | 0.14 (0.01) | 0.06, 0.22 | 0.02* | |
| | 3-4 semesters | 2 (11) | -0.08 (0.13) | -1.75, 1.59 | 0.66 | |
| | 5-6 semesters | 6 (22) | 0.21 (0.06) | -0.01, 0.42 | 0.05* | |
| | 7-8 semesters | 12 (28) | 0.04 (0.01) | 0.02, 0.05 | 0.01** | |
| | 9+ semesters | 15 (40) | 0.03 (0.02) | -0.02, 0.09 | 0.17 | |
| Degree Completion | | | | | | 0.14, 0.87 |
| | 5-6 semesters | 6 (18) | 0.03 (0.06) | -0.53, 0.59 | 0.70 | |
| | 7-8 semesters | 18 (52) | 0.02 (0.01) | -0.01, 0.04 | 0.08 | |
| | 9+ semesters | 18 (45) | 0.01 (0.01) | -0.01, 0.03 | 0.13 | |
| Post-College Labor Market | | | | | | 0.41, 0.56 |
| | 7-8 semesters | 5 (18) | 0.03 (0.01) | -0.02, 0.08 | 014 | |
| | 9+ semesters | 3 (4) | 0.08 (0.07) | -0.045, 0.60 | 0.45 | |

## Table S8. Confirmatory Moderator Analysis – Need/Merit Program Eligibility Criteria

| Outcome Domain | Level | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 1.59, 0.25 |
| | Neither | 4 (15) | 0.01 (0.04) | -0.12, 0.13 | 0.83 | |
| | Both | 9 (35) | 0.01 (0.02) | -0.04, 0.04 | 0.97 | |
| | Merit-Only | 14 (43) | 0.13 (0.07) | -0.03, 0.28 | 0.10 | |
| | Need-Only | 15 (60) | 0.13 (0.08) | -0.05, 0.30 | 0.13 | |
| Academic Achievement | | | | | | 0.80, 0.47 |
| | Both | 7 (17) | 0.02 (0.02) | -0.04, 0.07 | 0.46 | |
| | Merit-Only | 11 (23) | 0.02 (0.06) | -0.12, 0.16 | 0.75 | |
| | Need-Only | 18 (65) | 0.07 (0.04) | -0.02, 0.16 | 0.10 | |
| Credit Accumulation | | | | | | 0.24, 0.80 |
| | Both | 3 (17) | 0.08 (0.03) | -0.06, 0.23 | 0.13 | |
| | Merit-Only | 9 (22) | 0.12 (0.04) | 0.03, 0.2 | 0.01* | |
| | Need-Only | 19 (131) | 0.13 (0.07) | -0.02, 0.27 | 0.09 | |
| Persistence | | | | | | 0.11, 0.95 |
| | Neither | 3 (4) | 0.05 (0.03) | -0.26, 0.35 | 0.34 | |
| | Both | 6 (19) | 0.04 (0.01) | -0.01, 0.09 | 0.08 | |
| | Merit-Only | 9 (11) | 0.1 (0.08) | -0.11, 0.31 | 0.27 | |
| | Need-Only | 22 (101) | 0.04 (0.02) | 0.01, 0.08 | 0.04* | |
| Degree Completion | | | | | | 0.04, 0.99 |
| | Neither | 2 (10) | 0.02 (0.02) | -0.24, 0.27 | 0.57 | |
| | Both | 11 (22) | 0.01 (0.01) | -0.01, 0.04 | 0.25 | |
| | Merit-Only | 14 (36) | 0.02 (0.02) | -0.02, 0.06 | 0.24 | |
| | Need-Only | 16 (51) | 0.02 (0.01) | -0.01, 0.04 | 0.08 | |
| Post-College Labor Market | | | | | | 0.52, 0.52 |
| | Merit-Only | 4 (12) | 0.03 (0.01) | -0.01, 0.07 | 0.1 | |
| | Need-Only | 3 (6) | 0.12 (0.12) | -0.58, 0.82 | 0.46 | |

## Table S9. Confirmatory Moderator Analysis - Expansiveness of Institutions to Which Aid Funding Applies

| Outcome Domain | Level | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 0.05, 0.82 |
| | Expansive | 22 (79) | 0.07 (0.03) | 0.01, 0.13 | 0.05* | |
| | Restrictive | 19 (74) | 0.08 (0.06) | -0.06, 0.22 | 0.22 | |
| Academic Achievement | | | | | | 0.08, 0.79 |
| | Expansive | 20 (45) | 0.03 (0.03) | -0.04, 0.1 | 0.38 | |
| | Restrictive | 17 (64) | 0.04 (0.03) | -0.03, 0.11 | 0.21 | |
| Credit Accumulation | | | | | | 1.60, 0.22 |
| | Expansive | 14 (50) | 0.08 (0.02) | 0.03, 0.13 | 0.01** | |
| | Restrictive | 18 (121) | 0.16 (0.06) | 0.02, 0.3 | 0.03* | |
| Persistence | | | | | | 0.73, 0.43 |
| | Expansive | 22 (51) | 0.04 (0.02) | 0.01, 0.08 | 0.03* | |
| | Restrictive | 17 (86) | 0.08 (0.04) | -0.05, 0.21 | 0.15 | |
| Degree Completion | | | | | | 0.01, 0.95 |
| | Expansive | 28 (80) | 0.01 (0.01) | 0, 0.03 | 0.03* | |
| | Restrictive | 15 (39) | 0.01 (0.01) | -0.02, 0.04 | 0.21 | |
| Post-College Labor Market | | | | | | 0.09, 0.80 |
| | Expansive | 6 (14) | 0.05 (0.03) | -0.05, 0.14 | 0.24 | |
| | Restrictive | 2 (8) | 0.06 (0.01) | -0.09, 0.2 | 0.13 | |

## Table S10. Confirmatory Moderator Analysis - Program Models (with categories of Promise-Expansive and Promise-Restrictive broken out)

| Outcome Domain | Level | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 0.358, 0.873 |
| | Federal targeted - Expansive | 3 (12) | 0.18 (0.19) | -0.69, 1.06 | 0.45 | |
| | Promise program - Expansive | 8 (36) | 0.04 (0.02) | -0.02, 0.1 | 0.12 | |
| | Promise program - Restrictive | 2 (15) | -0.03 (0.05) | -0.59, 0.54 | 0.65 | |
| | Institutional aid - Restrictive | 8 (20) | 0.17 (0.11) | -0.13, 0.48 | 0.19 | |
| | National scholarship - Expansive | 3 (7) | 0.03 (0.02) | -0.11, 0.17 | 0.32 | |
| | Performance-based scholarship - Restrictive | 8 (33) | 0.03 (0.08) | -0.17, 0.23 | 0.74 | |
| | State aid - Expansive | 8 (24) | 0.09 (0.06) | -0.06, 0.23 | 0.2 | |
| Academic Achievement | | | | | | 0.376, 0.839 |
| | Federal targeted - Expansive | 3 (6) | 0.24 (0.27) | -1.85, 2.33 | 0.52 | |
| | Promise program - Expansive | 2 (3) | -0.03 (0.04) | -0.47, 0.41 | 0.53 | |
| | Institutional aid - Restrictive | 11 (33) | 0.05 (0.04) | -0.05, 0.14 | 0.28 | |
| | National scholarship - Expansive | 4 (12) | 0.04 (0.02) | -0.03, 0.11 | 0.17 | |
| | Performance-based scholarship - Restrictive | 5 (27) | 0.07 (0.05) | -0.07, 0.21 | 0.24 | |
| | State aid - Expansive | 11 (24) | 0.01 (0.05) | -0.1, 0.12 | 0.88 | |
| Credit Accumulation | | | | | | 0.317, 0.85 |
| | Federal targeted - Expansive | 2 (6) | 0.04 (0.07) | -0.83, 0.91 | 0.67 | |
| | Institutional aid - Restrictive | 8 (39) | 0.12 (0.04) | 0.01, 0.23 | 0.04* | |
| | National scholarship - Expansive | 2 (8) | 0.12 (0.01) | 0.10, 0.14 | 0.01* | |
| | Performance-based scholarship - Restrictive | 8 (77) | 0.23 (0.17) | -0.23, 0.69 | 0.24 | |
| | State aid – Expansive | 10 (36) | 0.08 (0.03) | 0.01, 0.15 | 0.03* | |
| Persistence | | | | | | 0.344, 0.836 |
| | Promise program - Expansive | 4 (4) | 0.05 (0.02) | -0.02, 0.11 | 0.12 | |
| | Institutional aid - Restrictive | 12 (41) | 0.12 (0.06) | -0.05, 0.30 | 0.12 | |
| | National scholarship - Expansive | 2 (9) | 0.04 (0) | 0.01, 0.07 | 0.04* | |
| | Performance-based scholarship - Restrictive | 4 (40) | 0.05 (0.08) | -0.2, 0.29 | 0.59 | |
| | State aid - Expansive | 14 (36) | 0.08 (0.06) | -0.05, 0.22 | 0.20 | |
| Degree Completion | | | | | | 0.188, 0.90 |
| | Promise program - Expansive | 4 (16) | 0.01 (0.01) | -0.02, 0.05 | 0.25 | |
| | Institutional aid - Restrictive | 13 (31) | 0.03 (0.02) | -0.06, 0.11 | 0.30 | |
| | National scholarship - Expansive | 4 (6) | 0.01 (0.02) | -0.06, 0.08 | 0.59 | |
| | State aid - Expansive | 18 (56) | 0.02 (0.02) | -0.01, 0.06 | 0.19 | |
| Post-College Labor Market | | | | | | 2.015, 0.394 |
| | Federal targeted - Expansive | 2 (3) | 0.19 (0.32) | -3.81, 4.2 | 0.65 | |
| | Institutional aid - Restrictive | 2 (8) | 0.06 (0.01) | -0.09, 0.21 | 0.13 | |
| | State aid - Expansive | 4 (11) | 0.02 (0.01) | -0.01, 0.06 | 0.13 | |

## Table S11. Confirmatory Moderator Analysis - Provision of Non-Financial Supports

| Outcome Domain | Level | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 0.55, 0.47 |
| | No Other Support | 20 (82) | 0.05 (0.02) | 0.01, 0.09 | 0.03* | |
| | Includes Additional Supports | 22 (71) | 0.09 (0.06) | -0.03, 0.22 | 0.12 | |
| Academic Achievement | | | | | | 0.75, 0.40 |
| | No Other Support | 20 (52) | 0.02 (0.04) | -0.06, 0.1 | 0.62 | |
| | Includes Additional Supports | 18 (57) | 0.06 (0.02) | 0.01, 0.1 | 0.02* | |
| Credit Accumulation | | | | | | 2.32, 0.14 |
| | No Other Support | 16 (71) | 0.07 (0.02) | 0.02, 0.12 | 0.01** | |
| | Includes Additional Supports | 17 (100) | 0.16 (0.06) | 0.04, 0.28 | 0.01** | |
| Persistence | | | | | | 0.50, 0.50 |
| | No Other Support | 22 (55) | 0.04 (0.02) | 0.01, 0.09 | 0.05* | |
| | Includes Additional Supports | 17 (80) | 0.07 (0.03) | -0.01, 0.14 | 0.06 | |
| Degree Completion | | | | | | 0.02, 0.91 |
| | No Other Support | 24 (73) | 0.01 (0.01) | 0, 0.03 | 0.04* | |
| | Includes Additional Supports | 20 (46) | 0.01 (0.01) | -0.01, 0.03 | 0.11 | |
| Post-College Labor Market | | | | | | 1.06, 0.40 |
| | No Other Support | 5 (13) | 0.02 (0.01) | 0, 0.04 | 0.05* | |
| | Includes Additional Supports | 3 (9) | 0.17 (0.15) | -0.62, 0.96 | 0.39 | |

## Table S12. Confirmatory Moderator Analysis - Duration of Years to be Eligible for Aid, or Full Benefits of Aid

| Outcome Domain | Level | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 0.72, 0.58 |
| | < 1 year | 12 (40) | 0.21 (0.11) | -0.05, 0.46 | 0.10 | |
| | 1-2 years | 20 (65) | 0.04 (0.03) | -0.02, 0.10 | 0.16 | |
| | 3-5 years | 5 (24) | 0.03 (0.02) | -0.06, 0.12 | 0.32 | |
| | 12-13 years | 4 (24) | 0.03 (0.01) | -0.01, 0.07 | 0.07 | |
| Academic Achievement | | | | | | 2.14, 0.27 |
| | < 1 year | 14 (59) | 0.11 (0.05) | -0.02, 0.23 | 0.08 | |
| | 1-2 years | 20 (46) | 0.02 (0.04) | -0.06, 0.09 | 0.64 | |
| | 3-5 years | 3 (4) | -0.02 (0.01) | -0.13, 0.10 | 0.36 | |
| Credit Accumulation | | | | | | 0.75, 0.40 |
| | < 1 year | 14 (96) | 0.16 (0.08) | -0.02, 0.34 | 0.07 | |
| | 1-2 years | 17 (69) | 0.09 (0.02) | 0.04, 0.14 | 0*** | |
| Persistence | | | | | | 0.17, 0.91 |
| | < 1 year | 11 (49) | 0.04 (0.03) | -0.04, 0.12 | 0.25 | |
| | 1-2 years | 22 (78) | 0.07 (0.04) | -0.01, 0.15 | 0.09 | |
| | 3-5 years | 3 (3) | 0.09 (0.09) | -0.59, 0.76 | 0.48 | |
| | 12-13 years | 3 (5) | 0.04 (0.01) | 0.02, 0.06 | 0.02* | |
| Degree Completion | | | | | | 0.12, 0.90 |
| | < 1 year | 7 (12) | 0.01 (0.01) | -0.03, 0.05 | 0.25 | |
| | 1-2 years | 30 (86) | 0.02 (0.01) | 0.01, 0.05 | 0.1 | |
| | 3-5 years | 5 (13) | 0.01 (0.01) | -0.02, 0.05 | 0.21 | |
| Post-College Labor Market | | | | | | 0.24, 0.68 |
| | < 1 year | 2 (3) | 0.18 (0.31) | -3.73, 4.09 | 0.66 | |
| | 1-2 years | 6 (19) | 0.03 (0.01) | 0.01, 0.06 | 0.04* | |

## Table S13. Confirmatory Moderator Analysis – Range of Costs Covered through First-Dollar or Last-Dollar Approach or Neither First-Dollar or Last-Dollar

| Outcome Domain | Level | k (m) | ES (SE) | 95% CI | *p*-value | *Q*, *p*-value |
|---|---|---|---|---|---|---|
| Enrollment | | | | | | 0.81, 0.55 |
| | Extra Financial Award | 9 (39) | 0.02 (0.05) | -0.11, 0.16 | 0.67 | |
| | First Dollar – Any Costs | 4 (20) | 0.01 (0.01) | -0.01, 0.04 | 0.13 | |
| | First Dollar – Tuition, Books, and Fees Only | 5 (15) | 0.1 (0.08) | -0.12, 0.32 | 0.28 | |
| | Last Dollar – Any Costs | 15 (45) | 0.13 (0.07) | -0.01, 0.27 | 0.07 | |
| | Last Dollar – Tuition, Books, and Fees Only | 8 (34) | 0.02 (0.03) | -0.08, 0.12 | 0.56 | |
| Academic Achievement | | | | | | 0.75, 0.61 |
| | Extra Financial Award | 6 (31) | 0.03 (0.03) | -0.09, 0.15 | 0.43 | |
| | First Dollar – Any Costs | 6 (19) | 0.05 (0.02) | -0.01, 0.11 | 0.06 | |
| | First Dollar – Tuition, Books, and Fees Only | 2 (4) | -0.04 (0.04) | -0.52, 0.43 | 0.45 | |
| | Last Dollar – Any Costs | 14 (36) | 0.01 (0.06) | -0.14, 0.16 | 0.86 | |
| | Last Dollar – Tuition, Books, and Fees Only | 8 (18) | 0.05 (0.03) | -0.03, 0.13 | 0.15 | |
| Credit Accumulation | | | | | | 0.54, 0.68 |
| | Extra Financial Award | 9 (81) | 0.19 (0.13) | -0.15, 0.52 | 0.22 | |
| | First Dollar – Any Costs | 6 (20) | 0.08 (0.02) | 0.01, 0.15 | 0.03 | |
| | Last Dollar – Any Costs | 9 (47) | 0.09 (0.05) | -0.04, 0.23 | 0.13 | |
| | Last Dollar – Tuition, Books, and Fees Only | 6 (16) | 0.12 (0.03) | 0.05, 0.19 | 0.01 | |
| Persistence | | | | | | 1.33, 0.34 |
| | Extra Financial Award | 4 (40) | 0.04 (0.07) | -0.2, 0.29 | 0.6 | |
| | First Dollar – Any Costs | 7 (16) | 0.02 (0.01) | -0.01, 0.05 | 0.09 | |
| | Last Dollar – Any Costs | 10 (19) | 0.08 (0.03) | 0.01, 0.16 | 0.04 | |
| | Last Dollar – Tuition, Books, and Fees Only | 10 (19) | 0.08 (0.03) | 0.01, 0.16 | 0.04 | |
| Degree Completion | | | | | | 0.34, 0.84 |
| | Extra Financial Award | 2 (8) | 0.01 (0.01) | -0.1, 0.11 | 0.63 | |
| | First Dollar – Any Costs | 7 (16) | 0.02 (0.01) | -0.02, 0.05 | 0.16 | |
| | First Dollar – Tuition, Books, and Fees Only | 7 (26) | 0.02 (0.01) | -0.01, 0.04 | 0.17 | |
| | Last Dollar – Any Costs | 18 (52) | 0.01 (0.01) | -0.01, 0.02 | 0.50 | |
| | Last Dollar – Tuition, Books, and Fees Only | 8 (16) | 0.06 (0.06) | -0.20, 0.32 | 0.41 | |
| Post-College Labor Market | | | | | | 1.16, 0.41 |
| | First Dollar – Tuition, Books, and Fees Only | 2 (5) | 0.03 (0.01) | -0.05, 0.11 | 0.14 | |
| | Last Dollar – Any Costs | 4 (12) | 0.2 (0.15) | -0.3, 0.69 | 0.29 | |

# S5. Exploratory Meta-Regression Results

## Table S14. Exploratory Multiple Predictor Meta-Regression

| Step | Variable | M1 b (SE) | M1 CI | M2 b (SE) | M2 CI | M3 b (SE) | M3 CI | M4 b (SE) | M4 CI | M5 b (SE) | M5 CI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | Intercept | 0.10 (0.06) | -0.02, 0.21 | 0.24* (0.12) | 0, 0.49 | 0.46* (0.24) | -0.06, 0.98 | 0.03 (0.05) | -0.09, 0.14 | 0.1 (0.1) | -0.12, 0.33 |
| Outcome Domain | College academic achievement | -0.03 (0.08) | -0.19, 0.13 | 0.02 (0.08) | -0.14, 0.18 | -0.06 (0.06) | -0.19, 0.06 | 0 (0.09) | -0.18, 0.18 | -0.08 (0.05) | -0.18, 0.02 |
| | Credit accumulation | 0.02 (0.05) | -0.08, 0.13 | 0.05 (0.06) | -0.07, 0.17 | -0.03 (0.06) | -0.16, 0.1 | 0.03 (0.06) | -0.09, 0.15 | -0.02 (0.05) | -0.13, 0.09 |
| | Persistence | -0.01 (0.05) | -0.12, 0.10 | -0.01 (0.06) | -0.13, 0.11 | -0.03 (0.07) | -0.16, 0.11 | 0.02 (0.06) | -0.1, 0.14 | -0.03 (0.05) | -0.12, 0.07 |
| | Degree completion | -0.04 (0.05) | -0.14, 0.06 | 0.03 (0.04) | -0.06, 0.11 | -0.01 (0.04) | -0.1, 0.08 | -0.04 (0.06) | -0.16, 0.07 | -0.03 (0.04) | -0.12, 0.06 |
| | Labor market | 0.01 (0.05) | -0.11, 0.11 | -0.03 (0.07) | -0.20, 0.14 | -0.05 (0.05) | -0.17, 0.07 | 0.01 (0.08) | -0.17, 0.19 | -0.01 (0.06) | -0.15, 0.14 |
| Study | Not peer-reviewed | 0.01 (0.04) | -0.06, 0.09 | 0.01 (0.04) | | | | | | | |
| | Not funded | -0.02 (0.04) | -0.09, 0.06 | -0.02 (0.04) | | | | | | | |
| | Publication date | -0.02 (0.03) | -0.08, 0.04 | -0.02 (0.03) | | | | | | | |
| Sample | Percent male: 33-44% | | | | -0.15 (0.09) | -0.33, 0.04 | | | | | |
| | Percent male: Greater than 44% | | | | -0.01 (0.01) | -0.34, 0.03 | | | | | |
| | Percent nonwhite | | | | -0.09 (0.08) | -0.26, 0.08 | | | | | |
| | Low middle SES | | | | 0.01 (0.04) | -0.08, 0.09 | | | | | |
| | Middle SES | | | | -0.08 (0.06) | -0.21, 0.05 | | | | | |
| | Middle upper SES | | | | 0.13 (0.15) | -0.19, 0.45 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Middle previous achievement | -0.06 (0.06) | -0.19, 0.08 | | |
| | High previous achievement | -0.0105 | -0.3, 0.01 | | |
| | 4-Year Sample | 0.09 (0.07) | -0.06, 0.24 | | |
| | Both 2- and 4-Year | 0.01 (0.06) | -0.12, 0.14 | | |
| Program – Group 1 | Promise program – Restrictive | | | -0.32 (0.24) | -0.87, 0.23 |
| | Promise program – Expansive | | | -0.2 (0.23) | -0.68, 0.27 |
| | Institutional aid – Restrictive | | | -0.21 (0.21) | -0.68, 0.25 |
| | National scholarship – Expansive | | | -0.26 (0.22) | -0.73, 0.2 |
| | Performance-based scholarship – Restrictive | | | -0.25 (0.23) | -0.73, 0.23 |
| | Emergency financial aid – Restrictive | | | -0.099 | -0.93, 0.03 |
| | State aid – Expansive | | | -0.23 (0.21) | -0.68, 0.22 |
| | Both need and merit Based | | | 0.01 (0.1) | -0.2, 0.22 |
| | Merit based only | | | 0.03 (0.06) | -0.09, 0.15 |
| | Need based only | | | -0.04 (0.1) | -0.31, 0.22 |
| | 3 – 4 semesters | | | 0 (0.11) | -0.26, 0.26 |
| | 5 – 6 semesters | | | 0.02 (0.13) | -0.27, 0.31 |
| | 7 – 8 semesters | | | -0.09 (0.12) | -0.37, 0.19 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 9 or more semesters | -0.11 (0.12) | -0.39, 0.17 | | | |
| | 1 – 2 years of residency | -0.06 (0.09) | -0.25, 0.13 | | | |
| | 3 – 5 years of residency | -0.1 (0.14) | -0.43, 0.23 | | | |
| | More than 5 years of residency | -0.14 (0.12) | -0.4, 0.11 | | | |
| Program – Group 2 | < $1500 | | | 0.02 (0.05) | -0.09, 0.13 | |
| | $1501 - $3000 | | | 0.02 (0.05) | -0.09, 0.13 | |
| | $3001 - $4500 | | | 0.01 (0.08) | -0.15, 0.18 | |
| | $4501 - $6000 | | | 0.09 (0.09) | -0.11, 0.28 | |
| | Non-financial aid supports provided | | | 0.05 (0.07) | -0.09, 0.19 | |
| | First dollar – any cost | | | 0.06 (0.07) | -0.1, 0.22 | |
| | First dollar – tuition and fees only | | | -0.01 (0.05) | -0.13, 0.1 | |
| | Last dollar – any cost | | | 0.01 (0.06) | -0.12, 0.14 | |
| | Last dollar – tuition and fees only | | | 0.05 (0.05) | -0.06, 0.15 | |
| Design & Analysis | Difference-in-difference – ITT | | | | -0.02 (0.05) | -0.13, 0.08 |
| | Randomized controlled trial – ITT | | | | 0.04 (0.08) | -0.13, 0.21 |
| | Regression discontinuity design – ITT | | | | -0.03 (0.04) | -0.12, 0.06 |

| | | | |
|---|---|---|---|
| | Author did not adjust effect size | 0.11 (0.09) | -0.13, 0.34 |
| | Original effect size – adjusted odds ratio | -0.02 (0.1) | -0.27, 0.22 |
| | Original effect size – regression coefficient | 0.02 (0.12) | -0.24, 0.29 |
| | Original effect size – computed effect size | 0.05 (0.29) | -0.63, 0.73 |

# S6. Publication Bias and Sensitivity Analysis

## Table S15. Publication Bias Analysis – Egger's Regression with Robust Variance Estimation ("Egger Sandwich" Analysis)

| Outcome Domain | k (m) | Beta (SE) | 95% CI | *p*-value |
|---|---|---|---|---|
| Enrollment | 41 (152) | 0.84 (0.41) | -0.06, 1.73 | 0.06 |
| Academic Achievement | 37 (109) | 0.25 (0.3) | -0.44, 0.95 | 0.43 |
| Credit Accumulation | 32 (170) | 0.53 (0.32) | -0.24, 1.29 | 0.14 |
| Persistence | 39 (137) | -0.42 (0.39) | -1.27, 0.44 | 0.31 |
| Degree Completion | 43 (119) | 0.21 (0.13) | -0.1, 0.51 | 0.15 |
| Post-College | 8 (22) | 1.48 (2.19) | -6.73, 9.7 | 0.56 |

*Note*: beta = slope regression coefficient from meta-regression model associated with test of small-study effects; SE = regression coefficient standard error; 95% CI = 95% confidence interval; non-significant beta indicates there's no evidence of publication bias.

## Table S16. Sensitivity Analysis – Winsorized versus Non-Winsorized Unconditional Analysis

| Outcome Domain | Type | ES (SE) | 95% CI | *p*-value | $I^2$, $\tau^2$ |
|---|---|---|---|---|---|
| Enrollment | Original | 0.07 (0.03) | 0.01, 0.13 | 0.02 | 95.43 (0.009) |
| | Non-Winsorized | 0.07 (0.03) | 0.01, 0.13 | 0.02 | 95.51 (0.009) |
| Academic Achievement | Original | 0.03 (0.03) | -0.02, 0.09 | 0.21 | 79.45 (0.004) |
| | Non-Winsorized | 0.03 (0.03) | -0.02, 0.09 | 0.21 | 79.45 (0.004) |
| Credit Accumulation | Original | 0.12 (0.03) | 0.05, 0.18 | <0.001 | 91.64 (0.011) |
| | Non-Winsorized | 0.13 (0.04) | 0.05, 0.21 | <0.001 | 95.34 (0.021) |
| Persistence | Original | 0.05 (0.02) | 0.02, 0.08 | 0.01 | 70.09 (0.002) |
| | Non-Winsorized | 0.05 (0.02) | 0.02, 0.08 | 0.01 | 70.67 (0.002) |
| Degree Completion | Original | 0.01 (0) | 0, 0.02 | 0.01 | 70.21 (0.000) |
| | Non-Winsorized | 0.01 (0) | 0, 0.02 | 0.01 | 70.37 (0.000) |
| Post-College | Original | 0.05 (0.03) | -0.02, 0.12 | 0.14 | 81.62 (0.002) |
| | Non-Winsorized | 0.05 (0.03) | -0.02, 0.12 | 0.14 | 81.62 (0.002) |

# S7. Studies Represented in the Meta-Analysis by Type of College Grant Aid

## *Studies Included in Meta-Analysis

1. *Anderson, D., Broton, K., Goldrick–Rab, S., & Kelchen, R. (2020). Experimental evidence on the impacts of need-based financial aid: Longitudinal assessment of the Wisconsin Scholars Grant. *Journal of Policy Analysis and Management, 39*(3), 720–739. https://doi.org/10.1002/pam.22190 [Note: Analyses for the two-year sample and four-year sample are counted as separate studies. This record includes reports on two-year students.]
    a. *Supplemental:* Anderson, D. M. & Goldrick–Rab, S. (2018). Aid after enrollment: Impacts of a statewide grant program at public two-year colleges. *Economics of Education Review, 67*, 148–157. https://doi.org/10.1016/j.econedurev.2018.10.008
    b. *Supplemental*: Anderson, D. M. (2015). Essays in public economics. [UMI Number 3702060]. [Doctoral dissertation, University of Wisconsin | Madison]. ProQuest Dissertations and Theses database. [Chapter 2, two-year students]
    c. Supplemental: Broton, K. & Monaghan, D. B. (2018, July). Seeking STEM: The causal impact of need-based grant aid on undergraduates' field of study. The Hope Center for College, Community, and Justice. https://hope4college.com/wp-content/uploads/2018/09/Broton-Monaghan-2018-Seeking-STEM-The-Causal-Impact-of-Need-Based-Grant-Aid-on-Undergraduates-Field-of-Study.pdf
    d. *Supplemental*: Broton, K., Goldrick–Rab, S., & Benson, J. (2016). Working for college: The causal impacts of financial grants on undergraduate employment. *Educational Evaluation and Policy Analysis, 38*(3), 477–494. https://doi.org/10.3102/0162373716638440
    e. Supplemental: Goldrick–Rab, S., Harris, D. N., Kelchen, R., & Benson, J. (2012). *Need-based financial aid and college persistence: Experimental evidence from Wisconsin*. Unpublished manuscript. https://www.irp.wisc.edu/wp/wp-content/uploads/2018/05/dp139312rev.pdf
2. *Anderson, D., Broton, K., Goldrick–Rab, S., & Kelchen, R. (2020). Experimental evidence on the impacts of need-based financial aid: Longitudinal assessment of the Wisconsin Scholars Grant. *Journal of Policy Analysis and Management, 39*(3), 720–739. https://doi.org/10.1002/pam.22190 [Note: Analyses for the two-year sample and four-year sample are counted as separate studies. This record includes reports on four-year students.]
    a. *Supplemental*: Goldrick–Rab, S., Kelchen, R., Harris, D. N., & Benson, J. (2016). Reducing income inequality in educational attainment: Experimental evidence on the impact of financial aid on college completion. *American Journal of Sociology, 121*(6), 1762–1817. https://doi.org/10.1086/685442 [four-year sample]
    b. Supplemental: Broton, K. & Monaghan, D. B. (2018, July). Seeking STEM: The causal impact of need-based grant aid on undergraduates' field of study. The Hope Center for College, Community, and Justice. https://hope4college.com/wp-content/uploads/2018/09/Broton-Monaghan-2018-Seeking-STEM-The-Causal-Impact-of-Need-Based-Grant-Aid-on-Undergraduates-Field-of-Study.pdf
    c. *Supplemental*: Broton, K., Goldrick–Rab, S., & Benson, J. (2016). Working for college: The causal impacts of financial grants on undergraduate employment.

*Educational Evaluation and Policy Analysis, 38*(3), 477–494. https://doi.org/10.3102/0162373716638440

d. Supplemental: Goldrick–Rab, S., Harris, D. N., Kelchen, R., & Benson, J. (2012). *Need–based financial aid and college persistence: Experimental evidence from Wisconsin*. Unpublished manuscript. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.372.9030&rep=rep1&type=pdf

e. *Supplemental*: Goldrick–Rab, S., Harris, D. N., Benson, J., & Kelchen, R. (2011). *Conditional cash transfers and college persistence: Evidence from a randomized need-based grant program* (Discussion Paper No. 1393–11). Institute for Research on Poverty. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.221.8871&rep=rep1&type=pdf [four-year sample]

3. *Andrews, R. J., Imberman, S. A., & Lovenheim, M. F. (2016). *Recruiting and supporting low income, high-achieving students at flagship universities*. NBER Working Paper No. 22260. Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w22260/w22260.pdf [Note: This PDF has two impact evaluations, one of Century Scholars and one of Longhorn Opportunity Scholars. These 2 evaluations are counted as separate studies.]
4. *Andrews, R. J., Imberman, S. A., & Lovenheim, M. F. (2016). *Recruiting and supporting low income, high-achieving students at flagship universities*. NBER Working Paper No. 22260. Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w22260/w22260.pdf [Note: This PDF has two impact evaluations, one of Century Scholars and one of Longhorn Opportunity Scholars. These 2 evaluations are counted as separate studies.]
5. *Angrist, J., Autor, D., Hudson, S., & Pallais, A. (2015). Evaluating econometric evaluations of postsecondary aid. *American Economic Review, 105*(5), 502–507. http://dx.doi.org/10.1257/aer.p20151025 [**Note: This study has a combined two-year/four-year sample analysis; plus individual sample analyses for two-year versus four-year institutions which measure different outcomes than the combined sample. These three "sample"-based analyses are counted as separate studies**.]
    a. *Supplemental*: Angrist, J., Autor, D., & Pallais, A. (2020). Marginal effects of merit aid for low-income students. [Discussion Paper 2020.06]. Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w27834/w27834.pdf
    b. *Supplemental*: Angrist, J., Autor, D., & Pallais, A. (2020, September). *Marginal effects of merit aid for low-income students*. Cambridge, MA: MIT Department of Economics, School Effectiveness and Inequality Initiative. https://mitili.mit.edu/sites/default/files/project-documents/SEII-Discussion-Paper-2020.06-Angrist-Autor-Pallais-1.pdf
    c. *Supplemental*: Hudson, S. L. (2016). *Essays on the economics of education*. [Doctoral dissertation, Massachusetts Institute of Technology]. MIT Department of Economics Dissertations. [Chapter 1]
6. *Angrist, J., Autor, D., & Pallais, A. (2015). Evaluating econometric evaluations of postsecondary aid. *American Economic Review, 105*(5), 502–507. http://dx.doi.org/10.1257/aer.p20151025 **[Note: This study has a combined two-year/four-**

**year sample analysis; plus individual sample analyses for two-year versus four-year institutions that measure different outcomes from the combined sample. These three "sample" based analyses are counted as separate studies.]**

   a. *Supplemental*: Angrist, J., Autor, D., Hudson, S., & Pallais, A. (2020). Marginal effects of merit aid for low-income students. [Discussion Paper 2020.06]. Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w27834/w27834.pdf
   b. *Supplemental*: Angrist, J., Autor, D., & Pallais, A. (2020, September). *Marginal effects of merit aid for low-income students*. Cambridge, MA: MIT Department of Economics, School Effectiveness and Inequality Initiative. https://mitili.mit.edu/sites/default/files/project-documents/SEII-Discussion-Paper-2020.06-Angrist-Autor-Pallais-1.pdf
   c. *Supplemental*: Hudson, S. L. (2016). *Essays on the economics of education*. [Doctoral dissertation, Massachusetts Institute of Technology]. MIT Department of Economics Dissertations. [Chapter 1]

**7.** *Angrist, J., Autor, D., & Pallais, A. (2015). Evaluating econometric evaluations of postsecondary aid. *American Economic Review, 105*(5), 502–507. http://dx.doi.org/10.1257/aer.p20151025 **[Note: This study has a combined two-year/four-year sample analysis; plus individual sample analyses for two-year versus four-year institutions that measure different outcomes from the combined sample. These three "sample" based analyses are counted as separate studies.]**

   a. *Supplemental*: Angrist, J., Autor, D., Hudson, S., & Pallais, A. (2020). Marginal effects of merit aid for low-income students. [Discussion Paper 2020.06]. Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w27834/w27834.pdf
   b. *Supplemental*: Angrist, J., Autor, D., & Pallais, A. (2020, September). *Marginal effects of merit aid for low-income students*. Cambridge, MA: MIT Department of Economics, School Effectiveness and Inequality Initiative. https://mitili.mit.edu/sites/default/files/project-documents/SEII-Discussion-Paper-2020.06-Angrist-Autor-Pallais-1.pdf
   c. *Supplemental*: Hudson, S. L. (2016). *Essays on the economics of education*. [Doctoral dissertation, Massachusetts Institute of Technology]. MIT Department of Economics Dissertations. [Chapter 1]

8. *Ayna, D. (2016). *Program evaluation of the Wayne State University (WSU) Transition to Independence Program (TIP)* (Publication No. 1514) [Doctoral dissertation, Wayne State University]. Wayne State University Dissertations. https://www.proquest.com/docview/1817036393?pq-origsite=gscholar&fromopenview=true
9. *Barrow, L., Richburg–Hayes, L., Rouse, C. E., & Brock, T. (2014). Paying for performance: The education impacts of a community college scholarship program for low-income adults. *Journal of Labor Economics, 32*(3), 563–599. https://doi.org/10.1086/675229

   a. *Supplemental*: 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: MDRC. https://eric.ed.gov/?id=ED503917
   b. *Supplemental*: Barrow, L., Richburg–Hayes, L., Rouse, C. E., & Brock, T. (2012, February). *Paying for performance: The education impacts of a community college*

*scholarship program for low-income adults*. Chicago, IL: Federal Reserve Bank of Chicago. Retrieved from https://www.chicagofed.org/publications/working-papers/2009/wp-13

10. *Bergin, D. A., Cooks, H. C., & Bergin, C. C. (2007). Effects of a college access program for youth underrepresented in higher education: A randomized experiment. *Research in Higher Education, 48*(6), 727–750. https://doi.org/10.1007/s11162-006-9049-9
11. *Bettinger, E., Gurantz, O., Kawano, L., Sacerdote, B., & Stevens, M. (2019). The long-run impacts of financial aid: Evidence from California's Cal Grant. *American Economic Journal: Economic Policy*, *11*(1), 64–94. https://doi.org/10.1257/pol.20170466
    a. *Supplemental*: Bettinger, E., Gurantz, O., Kawano, L., & Sacerdote, B. (2016). *The long run impacts of merit aid: Evidence from California's Cal Gran*t. [NBER Working Paper No. 22347.] Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w22347/w22347.pdf
    b. *Supplemental*: Bettinger, E., Gurantz, O., Kawano, L., & Sacerdote, B. (2016, June). The long run impacts of merit aid: Evidence from California's Cal Grant. [CEPA Working Paper No. 16–13]. Stanford, CA: Stanford Center for Education Policy Analysis. https://files.eric.ed.gov/fulltext/ED579684.pdf
12. *Bifulco, R., Rubenstein, R,, & Sohn, H. (2019). Evaluating the effects of universal place-based scholarships on student outcomes: The Buffalo "Say Yes to Education" Program. *Journal of Policy Analysis and Management*, *38*(4), 918–943. https://doi.org/10.1002/pam.22139
    a. *Supplemental*: Sohn, H., Rubenstein, R., Murchie, J., & Bifulco, R. (2017). Assessing the effects of place-based scholarships on urban revitalization: The case of Say Yes to Education. *Educational Evaluation and Policy Analysis*, *39*(2), 198–222. https://doi.org/10.3102/0162373716675727
    b. Bifulco, R., Rubenstein, R., Sohn, H., & Murchie, J. (2017, January). *Third-Year Report: Evaluating the Effects of the Say Yes to Education Program in Buffalo, NY*. Prepared for the Say Yes to Education Foundation.
    c. Bifulco, R., Rubenstein, R., & Sohn, H. (2017). Using synthetic controls to evaluate the effect of unique interventions: The Case of Say Yes to Education. *Evaluation Review*, *41*(6), 593–619. https://doi.org/10.1177/0193841X17742233
13. *Billings, M. S. (2018). *Free college for all: The impact of promise programs on college access and success* (Kalamazoo Promise Program) [Doctoral dissertation, University of Michigan]. Deep Blue. https://deepblue.lib.umich.edu/handle/2027.42/144101
14. **Binder, M., Krause, K., Miller, C., & Cerna, O. (2015). Providing incentives for timely progress toward earning a college degree: Results from a performance-based scholarship experiment (MDRC working paper). New York, NY: MDRC. https://www.mdrc.org/publication/providing-incentives-timely-progress-toward-earning-college-degree
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    a. *Supplemental*: Birch, M. R. (2018). *Financial aid policies and enrollment behavior in higher education* [Chapter 3] (Publication No. 10751151) [Doctoral dissertation, Washington State University]. ProQuest Dissertations and Theses Global. http://ses.wsu.edu/wp-content/uploads/2019/11/Final-Dissertation.pdf

16. *Bordoloi Pazich, L. (2014). Influencing transfer and baccalaureate attainment for community college students through state grant aid: Quasi-experimental evidence from Texas (Publication No. 3624524) [Doctoral dissertation, New York University]. ProQuest Dissertations and Theses Global. https://www.proquest.com/docview/1553234202
17. *Bruce, D. J., & Carruthers, C. K. (2014). Jackpot? The impact of lottery scholarships on enrollment in Tennessee. *Journal of Urban Economics, 81*, 30–44. http://dx.doi.org/10.1016/j.jue.2014.01.006
18. *Bucceri, K. (2013). *Are early commitment programs the answer to gaps in college enrollment and outcomes by income? The case of Oklahoma's Promise* [Doctoral dissertation, Columbia University]. Academic Commons. https://doi.org/10.7916/D8J390XJ
19. *Carlson, D. E., Elwert, F., Hillman, N., Schmidt, A., & Wolfe, B. (2019). The effects of financial aid grant offers on postsecondary educational outcomes: New experimental evidence from the Fund for Wisconsin Scholars. (NBER Working Paper No. 26419). Cambridge, MA: National Bureau of Economic Research. http://www.nber.org/papers/w26419 [Note: Analyses for the two-year sample and four-year sample are counted as separate studies.]
20. *Carlson, D. E., Elwert, F., Hillman, N., Schmidt, A., & Wolfe, B. (2019). The effects of financial aid grant offers on postsecondary educational outcomes: New experimental evidence from the Fund for Wisconsin Scholars. (NBER Working Paper No. 26419). Cambridge, MA: National Bureau of Economic Research. http://www.nber.org/papers/w26419 [Note: Analyses for the two-year sample and four-year sample are counted as separate studies.]
21. *Carpenter, D. M., II, Kaka, S. J., Tygret, J. A., & Cathcart, K. (2018). Testing the efficacy of a scholarship program for single parent, post-freshmen, full time undergraduates. *Research in Higher Education, 59*(1), 108–131. https://doi.org/10.1007/s11162-017-9456-0 [Note: This study has contrasts for aid plus supports versus no-aid comparison group, and aid without supports versus no-aid comparison group.]
22. *Carruthers, C., & Fox, W. (2015). Aid for all: College coaching, financial aid, and postsecondary persistence in Tennessee (Haslam College of Business Working Paper 2015–06). Haslam College of Business, University of Tennessee. Retrieved from https://www.maxwell.syr.edu/uploadedFiles/econ/seminars/Carruthers_Fox_May2015b.pdf
23. *Carruthers, C. K., & Welch, J. G. (2019). Not whether, but where? Pell Grants and college choices. *Journal of Public Economics, 172* (C), 1–19. https://doi.org/10.1016/j.jpubeco.2018.11.006
24. *Castleman, B. L. (2014). The impact of partial and full merit scholarships on college entry and success: Evidence from the Florida Bright Futures Scholarship program. EdPolicyWorks Working Paper Series No. 17. http://curry.virginia.edu/uploads/resourceLibrary/17_Castleman_All_or_Nothing.pdf
25. *Castleman, B. L., & Long, B. T. (2016). Looking beyond enrollment: The causal effect of need based grants on college access, persistence, and graduation. *Journal of Labor Economics, 34*(4), 1023–1073. https://doi.org/10.1086/686643
    a. Supplemental: Castleman, B. L. & Long, B. T. (2013). Looking beyond enrollment: The causal effect of need-based grants on college access, persistence, and graduation (No. w91306). Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/papers/w19306

    b. Supplemental: Castleman, B. L. & Long, B. T. (2013). *Looking beyond enrollment: The causal effect of need-based grants on college access, persistence, and graduation*. [NCPR Working Paper] New York, NY: National Center for Postsecondary Research. https://files.eric.ed.gov/fulltext/ED549167.pdf
26. *Clotfelter, C. T., Hemelt, S. W., & Ladd, H. F. (2018). Multifaceted aid for low-income students and college outcomes: Evidence from North Carolina. *Economic Inquiry, 56*(1), 278–303. https://doi.org/10.1111/ecin.12486
    a. *Supplemental*: Clotfelter, C. T., Hemelt, S. W., & Ladd, H. F. (2016). *Multifaceted aid for low-income students and college outcomes: Evidence from North Carolina*. NBER Working Paper No. 22217. Cambridge, MA: National Bureau of Economic Research. https://www.nber.org/papers/w22217
27. *Cohodes, S. R., & Goodman, J. S. (2014). Merit aid, college quality, and college completion: Massachusetts' Adams scholarship as an in-kind subsidy. *American Economic Journal: Applied Economics, 6*(4), 251–285. https://doi.org/10.1257/app.6.4.251
    a. *Supplemental*: Cohodes, S. R. (2015). *Essays on the economics of education*. [Doctoral dissertation, Harvard University https://dash.harvard.edu/handle/1/17467388 [Chapter 3]
    b. *Supplemental*: Goodman, J. (2009). *Essays on human capital*. [UMI Number 3373741] [Doctoral dissertation, Columbia University]. ProQuest Dissertations and Theses database. https://www.proquest.com/docview/304873655 [Chapter 1]
    c. *Supplemental*: Cohodes, S. & Goodman, J. (2012). *First degree earns: The impact of college quality on college completion rates*. [HKS Faculty Research Working Paper Series RWP12–033]. Cambridge, MA: John F. Kennedy School of Government, Harvard University. http://nrs.harvard.edu/urn-3:HUL.InstRepos:9396433
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29. *Coria, E. F. (2013). *The Board of Governors fee waiver, financial aid, and community college student success* (Publication No. 3577926) [Doctoral dissertation, California State University | Fullerton]. ProQuest Dissertations and Theses Global. https://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1215&context=mpampp_etds
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    a. *Supplemental*: Cornwell, C., Lee, K. H., & Mustard, D. B. (2006). Cornwell, C., Lee, K. H., & Mustard, D. B. (2006). *The effects of state-sponsored merit scholarships on course selection and major choice in college* (Discussion paper No. 1953). Institute for the Study of Labor (IZA). https://www.iza.org/publications/dp/1953/the-effects-of-state-sponsored-merit-scholarships-on-course-selection-and-major-choice-in-college
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33. *Desjardins, S., & McCall, B. (2009). *The impact of Washington State Achievers Scholarship on student outcomes*. Paper prepared for the Bill and Melinda Gates Foundation. Retrieved from: http://www.ymdhms.com/tsp/files/seminar_WSA_Report_Version_3.pdf
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35. *Dulniak, C. J. (2013). The promise of a college degree: Does West Virginia's merit-based scholarship program increase a student's propensity to graduate? [Master's thesis, Georgetown University]. Georgetown University Institutional Repository. https://repository.library.georgetown.edu/bitstream/handle/10822/558555/Dulniak_georgetown_0076M_12099.pdf?sequence=1&isAllowed=y
36. *Erwin, C., & Binder, M. (2020). Does broad-based merit aid improve college completion? Evidence from New Mexico's lottery scholarship. *Education Finance and Policy, 15*(1), 164–190. https://doi.org/10.1162/edfp_a_00270
    a. *Supplemental*: Erwin, C. & Binder (2017). Does broad-based merit aid improve college completion? Evidence from New Mexico's lottery scholarship (Working paper). Albuquerque, NM: University of New Mexico.
    b. *Supplemental*: Erwin, C. P. (2018). Transitions from higher education to the labor market: Merit aid, time to degree signals, and major choice (Publication No. 10785607) [Doctoral dissertation, The University of New Mexico]. https://www.proquest.com/docview/2088448584?pq-origsite=gscholar&fromopenview=true
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51. *Lee, J. (2018). Does merit-based aid promote degree attainment? *KEDI Journal of Educational Policy*, *15*(1), 99–118. https://www.proquest.com/docview/2064317559?pq-origsite=gscholar&fromopenview=true
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