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Cost-effectiveness Analysis of Interventions that Improve High School Completion

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Cost-effectiveness Analysis of Interventions that Improve High School Completion

Abstract

This report demonstrates the methods of cost-effectiveness analysis as applied to several educational programs that have been shown to improve the rate of high school completion.

Keywords

cost-effectiveness, high school completion

Disciplines

Economics | Educational Assessment, Evaluation, and Research | Education Economics

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Cost-Effectiveness Analysis of Interventions that Improve High School Completion

October 2012

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CONTENTS

SUMMARY

With 6% of GDP being spent on education in the United States, it is important to evaluate which educational strategies are both effective in eliciting desirable outcomes and in using available resources most judiciously. Evaluating productivity of educational programs, while rarely done, is especially critical as many states continue to cut education budgets and government agencies are pressed for adequate resources. In this report we describe the tool of cost-effectiveness analysis, identify methodological challenges in its application, and present cost-effectiveness analyses of several programs, each of which has been shown to be effective in helping students complete high school. We also demonstrate how cost-effectiveness comparisons can be used to inform decision-makers in allocating resources to meet their policy goals.

Completion of high school is a desirable educational outcome socially and economically from the perspectives of both the student and society, but more than 12 percent of American citizens (i.e. 28 million) age 18 or over are high school dropouts (Institute of Education Sciences, 2011; Rumberger, 2011b). Belfield, Levin, and Rosen (2012) estimated the cost of lost economic opportunities as well as fiscal costs from foregone tax revenues, and additional public costs such as crime and higher public health and welfare costs of so-called "opportunity youth," at $258,240 per youth, over a lifetime in present value, and the cost to society at $755,900. Rumberger (2001, 2011b) emphasizes that the causes of dropping out are not purely academic but also depend on factors such as family background, community and peers. Consequently, programs that address the problem successfully must address multiple factors and may need to be delivered both in school and out-of-school settings.

Based on a review of evidence from the What Works Clearinghouse's Dropout Prevention topic area, we identified five programs that have been found to be effective at helping students complete high school. The programs are: JOBSTART, New Chance, National Guard Youth ChalleNGe (NGYC), Job Corps and Talent Search. We demonstrate cost-effectiveness analysis for each program. Effectiveness data for each of the programs were extracted from rigorous prior evaluations. In four cases cost data, in some form, were also available from prior studies that we could match to the effectiveness data, after some adjustments. In the fifth case, Talent Search, we collected cost data using the well-established ingredients method (Levin & McEwan, 2001).

Ideally both cost and effectiveness data would be collected simultaneously for an intervention at the time of the evaluation. In order to provide a fair comparison of programs, assessments of effectiveness and costs need to address the same outcome for similar populations of students in similar settings. Additionally, the costs should be collected using the same methods across studies and adjusted to a uniform set of prices to establish a level playing field. We describe the methodological challenges we encountered in combining pre-existing cost and effectiveness data collected using different methods, often at different points in time, and in trying to compare programs that vary from each other along important dimensions.

Notwithstanding the challenges we encountered, we present cost-effectiveness estimates, summarized in Table S1, for the five programs from the social perspective, i.e., accounting for resources used regardless of which agency provided the funds for them.

Four of the programs reviewed, NGYC, JOBSTART, New Chance and Job Corps, shared several similarities: they targeted youth who had already dropped out of school; provided a comprehensive array of services including education, vocational training, life skills training and health services; and the cost data available represent "gross" costs in that costs of similar services generally available in the community for non-participants were not subtracted. While not perfectly aligned in terms of program goals or methods used for costing, we are able to demonstrate how cost-effectiveness comparisons can be made across similar programs to help decision-makers assess which programs are more efficient from a funding perspective. However, given differences among the four programs in the methods used to obtain cost and effectiveness data, we emphasize that ranking these programs in terms of relative cost-effectiveness is not reliable under the current analysis. To allow such a ranking, we recommend employing comprehensive and consistent methods for collecting both costs and impact data simultaneously. Sensitivity analyses are used to check the robustness of the cost-effectiveness analyses.

Talent Search, also a national program, serves a different population – low-income youth whose parents did not attend college, who are still in school, and who appear to be on track to graduate and attend college. Consistent with our recommended approach to costing programs, but in contrast to the gross costs obtained for the four programs above, we present the costs of Talent Search as incremental costs, i.e., the costs of the program over and above the underlying costs of schooling. Given the differences in target population, delivery setting and method of calculating costs, the results we present for Talent Search are not directly comparable with results for the four programs targeted at dropouts.

Our data for Talent Search are from five sites in Texas and Florida. We followed the ingredients method to obtain the cost data for each site, interviewing site directors and key personnel using a detailed protocol and compiling a database of national prices for all relevant resources. This compilation of ingredients took place many years after the evaluation and may not reflect the exact use of resources at that time. While interview responses indicated stability in the program over time, the accuracy of retrospection may not be ideal. However, given the consistency in method of costing each site, we are able to compare the five sites against each other to demonstrate how different implementations of the same program, each of which has been shown to increase the rate of high school completion for at least one cohort of students (Constantine, Seftor, Martin, Silva, & Myers, 2006), can result in dramatically different cost structures and relative cost-effectiveness. Such a site-level comparison within a single program can help program administrators identify the most efficient sites in order to investigate which factors lead to greater productivity. These practices may then be recommended for adoption at less efficient sites.

The results indicate that, for high school dropouts, the cost to produce each extra high school completer through the interventions studied here are very high, ranging from about $70,000 to $195,000 per completer. These high costs may reflect the difficulty for education reforms alone to overcome barriers to educational success deriving from both academic and out-of-school influences (Rumberger, 2001), or the fact that these programs address multiple outcomes in addition to high school completion. Two of these interventions look more cost-effective at increasing high school completion – NGYC and JOBSTART – with the other two programs, New Chance and Job Corps, having similar (but lower) cost-effectiveness.

The pooled estimate of the cost-effectiveness ratio for Talent Search is considerably lower than for the other interventions: the cost to produce an extra high school completer is only $30,660. Its cost-effectiveness ratio is more than two times lower than the most cost-effective out-of-school programs. The results for

Talent Search are, however, not directly comparable to the other four programs presented because Talent Search is an incremental program, providing resources to students over and above what they already receive in school. Additionally, a program targeting promising students, as opposed to dropouts, can be expected to result in greater effectiveness and cost-effectiveness in improving high school completion.

For three of the interventions studied, JOBSTART, New Chance and Talent Search, site-level data were available. We found that cost-effectiveness ratios varied significantly across sites in each program and consequently we caution evaluators against generalizing from cost-effectiveness results without evidence on site-specific variation. We conclude that site-level analyses are far more informative than overall program estimates that can mask a very wide range of results.

Table S1

Cost-Effectiveness Ratios across Interventions that Raise the High School (HS) Completion Rate

	Cost per student	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Gross costs of programs targeting dropouts			
NGYC	$14,100	$71,370	1.40
Job Corps	$22,290	$131,140	0.76
JOBSTART	$10,460	$69,510	1.44
New Chance	$17,820	$194,640	0.51
Incremental costs of program targeting promising students			
Talent Search (five sites)	$3, 400	$30,660	3.26

Given the difficulties of collecting cost data retrospectively to match with effectiveness data and of comparing programs evaluated and costed using different methods, we recommend that cost data should be collected at the same time as impact data, using consistent methods of data collection. In addition, collection of detailed implementation data can help explain variations in both costs and effectiveness and allow practices at the most cost-effective sites to be adopted elsewhere.

1. INTRODUCTION

Almost one trillion dollars of public funding, or 6% of Gross Domestic Product, is spent on education in the United States (U.S. Government Spending, 2012) with results that are relatively mediocre on average. Educational costs have risen historically at a much faster rate than the consumer price index. At the same time, state education budgets have been falling during the recent economic recession. The Center on Budget and Policy Priorities (2012) reports that for the 2012-2013 school year, 35 states are providing less funding for education than they did five years ago. Cuts at the state level often disproportionately affect school districts with high levels of low-income students. Yet, little attention has been focused on issues of cost and productivity of education and how we can improve outcomes relative to the costs. The purpose of this report is to incorporate a productivity dimension into the analysis of education, that is, to identify ways of improving education that are the most effective and that confer the highest benefits relative to the resources devoted to education. This effort requires consideration of both the effectiveness and costs of different alternatives for educational improvement.

Much more attention has been given in both the research literature and policy to the effectiveness of educational alternatives than to their costs. Although strong arguments have been made that cost also needs to be taken into account (Harris, 2009), the criterion of cost-effectiveness is rarely used in education and is largely unknown among evaluation specialists (Levin, 2002; Hummel-Rossi & Ashdown, 2002; Clune, 2002). This contradiction stands despite the method of cost-effectiveness analysis having been developed for educational applications almost four decades ago (Levin, 1975; and summarized in Levin & McEwan, 2001). The omission of cost considerations risks the promotion of educational interventions that have only small positive effects, but high costs that exceed those of equally effective alternatives. This report aims to demonstrate how effectiveness data can be combined with cost data to present cost-effectiveness comparisons that decision-makers can use for optimizing the efficiency of resource allocation. Specifically, this report generates cost-effectiveness results for interventions that increase the rate of high school completion.

The Value of Cost-effectiveness Analysis for Decision-makers

Despite limited attention to cost-effectiveness analysis in education, there do exist examples where the same educational result has been obtained for a fraction of the cost of an existing practice or policy. For example, an early study of teacher selection found that, in order to raise student achievement, it was five to ten times more cost-effective to select teachers with higher verbal test scores than to invest in teachers with additional teaching experience (Levin, 1970). Levin, Glass, and Meister (1987) found that, for raising the achievement of elementary students in mathematics and reading, peer tutoring was twice as cost-effective as computer-assisted instruction and almost four times as cost-effective as reducing class size or increasing instructional time.

In more recent work, Levin and Belfield (2007) compared the cost-effectiveness of five different programs for reducing the number of high school dropouts: two different preschool interventions, class size reduction, higher teacher salaries to obtain and retain higher quality teachers, and high school reform. All of the interventions had been found effective using sophisticated evaluation methods by independent evaluation organizations. As is often the case, the most effective of the five, Perry Preschool, was not the most cost-effective for this particular outcome (First Things First, a high school reform, ranked first and Perry Preschool was fourth). Indeed, the most cost-effective option was three times as effective per dollar as the least effective, even though all programs were deemed "effective". While all the programs met the "effectiveness" criterion, policymakers should consider that adoption of some of them costs 3-10 times as much as others to obtain the same educational result. It is this concern that is the focus of this report, demonstrating how educational decision-makers can scrutinize not only the effectiveness of a strategy, but also its burden upon resources. We are not arguing that this should be the only criterion for making a choice, but that it should be given heavy – and certainly greater – consideration than at present. In this respect, cost-effectiveness is information provided to the decision-maker that can be combined with other information in the decision-making process.

Dropping out of High School as a Policy Problem

Increasing the high school graduation rate should be a national priority in education reform (Rumberger, 2011a & 2011b). As described in detail by Duncan and Murnane (2011), the high school graduation rate in the U.S. has stagnated since the 1970s, such that the U.S. rate ranks 19th across the OECD. According to recent estimates, more than 12 percent of American citizens (i.e. 28 million) age 18 or over is a high school dropout (Institute of Education Sciences, 2011; Rumberger, 2011b). There are large racial, ethnic and gender gaps in graduation, with many dropouts clustered in so-called 'dropout factories', and there is significant variation across states, both in levels and trends of the graduation rate (Duncan & Murnane, 2011).

The economic and social consequences of dropping out of school have long-term negative effects both for dropouts themselves and for society as a whole. Belfield *et al.* (2012) estimated the cost of lost economic opportunities as well as fiscal costs from foregone tax revenues, and additional public costs such as crime and higher public health and welfare costs of so-called "opportunity youth," at $258,240 per youth, over a lifetime in present value, and the cost to society at $755,900. These can be viewed as the amount of a certificate of deposit in 2011 that would generate these returns over a lifetime.

To be effective, programs intended to reduce dropouts must address the underlying cause of dropping out of school. According to Rumberger (2011b, p.7), dropping out of school is mainly induced by two sets of factors: first, "individual factors," such as attitudes and behaviors of individual students, and their prior educational experience and academic performance; and second, "contextual factors," including family background, school characteristics, and community and peer factors. In particular, Rumberger emphasizes the critical role of school factors in influencing dropout behaviors. He makes the distinction between two ways of withdrawing from school: "voluntarily" dropping out due to poor grades and attendance, and "involuntarily" dropping out due to school policies that directly lead to suspensions, transfers, and expulsions (Rumberger, 2011b, p.10).

Over the past few decades, federal, state, and local governments have attempted to reduce dropout rates and raise graduation rates through targeted programmatic interventions to provide additional support to students at risk of dropping out, institutional interventions designed to strengthen schools and communities, and broad-based efforts to increase instructional effectiveness of high schools and raise academic achievement across the board. These efforts have yielded mixed results, in part because they tend to be modest in scope (Rumberger, 2011a). Also, many initiatives are implemented in ways that do not allow for a rigorous evaluation, either because they are part of a suite of reforms or because they do not allow for students to be followed over a long enough time horizon (Duncan & Murnane, 2011). Even where existing studies on dropout prevention have examined the effectiveness of the interventions, very few have incorporated cost-effectiveness analysis.

Our Approach

Our original goal for this report was to conduct cost-effectiveness analyses of effective "Dropout Prevention" programs with existing evaluations that have been reviewed by the What Works Clearinghouse (WWC) of the U.S. Department of Education's Institute of Education Sciences (http://ies.ed.gov/ncee/wwc/). The WWC is a national database of research reviews on the effectiveness of rigorously evaluated interventions in 15 different topic areas. The WWC has established a protocol for evaluating research and it summarizes the evidence from studies that meet reasonable standards of validity, as per its WWC Procedures and Standards Handbook (2008). Thus, we can be confident that the estimates of effectiveness have high internal validity.

Dropout Prevention is one of the 15 education topics covered by WWC and 13 of 28 reviewed dropout prevention interventions are listed as having positive or potentially positive impacts on at least one of three different outcomes: completing school, progressing in school and staying in school. As cost-effectiveness analysis is only possible when the alternatives being considered address the same outcome, we focused on the outcome of completing school. Five of the effective programs were found to help students complete school by obtaining a high school diploma or a GED (General Educational Development diploma, General Education/Equivalency Diploma, Graduate Equivalency Degree). These programs are: Talent Search, JOBSTART, New Chance, National Guard Youth ChalleNGe (NGYC), and Job Corps. We demonstrate cost-effectiveness analysis for each program.

We recognize that an evaluation of the cost-effectiveness, or indeed the effectiveness, of these five programs is not strictly an apples-to-apples comparison. The goals and intended outcomes of these programs are not identical, even within the class of dropout prevention programs. Ideally, a fair comparison of cost-effectiveness would compare programs targeting similar populations of students in similar settings, yet these five programs vary across these dimensions. In addition, the cost data for each program are not available in a consistent form.

Notwithstanding these challenges, we present cost-effectiveness comparisons across the five programs. The actual estimates are useful as very approximate indicators of the resources required to yield extra high school graduates. But we caution against ranking these programs in terms of relative cost-effectiveness. The results are derived so as to illustrate the methodological issues for cost-effectiveness analysis. This presentation of cost-effectiveness ratios allows us to perform a methodological critique of cost-effectiveness analysis within the context of a research field that has focused primarily on effectiveness.

Structure of this Report

We begin by describing the cost-effectiveness method and consider some key practical challenges in its application. Next, we review the educational interventions that have been identified by WWC under the domain 'Dropout Prevention'. This review prompts us to focus on the one program that targets students still in school and for which no cost analysis exists – Talent Search. For this intervention we collect direct information on the ingredients used for this program at five different sites in Texas and Florida, assign costs based on national prices, and relate these to the pre-existing effectiveness evidence on Talent Search. We are able to compare the five sites in terms of cost-effectiveness.

For the other four programs that WWC identifies as improving school completion – JOBSTART, New Chance, NGYC and Job Corps – we draw on the extant data on costs and effectiveness to derive cost-effectiveness ratios. Because the cost data in each case is collected using different methods, none being the ingredients method, and appear to be based on local prices rather than a common set of national prices, these ratios are only illustrative of the cost-effectiveness method and should not be used for ranking the programs by efficiency. We also include two early childhood interventions with pre-existing costs and effectiveness data, again for the purposes of illustration and comparison. Finally, we conclude our report by discussing the implications and applications of our research for policymakers, researchers, and education professionals.

2. METHOD AND PRACTICE

Cost-effectiveness analysis is a decision-oriented method of inquiry. The decision-maker's first task is to determine which educational outcome is to be pursued. In the case of the interventions reviewed here, the outcome of interest is increasing the rate of high school completion. Reforms and interventions can then be evaluated insofar as they improve that outcome and at what cost. The purpose of this report is not to review how improvements in high school completion are identified (e.g., through a field trial or correlational study) but to focus on the cost analysis and how cost data can be combined with existing effectiveness data to yield cost-effectiveness metrics to be used in decision-making.

Collection of Cost Data

Many evaluators and educators believe, naively, that the best method of gathering cost information is to rely on available budgets. There are many reasons why budgets are inadequate, indeed inappropriate, for determining costs (Levin & McEwan, 2001, pp. 45-46). Beginning with the definition of cost, the accepted standard in the field of economics is the concept of "opportunity cost", i.e., the value of what is sacrificed when a resource is directed to one use rather than its most valued alternative use. Educational interventions use personnel, facilities, materials, equipment, and other resources that we term "ingredients". Each of these ingredients has value in some best alternative use, and that is what we are giving up or sacrificing. Educational accounting and school budgets are not predicated on measuring costs in this way. Harris (2009) provides clear examples of how budgetary costs in education settings can fail to account for both opportunity costs and benefits of programs: in his analysis of the cost-effectiveness of the Abecedarian early childhood program, he demonstrates that accounting or budgetary costs of the program do not consider the financial gains to parents who are able to work whilst their children attend the program. In another example, he notes that the increased demand on parental time to facilitate implementation of the Success for All program results in budgetary costs underestimating the true costs of that program.

In contrast to cost accounting, the overriding concern of budget reporting in education is to establish transparency in how money is spent, primarily for auditing purposes. Often, capital improvements that last many years are charged to the budget in the year that the improvement is made or over a fixed time period based upon the payment terms of a bond rather than being spread out over all the years of serviceability of the ingredient. For example, a school building may be paid for over a period of 10 years but may have a usable life of over 50 years. A costs analysis would spread the costs over the serviceable life while school accounting practices would spread them over a shorter period, typically the period of financing repayment. Also, resources that are received from non-school sources (such as volunteers, gifts, use of facilities belonging to other agencies) are often not accounted for at all. In some states the pension system for schools is charged to the state and does not appear as a cost in local school budgets. There are many other such anomalies as well as the difficulties in linking line-item budgets based upon "functions and objects" to particular educational programs and interventions. For these reasons and many others, we use a different approach, which we believe has been honed successfully since its introduction in 1975 (Levin, 1975) and developed more fully in subsequent publications (Levin, 1983; Levin & McEwan, 2001). This is known as the "ingredients" approach. Other researchers have adopted similar methods. For example, Chambers and Parrish (1994a, 1994b) describe the "resource cost model" which follows similar procedures. By accounting for the ingredients used in a program or intervention, most errors of omission or cost distortion can be avoided.

The Ingredients Approach

The purpose behind the ingredients (or resource) approach is to account for the cost of all of the resources required to implement the particular educational intervention being evaluated irrespective of their source. By focusing on ingredients, this approach begins not with a budget, but with the details of the intervention and its resource requirements. Only after establishing a systematic specification of the ingredients that are used to produce a particular educational outcome of interest, do we attempt to measure the costs of these ingredients. In general, market values are used to assess opportunity cost, although other methods may also be necessary such as estimation of "shadow" prices.[1] This enables an overall measure of costs for the intervention that can be compared with the costs of other options by using common methods of estimating costs across different interventions.

The ingredients approach to cost estimation entails three distinct phases: (a) identification of ingredients; (b) determination of the value or cost of the ingredients; and (c) an analysis of the costs in an appropriate decision-oriented framework, e.g., based on cost burden across various agencies; at different levels of scale; adapted for different geographical locations or modes of implementation. A detailed example of how the ingredients approach is used is given in Levin, Catlin, and Elson (2007).

Identification of Ingredients

The identification of ingredients refers to the delineation of all of the resources required to implement a particular intervention relative to an alternative (typically the *status quo*). For educational programs, the main ingredient is often labor services of which the largest component is that of the teacher. But, facilities, equipment, supplies, outside services, and many other ingredients may be used, and these must be identified and measured. Educational interventions use not only these resources but also the time of the students who might otherwise be able to use their time productively in the workplace. If a student is required to spend four additional years in the educational system, those years could have been used for other productive activities that, when foregone, have a cost to the individual and society. Also, students may be used as inputs in helping deliver interventions, such as peer tutoring, to other students. Hence, student time may be an important ingredient in economic analysis, particularly if it entails student participation beyond the years or daily schedule required of compulsory schooling.

Because the detailed ingredients provide the most fundamental units for ascertaining costs, an attempt is made to measure them as accurately as possible in terms of both quantity and quality. Thus, it is usually important to know not only the role or function of a personnel ingredient, but also the skill, education, and experience required to carry out the job in order to determine what such an input or ingredient will cost. This information may be collected from various sources. Reports, articles, Web sites, and narratives on implementation of the intervention may serve as an initial basis for constructing an ingredients spreadsheet listing type and quantity of every resource. In some cases, the developer's program specifications may be used. This can be followed by conducting interviews and soliciting questionnaire responses from key personnel implementing the interventions. The interview protocols or survey instruments must be designed for each specific intervention. Finally, direct observation of the intervention may be an appropriate way to identify ingredients or confirm that nothing has been missed.

1 Where a market does not exist for an ingredient, e.g., a unique facility or a staff member with unusual talents, a shadow price is developed on the basis of market or other assumptions. See Levin and McEwan (2001, Chapter 4).

If a program that is implemented in many sites is evaluated for effectiveness by choosing a limited sample of sites, ingredients and their costs should be determined for those particular sites. Despite the use of generic titles for interventions, implying that they are all identical, specific sites may implement them in different ways and using resources that vary in quality and quantity from site to site. To the degree that there are site differences in effectiveness, it should be possible to relate those disparities to differences in ingredients and costs. Sensitivity analyses can be performed to estimate how these costs and the resulting cost-effectiveness ratios might vary at other sites under given assumptions.

Costs of Ingredients

Once ingredients have been identified and stipulated, the next step is to ascertain their prices. All ingredients are assumed to have prices, including donated or volunteer resources, because all have alternative uses that have value. A crucial requirement for costs analysis is that the cost estimates must be comparable. This is achieved by ensuring the cost estimates are based upon a uniform method of estimation, one of the purposes of using the ingredients approach. For example, different educational interventions that are evaluated are often initiated in different locations and in different years. Some parts of the country and some localities have lower prices than others for some ingredients and higher prices for others. For example, the average teacher salary in New York State is $57,354 compared with $38,284 in West Virginia (http://teacherportal.com/teacher-salaries-by-state). Moreover, prices can change over time with market shifts, e.g., depending on the supply of qualified teachers or principals, and general price level changes. These conditions are not intrinsic to the educational intervention. For this reason, cost-effectiveness comparisons of different interventions should use a standard set of prices, usually a national average for each ingredient in a common year. This enables a comparative measure of costs that is not biased by location or timing. Standardized "national" prices for each ingredient can be obtained from recognized data sources or computed based upon multiple sources of information or shadow prices. Prices are often standardized to the latest year for which the major national databases provide data in order to account for inflation. Of course, the user of a report on cost-effectiveness can insert the prices that are pertinent to a particular location and year when doing a cost-effectiveness analysis for a state or locality because the method is transparent with respect to the ingredients required.

Ingredients can be divided into those that are purchased in reasonably competitive markets and those obtained through other types of transactions. In general, the value of an ingredient for costing purposes is its value in the competitive marketplace. For personnel, the market value may be ascertained by determining the costs for hiring a particular type of person, including salary, fringe benefits, and other employment costs. Many ingredients can be costed out from their respective market prices. In general, these will be market price averages for the nation taken from national data indices. Such data are available for personnel from the periodic reports of the U.S. Department of Education, and especially the National Center for Educational Statistics, and publications of the American Federation of Teachers and the National Education Association. Materials and equipment can also be costed using market prices.

Cost data on facilities may be obtained from publications on school construction and on annual leasing costs for space with appropriate characteristics. Capital inputs are converted to annual costs by taking account of depreciation and interest on the undepreciated portion of investment. Some capital resources are not purchased directly in competitive markets. For example, additional facilities may be obtained by using more space in an existing building which is "owned" by a school district or which is provided by another government agency. No financial transaction occurs, but this resource use must still be accounted for as if the space had to be rented in the private market. Finally, volunteer time or in-kind contributions are not made via market transactions, so shadow prices are used. For volunteers, the shadow price is the opportunity cost of their time, which is typically based on the value of the services that they provide.

The cost values of all identified ingredients are accounted for, regardless of their source of finance or in-kind support. It is important to cost out all the ingredients necessary for the intervention and to do so in a neutral way that does not favor interventions taking place in areas where prices are relatively low. The duration of the intervention must also be taken into account. Educational interventions vary significantly in length, from a few days (e.g., teacher professional development) to multiple years (e.g., leadership programs). Yet, often the effectiveness measures are reported per intervention as if these are comparable. Thus, it is essential that costs analysis clarify the duration of each intervention and accounts for the cost burden over the entire period of the intervention.

Cost Metrics

The outcomes of the cost analysis are cost metrics for each intervention expressed as: a total cost for the intervention at the level of scale studied, i.e., across all sites; a cost per site when site-by-site data is available; and an average cost per student receiving the intervention. These costs should be calculated as incremental costs, i.e., taking into account resources utilized by the intervention beyond those utilized for "business-as-usual". For some interventions, students who do not participate may still gain access to alternative educational resources. If so, these alternatives need to be costed to allow determination of the incremental costs of the intervention.

Each of these metrics serves a particular purpose for comparing interventions. The total cost metric is used to inform decision-makers of the scale of the intervention, which may be particularly pertinent to decisions if there is a funding constraint. The average cost metric yields an easier comparison between interventions and may be useful when considering the equity of investments across subgroups of students.

Cost metrics per site are also very useful. Studies of effectiveness often report one effect size pooled across sites, despite the fact that implementation at different sites may result in different levels of effectiveness and costs. Pooling across sites is often performed in order to create a large enough sample to allow statistically significant effectiveness results to be shown or to allow analysis of sub-groups. In reality, however, the program might be better implemented and employ more resources at some sites, and these sites may have better outcomes. These differences are masked in the pooled estimate. Similarly, meta-analysis is often used to generalize about effects across different studies, sites, and versions of an intervention. Meta-analytic evaluations yield an "average" effect size across multiple studies that each relies on what appears to be a similar approach to evaluate a particular intervention. Both pooled and meta-analytic evidence is problematic for cost-effectiveness analysis because it does not allow for accurate matching of the costs of a specific implementation with the actual effectiveness at each site. A large effect size at one site might be due to the fact, unobserved in meta-analytic studies of effectiveness, that this particular site used considerably more resources for the same intervention than another site. Consequently we recommend, wherever possible, disaggregating effectiveness results to individual sites so that effect sizes for the individual sites can be matched with costs for each specific implementation of the intervention.

Using Cost Analysis in a Decision-oriented Framework

The initial aim of a cost analysis is to provide comparable cost estimates across different interventions, or across different sites implementing the "same" intervention. A later aim is to adapt the standardized findings to apply to situations encountered by different policymakers in varying educational jurisdictions. Most educational decision-makers will be found at state and local levels so that the initial cost analysis should be adjustable to reflect local prices in the decision-maker's geographical location. Ideally, the cost analysis should be designed to indicate how the cost burden is distributed, or "who pays", among school districts, other government agencies, private entities, volunteers and other providers of in-kind resources, and clients or users of the program. This allows a decision-maker to assess the burden that will fall on his/her particular budget, given the particulars of education cost sharing in his/her jurisdiction. Different interventions may reflect different patterns of cost-sharing and different cost-effectiveness implications for each of the cost-bearing constituencies or decision-makers.

In some instances, the policymaker's concern is with the costs of expanding the use of an existing intervention. For example, if a school district has already implemented a dropout prevention program for 11th- and 12th-grade students who had missed more than 30 days of school in the previous year but wanted to expand the program to include students missing more than 15 days of school, the district education agency would want to know the marginal or new costs involved in targeting these additional students, as opposed to the average cost per student. To address such questions involving a change in the scale of an intervention, costs must be distinguished as fixed or variable. In this situation, the marginal costs of the intervention can be determined by considering only the variable cost component of ingredients. In general, those interventions with high fixed costs such as those with large investments in facilities and equipment (e.g., establishing computer laboratories) will require a high enrollment or utilization to be most efficient. In contrast, interventions that are constituted largely of variable costs such as personnel (e.g., after-school tutoring) will have costs that are less sensitive to the scale of output. Thus, an economic evaluation of alternative interventions that differ in terms of their intensities of fixed versus variable costs may produce very different average and marginal cost results depending on the scale of enrollment or output. Therefore, it is advisable to compare interventions of similar scale.

A related analysis could estimate how many additional high school graduates or other units of educational outcome can be expected for a fixed monetary investment in a program. This analysis would be useful when the budget is limited and decision-makers need to determine how to maximize their return on investment. In this circumstance, decision-makers would choose the intervention that provides, for example, the greatest increase in high school completion but still falls within their budget limit.

Cost-Effectiveness Analysis

Once the cost metrics have been calculated, a cost-effectiveness ratio is derived. This ratio is calculated as the cost divided by the effectiveness. For example, if a program costs $2 million and yields 100 extra high school completers above and beyond what would be expected from a valid comparison group, the cost-effectiveness ratio is $20,000 per extra completer. This ratio shows the cost of "buying" an extra completer. Lower cost-effectiveness ratios are preferred - if the program yielded 200 extra completers the cost-effectiveness ratio would be $10,000. This ratio may be helpful because it can be easily related to the value of the program – specifically, whether it is worth spending $20,000 to "buy" an additional completer.

Alternatively, the ratio may be expressed by dividing the measure of effectiveness by the cost figure to provide a gain per dollar spent. For the above example, this ratio could be expressed as the yield of extra completers per $100,000 spent, which is 5. Therefore, the intervention generates 5 extra high school completers for every $100,000 spent. This ratio is helpful when there is a financing constraint (e.g., if the district can only spend $1 million). In addition, when a program evaluation includes multiple sites some of which show negative effects, i.e., the treatment group actually yields a smaller percentage of completers than the control group, a traditional cost-effectiveness ratio may be impossible to interpret for these sites.

Indeed, it would not normally be worth calculating a cost-effectiveness ratio for an ineffective program as it should not remain a policy option. If, however, it is desirable to show a ratio for all sites in an evaluation for comparative purposes and to show the possible range, presenting the number of graduates "lost" for every additional $100,000 spent is a feasible strategy. Thus, this alternative metric is useful and can be presented alongside the cost-effectiveness ratio where appropriate.

Cost-effectiveness ratios should be tested for sensitivity to see how robust the results are to alternative modeling assumptions. Boardman, Greenberg, Vining, and Weimer (2011) recommend three types of sensitivity analysis: best and worst case sensitivity testing, which places extreme bounds on the results; parameter variation sensitivity testing, where the most influential variables in the model are changed; and Monte Carlo simulation, where the distributions of variables are incorporated into the model.

The primary purpose of cost-effectiveness ratios is to compare interventions. If there are implementations at multiple sites, the cost-effectiveness of the intervention according to the version implemented at each site can be ranked for its efficiency in use of valuable resources. Where there is more than one intervention addressing a particular outcome, the ratios can be compared across all the interventions. Continuing the above example, imagine that a second intervention aiming to increase graduation has a total cost of $5 million and yields 200 extra graduates. This intervention is more effective, but the higher cost renders the comparable cost-effectiveness ratio less favorable ($25,000), i.e., it costs more to obtain an extra high school completer. Cost-effectiveness comparisons do not have to be limited to one type of approach or reform. For high school completion, for example, one can compare interventions based upon diverse approaches such as coaching, curriculum, technologies, professional development, grouping practices, counseling, and extended time. It is, however, critical that outcome measures are comparable and that ideally they are measured at a similar point in time (e.g., earning a high school diploma by age 18).

Principles and Practices for Cost-Effectiveness Analysis

Although the method of cost-effectiveness analysis is straightforward, practical application may be challenging, especially when "retrofitting" costs collected currently to pre-existing effectiveness estimates. Gathering cost data retrospectively to combine with pre-existing data on effectiveness for cost-effectiveness comparisons is not the most accurate or parsimonious way of incorporating costs into the evaluation process. Many interventions are described generically based on the theory of action and what is intended to take place and provide little or no actual details on the resources that were used. Interviews of program personnel may not yield an accurate record of ingredients if considerable time has passed since the evaluation. Even if the intervention continues to operate, it may have changed over time precluding the use of current observational data to determine the resources used at the time of evaluation. Substantial effort and multiple sources are likely to be needed to reconstruct the ingredients requirements of an intervention evaluated more than a few years in the past. We believe that by incorporating the ingredients method at the time of implementation of the intervention, the costs can be obtained with greater accuracy and less effort.

However, since most interventions do not provide accurate detail on ingredients, a second strategy is to attempt to reconstruct the resource base for interventions that were evaluated for effectiveness in the past and combine these with effect measures for comparison. In a few cases, costs have been estimated at the time of implementation, and reported with effectiveness measures. However, rarely is the methodology for estimating costs reported in adequate detail to know on what it was based or to know if it is comparable with costs of other alternatives. That is, we do not know if all ingredients were included or what prices were used or whether this is simply an "estimate" from a budget or a business manager who is not a cost accountant. In order to facilitate the ability of evaluators to take advantage of existing effectiveness data and existing cost data, we review in this section challenges we have encountered in our own such attempts and how we addressed them in order to conduct retrospective cost-effectiveness analyses.

Interventions may only be compared in a cost-effectiveness analysis if they measure at least one outcome in common. Of course, this is also true of effectiveness comparisons. Assumptions about the equivalency of outcomes need to be reviewed carefully. Indeed, many 'dropout prevention' programs have goals beyond completing high school such as increasing employability and earnings or improving health status and reducing crime. In these cases it is usually impossible to disentangle costs associated with one outcome from the costs associated with other outcomes. If performance on only one outcome, e.g., high school completion, of such multi-outcome programs is singled out for comparison with performance of programs which target that single outcome only, the multiple goal programs may appear unduly expensive because they are devoting their resources to much more ambitious endeavors than the single goal. Such an analysis does not reflect the fact that other desirable outcomes may also be obtained by the multi-goal programs. In such instances, cost-benefit analysis may be the most effective way to compare the programs.

It is also important to consider whether the interventions serve similar populations of students in similar settings, are delivered at similar scale, and are funded at similar levels. Each of these factors may affect both costs and effectiveness of a program and they almost certainly influence the decision-making process. To make a viable comparison, similarity in each of these characteristics is desirable. Yet, it is often hard to find programs that are genuine alternatives to each other and so may be meaningfully compared. Note that these challenges arise for a proper comparison of effectiveness, not just cost-effectiveness.

There are also challenges in interpreting the effectiveness of a program and linking this effectiveness measure to the appropriate costs. We identify four main challenges, noting that these arise even where there is only one effectiveness outcome being measured.

First, some interventions may have been evaluated through multiple studies, each showing different results and effect sizes. However, pooling results from multiple studies is problematic for cost-effectiveness analysis because it is likely that the cost of implementing the intervention has varied across studies. More resource-intensive implementations of the intervention are more likely to be more effective. Hence, the cost-effectiveness ratio from pooled results may be a biased estimate of the overall cost-effectiveness of the intervention. We recommend calculating cost-effectiveness only when individual effectiveness studies can be matched up with costs of the specific implementation(s) evaluated. We also suggest only using studies that employ randomized control trials or strong quasi-experimental designs, ideally conducted by researchers independent of the development and implementation of the intervention. In addition, only those studies with results that are statistically significant at the $p<0.05$ level should be considered. When more than one study is available that satisfies these criteria, the cost-effectiveness ratios calculated for each one can be used to present a range of cost-effectiveness values for the intervention in question, ideally accompanied by some insights as to how variations in implementation or other factors account for variations in the ratio.

Second, some evaluation studies report on multiple sites implementing the same program. In these cases, some sites appear to be effective while others are ineffective. As with multiple studies, the question arises as to which sites best represent the impact of the program for a cost-effectiveness analysis. Cost-effectiveness can be presented for the overall group and also for the subset of effective sites to show how the program in question compares with other programs when implemented optimally. Alternatively, if only some sites show statistically significant differences in outcomes for the treatment group compared with the comparison group (either positive or negative), another analysis can include only those sites as opposed to including all sites. We recommend presenting a number of different such analyses so that a policymaker can choose the analysis that makes most sense in his or her context.

A third challenge arises because effectiveness research typically distinguishes between study participants who are assigned to the intervention and those who actually participate in the intervention. For experimental studies, it is important to determine whether the evaluation includes all participants assigned to the treatment group, regardless of whether they actually attended the program (the Intent to Treat or ITT observations), or only those who actually participated in program activities (the Treatment on the Treated or TOT observations). Our preference is for cost-effectiveness analysis based on the TOT observations although the implications for ITT cost-effectiveness should also be explicitly considered.

Although interventions are typically allocated resources based on the ITT observations, these resources are actually used on the TOT observations. Where fewer students participate than expected (i.e. there are fewer TOT observations than ITT observations), resources are often not returned to the funding agency but instead are spread across the participants. The intervention is therefore more resource-intensive per participant. Critically, it is the actual resources used that will determine effectiveness.[2] In contrast, it may be hard to know how many resources would have been spent on the ITT individuals (or at least the subgroup who did not participate).

It is unclear how the decision to use ITT vs. TOT observations will drive the cost-effectiveness results. Clearly, TOT effectiveness is likely to be greater than ITT effectiveness, as in the former case the impact is only measured for those students participating in program activities. But TOT estimates may introduce an upward bias in effectiveness because those individuals assigned to treatment who actually show up to participate in the program are likely to be more motivated than those who do not. An ITT comparison eliminates this bias. However, the per-participant costs for TOT will also be higher because the total cost of the program is divided by fewer observations so it is not clear which way the cost-effectiveness results will move as the analysis is changed from TOT to ITT.

The final challenge relates to the incremental nature of programs in generating outcomes. Most programs assign resources to an intervention above and beyond some amount already being spent on the target population. For example, a dropout prevention program in high school uses incremental resources beyond regular instructional resources, but these regular instructional resources may also help prevent dropouts. Thus, the program is only an increment to what is already being spent. Another example is a boot camp: dropouts participate in the camp and receive all the resources of the boot camp but the costs should measure only the incremental resources beyond what the non-participants receive. Potentially, these non-participants may be enrolled in other training programs, receive welfare, or re-enroll in school. The cost-effectiveness of the boot camp depends on its incremental effectiveness and its incremental costs – both effects and costs must be expressed incrementally. However, in most studies we find that the resource use of the non-participants is not calculated. Failure to measure incrementally is likely to bias interventions toward lower cost-effectiveness.

Each of these four challenges has implications for cost analysis: cost data should be collected in a way that is consistent with how effectiveness is measured. Thus, cost data should be collected based on the actual implementation of the intervention from which the effectiveness data is derived. Where there are multiple sites, cost data should be collected for the actual sites for which effectiveness data are presented in order to determine what resource use is required to obtain observed levels of impact. When trying to collect cost data retrospectively to match to pre-existing effectiveness data, this is possible only when sites

2 For example, if the ITT observations are 2,000 and the intervention has a budget of $1 million, then the unit cost is $500. If there are only 1,000 TOT observations, the unit cost is likely to be $1,000 because the agency will spend the entire $1 million. Therefore, the intervention's effectiveness reflects $1,000 of resources per participant.

are identified by name. In evaluations where site identities are not provided in order to protect anonymity, this is not possible unless permission is obtained from the requisite authorities to identify the sites for the purposes of data collection. Cost data should be collected with cognizance as to what resources are allocated to participants who are actually treated, as distinct from the resources allocated to those whom the intervention is intended to treat. Finally, cost data should be calculated with respect to the incremental resources of the program relative to what would be allocated under the *status quo*.

All these practical considerations lead us to emphasize the need for cost data to be collected alongside and contemporaneously with the effectiveness evidence. Caution is required when trying to cost out programs with effectiveness results older than around five years.[3] If the program still exists today and therefore remains a viable policy option, significant changes in the way the program is delivered now from when it was evaluated would render those effectiveness results inapplicable to the current day. Conversely, any cost estimates based on current programming may be inapplicable to an evaluation conducted years ago. If, however, the program remains largely unchanged, costs collected today and matched with the older evaluation results may still yield useful cost-effectiveness data. Nevertheless, even if the program is unchanged, collecting cost data at a much later date is challenging because archival records showing the personnel, facilities, material, equipment etc. employed in delivery are often not available or detailed enough and interviewing current personnel is likely to yield inaccurate memories of past program implementation. All these challenges heighten the need for sensitivity analysis to check the robustness of the results of a cost-effectiveness analysis.

While we recommend the use of the ingredients method as the basis for conducting a cost analysis, researchers use other methods, some of which are similar and some of which differ significantly. In all cases, the methods used for collecting this data should be presented as fully as for the methods employed for collecting effectiveness data so that the reliability of the data may be ascertained. In order to present a fair cost-effectiveness analysis of a group of alternative interventions addressing the same outcome, it is necessary for the costs to be collected in a consistent manner in each case, just as we would expect for the effectiveness data.

Application to Dropout Prevention

Within the dropout prevention topic area, WWC has identified and fully reviewed 13 interventions with positive or potentially positive effects. These interventions, listed in Table 2.1, are categorized by WWC into three outcome areas: completing school (graduating from high school or earning a GED credential); progressing in school (moving up a grade); and staying in school across any grade. Our focus is on the first of these three outcomes: it is the strongest outcome (in terms of attainment) and accords with a general understanding of what dropout prevention programs should do. Improvements in the latter two outcomes – progressing and staying in school – are necessary but not sufficient for a student to complete high school. Also, it is not possible to equate the binary outcome of completing school directly with grade advancement in the progressing in school outcome. To do so would require assigning a probability to completing school conditional on progressing in school and that probability is uncertain.

3 For example, McConnell and Glazerman (2001, p.2) describe the operation of Job Corps as “complex, with multiple layers of administrative accountability, several distinct program components and numerous contractors and subcontractors.” Obtaining retrospective data under these conditions, which are almost certainly not exclusive to Job Corps, is therefore extremely difficult.

Table 2.1
WWC Dropout Prevention Interventions with Positive or Potentially Positive Effects

	Completing School	Progressing in School	Staying in School
Talent Search	C		
New Chance	C		
National Guard Youth ChalleNGe (NGYC)	C		
Job Corps	C		
JOBSTART	C		
Achievement for Latinos with Academic Success		P	S
Career Academies		P	S
Check and Connect		P	S
High School Redirection		P	
Talent Development		P	
Accelerated Middle Schools		P	S
Twelve Together			S
Financial Incentives for Teen Parents			S

Source: What Works Clearinghouse, retrieved June 2012 at http://ies.ed.gov/ncee/wwc/Topic.aspx?sid=3.
Notes: C = positive effects for completing school outcome; P = positive effects for progressing in school outcome; S = positive effects for staying in school outcome.

WWC identifies five interventions that have evaluations showing improvements in the completing high school outcome: Talent Search; JOBSTART; New Chance; NGYC; and Job Corps. These interventions differ in many ways such as scale, target population, duration, nature and intensity of services provided, nature and timing of outcomes sought and definition of school completion. One is an extant national add-on program that complements existing schooling for students who are expected to finish high school and attend college (Talent Search); two were limited-period demonstration programs for youth who had dropped out of school and needed job training and other life skills (JOBSTART and New Chance); two more are extant, intensive residential programs also targeted at youth who have already dropped out of school and need significant additional services beyond educational interventions (NGYC and Job Corps).

In addition to varying program characteristics, the definition of school completion is not uniform: in some programs students are motivated to pass the GED; others help students graduate from high school while yet others do both. While the economic consequences of earning a GED are different from earning a high school diploma, most studies of these programs combined the two outcomes as if they were equivalent such that we could not analyze them separately. Treating GED receipt as equivalent to high school completion with a diploma is problematic because there is substantial evidence that the economic benefits from possessing a high school diploma far exceed those from possessing a GED (Tyler & Lofstrom, 2009; Cameron & Heckman, 1993; Heckman, Humphries, & Mader, 2010; Boesel, Alsalam, & Smith, 1998).

More fundamentally, the intended outcomes of the programs were not unidimensional: all programs had multiple goals beyond high school completion, for example to increase employability and earnings. These other outcomes are more effectively captured in cost-benefit analyses. The five programs also target different student groups. Talent Search is the only program targeting students still in school, starting in some cases as early as 6th grade, with the primary goal of helping students who appear to be on track to graduate apply to and attend college. The other four programs all target populations of youth who have already dropped out of school, and New Chance more narrowly targets young mothers. Hence, Talent Search is not directly comparable with the other four interventions in two important respects. First, it is not directed at the same student population. Second, Talent Search is incremental, i.e., it is an add-on program beyond the services students receive from their high school, in contrast to the other stand-alone programs.

The programs also differ with respect to cost data. As explained previously, ideally costs for each of the programs would have been collected at the time of the effectiveness evaluations using the ingredients method (Levin & McEwan, 2001) and then combined with the effectiveness data to provide cost-effectiveness ratios. For four of the programs, JOBSTART, New Chance, Job Corps and NGYC, cost data were collected either during or after the impact evaluations. Although the availability of cost data is in itself laudable (and not typical), none of these four cost studies used the full ingredients method. Below we discuss how the methods used differ from our recommended method. In the case of Talent Search, no pre-existing cost analysis was identified, and so we undertook a full ingredients method approach to collect these data ourselves.

All these differences greatly restrict our ability to make comparisons across dropout prevention interventions. Overall, for the topic of dropout prevention, two of our key assumptions for cost-effectiveness analysis have not been validated. These key assumptions were that we would find "families" of interventions addressing the same outcome and that the evaluations were done recently enough that we could get information through archives and interviews to identify ingredients. In practice, we have not found interventions that show effects where we can make "apples-to-apples" comparisons, or studies of these interventions that allow determination of the ingredients with a reasonable degree of accuracy. It is worth emphasizing that, in conducting a cost-effectiveness analysis, often the problems arise in finding studies with comparable measures of effectiveness or detailed enough implementation data to identify ingredients. The many variations we identified among the five programs, their cost studies and effectiveness evaluations precludes the presentation of an array of fully comparable cost-effectiveness ratios.

Our analysis is therefore shaped by these methodological and practical considerations in two main ways. First, we have conducted a detailed site-by-site cost-effectiveness analysis of the Talent Search program, collecting ingredients data by interviewing directors of extant sites. This allows us to present cross-site cost-effectiveness ratios that may reflect implementation differences at these sites or differences in populations being served such that some are more likely to benefit from the program services than others. Given Talent Search is a large-scale program with a long history, this cost analysis, which is the first to our knowledge, should be of interest in its own right. But our intent is to link costs with well-identified evidence on effectiveness. However, the impact evaluation of Talent Search reflects results of the program from 1995-2002. The collection of cost data in 2012 therefore presents significant challenges in providing an accurate costing of the implementations that produced the published effectiveness results. Site directors interviewed for this study, some of whom have worked with Talent Search for many years, indicate that the program has not changed significantly since the time of the evaluation. Our ingredients data may therefore reasonably reflect resource use at the time of the impact evaluations although subtle changes may have occurred which we are not able to capture given the time lapse. For example, while the same number of personnel may staff the program, the level of competence may have increased or decreased over time as veterans gain knowledge of the program or as less experienced people replace personnel who move or retire.

Second, we present cost-effectiveness analyses for six other programs for comparative purposes. Four of these are listed by WWC as having positive or potentially positive effects on completing school– JOB-START, New Chance, Job Corps and NGYC – and cost data were extracted from existing reports. Two other programs are well-known preschool interventions - High/Scope Perry Preschool and Chicago Child-Parent Center - that have also been previously analyzed for costs and effects. The first four are broadly comparable amongst themselves, although quite different from Talent Search, while the latter two, well-known and much studied interventions, provide benchmark cost-effectiveness ratio comparisons. The goal of this presentation is not so much to derive precise cost-effectiveness ratios for each intervention in order to rank them by efficiency, as to illustrate the many practical challenges of performing cost-effectiveness analysis within a decision-making framework.

For these cost-effectiveness analyses all money values are reported in 2010 dollars and are rounded to the nearest $10. For a price index we use the average across the CPI-U and CPI-W.[4] The costs of the interventions are not discounted with the exception of our analysis of preschool programs. Most of the interventions are less than one year or individuals participate for less than one year. Also, we do not discount the effects: new high school completers are all valued the same however long it takes them to complete. Thus, programs are not rewarded for being expeditious at getting students to complete high school, other than if this means their costs are lower. Finally, we reported cost-effectiveness from the social perspective, i.e., accounting for all resources identified regardless of which agency provided the funds for them, and we do not cost out the value of participants' time in the program because participants are school age or have very limited income-earning opportunities.

4 Alternative indices for education prices, such as the Teacher Wage Index, the HEPI, and the HECA, yield very similar rates of inflation.

3. COST-EFFECTIVENESS ANALYSIS OF TALENT SEARCH

Talent Search Program

As a program to improve student progression through high school to college, Talent Search has a long history. In 1965, President Lyndon B. Johnson's War on Poverty included the Higher Education Act, which initially established three educational outreach programs called TRIO that targeted students from disadvantaged backgrounds (TRIO, 2012). Talent Search is one of the original TRIO programs, which have now expanded to encompass seven different interventions. Talent Search is a large-scale program. Federally funded and overseen by the U.S. Department of Education, total grant funding was $139 million in 2011 and across the U.S. Talent Search sites provided services to 320,000 students (Talent Search, 2012). Services are provided for students in 6th-12th grade with average or above average academic performance who are from low-income homes and who will be the first generation to attend college (LIFG students). The program can also serve students who need assistance, for instance those from non-English speaking homes, in foster care, or who have recently suffered the loss of a parent. Many agencies are eligible to provide Talent Search services, including universities, community organizations, and secondary schools. These agencies are typically awarded five-year grants. Each agency then selects middle schools and/or high schools to serve and targets students within those schools (or sometimes local communities).

Talent Search is not solely a dropout prevention program. Generally, the program encourages students to progress in school, provides students support to stay on track for college, and informs and assists students through the college application and financial aid process. In fact, the main goal of the program is to increase the number of LIFG students who enroll in postsecondary institutions. Nevertheless, dropout prevention is an antecedent goal and so it is appropriate to evaluate Talent Search in terms of how it enhances high school completion.

The design and implementation of Talent Search varies across sites. Within the umbrella of Talent Search, sites may provide a range of services. These include: counseling; informing students of career options; financial awareness training; taking students on cultural trips and college tours; assisting students and families with the Free Application for Federal Student Aid (FAFSA); preparation or tutoring for college entrance exams; and assistance in selecting, applying to, and enrolling in college. Sites may deliver these services in different ways. Most Talent Search personnel serve students at school sites by providing services to students during an elective course or during lunch, while some sites only provide services at the Talent Search site office or through weekend workshops. The age, grades, and levels of need served by the program can also vary across sites. While all sites target high school students, some locales focus more on middle school students than others and some may start providing services in earlier grades than others. The size of the program can also vary in the number of students served or the number of schools targeted.

Despite its long history, large scale, and variation in implementation, we are not aware of any cost-effectiveness analysis of Talent Search. Although Talent Search has been evaluated for its effectiveness, these evaluations have not been linked thoroughly enough to the resources used to implement the program to conduct a rigorous analysis of the costs of the program. Here, we perform a cost analysis of Talent Search using the ingredients method. This allows us to calculate the total resource requirements for the program, both those funded by the U.S. Department of Education and those obtained from other sources. We then link this cost information with extant evidence of effectiveness to calculate cost-effectiveness ratios. Given our methodological discussion above, this analysis should be performed at a site-specific level. However, we are still constrained by the fact that the evaluations were performed much before our costs analysis. As a result we match cost data collected in 2012 with effectiveness data from the late 1990s that was published in 2006. As we explained in Section 2 above, ideally cost data would be collected simultaneously with effectiveness data.

The Effectiveness of Talent Search

To identify the effectiveness of Talent Search at raising high school completion we rely on the evaluation by Constantine *et al.*(2006). The report evaluated Talent Search in Texas, Florida, and Indiana. The evaluations in Texas and Florida were reviewed by the WWC under the dropout prevention topic area and satisfied its methodological standards with reservations (WWC Intervention Report, 2006).[5] Constantine *et al.* (2006) used a propensity score matching method to estimate the impact of Talent Search on high school completion, applying for financial aid, enrolling in postsecondary education, and enrollment in a 2-year versus a 4-year institution.[6] The comparison group was composed of students in the same high schools as the Talent Search participants, who had similar rates of progression immediately prior to participation, and matched using a weighted replacement model. The evaluation found that Talent Search participants outperformed the comparison group across all outcomes.

For high school completion, the evaluation was based on data from 15 Talent Search sites across Texas and Florida. The sites included in the study were those that were operating in 1999 that provided project records to Constantine *et al*. The majority of the sites that were operating in both states at that time were included in the study. The study relied on existing longitudinal data for the cohort of students who were in the 9th grade in 1995. Across the sites in Texas, 86% of the Talent Search participants completed high school compared to 77% in the comparison group, a 9 percentage point difference. In Florida, the Talent Search participants had a completion rate of 84% compared to a rate of 70% among the comparison group, a difference of 14 percentage points. In both states, this overall effect masked considerable heterogeneity in effectiveness across sites and across cohorts within sites. For Texas, site- and cohort-specific gains in effectiveness ranged from a -9.2 percentage point difference to a +18.9 percentage point difference. For Florida, site-and cohort-specific gains in effectiveness ranged from a -5.9 percentage point difference to a +27.3 percentage point difference.

We interviewed 5 of the 15 originally evaluated sites to obtain information on program implementation and ingredients. In their evaluation, Constantine *et al*. (2006) do not identify the sites by name. However, in private communications we have been able to link the site identifiers directly to the costs information. We are therefore able to link effectiveness to costs at the site level.[7]

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5 The WWC also reviewed four other evaluations of Talent Search. None of the evaluations met their standards either because high school completion was not included as an outcome or because the method of evaluation did not meet their criteria.

6 Again, we emphasize that Talent Search is not only directed at raising high school completion rates. For accountability purposes with the U.S. Department of Education, each Talent Search site must set performance objectives. These objectives were revised in the last two grant cycles to make it easier to monitor sites and to obtain an overall picture of the program's performance. The current objectives being measured at each site are: number of participants served; secondary school persistence; secondary school graduation with a regular diploma; secondary school graduation from a rigorous or advanced program of study; postsecondary enrollment of graduated high school seniors; and postsecondary completion of graduated high school seniors (Higher Education Act, 2008).

7 We are very grateful for the assistance we received from the Department of Education's Talent Search TRIO office, the Institute of Education Sciences, and Mathematica Policy Research.

Effectiveness across the five sites is shown in Table 3.1. The high school completion rates of the treatment groups are high, from 63% up to 97%, compared to those of the comparison groups, which range between 61% and 81%. The 2006 evaluation listed multiple high school completion rates from some sites in an attempt to determine if the outcome varied by the length of time students participated in the program or the time at which a student joined the program. Because the cohorts are defined differently for different sites, we used an average of the high school completion rates for the treatment and comparison groups. For these five sites, on average Talent Search was found to increase the rate of high school completion by 2 to 27 percentage points. The sites included in our analyses were representative of the 15 evaluated sites.[8]

Table 3.1
Effectiveness of Talent Search

	Treatment Group	Comparison Group	Percentage Point Difference
Site One	90.4%	81.4%	9.1
Site Two	88.3%	80.6%	7.7
Site Three	63.4%	61.3%	2.1
Site Four	96.7%	69.4%	27.3
Site Five	85.0%	72.7%	12.4

Source: Constantine *et al.* (2006) Table III.6 and Table V.6. An average is listed where multiple cohorts were reported.

The Costs of Talent Search

Talent Search programs are allocated approximately $400 per student from the U.S. Department of Education (Talent Search, 2011). As discussed in Section 2, however, budgetary information is likely to be a poor proxy for actual resource use. In the case of Talent Search, a significant component of the intervention takes place at school sites, with input and effort from school personnel, as well as use of some school facilities. Where Talent Search sites are located on college campuses, they may use facilities that they are not required to pay for directly. Some sites also rely on in-kind resources from their local communities. Broadly, we anticipated that the budgetary allocations are lower than the actual program cost.

We conducted cost analyses on a subset of the 15 Talent Search sites in Texas and Florida for which high school completion data were available. Of the 15 sites contacted for our cost analysis, one site refused to participate (on the grounds that Talent Search is not a “dropout prevention” program) and two sites no longer provide Talent Search programming. We were unable to recruit two sites because of little or no contact with the program directors. At the time of this report, six sites were interviewed and four more had agreed to participate. This report relies on data from five sites that we were able to cost out fully to illustrate the range of costs per site.[9] Results from the additional sites will be included in future reports.

We contacted each site directly and conducted telephone interviews with key personnel. These interviews were based on a semi-structured interview protocol, which is provided in Appendix 2. Our interview protocol

8 The state-level averages of the percentage point differences between the treatment and comparison groups for the sites included in our analyses were similar to the state-level averages reported in the 2006 evaluation as noted above.
9 All 5 sites included in our analyses were located at post-secondary institutions.

focused on the program's ingredients in the categories of personnel, facilities, materials, and transportation.[10] We asked site personnel to distinguish between resources they had to pay for directly and those either funded from alternative sources or provided in-kind. We were unable to make site visits, so we also asked about the schools and students targeted, services provided, and the scale of the program to get a better picture of each site's characteristics. Because the impact evaluation was based on data from the late 1990s, we also asked about the evolution of the program as it has been implemented at each site. The interviews lasted between 1.5 and 2.5 hours. We followed up with each interviewee by email or phone as needed. For information on the scale of operation we also reviewed grant applications and performance reports for each site.

Having compiled a detailed list of ingredients, we derived the price of each of these ingredients from a national price database that we built specifically for this project. This price database includes prices for over 200 possible ingredients that may be used in educational interventions. It is described in more detail in Appendix 1. The specific prices of the ingredients used for Talent Search are reported in Appendix 3.

Our cost estimates are not strictly incremental because we do not know what resources were available for the comparison group. Other TRIO programs, such as Upward Bound or Gear Up, often also served schools targeted by Talent Search programs. Potentially, members of the comparison group used in the 2006 evaluation may have been enrolled in alternative TRIO programs, but we do not have the costs of those programs. We have not calculated the costs of the schooling that study participants received. It is likely that Talent Search works as a complement to the school services that students receive to help them complete high school, at least for the vast majority of students who participate in the program.[11] If a large portion of the students being served were not enrolled in school, the effectiveness of Talent Search would likely be diminished. The school resource use should therefore also be counted if a decision-maker is comparing a supplementary program such as Talent Search against a residential boot camp such as NGYC.

The total annual costs across the five Talent Search sites in our sample are given in Table 3.2. Costs are presented in 2010 dollars, the most recent year for which national prices are currently available for all relevant ingredients. As anticipated, the majority of the expenditure was on the Talent Search staff. Each site had a director, with broadly similar responsibilities, experience and qualifications. Each site employed Talent Search counselors or advisors, but varied in their staffing levels and the mix of counselors and other personnel. Each site relied on the commitment of school staff: not only principals and teachers but sites also reported that school guidance counselors and other school-site staff were key in recruitment, monitoring student progress in school, and in providing a liaison between the school and program. At one site (Site Four), the program utilized a significant in-kind contribution of personnel to provide workshops on specific topics, such as financial literacy, to students. In terms of facilities, the Talent Search sites were charged overhead by the host college, but they also drew on the general resources of their host college to provide services. Three sites were able to rely more heavily on facilities at the school site than others for meetings with students. For materials and equipment, the sites varied in terms of their reliance on Talent Search office resources versus those available at the schools or across the college campuses. Finally, we note two key costs of Talent Search that may often go unrecognized: the cost of transportation for students; and the other in-kind inputs such as ACT or SAT test fee waivers, college scholarships or courses for Talent Search students, food, gift certificates, or admissions to cultural events.

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10 We collected ingredients data based on the program in 2010. This was the most recent year of the last grant cycle. We selected this year to avoid programmatic changes that may have occurred in the new grant cycle due to new regulations.

11 Some Talent Search sites do occasionally accept students who are seeking help to attain a GED and who are not enrolled in the traditional school system.

Ingredients List	Site One	Site Two	Site Three	Site Four	Site Five
Personnel					
TS Staff: Directors	$73,890	$79,520	$79,520	$79,520	$79,520
TS Staff: Counselors (Level A)	$191,190	$108,850	$0	$74,700	$126,330
TS Staff: Counselors (Level B)	$0	$0	$195,210	$132,770	$66,380
TS Staff: Other	$25,970	$46,000	$70,610	$45,860	$107,540
TS Work Study	$0	$5,220	$6,960	$3,480	$7,540
TS Staff: Professional Development	$430	$3,220	$2,370	$3,970	$4,310
School Staff: Principals/Teachers	$1,730	$3,400	$7,230	$770	$5,370
School Staff: Guidance Counselors	$8,360	$9,430	$4,560	$12,780	$680
School Staff: Other	$3,180	$8,180	$1,930	$3,340	$740
In-kind Personnel	$230	$390	$1,230	$4,840	$630
Facilities					
Host College	$20,100	$17,360	$9,850	$12,340	$16,080
School Sites	$510	$10	$6,790	$1,980	$9,290
Overhead charged to TS	$23,380	$24,540	$19,710	$24,510	$25,490
Materials/Equipment					
TS Site	$8,800	$2,180	$11,890	$14,900	$12,380
Contributed	$3,440	$3,090	$740	$2,300	$3,520
Other Inputs					
Transportation	$14,960	$18,720	$18,280	$23,150	$14,960
Other TS Inputs	$1,270	$1,080	$7,140	$5,250	$3,610
Other In-kind Inputs	$3,450	$62,180	$12,700	$14,370	$21,710
Total Annual Cost	$380,880	$393,360	$456,700	$460,820	$506,060
Students Served	615	751	1100	705	759
Annual Cost per Student	$620	$520	$420	$650	$670

Table 3.2
Total Annual Costs of Talent Search (TS): Per Site

Note: Prices are in 2010 U.S. dollars and rounded to the nearest $10.

The results indicate significant variation across sites in how they allocate resources and how much they spend per student. Implementation variation has been studied extensively in education settings, especially for well-defined "boxed" programs. It has been noted that the context of reform often shapes the programs as much as, if not more than, a program changes schools (McLaughlin, 1990). A cost analysis of a well-defined or "boxed" program, Read 180, by Levin *et al.* (2007) found substantial variation in the costs of implementation. The cost per student at each of three Read 180 sites ranged widely from $285 to $1,514 compared to the $1,103 that the developer reported. Due to differences in implementation of the program, or site-level adaptations of the program, Levin *et al*. found that simply presenting an average cost for the program masked considerable variation. For Talent Search we similarly see significant variation in how resources are allocated.

The final rows of Table 3.2 show the total annual cost of the Talent Search program at each site. These annual costs vary from $380,880 to $506,060. When we account for the numbers of students served, the annual cost per student ranges between $420 and $670 per year; the most expensive site therefore spent 60% more than the least expensive (adjusted for local prices). In order to compare this cost data to the effectiveness data, it is important to note that these per-student annual costs do not account for the fact that each student typically participates in the Talent Search program for more than one year.

The per-student cost estimates we present are considerably above the average per-student federal funding of approximately $400: they account for the fact that sites draw on the resources of their host colleges and local schools and that these resources are not 'free'. There are two important reasons for this discrepancy. One is that we are using national prices. Our goal is to help decision-makers, not to inform specific sites of the costs of their programs. Second, we are counting all resources used. When we separate out resources provided outside of direct funding of the Talent Search sites, our cost estimates are closer to the funding amounts received from the Department of Education.

As shown in Table 3.3, each site utilizes significant amounts of resources from sources other than the Talent Search budget. At four sites, 11-13% of the total resource for Talent Search is from other sources, either the host college, the target schools, or in-kind resources. At one site (Site Two), over one-quarter of all resource allocation is from outside sources. The bottom row of Table 3.3 shows the estimated amount spent per student by each Talent Search site. As stated previously, our estimates are close to the original funding formulae, with differences largely due to our use of national wage prices and our inclusion of all ingredients used to implement the program.

Table 3.3
Total Annual Costs to Talent Search and Other Agencies

	Site One	Site Two	Site Three	Site Four	Site Five
Total Costs to Talent Search	$339,890 89%	$289,320 74%	$404,720 89%	$404,640 88%	$440,510 87%
Total Costs to Other Agencies	$40,990 11%	$104,040 26%	$51,980 11%	$54,390 12%	$63,270 13%
Per-student Cost to Talent Search	$550	$390	$370	$570	$580

Note: Prices are in 2010 U.S. dollars and rounded to the nearest $10.

Cost-Effectiveness of Talent Search

In order to perform cost-effectiveness analysis we need to be able to directly link the effectiveness and cost evidence. In the analysis we present, both pieces of evidence are from the same sites. However, the effectiveness evidence is from the 1990s and the costs data are for 2010, the last year of the previous grant cycle. This limitation is beyond our control. We attempted to mitigate this limitation by reviewing the implementation report (Cahalan, Silva, Humphrey, Thomas, & Cunningham, 2004) that accompanied the effectiveness evaluation. This report gave us some indications of ingredients used to implement Talent Search but were not detailed enough to provide site-level ingredients at the time of the effectiveness study. Therefore, we relied on our interviews with site directors and key personnel to identify the ingredients being used in 2010 to implement the program and explicitly asked how the program has changed over time.[12]

Most sites reported that the program has not changed considerably over time. In the last one or two grant cycles, some programs have cut back services due to funding constraints. Some sites cut back by no longer staying overnight during college visits, by reducing conference attendance, or by no longer serving middle schools. One site changed the focus of its summer program to aid the local school district's efforts to raise math and science performance. Many sites reported that the relationship they had with the schools was key. Over time, some sites were able to build a relationship with schools and then to focus their services on those schools that were most receptive to the program. One site mentioned that the longevity of the program served to improve the perception of the community and of the schools served by Talent Search, giving the program more recognition as it persisted. Another site indicated that having long-term staff helped them to build a strong relationship with the schools. While these changes are not substantial, they could impact the effectiveness of Talent Search across the various sites as it is implemented today such that our cost estimates may not reflect the exact resources required to obtain the effectiveness results reported.

In Table 3.4 we report the cost-effectiveness of Talent Search across the five sites we interviewed. For this analysis, we calculated a total cost per youth accounting for the average number of years students spend in the program at each site, as reported in the interviews. We included a question in our interviews about the average length of participation but it was not easily answerable. All sites reported that once students join the program, they are likely to continue through their senior year of high school. Some sites provide services starting in the 6^{th} grade while others begin in the 8^{th} grade. However, some students only begin participating in the program in high school, creating heterogeneity in the length of time a student participates in the program and the grade in which a student joins the program. While many students remain in the program once they join, some students, especially among this low-income population, are highly mobile and may exit the program. Most sites try to continue to provide services to their students even if they move to a different school, so long as the school is still within the same district or county. In a few cases, students choose to leave the program or lose eligibility to receive services due to low performance in school. Therefore, we were limited in our ability to precisely estimate the average length of treatment and had to rely on the reported average. Ideally we would collect actual years of participation for each student at a site at the time of the effectiveness evaluation in order to match costs of participation to impact observed. In the 2006 evaluation of Talent Search, the authors mention the complexity of estimating treatment dosage and the time participation began, but ultimately they were unable to provide a consistent definition for their analyses. Thus, our analyses rely on averages and may not accurately reflect the potential variation in costs and effectiveness due to variation in length of participation and the time at which a student joined the program.

We also asked each site about the differentiation of services for different grades to see if the cost per student varies based on the grade level of participation. Most sites reported that the services are similar across grade levels, but the language they use during the workshops differs based on the age and interests of the students. Some sites may see high school students more often than middle school students, but then make up for this difference by offering more cultural trips or a summer camp for middle school students. Because our estimate includes all costs for one year of the program, regardless of grade, the average cost

12 The individuals we interviewed had between 6-24 years of experience working with Talent Search. Some of those individuals were Talent Search students themselves when they were in school. While this increases our confidence in the accuracy of the interviews, the data are still limited because they rely solely on an individual's recollection.

per student per year captured variation that occurred across years. Once averaged across the number of years students participated, the total amount per student is likely very similar to the average cost per student based on the costs per grade per year. It would have been preferable to obtain more precise estimates of grade level variations in services provided in order to determine how this might affect costs.

We multiplied each site's annual cost per student from Table 3.2 by the number of reported years of participation to get a total program cost per participant. We then used a continuous discount rate of 3% to express the total cost per student as a present value at age 18.[13] We multiplied this cost by the number of students served by each site in 2010, as listed in Table 3.4, to arrive at the total cost per site. We calculated the number of high school completers produced in the treatment group above and beyond what would be expected in the comparison group by applying the percentage point difference in effectiveness between the treatment and comparison groups at each site (as shown in Table 3.1) to the number of students served in 2010. This number represents the number of students that were estimated to have graduated or completed school as a result of the program beyond those that would have likely graduated anyway. We then divided the total cost of the program at each site by the number of extra completers at that site to obtain the cost per extra high school completer.

Table 3.4 shows the cost-effectiveness ratios for each of the five sites and for a pooled estimate of the costs across all five sites. The pooled estimate shows that it costs $3,400 to provide the average student with Talent Search services over the middle and high school years. Across the five sites, Table 3.1 showed significant variation in effectiveness; Table 3.4 shows significant variation in costs of Talent Search per youth. At one site (Site One), spending on each student over his or her middle and high school years is $4,900. By comparison, three other sites (Sites Two, Three, and Four) spend less than $3,000 per student.

Table 3.4
Cost-Effectiveness of Talent Search

	Cost per Youth (Present Value)	Number of Students	Total Cost ($ millions)	Yield: Extra HS Completers	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Site One	$4,900	615	$3.012	56	$53,810	1.86
Site Two	$2,870	751	$2.154	58	$37,250	2.68
Site Three	$2,770	1100	$3.048	23	$131,930	0.76
Site Four	$2,820	705	$1.988	192	$10,330	9.68
Site Five	$3,650	759	$2.771	94	$29,560	3.38
Pooled Estimate	$3,400	3,930	$12.972	423	$30,660	3.26

Note: Discount rate of 3%. Pooled estimates weighted for number of students per site.

13 We also estimated the present value of the cost per youth using a discount rate of 5%. Our results were not sensitive to the selected rate.

The cost-effectiveness ratios and yields are reported in the last two columns of Table 3.4. The pooled estimate across the five sites yields a cost-effectiveness ratio of $30,660 per extra high school completer, and a yield of 3.26, i.e. for every $100,000 spent, Talent Search would yield 3 extra high school completers. Again, these cost-effectiveness metrics vary across the sites: the most cost-effective site (Site Four) was both low cost and very effective. Its cost-effectiveness ratio is $10,330 per extra high school completer. The least cost-effective site was also low cost, but it was not very effective: its cost-effectiveness ratio is $131,930 per extra high school completer.

In light of this variation in effectiveness and costs, we perform a series of sensitivity tests. These tests are reported in Table 3.5. First, we provide the upper and lower bound of the pooled cost-effectiveness ratio. We also computed the ratio using effectiveness from only those sites that reported a statistically significant difference in completion rates with costs from all five sites and separately with costs from only those sites with statistically significant results. Statistical significance was reported in the 2006 evaluation. Due to lack of sample sizes at each site, we are unable to estimate the statistical significance of the averaged percentage point differences for those sites that were listed with multiple high school completion rates. In the instance of one site (the least cost-effective, Site Three), two rates were listed: one was positive and statistically significant and one was negative and not statistically significant. We assume that the average of those rates (2%) is not a statistically significant difference.

Table 3.5
Sensitivity Analysis of Cost-Effectiveness of Talent Search

	Total Cost ($ millions)	Yield: Extra HS Completers	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Pooled estimate	$12.972	423	$30,660	3.26
Upper bound (most cost-effective site)	$1.988	192	$10,330	9.68
Lower bound (least cost-effective site)	$3.048	23	$131,930	0.76
Effectiveness only sig. sites*; costs of all	$12.972	400	$32,430	3.08
Effectiveness and costs of only sig. sites*	$9.925	400	$24,810	4.03

*Sig. sites are those that show statistically significant differences between treatment and control for high school completion.

These calculations were closer to the pooled estimate than the upper and lower bounds. While including all costs and only the effectiveness from sites that had statistically significant results slightly increased the cost per extra high school completer, the estimate that included only the cost and effects from those sites that were reported to have statistically significant impacts improved the yield per $100,000 by 1 additional high school completer. This provides the most optimal scenario. If the site level data were more precise, we could potentially examine the effects of variation in the years of service, the number of students served, and the dosage or amount of treatment received by students either on average or as cohorts. With additional sites, we could also include a Monte Carlo sensitivity analysis.

Conclusions about Talent Search

Talent Search program sites provide a range of services to many students across the country. The program is described as "low impact" or "low touch" because the program does not require extensive training or oversight and the amount of time spent with students can vary from site to site. Applying the ingredients method allowed in-depth exploration of heterogeneous implementations of Talent Search by allowing systematic quantification of how each site implemented the program. While our results show that Talent Search varies at the site level in costs and effectiveness, on average, the program produces additional graduates at low cost relative to other dropout prevention programs we review in this report. Even if underlying costs of schooling were added to our estimates, this finding would more than likely hold true. Future work will provide analyses of additional sites to further elucidate the extent of variability in ingredient usage and in the range of cost-effectiveness ratios for the program.

4. COST-EFFECTIVENESS ANALYSIS OF OTHER INTERVENTIONS THAT INCREASE HIGH SCHOOL COMPLETION

We now turn to the four other interventions with proven or promising effects on the completing school measure of dropout prevention: JOBSTART, New Chance, Job Corps and National Guard Youth ChalleNGe (NGYC). In each case cost data have already been collected, either to provide straightforward cost analyses or to combine with economic outcomes to present cost-benefit analyses. It is therefore possible to perform illustrative cost-effectiveness analysis on these four interventions by using the cost data and combining with the effectiveness data from the impact evaluations.

We emphasize that for two important reasons these analyses are presented for the purposes of demonstrating the methods of cost-effectiveness analysis, not for a strict cost-effectiveness comparison across the four programs. First, each of these four interventions is intended to influence multiple outcomes over a span of years. Therefore, there are very strong grounds for evaluating these interventions using cost-benefit analysis rather than cost-effectiveness analysis, as has been done previously for NGYC and Job Corps (Perez-Arce, Constant, Loughran, & Karoly, 2012; McConnell & Glazerman, 2001). Our cost-effectiveness analysis is not intended to substitute for cost-benefit analysis but to inform decision-makers whose primary goal is to increase high school completion.

Second, even as the existing studies are exemplary, using experimental designs for impact evaluation and with cost data that were often collected concurrently with the evaluation, there is much uncertainty surrounding the reliability and comparability of the cost analyses. For reasons explained in Levin and McEwan (2001), we believe that a true cost accounting approach must be based upon our ingredients approach. The costs data for these four interventions are not obtained using the ingredients method, but are collected using a variety of methods that are neither fully transparent nor consistent. The reader may be tempted to use the cost-effectiveness comparisons based upon these data as criteria for judging the efficiency of the alternative interventions. We wish to emphasize that we have tried to utilize the available information to demonstrate how cost and effectiveness information might be used to compare efficiency of alternative interventions, but the reader should understand that the purpose is illustrative rather than definitive.

The cost studies provided in conjunction with this series of studies suffer from a number of uncertainties and weaknesses. None of them document the precise method used to measure costs or provide assurance of inclusion of all of the ingredients. Most rely heavily on budgetary information, which has its own significant flaws and omissions. Further, the costs of the multi-site comparisons are based upon local costs which may vary significantly from place to place and are not based upon a common pricing or costing comparison. While we have made some adjustments to increase comparability of the cost estimates, inconsistencies remain where we are not able to disaggregate the data provided.

These illustrations show how cost-effectiveness analysis can be performed, as well as highlighting some important methodological issues. While a number of the cost analyses presented costs and effects for the ITT population, we have used participation rates in these programs to present TOT estimates for all programs as we feel that this presents a more accurate picture of the average costs per participant and increases comparability of the estimates.

National Guard Youth ChalleNGe

The National Guard Youth ChalleNGe Program (NGYC) is an extant non-school-based residential program targeting 16- to 18-year old youths who have dropped out or been expelled from school. The program currently serves 9,000 youth at sites across 27 states. Participants take part in a 22-week residential program, following discipline routines similar to the military while living in barracks. They take courses in GED preparation, leadership development, job skills, and community service. Participants receive ongoing mentoring from trained mentors of their own choosing for one year after the program (WWC Intervention Report: National Guard Youth ChalleNGe Program, 2010). As well as successfully helping participants to obtain a high school credential, NGYC is also intended to enhance participants' employment opportunities, earnings, health, and lifestyle and to reduce their involvement in delinquency and crime.

Costs of NGYC

We apply cost data reported by Perez-Arce *et al.* (2012). These costs data were estimated using budgeted expenditures from ten NGYC sites. Subsequent interviews with site directors allowed clarification and additional information on items such as facilities, volunteer time, funds received from other national or state programs and administration costs at the National Guard Bureau. Perez-Arce *et al.* (2012, pp.15-20) estimate average site-level operating costs at $10,854 per admittee and add the average administration cost at the National Guard Bureau of $779 per admittee to obtain a total average operating cost of $11,633 per admittee.[14] We transformed this ITT estimate into a TOT estimate of $14,100 per participant based on the program registration rate of 82.5%[15].

These costs data deviate in some ways from the ideal, i.e., the use of the ingredients method. Cost data collected reflected local prices rather than national prices; this makes it difficult to establish a fair comparison with other interventions. No cost data for the control group were collected, so it is implicitly assumed that no resources were allocated to this group to help them complete high school. This may be unrealistic because it is likely that similar, if piece-meal, services are available in the community. Also, we note that for the purposes of their cost-benefit analysis, Perez-Arce *et al.* (2012) reported average cost based on an equal weighting of the average cost per site, consistent with the methods of the impact evaluation by Millenky *et al.* (2011). This effectively treats all sites as operating at the same scale unlike the cost analyses of other programs reviewed in this report, which report costs reflecting the actual size of each site. Finally, the cost data were not collected concurrently with program implementation, but several years later. As we have found through similar efforts with other interventions, this presents challenges in terms of achieving accuracy in interviews from retrospective accounts of what resources were used.

Without seeing a detailed protocol used for the interviews, or an ingredients list, it is not possible to determine whether all relevant resources were accounted for or whether the entire period of program operation was considered, as opposed to the time participants spent in the program. For example, each site offers two 22-week cycles per year for a total of 44 weeks of programming but some costs are likely to be incurred for the entire year, such as the salary of a full time director, some personnel and facilities costs. It is not clear whether all these costs were accounted for in the estimates provided.

14 Perez-Arce *et al.* (2012) also report other costs of the NGYC program. Per admittee, these are: costs of student time spent on applications to the program ($110), lost earnings for the cadets during the residence period ($2,970), and lost earnings of both mentors and mentees in the post-residential phase ($292). Negative opportunity costs of $1,314 for meals and allowances supplied to participants are applied and 15% deadweight loss of taxation is added ($1,745 per admittee). We exclude these amounts in order to increase comparability with the costing practices used for other interventions reviewed in this report.

15 This registration rate is presented for the entire treatment sample (n=2,320) in Millenky, Bloom, Muller-Ravett, & Broadus, 2011 (p.13). We assume that the 21-month and 36-month survey samples are representative of the entire treatment sample and apply this rate to both of the follow-up samples. Registration is defined by Millenky *et al.* (2011) as "begin[ning] the Pre-ChalleNGe program, a physically and psychologically demanding assessment and orientation period."

Effectiveness data for NGYC

The NGYC program was evaluated by MDRC using a random assignment design (Millenky, Bloom, & Dillon, 2010; Millenky *et al.*, 2011). With more qualified applicants to NGYC than places available, a lottery-type process was utilized to admit applicants in 2005-06 either to a program group or a control group. The actual evaluation included 3,074 youth across ten NGYC sites. Of the total, 2,320 were in the treatment group and 754 were in the control group. Educational attainment data was obtained from surveys at 21-months and 36-months post assignment. The TOT estimates of differences in high school completion are given in Table 4.1. After 21 months, youth who participated in the program were 29.2 percentage points more likely than the control group to have earned a GED or high school diploma. By the end of 36 months, the gap had narrowed to a 19.8 percentage point advantage for program participants. Both gaps are statistically significant ($p<0.01$).[16]

Table 4.1
NGYC: High School Completion Rates

	Treatment Group	Control Group	Difference
Earned high school diploma or GED at 21-month follow-up	73.3%	44.1%	29.2%
Observations	*607*	*380*	
Earned high school diploma or GED at 36-month follow-up	87.0%	67.3%	19.8%
Observations	*596*	*372*	

Sources: Original data are from Millenky *et al*., 2010, Table 5, p.18 for 21-month results; Millenky *et al*., 2011, Table 4, p.16 for 36-month results; Millenky *et al*., 2011, Table 3, p.13 for participation rate. We divided the ITT sample size and high school completion rates by the participation rate to obtain the TOT estimates reported in this table.

Cost-effectiveness analysis of NGYC

Our estimates of the cost-effectiveness of NGYC are given in Table 4.2. We begin with the 21-month results. Across the 607 NGYC participants, 445 or 73.3% were high school completers. If these individuals had not participated in NGYC, only 268 or 44.1% would have been high school completers. Thus, NGYC yields 177 extra high school completers, above and beyond the number that would be expected without the program. The total costs for these 607 participants were $8.56 million. Therefore, the cost-effectiveness ratio for NGYC is $48,270 per extra high school completer. Per $100,000 spent on NGYC, the yield of extra high school completers is 2.1.

Subsequent rows of Table 4.2 apply the same calculation but based on different assumptions. Using the 36-month survey data, there is a total yield of 117 extra high school completers at a total cost of $8.40 million. The cost-effectiveness ratio is therefore $71,370 per extra high school completer and the yield per $100,000 expenditure is 1.4. The lower yield of extra high school completers at 36 months after assignment

16 The WWC review was based on the results at 21 months.

Table 4.2 NGYC: Cost-Effectiveness Analysis						
	Cost per Participant	Number of Participants	Total Cost ($ millions)	Yield: Extra HS Completers	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Data from 21-month follow-up	$14,100	607	$8.562	177	$48,270	2.07
Data from 36-month follow-up	$14,100	596	$8.400	117	$71,370	1.40

Sources: Original data for cost per admittee are from Perez-Arce *et al.*, (2012, pp.15-20). We divided the ITT estimates of average cost by the participation rate to produce TOT estimates (i.e., cost per participant), reported in this table. *Notes:* All values in 2010 dollars. Yield of extra high school (HS) completers is the number of participants multiplied by the gap in high school completion rates between the treatment group and the control group.

most likely reflects the fact that, soon after the intensive part of the program was over, the rate of high school completion was more similar for the treatment and control groups.

Job Corps

Job Corps is an extant, non-school based, primarily residential program for 16-24 year olds. The program serves around 60,000 students across the United States, funded through Congressional appropriations of over $1.7 billion in Fiscal Year 2013.[17] Job Corps participants must have already left school and come from households that receive welfare or have income below the poverty level.[18] The program includes basic education, vocational training and job placement assistance, residential living and social skills training, health education and health care, as well as counseling and driver education. These services are tailored to the needs of each participant, with at least 80% of students receiving living accommodation. Education programs and vocational training at Job Corps centers operate on an open-entry, open-exit basis so that student learning is individualized and self-paced. Counselors and residential advisers at each center help students plan their education and vocational training and provide support services through recruitment, placement and transition to "regular life and jobs" (McConnell & Glazerman, 2001, p.5) after completing the program. Some Job Corps centers are eligible to issue their own high school diplomas. As for NGYC, Job Corps is intended to help participants in many ways besides increasing educational attainment.

Costs of Job Corps

We use the cost data from McConnell and Glazerman (2001). This cost analysis gathers data on resource use in 1996-1997, soon after the 1994-1996 period of implementation evaluated for effectiveness by Scho-

17 FY 2013 Congressional Budget Justification Employment and Training Administration, Job Corps. http://www.dol.gov/dol/budget/2013/PDF/CBJ-2013-V1-05.pdf

18 http://www.jobcorps.gov/home.aspx; WWC Intervention Report: Job Corps (2008) U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, What Works Clearinghouse.

chet, Burghardt, and Glazerman (2001). The authors estimate three types of costs: reported operating costs; unreported operating costs including the costs of operating regional and national offices as well as the value of in-kind contributions, donations, and volunteer time; and capital costs. These estimates start with budgeted expenditures, which are then supplemented with an analysis of the costs of national and regional offices performed by an independent auditor, as well as paper and in-person surveys of a stratified random sample of 23 Job Corps centers, inquiring about grants and in-kind or donated goods and services. Operating costs were estimated for seven categories of costs incurred by the centers, and capital depreciation was measured using allocations for the rehabilitation and relocation of Job Corps centers.[19]

McConnell and Glazerman (2001) estimate costs to participants, to the rest of society (taxpayers), and the net costs to society in general (net of transfer payments). For the purposes of this analysis, we start with the cost estimated to taxpayers ($16,489), and adjust this cost to exclude cash transfers of $1,427 per participant to obtain a social perspective on cost-effectiveness: $15,062 per participant in 1995 dollars, or $22,290 in 2010 dollars. We do not exclude cost of food and clothing ($934), which are usually considered transfers, in order to allow comparability with other programs presented in this report as in some cases it was not possible to disaggregate these costs. Although the cost information provided by McConnell and Glazerman is detailed, we note that it was not collected using the ingredients method and as such we cannot adjust for variations in costs to reflect local prices.

Effectiveness Data for Job Corps

Effectiveness data on Job Corps is available from the impact evaluation part of the National Job Corps Study by Schochet *et al.* (2001), funded by the U.S. Department of Labor. All youths eligible for Job Corps throughout the U.S. between November 1994 and February 1996 were randomly assigned to either a treatment group, which could enroll in the program, or a control group, which could not enroll in Job Corps for three years but could take advantage of any other programs available in the youths' communities. Of 80,883 eligible applicants during the 16-month period, 5,977 were selected into the control group, 9,409 to the treatment group and the other 65,497 were randomly assigned into a program "non-research group", i.e., they could enroll in Job Corps but were not in the research sample.

Job Corps is effective at increasing the high school completion rate. Schochet *et al.* (2001) report both ITT and TOT estimates (just over one-quarter of those assigned to the treatment group did not enroll). So as to be consistent with the cost estimates, we apply the TOT results. As given in Table 4.3, Job Corps participants who did not already have a high school credential at program entry were 17 percentage points more likely than a control group to earn a GED or high school diploma within 48 months. However, this effect is driven by GED receipt; control group members were in fact slightly more likely than program participants to earn a high school diploma. This is not surprising as participation in the residential program would preclude regular school attendance.

19 The cost analysis estimated a cost per participant based on which center he or she attended, the participant's residential status, and the length of time spent in Job Corps, and then computed an average cost per participant for the sample, rather than aggregating an average cost for a given time period across all participants and then applying an average length of participation of 7.5 months; this allows for sub-group analysis, and avoids potential bias that could be introduced by correlation between cost and length of participation. However, it is not clear how fixed costs that are incurred regardless of enrollment numbers and length of participation are handled.

Table 4.3 Job Corps: High School Completion Rates	Treatment Group	Control Group	Difference
Earned high school diploma or GED at 48-month follow-up	51.4%	34.4%	17.0%
Observations	3,940	4,485	

Source: Schochet *et al.* (2001), Table V.7, p. 104. *Notes:* Sample only includes those who did not already have a high school diploma on entry to Job Corps, 80% of the total sample.

Cost-effectiveness Analysis of Job Corps

The cost-effectiveness of Job Corps is calculated in the same way as for NGYC above. The results are given in Table 4.4. Of the 3,940 participants in Job Corps, 2,025 or 51.4% completed high school. If these youth had not participated in Job Corps, only 1,355 or 34.4% would have completed high school. Therefore, at this scale of operation, Job Corps yields 670 extra high school completers.

Table 4.4
Job Corps: Cost-Effectiveness Analysis

	Cost per Youth	Number of Youth	Total Cost ($ millions)	Yield: Extra HS Completers	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Data from 48-month follow-up	$22,290	3,940	$87.838	670	$131,140	0.76

Sources: See Table 4.3; McConnell and Glazerman (2001), Table VI.4, p.125). *Notes:* All values in 2010 dollars. Yield of extra high school (HS) completers is the multiplication of number of admittees and the gap in high school completion rates between the treatment group and the control group.

At a cost per youth of $22,290, the total costs for 3,940 participants in the treatment group are $87.838 million. The cost-effectiveness ratio is therefore $131,140 per extra high school completer. This equates to 0.76 extra high school completers per $100,000 spent on the program.

JOBSTART

JOBSTART was a non-residential alternative to Job Corps. It was developed and evaluated by MDRC with funding from private and government sources, primarily through the Job Training Partnership Act of 1982. JOBSTART was a demonstration program operating from 1985-88 in 13 sites in ten states. The program targeted economically and socially disadvantaged 17-21 year old dropouts with less than 8th grade reading skills. JOBSTART services included: instruction in basic academic skills; vocational education; training-related support services; and job placement assistance.

Costs of JOBSTART

Costs data for JOBSTART are reported by Cave, Bos, Doolittle, and Toussaint (1993). Costs data were gathered from a variety of sources, including salary reports, site expenditure reports, interviews with staff, and participation data. Information was collected on both direct and indirect costs incurred by the JOBSTART program, but these costs were estimated for a one-year steady-state period, i.e. they excluded start-up and phase-out expenditures. Rather than tabulating each individual resource required for the intervention as in the ingredients method, the authors estimated a cost for each activity or "component," namely, recruitment, intake and orientation, basic education, occupational skills training, work-readiness classes, job placement, coordination and counseling, support services, and medical and dental services. A per-person cost was calculated for each activity and then applied to a relevant participation rate – either the average number of months in an activity for open-entry activities, or the percentage of the treatment group ever participating in an activity for fixed, closed-entry activities. The authors then report an average cost per 'experimental', i.e., those assigned to treatment, and per 'participant', i.e., those who actually received treatment. These average costs varied widely from site to site, due to differences in enrollment levels and scale, program design and implementation, and regional cost differences (Cave *et al.*, 1993).

For our analysis we use the site-by-site cost per participant (i.e. the TOT costs) from Cave *et al.*, 1993 (Table 7.3, p. 191). One adjustment we make is to add in medical and dental services for the sites that provided them. While these costs are often considered transfers, there is no data for the control group that allows us to determine whether or not these costs are equivalent to "business-as-usual" or are incremental. To be conservative we assume that they are incremental. Expressed in 2010 dollars, the weighted average cost we calculate per participant across all sites is $10,460.

We note that this cost figure may over-estimate the resources required for JOBSTART. Specifically, because the difference in number of hours of any services received between the treatment and control groups is approximately equal to the average number of hours of the JOBSTART program, Cave *et al.* (1993) assume that all costs associated with JOBSTART are incremental costs. They do not collect and subtract any costs that might be associated with services received by the control group and are therefore effectively reporting gross costs.

Effectiveness Data for JOBSTART

Cave *et al.* (1993) evaluated the effectiveness of JOBSTART using a random assignment design. Following a screening process for suitability for JOBSTART, 1,163 individuals were randomly assigned to the experimental group and were eligible to receive JOBSTART services, while 1,149 people were assigned to the control group and were free to seek services elsewhere. In addition to the overall evaluation of the program, we were able to obtain site level effectiveness data from one of the authors of the program evaluation (Personal communication, Johannes Bos, September 6th, 2012). We base our analysis on the site level data.

By the 48-month follow-up survey, 39.2% of those individuals who were assigned to the treatment group and responded to the survey had received a GED or high school diploma, whereas 25.9% of respondents in the control group had earned a high school credential, for a statistically significant difference of 13.3 percentage points. When adjusted for the participation rate of 88.4% across sites to obtain a TOT effectiveness estimate, the impact increases to 15.1 percentage points. As for Job Corps, those assigned to JOBSTART were more likely to complete high school by obtaining a GED than by earning a high school diploma. Site-specific differences in effectiveness are given in Table 4.5. Across the 13 sites, two show a negative association between participation and high school completion and another site has a zero association.

The aggregate result appears to be driven primarily by four highly effective sites with gains of 18-39 percentage points in high school completion.

Table 4.5
JOBSTART: High School Completion Rates

	Treatment Group	Control Group	Difference	TOT Difference (adjusted for participation rate)
Earned high school diploma or GED at 48-month follow-up:				
All sites	39.2%	25.9%	13.3%	15.1%
Observations	*1,034*	*1,149*		
Site-specific results:				
Atlanta	35.0%	30.0%	5.0%	5.9%
CET/San Jose	36.0%	34.0%	2.0%	3.1%
Chicago Commons	12.8%	17.4%	-4.6%	-5.0%
Connelley*	60.0%	32.1%	27.9%	28.2%
East LA	14.3%	14.3%	0.0%	0.0%
EGOS Denver	28.3%	21.4%	7.0%	7.4%
Phoenix*	37.7%	19.7%	17.9%	20.7%
SER/Corpus Christi*	51.7%	24.2%	27.5%	28.0%
El Centro*	66.0%	27.0%	39.0%	39.0%
LA Jobs Corps	30.4%	24.3%	6.1%	7.7%
Allentown	44.7%	35.2%	9.5%	9.5%
BSA (NYC)	32.0%	32.9%	-0.9%	-1.2%
CREC (Hartford)	27.3%	20.4%	6.9%	7.8%

Sources: Personal communication, Johannes Bos, September 6th, 2012. Adjusted for participation rates from Cave *et al.* (1993), Table C.1, p. 283, to obtain TOT estimates. *According to a z-test of significant differences in proportions, sites showing significant differences between treatment and control group in high school completion rate are: Connelley, Phoenix, SER/Corpus Christi and El Centro.

Cost-effectiveness Analysis for JOBSTART

The cost-effectiveness of JOBSTART is reported in Table 4.6. Across the full sample of youths assigned to treatment, the total cost of the program was $10.75 million. Compared to the control group, the program yielded 154 extra high school completers. Therefore, the cost-effectiveness ratio was $69,510 per extra high school completer. The yield of extra high school completers per $100,000 expenditure was 1.44.

Table 4.6
JOBSTART: Cost-Effectiveness Analysis

	Cost per Youth	Number of Youth	Total Cost ($ millions)	Yield: Extra HS Completers	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Data from 48-month follow-up						
Full sample	$10,460	1,028	$10.748	154	$69,510	1.44
Atlanta	$11,660	34	$0.395	2.00	$197,800	0.51
CET/San Jose	$6,460	64	$0.413	2.00	$206,830	0.48
Chicago Commons	$14,330	43	$0.619	-2.17	N/A	-0.35
Connelley*	$10,660	109	$1.160	30.68	$37,809	2.64
East LA	$12,060	52	$0.626	0.00	N/A	0.00
EGOS Denver	$4,570	112	$0.512	8.36	$61,310	1.63
Phoenix*	$12,480	67	$0.832	13.80	$60,280	1.66
SER/Corpus Christi*	$4,340	148	$0.644	41.52	$15,520	6.44
El Centro*	$10,790	100	$1.079	39.00	$27,670	3.61
LA Jobs Corps	$15,720	117	$1.840	9.00	$204,470	0.49
Allentown	$11,920	76	$0.906	7.24	$125,150	0.80
BSA (NYC)	$20,190	57	$1.141	-0.67	N/A	-0.06
CREC (Hartford)	$11,820	49	$0.578	3.80	$152,210	0.66

Sources: 48 month results: Cave *et al*. 1993, Table 4.5, p. 108; cost per participant calculated based on the information provided by Cave *et al*., 1993, Table C.1 p. 283; Number of new graduates is the number of participants multiplied by the gap in high school (HS) completion rates between the treatment group and the control group. High school completion rates are divided by the participation rate to obtain TOT estimates. N/A indicates that, as there were no extra high school completers at this site, a cost-effectiveness ratio showing cost per extra completer is not calculable.

We also perform site-specific cost-effectiveness analysis for JOBSTART. Average costs varied widely from site to site, due to differences in enrollment levels and scale, program design and implementation, and regional cost differences (Cave *et al*., 1993). As shown in Table 4.5, there is also significant variation in effectiveness across sites. Consequently, as shown in Table 4.6, there is considerable variation in the cost-effectiveness of JOBSTART sites. The least cost-effective site was Chicago Commons, with a loss of 0.35 high school completers, compared with the control group, per $100,000 expended; the BSA (NYC) site also 'lost' graduates; and the East LA site had zero effect on the high school completion rate. In contrast, SER/Corpus Christi was four times more cost-effective than the average site. Relatively effective sites tended to be relatively cost-effective. However, the variation in cost per youth was substantial across JOBSTART sites: high cost sites spent approximately three times as much as low cost sites, on a per youth basis. Thus, the cost-effectiveness of the SER/Corpus Christi site is driven both by its relatively low cost and strong evidence of effectiveness.

One factor that could contribute to both lower costs and higher effectiveness is a high rate of participation; higher participation rates imply that the fixed costs of operating a center are divided among more participants, leading to lower average costs. The most cost-effective sites, SER/Corpus Christi, El Centro, and Connelley, all had very high rates of participation, although some less cost-effective sites, such as Chicago Commons and Atlanta did also. Auspos and Price (1989) rated the implementation of JOBSTART sites on four key categories – education, training, support services, and job placement. Not surprisingly, three of the four sites with statistically significant effects on high school credential receipt were among the four sites that received a rating of "High" on implementation of education programs. The fourth received a rating of "Medium".

New Chance

New Chance, designed and evaluated by MDRC, was a national demonstration project that operated between 1989 and 1992 in 16 sites in ten states across the country. New Chance was targeted at 16- to 22-year-old mothers who had first given birth as teenagers, had dropped out of high school, and were receiving cash welfare assistance. New Chance had three important features. First, the program was relatively small in scale. Sites were generally expected to serve 100 participants over 12 to 18 months. Second, the schedule for New Chance participation was similar to that of school: participants were expected to attend New Chance five days a week and to attend all classes. Third, New Chance had a longer duration than many high school dropout programs: participants could remain enrolled for 18 months, with up to a year of follow-up services. New Chance offered five main types of services: education (adult basic education and GED preparation); employment-related services; health and personal development; services to enhance the development of the children of participants; and case management (Quint, Bos, & Polit, 1997; WWC Intervention Report: New Chance, 2008).

Cost Estimates for New Chance

Cost estimates for New Chance were collected by Fink and Farrell (1994). These estimates were based on: individual staff salary information; time-study data; staff interviews; site expenditure reports; and the participation information tracked by MDRC's management information system. It is not clear whether local cost data collected were adjusted to reflect national prices. Unit costs are reported for a one-year "steady-state period" from 1990-91, presented in 1991 dollars. Similar to JOBSTART, the cost estimations for New Chance were also based on the multiplication of unit costs and participation measures. The program was first categorized into different components, namely, recruitment, intake, orientation, basic education, skills training, etc. The authors then divided the total annual expenditure for one component by the participation measure for this component over a one-year period to obtain the unit cost per period of time.[20] The cost per experimental for each component is the unit cost multiplied by the participation measure over the whole period of the program. The total cost per experimental for each site is then calculated as the sum of the cost per experimental of each component. We divided these ITT estimates of the site-level average costs by the corresponding participation rates and obtained the TOT estimates of average cost (i.e., cost per participant).

As for other studies, we note some concerns over the interpretation of the costs data. Firstly, the resources that were used to produce the effectiveness of each component of the program are not clearly specified. Relevant information is provided when calculating the unit cost; however, the characteristics of these

20 Participation measure refers to either the number of New Chance participants who participated in that component (e.g., for recruitment, intake and orientation) or the total number of months that New Chance participants attended the component (e.g., for basic education, skills training, etc.).

resources are not identified. Secondly, the estimated costs refer to the monetary value of all resources used to provide New Chance services for the participants rather than the incremental cost incurred by the New Chance services for these participants compared to their counterfactuals represented by the control group. As a high proportion of the control group did receive educational and occupational training services from other programs (Fink & Farrell, 1994; Quint *et al.*, 1997), the net (or incremental) cost of New Chance would be smaller than the gross cost reported here. Thirdly, the cost estimation method is based on the multiplication of unit cost by the participation measure which may introduce bias. Since the unit cost estimation is based on the annual expenditure by each site rather than a national price index, the results may be highly influenced by the local price level of labor and materials. As for JOBSTART, we have added the costs for medical care and housing as we have no comparable data for the control group to determine whether or not they were incremental, and these services are likely to have contributed to the effectiveness of the program.

Effectiveness Estimates for New Chance

An evaluation based on a random assignment of 2,322 women showed that participants in New Chance were much more likely than the control group to receive a GED certificate within 42 months after assignment. New Chance, like JOBSTART, had a small but statistically significant negative effect on the likelihood of earning a high school diploma but the overall effect on high school completion was strongly positive. As shown in the first row of Table 4.7, New Chance increased the high school completion rate by 9.2 percentage points.

While the pooled result was statistically significant, there was considerable variation in effectiveness across sites. Of the 16 sites, only four showed improvement in the high school completion rate that was statistically significant. At three sites, the high school completion rate was actually lower for the treatment group than for the control group.

Cost-effectiveness Analysis for New Chance

The cost-effectiveness results for New Chance are given in Table 4.8. Across the full sample of 1,240 participants, New Chance yielded 113 extra high school completers above and beyond those that would be expected without treatment, at a total cost of $22.1 million. These results translate into a cost-effectiveness ratio of $194,640 per extra high school completer and a yield of 0.51 extra high school completers per $100,000 expenditure.

The results in Table 4.8 also show large variations in cost-effectiveness across the sites. Three sites had negative cost-effectiveness results – expending additional resources but yielding a smaller percentage of high school completers than a control group. At the other end of the spectrum, the Bronx site was three times as cost-effective at raising the high school completion rate as the average site ($59,820 versus $194,640). In general, sites that were relatively effective were also relatively more cost-effective. Although sites may vary in costs for many reasons – differences in enrollment, number of months that the young women participated, staffing arrangements, and in the scope of activities and services (Fink & Farrell, 1994, pp.19-22) – the absolute variation in cost per youth per site was not large. That said, the Allentown and Chicago Heights sites are equally cost-effective, despite expenditure per youth in Allentown being more than double that in Chicago Heights.

Table 4.7
New Chance: High School Completion Rates

	Treatment Group	Control Group	Difference
Earned high school diploma or GED at 42-month follow-up:			
All sites	58.6%	49.5%	9.2%
Observations	*1,240*	*839*	
Site-specific results:			
Allentown	66.3%	48.0%	18.3%
Bronx*	64.6%	38.2%	26.4%
Chicago Heights	61.2%	51.1%	10.0%
Chula Vista	57.3%	58.0%	-0.7%
Denver	60.3%	60.1%	0.2%
Detroit	42.1%	52.0%	-9.9%
Harlem	67.6%	56.7%	10.9%
Inglewood*	70.3%	39.6%	30.7%
Jacksonville	46.3%	30.3%	15.9%
Lexington	46.7%	46.0%	0.8%
Minneapolis	74.1%	69.9%	4.1%
Philadelphia	39.8%	41.6%	-1.9%
Pittsburgh*	83.5%	66.1%	17.4%
Portland	68.8%	65.7%	3.2%
Salem	46.5%	44.1%	2.3%
San Jose*	73.1%	47.6%	25.5%

Sources: Original data for the effect of the program (ITT estimates): high school completion data for each site (Quint *et al.,* 1997, Table D1, Appendix D, p.322); high school completion data for the full sample (Quint *et al*., 1997, Table ES-4, p.ES-15); sample size for the treatment group and participation rates at the site-level (Quint *et al*., 1997, Table 4.4, p.88). We divided the ITT estimates by the participation rates to transform them into the TOT estimates reported in this table. Small mathematical discrepancies arise in some instances due to rounding.
*Denotes statistically significant difference between treatment and control groups. After transforming estimates to TOT from ITT, two sites, Allentown and Jacksonville no longer appeared to show significant results based on a z-test.

Table 4.8
New Chance: Cost-Effectiveness Analysis

	Cost per Youth	Number of Youth	Total Cost ($ millions)	Yield: Extra HS Completers	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Data from 42-month follow-up						
Full sample	$17,820	1,240	$22.092	113.48	$194,640	0.51
Allentown	$19,990	71	$1.419	13.00	$109,190	0.92
Bronx*	$15,790	59	$0.932	15.58	$59,820	1.67
Chicago Heights	$10,400	33	$0.343	3.31	$103,560	0.97
Chula Vista	$16,300	79	$1.288	-0.54	N/A	-0.04
Denver	$12,790	70	$0.895	0.14	$6,395,330	0.02
Detroit	$14,410	104	$1.498	-10.28	N/A	-0.69
Harlem	$21,890	64	$1.401	6.97	$201,010	0.50
Inglewood*	$21,540	72	$1.550	22.10	$70,150	1.43
Jacksonville	$14,220	94	$1.336	14.98	$89,210	1.12
Lexington	$21,630	79	$1.709	0.62	$2,743,730	0.04
Minneapolis	$19,320	80	$1.545	3.32	$466,210	0.21
Philadelphia	$12,060	84	$1.013	-1.56	N/A	-0.15
Pittsburgh*	$17,930	97	$1.740	16.83	$103,380	0.97
Portland	$31,520	93	$2.931	2.94	$996,950	0.10
Salem	$11,980	73	$0.875	1.71	$511,510	0.20
San Jose*	$18,350	88	$1.615	22.46	$71,910	1.39

Sources: Original data for youth receiving intervention from Quint *et al.*, 1997, Table 4.4, p.88; original data for cost per youth from Fink & Farrell, 1994, Table 4, p.24; medical care and housing costs are added based on the data provided by Fink & Farrell (1994, pp.41-42); participation rates from Quint *et al.*, 1997, Table 4.4, p.88; effectiveness data on high school completion rates from Quint *et al.*, 1997, Table D1, p.322. Number of new graduates is number of participants multiplied by the gap in high school (HS) completion rates between the treatment group and the control group. Completion rates are divided by the participation rates to obtain a TOT estimate. We also divided ITT estimates of the site-level average costs by the corresponding participation rates to obtain TOT estimates of average cost (i.e., cost per participant). *Notes:* * Denotes statistically significant ($p<0.05$) effect on high school completion. All values are presented in 2010 dollars. N/A indicates that, as there were no extra high school completers at this site, a cost-effectiveness ratio showing cost per extra completer is not calculable.

Early Childhood Interventions

While not identified by the WWC as interventions to prevent dropout, two high quality early childhood interventions have demonstrated gains in high school completion. These are the Chicago Child-Parent Center program and the High Scope/Perry Preschool program. As the two programs have been evaluated for their effectiveness evidence and cost data were collected near-contemporaneously with the interventions, we are able to estimate their cost-effectiveness for improving high school completion. Again, these cost-effectiveness ratios are subject to the caveats noted above for our five other interventions. However, given their research prominence, it is of interest to estimate how cost-effective these early education programs are in increasing the high school completion rate.

Chicago Child-Parent Center Program

The Chicago Child-Parent Center (CPC) Program provides comprehensive educational and family support services to children from ages 3-9 in multiple sites in low-income neighborhoods in Chicago.[21] Funded by Title I, CPC involves structured educational activities to improve children's language and mathematical skills. Programs offer low child-to-staff ratios in preschool and kindergarten, certified and highly trained teachers in the preschool program, intensive parental participation, and health and nutrition services.

We adopted the cost and effectiveness data from a cost-benefit study of CPC conducted by Reynolds, Temple, Robertson, and Mann (2002). Costs data include the operational budget of the program for the 1985-1986 year and the opportunity costs of parents' participation in the program. Reynolds *et al*. assume a mean duration for participation of 1.5 years. We adjust costs for inflation to 2010 and adjust for the gap between program delivery and high school completion using a 3% discount rate. From the social perspective, we obtain a cost per child of $ 14,090.

The effectiveness evaluation is based on a quasi-experimental design using the Chicago Longitudinal Study, a dataset tracking 1,539 children from low-income families born in 1980. The researchers compared the adjusted high school completion rates between the treatment group (61.9%) and comparison group (51.4%) at the age of 21, and concluded that the preschool program of CPC increases the likelihood of high school completion by 10.5 percentage points.

Our cost-effectiveness analysis of CPC is given in Table 4.9. The CPC program was delivered to 4,114 children across 25 different centers (site-specific data on costs and effects are not publicly available). Relative to a control group, the program yielded 88 extra high school graduates out of the 841 children tracked by the Chicago Longitudinal Study. The cost-effectiveness ratio is $134,150 per extra high school completer and the yield per $100,000 is 0.75 extra graduates.

Our confidence in the accuracy of this analysis is mitigated by a number of issues regarding both the effectiveness and cost data for CPC. Without random assignment of individuals into the treatment and comparison group, the validity of the causal relationship between the treatment and the outcomes is subject to threat. Unobservable differences in characteristics among study participants may bias the results in favor of the treatment group. With respect to the cost analysis, reliance on budget expenditures risks the omission of inputs that do not incur outright expenditures. For example, it is possible that some teachers devoted extra hours to the program, but that these extra efforts were not compensated. The contribution of volunteers should also be counted. It is possible that the estimated effectiveness is upward biased while the costs are underestimated, leading to an overly optimistic cost-effectiveness ratio.

21 http://www.cps.edu/Schools/Preschools/Pages/Childparentcenter.aspx.

Table 4.9
Early Childhood Interventions: Cost-Effectiveness Analysis

	Cost per Youth	Number of Youth	Total Cost ($ millions)	Yield: Extra HS Completers	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Chicago Child-Parent Centers:	$14,090	841	$11.846	88.31	$134,150	0.75
Perry/High Scope Preschool	$31,840	56	$1.783	10.78	$165,430	0.60

Sources: For CPC: cost per child from Reynolds *et al.* (2002), Table 3; effectiveness, Table 4. Cost per child assumes participation in program for 1.5 years. For Perry: cost per child from Barnett, 1996, pp.19-27; effectiveness from Belfield, Nores, Barnett, and Schweinhart (2006), Table 1. Cost per child assumes participation in program for 1.78 years. *Notes:* All values expressed as present values at age 18 in 2010 dollars; discount rate 3%.

Perry Preschool Program

The High Scope/Perry Preschool Program (PPP), which operated from 1962 to 1967, provided high-quality early childhood education to low-SES African-American children aged 3 to 4 at Perry Elementary School in the Ypsilanti Public School District, Michigan. Study participants were randomly assigned into a treatment group (58 in total, and 56 remained in the follow-up sample at age 27) or a control group (65 in total). Children in the treatment group participated in a 2.5-hour classroom session guided by four certified public school teachers every weekday. The program also provided weekly 1.5-hour home visits to children in the treatment group and parent group meetings. The treatment group participated in the program for one or two short academic years, each lasting 30 weeks from October to May.

The average cost of PPP, estimated by Barnett (1996), is based on the school district budgets, the school district accounting department records, and information from the program's administrator. We note that the cost calculation only covers operating costs and capital costs that are recoded in the budgets as current dollars, such that in-kind resources are not accounted for. For comparability with other interventions presented in this report, we adjusted Barnett's cost estimate to age 18 using a 3% discount and to 2010 dollars using a CPI-W and CPI-U average index for inflation. Per child, the cost of PPP is therefore $31,840. The program was very effective at raising the high school graduation rate: according to Belfield, Nores, Barnett, and Schweinhart (2006), participating in PPP increased the likelihood of high school graduation by 19.2 percentage points (from 54.0% to 73.2%) by the age of 27.

The cost-effectiveness of PPP is given in the lower panel of Table 4.9. The cost-effectiveness ratio is $165,430 per extra high school completer and the yield per $100,000 is 0.60 extra graduates. Thus, PPP appears modestly less cost-effective than CPC, although differences in measuring costs and effectiveness of the programs render a direct comparison imprecise.

Sensitivity Testing

Given the practical challenges involved in estimating costs and integrating them with the appropriate effectiveness results, it is very important to check the sensitivity of the calculations. For these programs, the main practical concern is how pooling results across sites may influence the cost-effectiveness analysis although we are also interested in how the ratios vary according to modeling assumptions. Site-specific data is only available for New Chance and JOBSTART, so we focus on these two interventions for sensitivity testing.

In Table 4.10 we show the results from our sensitivity analysis. For each program, the first row reports the overall cost-effectiveness analysis, which we interpret as the baseline from which to test for robustness. The next two rows (i and ii) show the upper and lower bounds, i.e., the best and worst case scenarios. The next sensitivity test (iii) considers total costs for each program divided by the subset of participants at the sites where there is a statistically significant positive difference between the treatment and control groups (denoted by asterisks). Thus, the total costs of the program are divided by the number of youth receiving the intervention only at the "effective" sites. At the other sites, where the difference in number of graduates between treatment and control groups is not statistically significant, we cannot reject the hypothesis that the mean differences were a result of sampling error. So for these sites we assume that the program had no impact but they still expended resources. If, *ex ante*, it is not possible to predict the effective sites, then the resources required for the ineffective sites must also be included in the cost-effectiveness analysis. As an alternative, our fourth sensitivity test considers only the costs and only the effectiveness of the effective sites. This test is more 'generous' in the sense that it implies that decision-makers can identify effective sites *ex ante* and that they will invest only in those sites. Our fifth sensitivity test looks at how the scales of operations at each site influence the results. These results might correspond to how programs are planned in advance, with each site having the capacity to enroll the same number of participants. The baseline model aggregates effectiveness weighted according to the scale of provision at each site. But programs may vary in scale over time. To test for scale effects, we recalculate the cost-effectiveness ratios as if each site was the same scale.

Our final sensitivity test is Monte Carlo simulation (vi). We create normal distributions of enrollment numbers, unit costs, and effectiveness yields of new graduates from the standard deviations across the sites. These normal distributions are centered at the aggregate values in the first row of Table 4.10. We then draw 2,500 iterations from these distributions and recalculate the cost-effectiveness ratios and the yield per $100,000 expenditure. The mean and standard deviation from these iterations are calculated to indicate the spread of results.

For New Chance, the baseline yield is 0.51 extra high school completers for each $100,000 spent. However, the most cost-effective site (Bronx) has a cost-effectiveness ratio of $59,820 per extra high school completer, which is less than one-third of the overall estimate, for a corresponding yield of 1.67 extra high school completers for each $100,000 spent. At the least cost-effective site (Detroit), the treatment group graduated 0.69 fewer students than the control group for every $100,000 spent. Similarly, for JOBSTART, the baseline yield is 1.44 extra high school completers for each $100,000 spent, but the upper and lower bounds range from 6.44 to -0.35, which is a very broad range. Thus there is a reasonable possibility that these programs may be very cost-*ineffective* in raising the high school completion rate.

The results for sensitivity test *iii* show how the yield falls if only the statistically significant effects are counted. For New Chance, the cost-effectiveness ratio is $287,010 per extra high school completer and the yield of extra graduates per $100,000 is 0.35. For JOBSTART, the corresponding yield is 0.88. For both

Table 4.10 New Chance and JOBSTART: Sensitivity Analysis				
	New Chance		JOBSTART	
	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
Baseline	$194,640	0.51	$69,510	1.44
i. Upper bound (most cost-effective site)	$59,820	1.67	$15,520	6.44
ii. Lower bound (least cost-effective site)	N/A	-0.69	N/A	-0.35
iii. Effectiveness only sig. sites†; costs of all	$287,010	0.35	$113,140	0.88
iv. Effectiveness and costs of only sig. sites†	$75,840	1.32	$47,120	2.12
v. All sites same scale	$191,250	0.52	$75,620	1.32
vi. Monte Carlo simulation:				
Mean	$153,770	0.65	$43,936	2.28
Standard deviation	$94,580	[1.04]	[$39,945]	[22.78]

Notes: For New Chance: Sig. sites (sites showing statistically significant differences between treatment and control for high school completion) are Bronx, Inglewood, Pittsburgh, and San Jose. All sites same scale test assumes the average of average cost per site delivered to all 1,240 youth and average effectiveness per site. For JOBSTART, according to a z-test of significant differences in proportions, sig. sites are Connelley, Phoenix, SER/Corpus Christi and El Centro. Monte Carlo simulation from 2,500 trials using overall results as baseline and standard deviations of site size, site costs, and site effectiveness. N/A indicates that, as there were no extra high school completers at this site, a cost-effectiveness ratio showing cost per extra completer is not calculable.

programs, therefore, their cost-effectiveness is about one-third less than the baseline results if we use this sensitivity test. Under the more generous assumption of perfect targeting to effective sites, which is sensitivity test *iv*, the programs appear considerably more cost-effective. New Chance now has a yield rate of 1.32 extra high school completers per $100,000 spent. JOBSTART has a corresponding yield of 2.12. Sensitivity test *v* shows that, at least with regard to assumptions about scale, the baseline results for New Chance are robust (yield of 0.52 versus the baseline of 0.51) and those for JOBSTART are modestly robust (yield of 1.32 versus the baseline of 1.44), i.e., differences in scale of operations do not seem to significantly affect the cost-effectiveness of the programs, at least within the range of variation found across these sites.

More critically, the Monte Carlo simulation shown in Table 4.10 illustrates how wide the variation in cost-effectiveness ratios may potentially be. This simulation is at the site level, rather than per individual, so the sample size is very small (and hence the spread of results is wide). But this is magnified by the wide variation in costs and effects across the sites. For New Chance, the Monte Carlo simulation in Table 4.10 shows an average yield of extra high school completers per $100,000 spent that is close to the average effect (0.65 versus 0.51) but the standard deviation of the yield is 1.04. That is, the standard deviation of the cost-effectiveness of New Chance at yielding new high school completers is +/-$104,000 against a mean of $153,770.

For JOBSTART, which has fewer sites and as large a distribution of results per site, the Monte Carlo simulation results are extremely wide. Therefore, it is clear that substantial site-level variation renders an overall cost-effectiveness analysis of both New Chance and JOBSTART – and perhaps by implication other interventions with site-specific variation – very imprecise. This strengthens our belief that site-level cost effectiveness ratios are needed and are likely to be much more informative for decision-makers.

5. SUMMARY OF EVIDENCE AND CONCLUSIONS

We summarize our cost-effectiveness results across all the interventions in Table 5.1 but emphasize that these results should be regarded as demonstrative of cost-effectiveness rather than precise values that can be used to rank the interventions on efficiency grounds. Such a ranking would be meaningful only if the programs each addressed the same exact outcome, targeted similar populations and were each costed using a consistent method.

Table 5.1
Cost-Effectiveness Ratios across Interventions to Raise the High School (HS) Completion Rate

	Cost per Student	Cost per Extra HS Completer	Yield: Extra HS Completers per $100,000
NGYC	$14,100	$71,370	1.40
Job Corps	$22,290	$131,140	0.76
JOBSTART	$10,460	$69,510	1.44
New Chance	$17,820	$194,640	0.51
Chicago CPC	$14,090	$134,150	0.75
Perry Preschool	$31,840	$165,430	0.60
Talent Search	$3,400	$30,660	3.26

The results indicate that the cost to produce each extra high school completer through educational reforms such as the interventions studied here are very high, ranging from about $70,000 to $195,000 per completer, excluding Talent Search. These high costs may reflect the difficulty for education reforms alone to overcome barriers to educational success deriving from both academic and out-of-school influences (Rumberger, 2001), or the fact that all the higher cost programs address multiple outcomes in addition to high school completion. Broadly, of the class of programs targeted at dropouts, two interventions look more cost-effective at increasing high school completion – NGYC and JOBSTART – with the other two programs, New Chance and Job Corps, having similar (but lower) cost-effectiveness. These less cost-effective interventions demonstrate efficiencies fairly close to the early childhood interventions.

Comparing the costs of the two more cost-effective interventions, the result appears in part to be driven by their relatively low unit cost. The costs for NGYC seem low considering it is an intensive residential program, but the intensive part of the program is relatively short (22 weeks residency with around 20 hours of follow up over the next year) compared with six to seven months (26 - 30 weeks) average time spent in New Chance. The costs per student for Job Corps of $22,290 are fairly high although this is in part due to the residential nature of the program for the vast majority of participants, and the fact that services were described as more intensive than JOBSTART, which is a similar but non-residential program.

We are, however, cautious about drawing conclusions regarding the costs of the programs because the cost data were not collected in a consistent manner across programs, such that comparisons may be misleading.

Table 5.1 shows that the cost-effectiveness ratio for Talent Search is considerably lower than for the other interventions. When evaluated purely in terms of getting more students to complete school, Talent Search appears to be the most cost-effective program. Its cost-effectiveness ratio is more than two times lower than the most cost-effective out-of-school programs. Of course, there are some straightforward reasons for this finding. Talent Search is an incremental program providing resources to students over and above what they already receive in school; it is not an independent program that must provide all the services needed to help students complete high school. Talent Search is more narrowly focused than other programs: as well as graduation, its goal is to get students into college; the other programs provide an array of services including health services and employment training with the aim of improving employability, earnings, health and other life outcomes. Finally, Talent Search is targeted at students who are relatively more likely to complete school; these students are still in school and so may need fewer resources to persuade them to complete school relative to students who have already dropped out.

While illustrative rather than definitive, the cost-effectiveness results we present are still informative for policymakers. If the goal is to increase the high school completion rate, investing in Talent Search appears to be highly cost-effective and it may make sense to fund programs that target the 'low-hanging fruit'. However, policymakers also need to address high school completion for more disadvantaged youth. The cost-effectiveness ratios can inform decisions regarding what proportion of the budget to allocate to one population *vs*. another in order to produce a desired level of impact. A cost-effectiveness analysis that used consistent methods for comparing multiple programs targeting the same outcome would allow a decision-maker to rank the programs in terms of efficiency.

Conclusions

Our efforts to conduct a cost-effectiveness analysis of programs that improve high school completion lead us to a number of conclusions regarding 'dropout prevention' programs and about conducting cost-effectiveness analysis using pre-existing data. The former provide some insights into the costs of producing high school graduates, especially how the costs vary dramatically when the programs are targeted at different populations. The latter set of conclusions highlight a number of practical challenges that we offer as lessons for others attempting to conduct similar analyses in this or other areas of educational programming. Finally, we review the value of cost-effectiveness analysis as a decision-making tool.

With respect to dropout prevention programs, we conclude that remedial programs that aim to help youth who have already dropped out of school graduate with a GED or high school diploma are very expensive relative to preventative programs targeting students still in school. Generally dropouts require multiple services in addition to academic support, including vocational training, life skills and health services. While the benefits of such extensive services may extend beyond academic attainment to include higher earnings and better life outcomes, these are not captured in a cost-effectiveness analysis that compares programs on a single outcome. However, given the high returns to individuals and society of high school graduation (Levin, Belfield, Muennig & Rouse, 2007; Belfield, Levin & Rosen, 2012), the costs of remedial programs are probably worthwhile, i.e., the total long-term benefits are likely to exceed the total costs, as is found for NGYC by Perez-Arce *et al*. (2012) and for Job Corps by McConnell and Glazerman (2001).

Talent Search, a preventative program, targets youth who, in spite of being subject to certain risk factors, are academically promising and are likely to be far less costly to serve and more likely to complete school. Most Talent Search participants who complete school do so by obtaining a high school diploma rather than a GED. This contrasts with the remedial programs for dropouts where most students who complete school do so by earning a GED. As previously noted, the high school diploma is more valuable than a GED from an economic perspective. This arguably renders the effectiveness of Talent Search more valuable than the effectiveness of the remedial programs, but this could only be confirmed through a comparative analysis of longer-term economic benefits.

As for lessons that we can offer to others attempting to conduct cost-effectiveness analysis, the most essential is that costs and effectiveness of an intervention should be assessed simultaneously at the same sites, based on the same sample of study participants during the same time period. The latter is important because unemployment rates and business cycles are external factors that affect the dropout rate (Bell & Blanchflower, 2011). In order to present a fair cost-effectiveness analysis across a group of alternative interventions addressing the same outcome, it is necessary for the costs to be collected in a consistent manner in each case, just as we would expect for the effectiveness data. Also, just as it is important to determine effectiveness for a comparison group, it is also important to determine costs of "business as usual" in order to correctly identify the additional resources required by an intervention. Data on impact and costs should be accompanied by descriptions of program implementation at each site evaluated such that variations in implementation can be used to help explain variations in costs and effectiveness. We observe from our analyses of New Chance and JOBSTART that, when variability in site-level cost and effectiveness are high, a cost-effectiveness ratio based on the overall program is imprecise. Site level cost-effectiveness analysis yields far more accurate results and demonstrates the range of cost-effectiveness across different implementations of the same program.

The ultimate value of a cost-effectiveness analysis is its ability to help decision-makers allocate limited resources to the maximum effect. However, while a cost-effectiveness ranking is a key piece of information for choosing among alternatives, it is not the only criterion. If the decision-maker needs to work within a limited budget, as might be the case for a school principal, a table of cost-effectiveness ratios for the interventions addressing the outcome of interest can help determine which intervention would provide the most impact for the lowest cost. If the budget limit is not yet established, as might be the case for a legislator with flexibility to allocate funds across social program areas, the data could be used to identify the interventions that provide the greatest desirable impact and are also politically most feasible. The decision-maker must use his/her knowledge of what policies are likely to be acceptable in his/her area of jurisdiction from both a regulatory and political standpoint in order to rule out any potential options that would not be feasible. For example, an intervention that would require eliminating teachers might contravene an existing contract with a teachers' union or run up against nationally determined class size requirements. Additionally, many parents will object to any increase in class size.

Other considerations in choosing among interventions include an assessment of whether the resources or ingredients required to implement it would be easily available at comparable costs in the decision-maker's jurisdiction. If, for example, an intervention required the employment of additional specialists in reading and the decision-maker was aware that a shortage of such individuals existed, (s)he might anticipate that the local costs would be higher than the national average and would therefore result in a less favorable cost-effectiveness ratio.

Analyses that calculate the cost-effectiveness ratios of interventions at different levels of scale allow decision-makers to assess whether an intervention that has been cost-effective in a small setting, such as one school, is likely to be cost-effective if adopted on a broad scale, such as at the district or state level. Had such an analysis been conducted in 1996 for decision-makers in California prior to adopting Class Size Reduction for 1.6 million children modeled on the Tennessee Student/Teacher Achievement Ratio (STAR) project, which served only 7000 children, it would have been clear that the costs of recruiting and training an enormous cadre of new and inexperienced teachers and of finding additional space would severely mitigate the appeal of the intervention. Now that Class Size Reduction has amassed such significant public backing that it is proving politically difficult to eliminate, the availability of cost-effectiveness ratios on alternative interventions would provide state policymakers with a plausible defense of their actions and allow for wiser allocation of reduced resources.

Further, decision-makers can use contextual information to analyze possible reasons for drastic differences between cost-effectiveness ratios of various alternatives. For example, a comparison between the cost-effectiveness ratio for a highly focused program with a single outcome and a broad-based program with multiple outcomes may be misleadingly unfavorable to the program with multiple outcomes, as the cost in question is, in effect, “buying” more than the single measured effect. Programs may also differ in their level of targeting; for example, dropout prevention programs that successfully target high school students just on the margin between dropping out and graduating will, all else being equal, appear to be more cost-effective than those that serve a broader population of students. Decision-makers must consider whether such preventative targeting could realistically be expected when implementing programs in their own context, or, if a program may have benefits to participants beyond the immediate intended effect, whether that targeting is even desirable.

It is important for decision-makers to remember that cost-effectiveness data is only comparable across interventions that address the same educational outcome (e.g., obtaining a high school diploma). However, if the decision-maker is attempting to decide how to allocate a budget among programs addressing different educational outcomes, for example reducing dropouts *vs.* increasing early literacy, the required comparison would be a cost-benefit analysis where the different types of outcomes would need to be translated into financial or other commensurable benefits. For example, the outcome of graduating from high school would be evaluated by estimating the additional earnings for a high school graduate as compared with a dropout, the associated higher tax revenues to the government and reductions in social costs due to lower crime rates and better health observed in high school graduates.

We conclude with the emphasis that, in order to inform educational policymaking, cost-effectiveness comparisons should be routinely incorporated into educational evaluations. In this project we have retrospectively combined cost data with existing data on effectiveness. However, it is clear that this is not the most accurate or parsimonious way of incorporating costs into the evaluation process. We believe that by incorporating the ingredients method at the time of the intervention, costs can be obtained with greater accuracy. A consistent approach across several interventions will allow precise cost-effectiveness comparisons. The goals of cost-effectiveness analysis are to encourage policymakers to consider productivity as well as effectiveness of alternative educational interventions and to improve the efficiency with which public and private resources are employed in education.

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APPENDICES

Appendix 1 Prices of Ingredients

The prices of ingredients were collected from databases, documents, and Web sites across a range of sources. From these sources we compiled a database of ingredients prices.

Personnel Pricing

The prices of personnel are the most important item in ingredients pricing. We reviewed many potential sources for data on personnel prices, including:

- **CPS (Current Population Survey, US Department of Labor).** Reports median gross wages per occupation reported by occupied households. Reported wage is on an annual basis for every occupation estimated from an hourly wage considering 2,080 hours a year, except for teachers. For teachers the wage reported is annual. Teachers are asked to report their annual wage regardless the amount of hours they work. Teacher wages for year 2010 are available (see Allegretto, Corcoran, & Mishel, 2004). [http://www.bls.gov/bls/empsitquickguide.htm]

- **CPS-ORG (Current Population Survey - Outgoing Rotation Groups, US Department of Labor).** Includes earnings data per occupation per educational level (see Allegretto, Corcoran, & Mishel, 2008). [http://www.nber.org/data/morg.html]

- **NCS (National Compensation Survey, US Department of Labor).** Reports mean annual and weekly wages from survey of employers. NCS also reports employee benefits per hour worked for state/local government employees and civilian workers. Teacher wages and benefits for year 2010 are available but weekly wage estimates are sensitive to assumptions about weeks worked per year (see Allegretto *et al.*, 2004). [http://www.bls.gov/ncs/]

- **CES (Current Employment Statistics, US Department of Labor).** Reports industry – but not occupational – data on employment, hours, and earnings of workers on nonfarm payrolls. [http://www.bls.gov/ces/home.htm]

- **NEA Education Worker Survey (National Education Association).** Reports mean wages per occupation for teachers and educational paraprofessionals. Data are collected from state departments of education. [http://www.nea.org/home/13566.htm]

- **SASS (Schools and Staffing Survey, US Department of Education, National Center for Education Statistics).** The Public Teacher Questionnaire from SASS reports national data on teachers' wages by highest degree earned and years of experience. Data for primary and secondary school teachers is aggregated; results for some teacher qualifications and years of experience not reported due to low sample size. Data from Public and Private School Principal Questionnaire from SASS reports information on wages for K-12 principals by years of experience and institutional type. Data from 2007-2008. [http://nces.ed.gov/programs/digest/d11/tables/dt11_079.asp]

- **IPEDS (Integrated Postsecondary Education Dataset, US Department of Education, National Center for Education Statistics).** Reports salaries for faculty in public and private institutions for the academic year on 11/12-month and 9/10-month contracts. No data is reported for salaries and benefits of other staff. [http://nces.ed.gov/ipeds/].

- **CUPA-HR (College and University Professional Association for Human Resources)**. Reports data on median salaries from annual survey for senior and mid-level college administrators in different types of institutions based on the 2005 Carnegie Classification. [http://www.cupahr.org/surveys]

- **OECD-INES (Indicators of Education Systems) Survey on Teachers and Curriculum (Education at a Glance 2011)**. Reports data on statutory teachers' salaries for 2008-2009. Statutory salary for a full-time teacher is the number of hours per year that a teacher is required to spend teaching. It does not adjust salaries for the amount of time that teachers spend on other teaching-related activities. [http://www.oecd-ilibrary.org/]

- **OES (Occupational Employment Statistics Survey, US Department of Labor).** Reports mean annual wages reported by employers (but not disaggregated by educational levels or years of experience) and information on minimum levels of educational level required across occupations. Teacher wages for year 2010 are available. [http://www.bls.gov/oes/home.htm]

- **OOH (Occupational Outlook Handbook, Bureau of Labor Statistics, US Department of Labor).** Reports median salaries for over 340 occupations that cover 85 percent of jobs in the economy. [http://www.bls.gov/ooh/home.htm]

- **NCS (National Compensation Survey, Bureau of Labor Statistics, US Department of Labor).** Provides detailed information on average wages for over 800 occupations, measures of benefits, and employer cost for employee compensation. Three levels of data are reported in the survey: local, regional, and national. [http://www.bls.gov/ncs/home.htm]

Facilities Pricing

Facilities prices are important because educational buildings have specific requirements with respect to space, building codes, and provisions.

Data on prices for facilities is less detailed than for personnel and reports vary in terms of the type of costs they report and the categories of costs included. For example, costs may refer exclusively to construction costs and not include the costs of acquiring the site, site development, or furnishings and equipment. These prices are sensitive to location. For example, state policies on school construction differ because of state specification requirements (e.g., for earthquake-proof construction in California and for hurricane shelters in Florida). These prices are also sensitive to reporting year because the construction industry is sensitive to market trends. For instance, *College Planning and Management* magazine reports the 2011 price per square foot for technology buildings in postsecondary education at almost twice the price for 2010.

We reviewed several sources for information on national prices of school facilities. These included:

- **NCEF (National Clearinghouse for Educational Facilities).** The NCEF recommends as sources of facility costs the Annual Construction Reports from the *School Planning and Management* and *College and Planning and Management* magazines. Their annual construction reports provide national and regional cost data on school and university construction. [http://www.ncef.org/ds/index.cfm]

- **School Planning and Management magazine** reports total cost per construction reported. Construction costs are two-thirds of total costs per square foot (sq. ft.). Other costs include: site purchase (2%), site development (9%), furnishing and equipment (14%), fees/others (8%). Also, square footage is not disaggregated by functionality. [http://www.peterli.com/spm/pdfs/SchoolConstructionReport2011.pdf]
- **College Planning and Management magazine** reports construction costs and these are disaggregated in terms of functionality of the sq. ft. [http://www.peterli.com/cpm/pdfs/CollegeConstructionReport2011.pdf]

- **Reed Construction Data** provides detailed information on building costs based mainly on cost estimation from 2008. Costs are separated for universities and community colleges, as well as for schools by level (elementary, middle, and high) and by use (classrooms, auditoriums, laboratories). [http://www.reedconstructiondata.com/building-types]
- **State statutes for California, New York, New Jersey, Washington, DC.** State statutes include some information on the requirements for school facilities construction and/or instructional building aid.

Educational institutions vary in the square footage requirements. Per student in a school building, these are: 125 sq. ft. for elementary school; 149 sq. ft. per middle school; and 156 sq. ft. per high school (Abramson, 2011). Per student in a classroom, the occupancy load requires 20 sq. ft. (National Fire Protection Association, 1999).

The costs of facilities need to be amortized over their operational life. This lifespan may vary but is at least 25 years. According to the National Center for Education Statistics, in 1998 the average public school building in the United States was 42 years old. [http://nces.ed.gov/surveys/frss/publications/1999048/index.asp]

Materials and Equipment Pricing

The prices for materials and equipment vary according to type. For most materials, e.g. printers and computers, we derived prices from market prices using internet searches. We used retail prices net of transportation [http://www.educationmarketplace.com].

Current prices were adjusted to 2010. In the particular case of technological equipment such as computers and laptops, prices were adjusted using the Producer Price Index (PPI) [http://www.bls.gov/ppi/], and amortized with depreciation periods reported by the IRS [http://www.irs.gov/pub/irs-pdf/p946.pdf]

Database of Ingredients Prices

From the above sources we compiled a database of prices of ingredients. This database encompasses many items for each category of ingredient:

- **Personnel** (190 items). These items vary with level (K-12, postsecondary), occupation, education, annual/weekly/hourly wage, full-time/part-time status, years of experience, mean/median salary, date of estimate, and data source.

- **Facilities** (17 items). These items vary across level of institution, purpose of building, date of estimate, data source, and median sq. ft. for use versus new construction. They also vary with assumptions about amortization.
- **Materials/equipment** (5 items). These items varied with the type of equipment, and duration of rental.

Appendix 2 Interview Protocol – Talent Search

Interviews were administered to Talent Search program directors between June and September 2012. All interviewees signed informed consent documents to conform to Teachers College Institutional Review Board Protocol #12-270. Not all questions were asked of all sites; interviews were modified based on information provided by interviewees. Interviewees were asked to report on resources employed in 2010, the most recent year of the last grant cycle. We selected this year to avoid programmatic changes that may have occurred in the new grant cycle due to new regulations.

Introduction to Interview:

The federal government's What Works Clearinghouse has identified Talent Search as an effective program in increasing high school graduation rates. We are interested in what resources are used for implementing Talent Search at your site. So, our questions will help us understand *how you make Talent Search work*. All responses will be anonymous and confidential as per IRB protocol #12-270. We would like to know about all the resources for Talent Search, including those not covered in budgets or paid for directly. We know that Talent Search is one of the federal TRIO programs, and may work together with other TRIO programs or outreach programs at your center. As best we can, we would like to focus only on the Talent Search activities, even if it means saying something odd like approximately 20% of a person's time is devoted to Talent Search. Our questions are intended to help us learn which Talent Search services are provided at your site and the resources required to provide them.

A. TS at your site:

A1. Students Served. What grades/ages are they? Do you provide services for children based on their specific age or grade? Does your program provide services for students who have dropped out? What about students who have entered college?

A2. How are students recruited? Or how do they learn about your program and apply?

A3. Can you describe what the typical experience is of a middle school student in your program?

A4. Describe a typical high school student's experience in your program. Does the experience of a 10th grade student differ from that of a junior or senior? So on average, about how many years do students participate? Do they tend to stay in the program once they enroll or is their participation more staggered? Do you tend to operate on an academic calendar or when do services generally begin each year?

A5. How many students were served in the 2010 - 2011 year? Was this a typical year for the program?

B. Site personnel:

B1. Who is involved in implementing Talent Search (TS) at this site?

Percent time devoted to TS or amount of time within period [2010-11]	Qualifications; Experience - prior and on the job; Specific prior training needed before employment; Works on calendar or academic year; Roles and responsibilities; Eligibility for benefits
Staff on-site:	
Program coordinator or director	
Counselors – by type	
Professional staff - psychologists, etc.	
Support staff – administrative assistants, etc.	
Information specialist	
Computer technician	
Recruitment specialist	
Tutors	
Other staff (e.g. for summer enrichment)	
Personnel off-site:	
Teachers at schools	
Tutors at schools	
Counselors at schools	
Principals at schools	
Others (external reviewers)	
Other Personnel:	
Parents (e.g. in workshops, as chaperones)	
Council for Opportunity in Education	
Federal agency staff	

B2. Did any personnel receive training prior to starting their work with the program? Who provided that training? How long was the training period?

B3. Do you provide any ongoing training for staff? Is this part of the regular workday or is there any training that is extra or considered to be over-time? Have you received any training from the Department of Education? Did you have to apply for it or travel to receive it? Any other training from the Council for Opportunity in Education or any other related organizations?

Facilities:

C1. At your site, what size office space was provided for people who worked on the program? Is this site space shared with other programs or offices? What percentage of the time was that space used by Talent Search?

C2. Do you use any other on site space to provide services? Could you tell me the approximate size and describe the space? How often do you use it? Is it shared with other programs or offices?

C2. What about off-site locations, like schools or community centers? Can you tell me about the space that is used off-site to recruit students or to provide services?

D. Site equipment and materials:

D.1 Does the site use the following? Do persons off-site use the following for TS services?

	Usage (on and off-site): Across how many workers; Scale of operation?
Computing facilities	
Telephones	
Printers	
Internet services	
Video recorders/Headphones	
Information materials (e.g. pamphlets)	
Materials for: advertising, recruitment, or incentives; summer programs; Test Prep; tutoring; parent workshops; parent counseling; career assessment	

E. Other Inputs:

	Brief description: Approximate direct spending on these items
Transport:	
Transport for staff to meet students off-site?	
Transport for students to access TS services?	
Transport for students on field trips or other activities?	
College site visits?	
Does your site provide any of the following for participants?	
Tickets or admission fees for field trips	
Tuition waivers (e.g. for after-school classes)	
Student incentives (e.g. movie tickets, prizes)	
Standardized test waivers	
College application fee waivers	

F. Changes in program implementation over time:

F1. Has the program changed in scale since the 1990s? Has the number students served changed over time?

F2. Has the staff mix changed? If so, give details of new positions added/augmented.

F3. Are there any other ways the program has changed since the 1990s?

F4. Do you do things differently from other Talent Search offices? How so?

F5. Are there any other services, volunteered or donated time or materials, or other aspects of the program we haven't already covered?

Appendix 3 Ingredients and Pricing for Talent Search (TS)

Description of Ingredients and Pricing	
Personnel	
TS Staff: Directors	Program directors and associate directors: Average of director student activities and student counseling (7026/7052 codes, CUPA-HR, 2010-11). Benefits at 32% (NCS, 2010). Full-time annual salary: $79,519 per director ($68,269 for associate director).
TS Staff: Counselors (Level A)	Academic advisor / student support services occupation. MA degree in counseling with adjustment for years of experience and education. Median across colleges (7602, CUPA-HR, 2010-11). Benefits at 32% (NCS, 2010). Full-time: $62,198.
TS Staff: Counselors (Level B)	Academic advisor / counselor occupation. BA degree with adjustment for years of experience and education. Median across colleges (7550, CUPA-HR, 2010-11). Benefits at 32% (NCS, 2010). Full-time: $53,161.
TS Staff: Other	Administrative assistants (high school diploma, administrative assistant BLS Occupational Outlook Handbook, includes benefits full-time at $45,855); database specialist ($32-$42ph); IT support ($23-$31ph); and work study, tutors, and other college student workers ($7 ph, federal minimum wage).
TS Staff: Professional Development	Costs for travel, accommodation and subsistence for attendance at National COE conference ($1,729 per person) and local conferences ($212 per person).
School Staff: Principals/Teachers	Principals ($54ph including benefits) BLS: Occupational Outlook Handbook http://www.bls.gov/ooh/management/elementary-middle-and-high-school-principals.htm. Teachers ($35ph) NEA 2010 average secondary school teacher salary plus benefits.
School Staff: Guidance Counselors	Counselor ($38ph including benefits) Educational Research Services "National Survey of Salaries and Wages in Public Schools" - (BLS, National Compensation Survey, 2010).
School Staff: Other	Tutors (in school, $13ph; online, $40ph, or based on teacher hourly wage $38ph). Educational Research Services "National Survey of Salaries and Wages in Public Schools" - Teacher aides, instructional (U.S. Census Bureau, Statistical Abstract of the United States: 2012). Administrative assistants ($19ph) ERS, "National Survey of Salaries and Wages in Public Schools" – Secretaries. Data clerks ($21ph) ERS "National Survey of Salaries and Wages in Public Schools" - Typists/data entry clerks.
In-kind Personnel	Former TS participants ($7ph); parents ($14ph, median net annual earnings for high school diploma); board members of TS (Assistant Provost, $46ph, NCS 2010); college student support services (net salary academic advisor, $19ph, CUPA-HR [7550]); college financial aid staff (net salary, financial aid counselor, $18ph, CUPA-HR); college faculty (net public college faculty salary, 9 month contract, NEA/IPEDS, NCS $35ph); members of local community (personal financial advisors, $31ph, NCS).

Description of Ingredients and Pricing	
Facilities	
Host College or School Site	Permanent office space for TS at school; implicit capital costs for computer labs, auditoriums, classrooms, library, or other spaces. Space priced per square foot based on length of school day and school year (range for middle and high schools). Median cost per sq. ft. for construction cost (School Planning and Management magazine, 2011) uprated by 33% for site, site development, and furnishing/equipment. Capital costs amortized over 30 years of construction with interest rate of 5% (Levin & McEwan, 2001). Dormitory costs for overnight stays at colleges ($21 per night based on semester dormitory charges).
Overhead charged to TS	Applied as a standard rate at 8% of total annual funding. Statute is >=8% for educational training programs based on US DOE applications. Overhead includes some personnel services not itemized above. It does not include materials/equipment or other inputs detailed below. This amount was adjusted for any percentage that was returned to the site from the host college.
Materials/Equipment	
TS Site or off-site	Computers, student database service, telephones and service, printers, internet access, video recorders, headphones, school supplies, newsletters and other printed materials. Prices based on market prices per item.
Other Inputs	
Transportation	Mileage for staff to schools (IRS 2010 Standard Mileage Reimbursement Rates); cultural trips; college visits (charter bus cost per day, $595).

Appendix 4 Abbreviations

BA	Bachelor of Arts
BLS	Bureau of Labor Statistics
COE	Council for Opportunity in Education
CPC	Child-Parent Center
CPI-U	Consumer Price Index-All Urban Consumers
CPI-W	Consumer Price Index for Urban Wage Earners and Clerical Workers
CUPA-HR	College and University Professional Association for Human Resources
ERS	Educational Research Services
FAFSA	Free Application for Federal Student Aid
GED	General Educational Development
HECA	Higher Education Cost Adjustment
HEPI	Higher Education Price Index
IPEDS	Integrated Postsecondary Education Dataset
IRS	Internal Revenue Service
IT	Information Technology
ITT	Intent to Treat
LIFG	Low-income first generation
MA	Master of Arts
NCS	National Compensation Survey, Bureau of Labor Statistics, United States Department of Labor
NEA	National Education Association
NGYC	National Guard Youth ChalleNGe
ph	Per hour
PPP	Perry Preschool Program
STAR	Student/Teacher Achievement Ratio
TOT	Treatment on the Treated
USDA	United States Department of Agriculture
US DOE	United States Department of Education
WWC	What Works Clearinghouse