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Promoting Educational Success: Which GEAR UP Services Lead to Postsecondary Enrollment and Persistence?

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Abstract

Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP) is a federal program designed to promote postsecondary readiness and success among low-income students. Some evidence suggests that this program promotes college enrollment and persistence, but GEAR UP may include a wide variety of services, and it is unclear which ones actually contribute to these apparent overall effects. The present study investigates this issue using doubly robust propensity score analyses to provide stronger causal conclusions. Four general service types and seven specific services were examined; the results provide important implications for GEAR UP and other programs designed to promote postsecondary attainment.

Keywords

GEAR UP, college enrollment, college persistence, student services

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A college education has increasingly become necessary to achieve social mobility and membership within middle-class America (Autor, 2014; McMahon, 2009). However, substantial disparities by socioeconomic status (SES) remain in students' postsecondary enrollment and degree attainment. Among high school sophomores in 2002, 60% of students from high-SES backgrounds (defined as the top quartile of a combination of parental education, parental occupation, and family income) had received at least a bachelor's degree within 10 years, whereas only 14% of those from the lowest SES quartile had done so (U.S. Department of Education, National Center for Education Statistics, (2018)). This massive difference in degree attainment is a function of both college enrollment and persistence. Specifically, people from low-SES backgrounds were more likely than those from high-SES backgrounds to have not attended college at all (28% vs. 4%, respectively), to have attended college but not received a degree or certificate (36% vs. 24%), and to have obtained a postsecondary certificate but no degree (13% vs. 5%).

Several large-scale programs have sought to improve college outcomes for low-SES students (for descriptions and evaluations of programmatic impact, see Haskins & Rouse, 2013). One salient federal program designed to achieve this goal is Gaining Early Awareness and Readiness for Undergraduate Programs, which is more commonly known as GEAR UP. In the most common approach, GEAR UP starts in seventh grade and follows a cohort of students throughout high school; grants are awarded to states or partnerships for providing a variety of services to high-poverty schools and communities (for more information, see U.S. Department of Education, 2017). Although some requirements about the timing and nature of services are mandatory, the exact services are largely left to the discretion of the GEAR UP grantee and participating schools. Previous research has found that GEAR UP programs in Ohio, Rhode Island, and Iowa may bolster college enrollment and persistence (Bowman, Kim, Ingleby, Ford & Sibaouih, (2018); Fogg & Harrington, 2015; Knaggs, Sondergeld, & Schardt, 2015; Sondergeld, Fischer, Samel, & Knaggs, 2013).

The present study addresses a critical question that follows from this overall impact: What types of services offered through GEAR UP are effective at promoting college outcomes? To date, little inquiry has explored the effects of such program components. As Perna and Swail (2001) have noted, most outreach and early intervention evaluations for programs targeting low-income students only provide records of the numbers of students who participated in particular activities, so the potential contribution of each service or activity cannot be determined. The findings of this study will help inform policy and practice not only within GEAR UP programs, but also for anyone

who seeks to provide precollege interventions to facilitate college access and success.

Research on GEAR UP and K-12 Student Outcomes

A few studies have examined how participation in services within GEAR UP predicts secondary school outcomes. Using a mixed methods approach, Morgan, Sinatra, and Eschenauer (2015) found that academic support services (e.g., academic advisement, test preparation, during and after school tutoring, college and career readiness, and parent services) had stronger relationships with students' SAT scores and high school graduation rates than did community support services (e.g., college tours and fairs, educational field trips, financial aid workshops). However, when students were asked what they perceived to be the most influential programmatic component, their most common response was college tours and fairs, followed by tutoring and test preparation, then financial aid workshops, academic advising, and parent workshops. Kennedy (2016) only focused on the relationship between a subset of academic support services (academic tutoring, academic mentoring, and study skill workshops) within the GEAR UP program as well as English and math scores for two ACT practice tests (ACT Explore and ACT Aspire) among students enrolled in 13 high schools in nine partnership school districts in Arizona. She found that participation in English tutoring was significantly and negatively related to ACT Aspire English scores, but there was no significant relationship between attendance in study skills workshops and test scores. Also, she found no significant relationships between participation in any service and students' math performance.

Beyond investigation of the relationship between specific aspects of the GEAR UP program and various outcomes, Yampolskaya, Massey, and Greenbaum (2006) examined the amount of time spent on different program activities by comparing three levels of student program involvement (no participation, low participation, and high participation) at a large urban high school in Florida. They found that high school students who had high overall participation in GEAR UP academic activities improved their GPAs during that semester. Moreover, high participation in behavior-related activities (e.g., behavioral counseling) and social activities (e.g., field trips) were associated with fewer disciplinary referrals.

One additional study examined whether the amount of time students spent in GEAR UP services predicts outcomes in secondary education within a predominantly Latinx sample (Cates & Schaefle, 2011). These authors

limited their analytical sample to students who participated in the program over a 6-year period and collected students' information from fifth or sixth grade through their 10th- or 11th-grade year in the final data collection period. They found that hours of participation in advising and tutoring were positively associated with the number of college-track courses completed between seventh and 11th grade. The number of advising hours was also positively associated with preliminary SAT participation in the sophomore or junior year. The results of the correlation analysis reveal that 10th-grade speakers about college, college information booklets, summer programs at a 4-year university, and college visits were associated with students' self-reported expectations for college attendance.

Although these studies provide interesting insights, they also have important limitations. First, all of the outcomes occurred during high school, so it is unclear whether or how these practices affect college enrollment and persistence, which constitute the primary intended outcomes of GEAR UP. Second, with the exception of Yampolskaya et al. (2006), these studies often included no control variables, so student selection into GEAR UP services constitutes a substantial concern for drawing conclusions about their effectiveness. Finally, the conclusions of these studies are limited in terms of strength and generalizability, because most previous studies examined the impact at a single high school or a small handful of schools.

Human Capital and Social Capital Theory

Our study draws upon human capital and social capital theory and their relationship with educational attainment (Becker, 1993; Coleman, 1988). Human capital consists of resources (e.g., knowledge, skills, motivation) embedded in a person's ability; a person can invest in human capital through education, training, or other types of experiences to produce economic value. In human capital theory, formal schooling provides an important way to increase economic value; indeed, this theory has been widely used to explain how students make the decision to attend college (see Becker, 1993; Paulsen, 2001). Within educational contexts, precollege academic preparation is one of the most important components of human capital for promoting college enrollment (Cabrera & La Nasa, 2001; Perna & Titus, 2005). Some of the ways this approach has been operationalized include college preparatory track curricula (with an emphasis on highest level of mathematics completed), high school GPA, and college admissions test scores (e.g., Engberg & Wolniak, 2010).

Strong precollege academic preparation is considered as one of the strongest predictors of college enrollment and success, and higher education

institutions rely substantially on students' high school coursework and GPA, along with standardized test scores, to assess college readiness in the admissions process (Grodsky, Warren, & Felts, 2008; Roderick, Nagaoka, & Coca, 2009). In K-12 research, achievement gaps across students' socioeconomic backgrounds have been well-established. In fact, the achievement gap in reading and math test scores between students from low- and high-income families has actually increased over time (Reardon, 2011), and the impact of family income on college attendance in general and at selective institutions has also grown substantially (Belley & Lochner, 2007; Karen, 2002; Reardon, Baker, & Klasik, 2012). In the light of the considerable differences by social class, low-income students' lack of academic preparation is considered as one of potential mechanism in explaining lower college rates compared with their middle- and high-income peers.

In addition to academic preparation, college-related knowledge can be also considered as an important component of human capital in promoting college enrollment. A lack of knowledge and information about college prices and financial aid likely contributes to persistent gaps in college enrollment by race/ethnicity and SES (e.g., Grodsky & Jones, 2007; McDonough & Calderone, 2006). Exploring this mechanism, Peter and Zambre (2017) examined the causal relationship between college information and educational expectations in Germany through a randomized controlled trial. They found that providing information about the benefits of postsecondary education and funding opportunities increased college enrollment intentions among first-generation university students. Another experimental study from Germany observed that a 25-min information session about funding opportunities and economic returns to higher education increased the university application rates of less-privileged students (Ehlert, Finger, Rusconi, & Solga, 2017). In short, even modest interventions designed to increase college-related knowledge can increase students' educational intentions and postsecondary application behavior.

Social capital inheres in the structure of social relations, and it represents the resources based on and shared by all members of the group (Bourdieu, 1986; Coleman, 1988; Lin, 2001). The influence of social capital is similar to the function of human and financial capital, because it is productive and makes certain actions and results possible through individual investment in social connections. Coleman (1988) argued that social capital constitutes the resources that exist in social structures, which are then used to perform certain actions and reach certain goals within the social structure. Social capital can be created and strengthened through various forms of social relations, including obligations, solidarity, expectations, information channels, and

social norms (Bourdieu, 1986; Coleman, 1988). The information channels are especially relevant for the present study as a means of learning about college and navigating the steps required to prepare for and attend postsecondary education.

In addition to this general definition, Coleman describes social capital that exists within the family and outside the family. The former identifies the relationships between parents and children; high levels of interaction between parents and children as well as parental involvement in their children's educational activities indicate high levels of this type of social capital. Social capital outside the family refers to the social relationships of parents and other adults in the community; these constitute the cultural norms and the value system of the community and can aid in the creation of human capital (Coleman, 1988; Kao & Rutherford, 2007). These community relationships among adults create or use social capital within the community, because these parents can monitor not only their own children but also other people's children, which enables them to establish trust and improve community functioning (see Kao & Rutherford, 2007; Pong, Hao, & Gardner, 2005).

Given this influential advantage arising from social relations, sociologists view disparities in social capital as one mechanism of inequality, as unequally distributed social capital across social class or race/ethnicity leads to unequal educational outcomes, and presumed positive effect of social capital occurs primarily for advantaged families and students (Horvat, Weininger, & Lareau, 2003; McNeal, 1999). Individuals with high levels of social capital may have more and better informational resources that come from social relations; they can then use these advantages to perform certain desired actions. For instance, the quantity and quality of students' college information varies by the family's SES. Students from upper-and middle-class families can maximize the advantages of their parents' social capital in that they gather college-related information and extend the knowledge from their parents' capital. They may also engage professional college guidance and services such as counselors, private tutors, and psychologists by using their parents' social capital to provide college-related information and bolster the likelihood of acceptance at their preferred colleges (Arum & Roksa, 2011; Bell, Rowan-Kenyon, & Perna, 2009; Stevens, 2009).

Capital Theory and the Design of GEAR UP Services

These theoretical perspectives suggest that GEAR UP programs can promote both human and social capital for low-income students and families who may not otherwise have such opportunities. GEAR UP seeks to improve college

readiness and success for low-income students by offering various types of services that prepare students academically for postsecondary education and help them with planning for college and obtaining financial aid (please see the Method section for more detailed descriptions of services). First, students who participate in the academic enhancement services of GEAR UP programs may benefit significantly from increased precollege academic preparation, which constitutes a fundamental dimension of human capital development. Specifically, tutoring and academic presentations are designed to bolster students' academic skills and knowledge in their high school courses, which may lead both to higher grades and stronger preparation for college coursework. ACT/SAT tutoring may also improve students' likelihood of acceptance at colleges that are at least moderately selective. For both forms of academic enhancement, improved grades and test scores may enhance students' chances of receiving some forms of financial aid, which will then enable them to successfully complete their college degree.

Second, receiving counseling for financial aid and career services or participating in college visits can yield valuable college-related knowledge that contributes to students' human capital, because these experiences allow students to gather college-related knowledge and information directly. Visits to college can provide not only general information about college life and preparing for college but also insights into what it means to be a college student, such as balancing school and work responsibilities, developing peer relationships, and differences between college and high school coursework. This firsthand information and experience can be extremely valuable and difficult to obtain in any other way, especially for students who are seeking to become the first in their family to attend college.

Third, some GEAR UP services may also promote social capital. In GEAR UP Iowa, each school was required to have an employee who was in charge of GEAR UP services; this person was often hired exclusively to support the GEAR UP initiative at that school. The organizational structure served to facilitate interpersonal relationships between this person and students in the GEAR UP program. Moreover, services that involved repeated engagement also typically occurred with the same tutor or counselor, which allowed these students to develop social bonds and to have an additional resource for information about college enrollment and success that extends beyond the particular GEAR UP service. Although the college visit often occurred only once per campus, GEAR UP students may still make connections with college students or staff, which they can maintain through email, text messaging, and/or social media.

Finally, in addition to students' development and relationships, GEAR UP is also designed to promote human and social capital through parental

involvement and parental knowledge about postsecondary education opportunities for their children (Cabrera et al., 2006; Standing, Judkins, Keller, & Shimshak, 2008; Ward, Strambler, & Linke, 2013; Weiher, Hughes, Kaplan, & Howard, 2006). Structured events for parental engagement also create opportunities for parents to form relationships with school staff and other parents. These kinds of parental involvement may have indirect positive effects on students' college enrollment and retention in the long-term. By engaging with a variety of GEAR UP services, students and their families can develop human and social capital that promote college outcomes.

Present Study

This study examined outcomes from a region of the state of Iowa. In 2008, the Iowa College Student Aid Commission received a GEAR UP grant from the U.S. Department of Education. The Iowa Department of Education, the Iowa Association of Independent Colleges and Universities, and the Iowa Association of Community College Trustees collaborated to use statewide and school-based services to create a "college-going culture" among underserved populations and first-generation students. Districts were assigned to GEAR UP based on the proportion of their students who were eligible for free or reduced-price lunch. GEAR UP uses a cohort model, in which services are administered to students in GEAR UP school districts from seventh grade (i.e., 2008-2009 in this administration) until 12th grade (i.e., 2013-2014).

Using available student data, each partner school developed an annual implementation plan that outlined the school-based services for students, parents, and educators. These services varied somewhat across high schools and districts, but they generally included some combination of academic enhancement (e.g., one-on-one tutoring, computer-assisted learning), academic and career planning, college visits, financial aid counseling, test preparation (e.g., ACT, Advanced Placement), and other services. GEAR UP Iowa provided each partner school with an annual allocation of funds to assist in carrying out its plan. GEAR UP students were also eligible to receive a scholarship for up to US$1,300 per semester for up to 4 years of postsecondary education (students who were enrolled part-time received a reduced amount based on the number of credits). All students who attended a GEAR UP high school were eligible to receive services (i.e., these were not limited to lower income students within the high school).

The ways in which students ultimately participated in services varied notably across services and schools. Engagement in some activities occurred entirely through student self-selection (e.g., assistance with college

applications), whereas others occurred through a combination of self-selection and targeting students who had lower academic achievement (e.g., academic assistance, admissions test preparation). Each school created its own implementation plan; as a result, schools differed in the extent to which they used academic performance to target services and embedded services within the existing school structure (by offering these during regular class periods).

The state of Iowa offers a unique context in which to examine the effects of GEAR UP services. Over 90% of Iowans who are at least 25 years old had earned a high school diploma, and the percentage of Iowans with high school diplomas was greater than the national average for all age groups (U.S. Census Bureau, 2015). Iowa was also the first state to have a high school graduation rate over 90%, and it is one of only six states in which the graduation rate of low-income students is above the national average for all students (Civic Enterprises, 2016). However, Iowa's graduation rate for low-income students still lags behind that of higher income students by over 10 percentage points. Iowa also holds an unusual position in terms of higher education. Iowa had above-average college graduation rates at public 4-year, public 2-year, and private not-for-profit institutions in 2013 (Chronicle of Higher Education, 2015). In contrast with these strong high school graduation rates and college graduation rates among people who do attend higher education, Iowa was in the bottom third of states in the proportion of adults 25 years and older who hold at least a bachelor's degree in 2015 (U.S. Census Bureau, 2017). Altogether, these statistics suggest a low rate of college enrollment among Iowa high school graduates; thus, GEAR UP has the potential to serve a critical role in improving college attendance.

Method

Participants and Data Sources

Participants were 682 students who attended seventh grade in a GEAR UP Iowa school district during the 2008-2009 academic year and later graduated from a high school in the Mississippi Bend Area Education Agency (MBAEA), which covers counties in Eastern Iowa that largely border the Mississippi River (MBAEA, 2017). The MBAEA includes 19 high schools; at least three schools were in each of the following urban-centric locales: city, suburb, town, and rural. Relative to the state as a whole, MBAEA had larger proportions of students of color and students who were eligible for free and reduced-price lunch, along with lower average performance on K-12 assessment tests (based on figures from the first year of GEAR UP Iowa; see Iowa Department of Education, 2018).

Data for this study were obtained from several sources. GEAR UP Iowa maintained records about this cohort, including all GEAR UP services that each student received. According to this detailed data, over one third of students received three to five distinct types of services, about one third received six or more distinct types, and only 5% received no services. Students may have received the same service type on various occasions over a period of up to 6 years. MBAEA provided information about students' K-12 enrollment and high school graduation. These data were linked with postsecondary enrollment information from the National Student Clearinghouse (NSC), which covers over 3,600 colleges and universities that enroll 98% of all postsecondary students in the United States (NSC, 2017). Of the 682 participants, 54% were eligible for free or reduced-price lunch, 50% were female, 62% were White/Caucasian, 15% were Black/African American, 15% were Hispanic/Latino, 6% were multiracial, 2% were Asian/Pacific Islander, and 0.4% were American Indian/Alaskan Native.

Measures

Three binary dependent variables were created from NSC data (0 = no, 1 = yes). These indicated whether the student (a) enrolled in postsecondary education in the first year after high school graduation, (b) enrolled within 2 years of high school graduation, and (c) persisted to the second year of postsecondary education (only among students who enrolled in their first year after high school).

The first set of treatment variables were four general categories of GEAR UP services. *College visits* consisted of physical trips to college campuses, which often included presentations by various campus constituents (e.g., admissions, student affairs, multicultural affairs). *Financial aid counseling* included information about the Free Application for Federal Student Aid (FAFSA), financial aid opportunities, and financial literacy. *Academic enhancement* included services that mostly (but not entirely) occurred outside of formal classroom time, such as after-school tutoring, homework assistance, and presentations on academic topics. *Academic and career counseling* involved individual or small-group assistance to students or parents about coursework selection, college planning, undergraduate major selection, and career planning. The benefit of considering these broad categories is that the larger number of students ensures sufficient statistical power, and practitioners may want to know which general domain(s) of services should receive the most attention. However, the drawback is that these categories inherently contain multiple specific types of services, so the analyses cannot provide information about any differences in effects among these types.

Therefore, seven specific services were examined as additional treatment variables. *College campus activities* moved beyond listening to presentations by having participants "shadow" college students throughout their day and engage in activities. *Academic assistance* included tutoring in various subjects outside of normal school hours (after-school, Saturdays, and summers). *I Have a Plan Iowa* is an online system for college and career planning that students completed across multiple grades; the resources included an interest profiler, career finder, education requirements and average annual income for individual careers, career clusters and pathways, basic skills self-assessment, plan of study, and coursework plan for Grades 9 to 12. *Four-year graduation plans* were developed during student appointments with counselors. A *motivational speaker* gave talks in student assemblies about seeing themselves as college students, overcoming obstacles, and adopting a growth mind-set. *ACT/SAT test preparation* occurred during lunch and/or after school; this service specifically targeted students who were scoring below a 19 for their ACT composite score. Finally, *college application assistance* consisted of one-on-one help from an advisor or volunteer; these often occurred during larger schoolwide events celebrating college applications and expected college enrollment. Each of these seven specific services was utilized by more than 40 participants; preliminary analyses of both specific services and general service categories with fewer than 40 students in the treatment condition found that the treatment and control groups could not be balanced on all covariates, even when attempting a variety of matching techniques. All other general categories and specific services that appeared within the GEAR UP records had a sample size below 40 students, so these were therefore excluded from the analyses. A brief overview of all services explored in this study and the number of students who received each service appears in Table 1.

Although the records used for the study denoted whether students participated, they did not contain information about the timing of that participation. The vast majority of services were administered at some point during high school, and some of these occurred for everyone at times that were driven by the nature of the service (e.g., junior year for SAT/ACT preparation, senior year for college application assistance). In addition, some services occurred across multiple years (e.g., academic assistance, I Have a Plan Iowa), but it was unclear when and over what period of time each student participated. There also was not reliable information about the duration of each student's engagement with that service. Finally, over 90% of students within the sample who attended college received a scholarship. Because the scholarship was conditional on college attendance, the effect of this aspect of the GEAR UP intervention could not be tested directly.

Table 1. Summary of GEAR UP Iowa Program Services.

	Brief description	Number of students who received service	Number of immediate college enrollees who received service
General service type			
College visits	Trip to college campus	358	209
Financial aid counseling	Information about FAFSA and financial aid	90	59
Academic enhancement	Tutoring and academic presentations	106	61
Academic and career counseling	Planning assistance provided to students or parents	475	263
Specific service type			
College campus activities	Shadowing college students and activity participation	315	180
Academic assistance	Tutoring outside of school hours	89	55
I Have a Plan Iowa	Online college and career planning system	56	35
Four-year graduation plans	Plans developed through counseling appointments	285	155
Motivational speaker	Provided presentations in student assemblies	368	190
ACT/SAT test preparation	Targeted students with lower test scores	164	106
College application assistance	One-on-one assistance with completing applications	351	197

Note. "Immediate college enrollees" refers to participants who enrolled in college during their first year after high school graduation; these students constituted the treatment group among the 367 participants examined in the college persistence analyses. The left-hand numerical column provides the sample size for the treatment group in the full-sample analyses of 682 students. Please see the main text for more detailed descriptions of each general and specific service. GEAR UP = Gaining Early Awareness and Readiness for Undergraduate Programs; FAFSA = Free Application for Federal Student Aid.

The covariates included dummy-coded variables for race/ethnicity (Black/African American, Hispanic/Latino, and multiracial/other, with White/Caucasian as the referent group), sex (0 = male, 1 = female), eligibility for

free or reduced-price lunch (to indicate low SES; 0 = no, 1 = yes), and K-12 special education status (0 = no, 1 = yes). Seventh-grade Iowa Assessment achievement test scores in mathematics and reading were also used; these indicated students' percentile relative to others within their grade (on a scale from 1 to 99). Because the math and reading measures were very highly correlated with each other (r = .77), they were combined into a single pretest academic achievement score.

Analyses

Propensity score analyses were used to account for nonrandom selection into each GEAR UP service. The analyses used covariates that occurred before the treatment (i.e., a particular GEAR UP service) to create a propensity score that indicates each participant's likelihood of receiving the treatment. The propensity score is then used to match comparable students who did and did not receive that particular treatment to compare their outcomes and draw more accurate conclusions about the causal effect of the treatment (for detailed discussions, see Austin, 2011; Guo & Fraser, 2015; Pan & Bai, 2015). Given the use of various treatments and multiple outcomes in this study, separate analyses were conducted for each treatment and each outcome.

Covariates were selected on the basis of their anticipated relationship with both the treatment and the outcomes; research has shown that covariates that predict the outcome should be retained in the model even if they do not significantly predict the treatment, especially for smaller sample sizes (Brookhart et al., 2006; Patrick et al., 2011; Westreich, Cole, Funk, Brookhart, & Stürmer, 2011). The covariates included student race/ethnicity, sex, SES, and test scores, all of which are well-established predictors of college enrollment and persistence (see Perna & Jones, 2013; Radford, Berkner, Wheeless, & Shepherd, 2010; Robbins et al., 2004). Moreover, the fact that some services were targeted based on students' lower academic achievement makes the inclusion of test scores particularly important. K-12 special education status was also used as a covariate; it is not frequently considered in college research, but preliminary analyses indicated massive differences in enrollment and persistence by special education status within the present sample.

An important feature of propensity score matching is that it can only remove selection bias associated with the covariates that are used to create the propensity score; therefore, omitting important variables, such as a pretest for an outcome that changes over time, is a notable concern (e.g., Pascarella, Salisbury, & Blaich, 2013; Steiner, Cook, Shadish, & Clark, 2010). To help minimize the potential for this issue to be problematic, we used doubly robust estimation of causal treatment effects, which obtains

unbiased results even when the analysis predicting either the treatment or the outcome—but not both—is misspecified (see Funk et al., 2011; Glynn & Quinn, 2010; Lunceford & Davidian, 2004). In a sense, this approach gives the researcher two chances, instead of only one, to draw a valid inference (Bang & Robins, 2005). In particular, this study employed propensity score analyses with an augmented inverse probability weighting (AIPW) estimator using the teffects program in Stata 14 (Drukker, 2014). This technique achieves double robustness by creating the propensity score and conducting the outcome analysis within the same process rather than separating these into two distinct stages. These analyses retained all students, because the weighting approach serves to substantially reduce or increase the influence of individual participants to create treatment and control groups that are very similar in terms of covariates. We report estimates of the average treatment effect; because all participants were attending GEAR UP schools, we were interested in determining the causal effect for all of these students. The analyses appropriately modeled the college outcomes as binary and also adjusted the standard errors to account for the nonindependence of students nested within high schools (Snijders & Bosker, 2012).

We assessed balance within all propensity score analyses to determine that the treatment and the control groups were similar on observed covariates. For all covariates in all analyses, the ratio of variances for the treatment and control group was between 0.5 and 2.0 (with most being quite close to 1.0). The differences between these two matched groups were below or approximately one tenth of a standard deviation on all covariates in the vast majority of analyses, but a few exceptions occurred for some analyses that had smaller numbers of participants in the treatment group. The balance issues for financial aid counseling predicting college enrollment were resolved by standardizing the test score measure, multiplying it by itself, and then adding this squared term to the model. However, attempts to create squared terms and interactions among covariates did not resolve the balance issues for overall financial aid counseling predicting persistence as well as I Have a Plan Iowa predicting all outcomes. As an alternative to doubly robust AIPW estimation, kernel matching was used for those treatments and outcomes, as this approach yielded appropriate balance. Detailed information about covariate balance before and after propensity score adjustment is provided in Appendices A and B.

Limitations

Some limitations should be noted. First, the analyses were limited to GEAR UP participants who had graduated from high school. GEAR UP may enhance

the likelihood of high school graduation, so the present results may underestimate the impact of these services. Second, given the several data sources required to assemble the dataset, the sample consists of one area education agency in the state of Iowa. We suspect that the challenges with obtaining relevant data constitute the main reason why so few studies have been conducted on GEAR UP and college outcomes; that said, this feature may limit the generalizability of our results. This study does constitute an important first step toward understanding the long-term effects of GEAR UP services on college outcomes. Third, although we were able to obtain students' achievement test scores and several student demographics, we did not have a direct measure of student educational plans or other potential indicators of motivation in the seventh grade. The doubly robust estimation likely resolves this problem to some extent, but this issue may be a greater concern for selection into some services than others, which we discuss below.

Finally, GEAR UP is a multifaceted program, so most students participated in more than one of the services examined in this study. As a result, the control group for each analysis always consisted of students who did not participate in that particular treatment, but most students in the control group did participate in at least one other GEAR UP service. As a result, one should not necessarily think of students in the control group as "untreated"; instead, they simply did not receive the particular treatment examined in that analysis. Similarly, most students in the treatment condition have also participated in at least one other GEAR UP service. It is certainly possible that some combination of these treatments may interact with each other, such that the outcomes that result from multiple treatments are not simply the sum of the individual treatment effects. Unfortunately, the presence of many different combinations makes it difficult to test each possible set of treatments. When considering just the four general service categories, students could participate in 16 different combinations of 0 to 4 categories; there are also 128 different combinations of treatments for the seven specific services. The sample size for each combination also becomes small very quickly when creating these intersecting groups. Some of these same challenges also apply to the consideration of potential dosage effects, because creating multiple treatment categories with this study's modest sample size would lead to substantial difficulty for achieving covariate balance across all treatment and control groups. As a result, only the individual effects of participating (or not) in each specific service or type of service were examined.

Results and Discussion

The results of propensity score analyses for the impact of the general GEAR UP service types are presented in Table 2. Among these four general

Table 2. Results for Propensity Score Analyses Examining the Effect of General GEAR UP Services on College Enrollment and Persistence.

	College outcome					
	Enrollment within 2 years of high school graduation		Enrollment within 1 year of high school graduation		Persistence to the second year	
GEAR UP general service	Average treatment effect	Robust standard error	Average treatment effect	Robust standard error	Average treatment effect	Robust standard error
College visit	.085*	.037	.094*	.037	.126**	.044
Financial aid counseling	.169**	.061	.173**	.063	.049	.070
Academic enhancement	.067	.054	.060	.055	.070	.053
Academic and career counseling	.073	.040	.063	.040	.056	.055

Note. Doubly robust propensity score analyses with augmented inverse propensity weighting were used in virtually all analyses (financial aid counseling predicting persistence did not have sufficient balancing across conditions with this approach, so propensity score analyses with kernel matching were conducted instead). The covariates were race/ethnicity, sex, eligibility for free or reduced-price lunch (socioeconomic status), K-12 special education status, and seventh-grade test scores (average of mathematics and reading). The analyses used robust standard errors that accounted for the clustering of students within high schools. $N = 682$ for predicting college enrollment, and $N = 367$ for predicting college persistence. GEAR UP = Gaining Early Awareness and Readiness for Undergraduate Programs.
*$p < .05$. **$p < .01$. ***$p < .001$.

categories, college visits and financial aid counseling both had positive effects on college enrollment within a year and within 2 years of high school. Students who participated in college visits were approximately 9 percentage points more likely to enroll in college within a year and within 2 years of high school graduation, and they were almost 13 percentage points more likely to persist in college compared with college enrollees who did not participate in such visits. These figures are close to the values for a medium effect size (9 percentage points) and large effect size (15 percentage points) within college impact research (Mayhew et al., 2016).

Financial aid counseling appeared to be highly effective in bolstering college enrollment, as doubly robust propensity score analyses found an effect of over 17 percentage points on both enrollment outcomes. These findings

are consistent with a human and social capital explanation in that students and parents—particularly those from low-income backgrounds—often have substantial misunderstandings about college finances. For instance, students and parents both overestimate college costs by as much as 200%, and more than two thirds of students who do attend college and take out student loans are surprised by some aspect of their loan (ideas42, 2016). Financial aid counseling can help families navigate the complex process (notably including the FAFSA application) and realize that college may be more affordable than they had expected, especially when making well-informed choices about applying for aid and enrolling in a particular college or university.

Table 3 displays propensity score results for specific GEAR UP services; this table also provides the broader general category in which each service was included (those described as "other" did not fall into any of the four categories discussed above). College campus activities, academic assistance, I Have a Plan Iowa, and ACT/SAT test preparation were all positively and significantly related to college enrollment, especially within 1 year of high school graduation. Perhaps not coincidentally, the two services that significantly predicted only immediate college enrollment—college campus activities and I Have a Plan Iowa—were likely to help students "see" themselves in college through engaging in campus life and planning for college majors and resulting careers, respectively. This short-term college enrollment outcome may be especially important, because students who do not delay college entry after high school are much more likely to receive a college degree than their peers who enroll even a year or two later (e.g., Horn, Cataldi, & Sikora, 2005).

Although academic enhancement as a general category did not significantly predict college outcomes (see Table 2), academic assistance services that largely consisted of one-on-one tutoring were associated with a 12 percentage-point increase in college enrollment within a year and 2 years after high school graduation. This disconnect between general and specific outcomes also occurs for overall academic and career counseling (which exhibited no significant relationships) versus the specific enhancement service of I Have a Plan Iowa (which had a $16^{1}/_{2}$ percentage-point effect on college enrollment within 1 year). These findings illustrate the importance of drilling down to specific services rather than only examining broad service types. Four-year graduation plans (which were generally one-time activities) were included in the same general academic and career counseling category as I Have a Plan Iowa (which engaged students repeatedly over an extended period of time). Similarly, academic assistance services often occurred repeatedly, whereas presentations on academic topics were short-term, one-time activities that also fell within the same general academic enhancement

Table 3. Results for Propensity Score Analyses Examining the Effect of Specific GEAR UP Services on College Enrollment and Persistence.

		College outcome					
		Enrollment within 2 years of high school graduation		Enrollment within 1 year of high school graduation		Persistence to the second year	
General service category	Specific service	Average treatment effect	Robust standard error	Average treatment effect	Robust standard error	Average treatment effect	Robust standard error
College visit	College campus activities (beyond general visit)	.067	.037	.076*	.037	.102*	.043
Academic enhancement	Academic assistance (mostly one-on-one tutoring)	.122*	.056	.122*	.057	.060	.056
Academic and career counseling	I Have a Plan Iowa (online career and academic planning)	.129	.088	.166*	.080	—	—
Academic and career counseling	Four-year graduation plan	.051	.036	.036	.037	.052	.044
Other	Motivational speaker (student assembly)	−.056	.037	−.042	.038	−.008	.046
Other	ACT/SAT test preparation	.120**	.044	.118**	.044	−.065	.046
Other	College application assistance	.040	.038	.043	.038	.050	.048

Note. Doubly robust propensity score analyses with augmented inverse propensity weighting were used in most analyses (academic and career counseling did not have sufficient balancing across conditions using this approach, so propensity score analyses with kernel matching were conducted instead). The covariates were race/ethnicity, sex, eligibility for free or reduced-price lunch (socioeconomic status), K-12 special education status, and seventh-grade test scores (average of mathematics and reading). The analyses used robust standard errors that accounted for the clustering of students within high schools. The analysis for I Have a Plan Iowa predicting persistence was not conducted, because too few students participated in this service. $N = 682$ for predicting college enrollment, and $N = 367$ for predicting college persistence. General Service Category maps each specific service onto the four general types that appear in Table 2 ("other" indicates that it does not fall into any of those types). GEAR UP = Gaining Early Awareness and Readiness for Undergraduate Programs.

*$p < .05$. **$p < .01$. ***$p < .001$.

category. Thus, both the quality and quantity of the service may play a key role in these results, and the relationships that are developed within some long-term engagements may serve as an important form of social capital for promoting college access and success.

These findings expand and improve upon existing studies that explored the link between specific GEAR UP components. Prior research showed that GEAR UP academic activities were generally associated with improved academic outcomes in high school (Kennedy, 2016; Morgan et al., 2015; Yampolskaya et al., 2006). The present study yields additional insights by distinguishing among specific academic (and other) services and identifying the differential relationships across types. Furthermore, the positive relationship for college visits and college enrollment is also consistent with Cates and Schaefle's (2011) examination of high school outcomes. College visits seem likely to build human and social capital by allowing students to gather college-related information and develop interpersonal relationships through firsthand engagement with students and administrators.

ACT/SAT test preparation was also positively and significantly related to college enrollment. Students who participated in this service were approximately 12 percentage points more likely to enroll in college within a year and within 2 years after high school graduation. At first glance, one might argue that the test preparation result is significant only because students who are already planning to attend college would decide to engage in this activity. However, the findings were not significant for other services that were very strongly tailored toward students who are already on the road to college attendance, such as making a plan to graduate from college within 4 years and assistance with college applications. College application assistance may indeed be helpful for students who are navigating this process (and therefore constitute an important service to provide), but it may not make a difference in whether students ultimately apply and decide to attend. Moreover, many students who intend to start college and have taken various concrete steps toward doing so ultimately decide not to attend. This "summer melt" phenomenon may affect more than 10% of college-intended students, with higher rates of melt among high-poverty high schools and students who plan to go to community college (Castleman, Page, & Snowdon, 2013). Because college admissions tests are only required at 4-year institutions, ACT/SAT preparation may help students not only gain admittance at these schools, but also reduce the likelihood of experiencing summer melt. ACT/SAT preparation targeted toward low-income students can also promote the reduction of social class inequalities in college test preparation activities (Buchmann, Condron, & Roscigno, 2010), because it provides students with knowledge

about the tests themselves and how to approach these exams effectively, while removing obstacles associated with the usual high cost of such services.

Having a motivational speaker was not significantly associated with college enrollment and persistence; it was also the only service in which the direction of the coefficients was consistently negative and therefore would be very unlikely to have a positive effect even within a larger sample. The use of a motivational speaker may rest on an unfounded assumption that students are not attending college because they lack the motivation to do so. That said, the content of the speaker seemed to move beyond mere motivation to include strategies for overcoming obstacles and having a growth mind-set (in which intelligence is viewed as malleable, not innate). However, attempting to influence student mind-sets can be very difficult without a strong psychological understanding of how to do so effectively, and large student assemblies constitute a less-than-ideal context for achieving these conditions (for a detailed discussion, see Yeager & Walton, 2011).

Finally, the only significant, positive predictors of persistence were general college visits (about 13 percentage points) and the specific service of college campus activities (about 10 percentage points). These in-person visits may help students understand what it is like to attend college in a manner that cannot easily be replicated by hearing or reading about college. As a result, students may be better prepared for the daily routines as well as potential challenges and opportunities of college life. This awareness may prevent the postsecondary transition from being as surprising or stressful as it would otherwise be, especially among first-generation college students.

Conclusion and Implications

This study investigates the effects of general and specific GEAR UP services on college enrollment and persistence. It contributes to the research literature by examining college outcomes, using doubly robust propensity score analyses that account for student selection into services, considering both general service types and specific services, and exploring a regional sample rather than students at a single high school. These features constitute noteworthy strengths for the ability to draw generalizable causal conclusions about particular GEAR UP services and their intended outcomes. These findings may be useful to GEAR UP initiatives around the country, as they seek to create programs that are optimally effective in promoting college access and success. These results are also likely applicable to a broad range of efforts to

increase college-going and reduce long-standing economic disparities in educational attainment.

Perhaps not coincidentally, the specific services that appeared to be ineffective in promoting these outcomes were activities that happened only 1 time or perhaps a couple of times, including an assembly with a motivational speaker, assistance with college applications, and creating a 4-year graduation plan. It makes sense that such shorter term activities may not have a significant effect on college enrollment or persistence. That said, it is possible that such services may still be worth providing, because they may simplify college access and ultimately reduce student debt, which were not directly assessed in this study. Although students' decision to attend college may not be based on the presence of help with the college application process, this effort may certainly still help students with an important—and often complicated—task that is necessary for college enrollment. This assistance could also involve making a request to waive the application fee for low-income applicants, which would further help students navigate an option of which they may not be aware.

In some cases, 1-time services may ultimately prove to be influential for directly affecting these primary outcomes. College visits constitute a notable example, because a 1-day trip could involve meeting with various student support staff, shadowing a current student around campus, and participating in co-curricular activities. Campus visits were the only service type that was significantly related to both college enrollment and persistence; indeed, experiencing the campus firsthand may lead to insights about navigating the college environment that are unlikely to be obtained through other approaches. Moreover, financial aid counseling appeared to be the most effective practice for promoting college enrollment. This counseling could occur in a single session, but only a handful of sessions may be needed to provide valuable information at key points in the college preparation and decision-making process: (a) understanding actual college costs and opportunities for obtaining grants and/or loans, (b) completing the FAFSA and other applications that may result in receiving aid, and (c) making decisions about where to attend college after financial aid options are known.

The other seemingly effective services involve repeated engagement with specific forms of assistance, including tutoring, test preparation, and career planning. Most of these services entail one-on-one or small-group interpersonal sessions, but the I Have a Plan Iowa online system also significantly promoted college enrollment within a year of high school graduation.

Therefore, the social capital obtained through human interaction may be helpful—but not always necessary—for facilitating college attendance, because this online program may have an impact solely through promoting human capital. These sustained initiatives have the potential to be quite expensive, especially when compared with a 1-time student assembly or college application fair. That said, some strategies may help to reduce or avoid many of the costs needed to provide help with academics and career planning. High schools and local colleges could partner to offer academic service-learning courses (or simply volunteer opportunities) in which college students provide after-school tutoring to high school students. Local community organizations could also work with high schools to offer these services over an extended period of time, perhaps with the same pairing of tutors and students continuing over multiple years. By developing these personal relationships, college students and graduates can offer insights and mentoring that extend well beyond academic content.

Future research is needed to replicate and extend these findings. Because GEAR UP is awarded to states or partnerships, broad categories of services may look very different—and entail different specific practices—when examined across states. The present study took an important step toward this level of specificity, but additional research in other GEAR UP and college preparatory contexts is needed. In addition, students often engage in multiple GEAR UP services, so determining the potential impact of particular combinations of services would be informative. This approach would require a large sample size as well as a priori expectations about which combinations merit attention, because the number of potential combinations increases considerably with each additional service or service type. Another important issue pertains to the timing of services. In GEAR UP Iowa, fewer services were available in seventh grade, and the vast majority occurred during high school, but the records do not include the timing of service provision. Some services have fairly logical timing (e.g., college application assistance), but others could occur in some or all years from Grades 7 to 12 (e.g., academic tutoring, career planning). When might they be offered to obtain the greatest impact on college outcomes? The answers to such questions will provide concrete guidance to maximize the benefits of college preparation programs.

Appendix A

Balance of Covariates Between Treatment and Control Condition for Samples That Did and Did Not Employ Propensity Score Weighting for Analyses Predicting the College Enrollment Outcomes.

	Female		Black		Latino		Multiracial		Low-SES		Special Ed		Test scores	
Treatment variable	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt
College visit	.19	.00	.21	.00	.14	−.00	.03	−.00	.13	.00	−.04	.00	.02	−.01
Financial aid counseling	.17	.00	−.04	.01	.77	.00	.02	−.04	.21	−.10	−.18	−.01	.01	.02
Academic enhancement	.15	.03	−.05	−.01	.36	−.02	.15	−.02	.10	−.05	−.07	.02	−.25	.10
Academic and career counseling	.24	.01	.01	−.00	0.19	.01	−.03	−.00	.20	−.00	−.12	.01	.07	−.01
College campus activities	.15	−.00	.13	−.00	.20	.00	.05	−.00	.17	−.00	.01	−.00	−.10	.00
Academic assistance	.14	.01	−.04	−.04	.42	−.02	.06	−.01	.02	−.05	−.04	.03	−.26	.07
I Have a Plan Iowa	.19	.05	−.51	−.04	1.17	−.00	−.22	−.04	.14	−.06	−.16	−.02	−.26	−.12
Four-year graduation plan	.10	−.01	.14	−.00	.12	−.00	−.09	.00	.15	−.00	.07	−.00	−.17	.01
Motivational speaker	.12	.01	−.02	−.00	.33	.01	−.01	.00	.21	.01	−.07	−.01	−.01	−.01
ACT/SAT test preparation	.23	−.02	−.09	.05	−.00	−.02	.08	.00	.02	.01	−.18	.01	.33	−.04
College application assistance	−.10	−.01	.26	−.00	−.45	−.01	−.02	.00	−.16	−.01	.10	−.01	−.02	.01

Note. "Unw" refers to unweighted sample, and "Wt" refers to weighted sample. Standardized mean differences are reported. Variance ratios were between .38 and 2.63 for the unweighted sample and between .93 and 1.30 for the weighted sample. These values are identical for analyses that use college enrollment within 1 year and within 2 years of high school graduation. SES = socioeconomic status.

Appendix B

Balance of Covariates Between Treatment and Control Condition for Samples That Did and Did Not Employ Propensity Score Weighting for Analyses Predicting the College Persistence Outcome.

	Female		Black		Latino		Multiracial		Low SES		Special Ed		Test scores	
Treatment variable	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt	Unw	Wt
College visit	.04	.01	.18	−.00	.04	.00	.05	.00	.15	.00	.05	−.01	−.06	−.01
Financial aid counseling	.03	.10	.03	.14	.68	−.02	.00	.07	.44	.01	−.24	−.12	−.18	−.10
Academic enhancement	.14	.02	−.18	−.07	.33	.00	.18	.01	.15	.01	.04	.07	−.23	.03
Academic and career counseling	.30	.03	−.14	−.02	.19	.00	.14	−.04	.37	−.01	−.21	.01	.12	−.03
College campus activities	.03	.00	.13	−.00	.11	.00	.07	.00	.21	.00	.08	.00	−.17	−.00
Academic assistance	.21	−.01	−.14	−.08	.34	.01	.10	.01	.15	.01	.07	.06	−.28	.03
Four-year graduation plan	.13	−.01	−.06	−.00	.16	−.00	.08	−.00	.15	−.01	.01	−.01	−.15	.01
Motivational speaker	.15	.01	−.01	.00	.26	.01	−.00	−.00	.31	.01	−.09	−.00	−.03	−.00
ACT/SAT test preparation	.21	−.02	−.06	.04	−.04	−.02	.00	−.03	.12	−.01	−.06	.02	.25	−.04
College application assistance	−.15	.01	.22	−.01	−.44	−.03	.17	.00	−.20	−.02	.08	.00	−.03	.01

Note. "Unw" refers to unweighted sample, and "Wt" refers to weighted sample. Standardized mean differences are reported. Variance ratios were between .46 and 1.80 for the unweighted sample and between .83 and 1.40 for the weighted sample. I Have a Plan Iowa is not shown above, because the sample size for the persistence outcome was too small to conduct analyses for this treatment. SES = socioeconomic status.

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Christina Sibaouih is the Director for the statewide GEAR UP (Gaining Early Awareness and Readiness for Undergraduate Programs) grant in Iowa, as well as division administrator for Community Engagement for the Iowa College Student Aid Commission. Her research background has included the role of identity in conflict and democratization models to support enhanced civic engagement and stability. Her current work focuses upon the promotion of educational equity and access through collective impact and systems change.