The Role of Information in College Scholarship Enrollment: Evidence from a Light-Touch Intervention*

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Abstract

Many students fail to enroll in college because of lack of information about available financial aid and scholarships. We analyze a low-cost, randomized nudge intervention aimed to promote enrollment in a state-run college scholarship program for qualified, low-income students with historically low take-up rates among at-risk students. Students enroll in the program at the end of their eighth-grade year and are eligible for funds if they meet certain milestones throughout their high school years. The intervention was fielded in a local school district with high eligibility but historically low enrollment rates, and the sample population consisted of students that had not enrolled within one month of the enrollment deadline. The treatment groups received either a phone call or a letter providing basic program information and directions about how to apply while the control group received no additional information about the program. We found that assignment to the nudge treatment group increased enrollment rates by 56%. The treatment-on-treated effect was an increase in the enrollment probability among the targeted subsample of nearly 73%. These findings are consistent with previous research suggesting that even very low-cost information interventions can act to mitigate low take-up.

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1 Introduction

Attainment of a college degree is one of the strongest predictors of employment and social mobility, yet the vast majority of children from low-income families fail to even apply to colleges (Avery and Turner, 2009; Avery and Hoxby, 2013). For many families, this failure is driven by a perception that a college education is prohibitively expensive (Hoxby and Turner, 2015). Although parents from all income levels tend to overestimate the true out of pocket costs their family would incur to send a child to college, low income and minority families are the most uninformed about the costs of college (Horn, Chen and Chapman 2003; Avery and Kane 2004; Grodsky and Jones 2007).

Given the perceived financial barriers to college, take-up rates for available financial aid programs are surprisingly low (Bettinger et. al, 2012). Dynarski (2003) shows that increasing available financial aid does increase schooling attainment and college completion for the general population, but that these gains are primarily concentrated among those students who have already overcome the hurdle of applying to college. There appears to be an additional barrier between financial aid availability and low-income high school students, or students who would be first-generation college students. Many researchers have pointed out that even students who do enroll in college lack information about cost and funding opportunities and find the process of applying for grants and loans to be too complex and overwhelming (Dynarski and Scott-Clayton 2006; Dynarski, Scott-Clayton and Wiederspan 2013). Dynarski et al. (2018) showed that informing low-income high-school seniors that they would qualify for nearly full tuition benefits at the University of Michigan more than doubled enrollment, increasing enrollment at highly selective, four-year institutions from 28 percent to 67 percent.

As a result of this knowledge gap, a substantial portion of disadvantaged students fail to benefit from available college funding programs. Dynarski and Scott-Clayton (2006) show that policies intended to increase available student aid result in compliance costs born primarily by low-income, non-white, and non-English speaking high schoolers. Aid that

requires the FAFSA (Free Application for Federal Student Aid) is particularly inaccessible to this population. Kantrowitz (2009) estimates that 16 percent of Pell eligible students who are enrolled in college full time do not complete the required FAFSA form. Similarly, many low-income students are ill-informed about state or local government financial aid opportunities, in spite of the fact that such programs are targeted at low income populations. Brouder (1987) conducted surveys of low income parents of 8th-10th graders and found that none of the focus group parents had an accurate estimate of what it would cost to send their own child to college. The majority did not know what academic preparation their child needed for college. Parents tended to believe the cost of post-secondary education was far greater than the expected benefit. They overestimated the competitiveness of getting into college. Importantly, parents and students did not change behaviors based only on information, they acted only when they perceived a financial advantage to doing so.

This lack of information regarding the cost of college and how to pay for college has significant costs, as lifetime income is, on average, one million dollars lower for individuals without a college degree (Tamborini, Kim, Sakamoto 2015). Baum et al (2013) estimate this earnings premium as a return of roughly two-thirds more than high school graduates. In addition to financial benefits, Oreopolous and Salvanes (2011) show that college causes a significant jump in reported health and happiness, job satisfaction, and desirable family outcomes. Given these high stakes, policies and services that raise awareness of college funding opportunities could have massive implications for students of low socioeconomic backgrounds.

In this paper, we analyze a low-cost, randomized nudge intervention aimed to promote enrollment of low-income eighth graders in an Indiana college scholarship program. The Indiana Commission for Higher Education's 21st Century Scholars (21C) is a state-run program that provides up to four years of college tuition at participating public Indiana colleges and universities for qualified, low-income students. Students enroll in the program at the end of their eighth-grade year and are eligible for funds if they meet certain milestones throughout

their high school years. Although 21C began in 1990, many families appear to be unaware of the program's existence and a majority of eligible students fail to participate. Currently, less than half of eligible students receive funds through the program and the low enrollment rate is particularly a problem for students from majority-minority districts.

Qualitative research and reports from guidance counselors and school administrators suggest that there are several potential obstacles to 21C enrollment. Low socioeconomic status (SES) populations are often difficult to reach due to unreliable contact information or parents who cannot easily answer the telephone. The enrollment process itself requires detailed information about the students, their school, and parents' tax information. The hard enrollment deadline falls in the middle of the summer, when parents may be less attuned to school matters. Additionally, because many students from the pool of eligible families would be first-generation college-goers, their families might not fully understand the value of a college education or the proven difference in lifetime earnings for college-educated workers. For this reason, families also may not know the dollar value of a full tuition scholarship.

The nudge intervention in this analysis focused on a local Indianan school district that exhibited 21C enrollment rates far below the state average. The district in question, the South Bend Community School Corporation (SBCSC), had an enrollment rate of around 30% during the three years prior to the intervention (Indiana Department of Education); this rose to 39% following the nudge as in Figure 1. The overall enrollment rate among eligible SBCSC eighth graders stood at 31.5% in the year prior to the intervention. The nudge was directed only at these eligible students who remained unenrolled in the month before the deadline.

The cohort as a whole entered ninth grade with 38.6% of eligible students enrolled in 21C. Within study participants, the nudge increased application rates from 6.2% of late enrollers to 12.7%. The impact on successful enrollments among this population was an increase from 6.2% to 9.7%. The impact of the intervention was quite substantial given that this intervention was a low-cost, light-touch nudge that was conducted over the two-week

period preceding the hard registration deadline. These findings are consistent with previous research that demonstrate how information can effectively mitigate problems of low take-up, particularly with respect to accessing funds for college tuition.

2 Background

Existing research suggests that nudge interventions can be effective, but that the timing and nature of the nudge are important (Currie, 2004; Thaler and Sunstein, 2008; Castleman, 2013). In particular, reminders at critical junctures that prompt active engagement are the most effective at encouraging people to participate or enroll in a program. The majority of studies in the college nudge literature focus on the outcome of college enrollment. In a recent study of 4,754 college-intending high schoolers from the class of 2014, research showed that text interventions increased on-time college application submission by a statistically significant 3.1 percentage points (Castleman, 2017). Additionally, informing parents about college increases engagement and awareness among parents. In one study, researchers distributed information from the College Board about the net price of attending college to the parents of low-income middle school students. Follow-up results revealed that those who received the brochure were more likely to know the cost of attending college in their state, and the various types of colleges available to them (Hoxby and Turner, 2015). This improvement could be very important for this population, since studies show that parents with lower SES tend to be less involved in their children's college decision process and in completing the application process (Grodsky and Jones, 2007; Lareau, 2011; King 2004).

There is a large body of work that uses experimental or quasi-experimental methods to study the effect of accessible funding on college enrollment and persistence: this includes Goldrick-Rab et al (2012), Angrist, Hudson, and Pallais (2014), Angrist, Autor, Hudson, and Pallais (2015). The literature is well summarized by Deming and Dynarski (2009) and Nguyen, Kramer, Evans (2018). Both these survey papers estimate the causal effects through

meta-analysis: Deming and Dynarski estimate that each additional $1,000 of available grant aid increases enrollment by 3 to 4 percentage points (Deming and Dynarski 2009) and improves persistence by 1.2 percentage points (Nguyen, Kramer, Evans 2018). Other studies demonstrate that parents are likely to take action to improve their child's educational success when provided with information on how to do so: Hastings and Weinstein (2008), Andrabi, Das and Khwaja (2017).

The 21C nudge was a minimal-touch intervention compared to most educational nudges. Parents were given the information of the application deadline, student test number, and the student's school number. Other nudges that have had significant educational impacts have generally been much more extensive and detailed. For example, York and Loeb (2014) and Castleman and Page (2017) study the effectiveness of long-term text messaging programs on student success. Although both programs studied were effective, they changed outcomes by only a few percentage points and required regular messaging over the course of an entire school year.

Two earlier experiments are the most closely related to this paper. The first study, by Bettinger, Long, Oreopoulos, and Sanbonmatsu (2012), provided a completed FAFSA form to high school students and hence customized information about expected family contributions to college costs to parents of low income students at a specific time period when parental action is critical. In contrast, the 21C enrollment nudge was much less intense and as a result less costly than the FAFSA assistance. In spite of the minimal nature of the 21C nudge, we found a large increase in scholarship enrollment rates. The second highly relevant study is by Dynarski, Libassi, Michelmore, and Owen (2018). These authors showed that informing low-income, high-performing, high school seniors that they were likely to receive full tuition support at the University of Michigan more than doubled the subsequent college enrollment rate. Our study, while unable to examine college enrollment outcomes, shows comparable magnitudes in the 21C program enrollment outcomes following the intervention.

3 The Nudge Intervention

The impact evaluation was conducted as a randomized controlled trial within the South Bend Community School Corporation (SBCSC), the public school district in South Bend, IN. The full sample was comprised of 655 Free and Reduced Lunch (FRL) eligible 8th grade students who had not yet enrolled in 21st Century Scholars. On June 1, 2017, the school district sent our research team the de-identified universe of FRL eligible 8th grade students minus students that the schools were able to confirm had already enrolled in 21C. Each student in this sample was assigned by random lottery to one of three experiment arms: control, recipients of an outreach letter, or recipients of an outreach telephone call. In the following discussion, we will refer to these three arms as Control, Letter, and Call. Most schools in SBCSC and throughout the state perform a certain amount of baseline advertising for the 21st Century Scholars program in the absence of this intervention. This baseline advertising for 21C usually occurs in the form of a letter mailed home to parents. These letters typically direct parents to the 21C website and remind them that the deadline to enroll is on June 30 following the child's eighth grade year. They do not, however, include any personalized information specific to the student. These letters are mailed in the fall and the winter several months before the deadline.

The nudge intervention for college scholarship program designed a new form of contact that is distinct from baseline outreach in several intentional ways. Extensive planning went into the drafting of the nudges. Guidance counselors from participating schools provided context to the issue of low enrollment: their experience working with low-income families suggested that there was a serious information gap that prevents parents from enrolling their children in the program. First and foremost, the guidance counselors reported that many families seemed to be unaware of the program or did not fully understand the benefit. Second, many eligible students would be first-generation college students, and their parents might underestimate the value of a college education. Additionally, in order to enroll, parents must know the nine-digit student test number (STN) of their child, their four-digit middle

school code, and their four-digit high school code. None of these numbers are readily or easily available to parents, and require parents to dig through student test reports or search online for them. Finally, the guidance counselors also suggested that parents were prone to forget the deadline or lose the necessary application information long before the deadline. In general, it is harder to reach low-SES families as schools are more likely to lack reliable contact information for this demographic. Low-SES populations are highly mobile, which increases the likelihood that a school does not have an up to date address on file. Additionally, many low-SES parents do not answer their telephones, or have listed numbers that have been discontinued.

Both the letter nudge and the phone call nudge were designed to include four main components in an attempt to abate some of the previously stated obstacles: (1) a clear explanation of the program, including a dollar amount for the average benefit that the student is entitled to (in the case of this study, the average benefit was $35,000 in scholarship funds towards tuition to cover the cost of public school tuition in Indiana); (2) the research-supported difference in lifetime earnings for someone with a college degree compared to someone with only a high school degree (dollar value of $1 million); (3) personalized information to the student: the child's personal nine-digit STN, the relevant four-digit middle school code, and the relevant four-digit high school code; and (4) the enrollment website and deadline reiterated. This information was laid out as such in the letters that were sent home to parents of students in the Letter Group, and the Call Group received a nearly verbatim verbal version of the letter over the phone.

In our implementation, the letters were sent out by the school district on the Monday of the week that the phone calls were made, approximately two weeks prior to the June 30 enrollment deadline. The timing of the nudge was also strategically closer to the deadline in order to encourage urgency in enrollment. Phone calls were placed from the SBCSC headquarters by undergraduate research assistants. While there was no way to verify that letters reached their intended destinations, callers employed a protocol to increase the number

of successful calls. Up to two calls were made to any given number in the Call Group. If there was no answer when the first call was made, callers were instructed not to leave a voicemail. The number was then added back into the pool of calls to be made and marked as needing to receive a second call. If there was still no answer on the second call, callers were instructed to then leave a voicemail using a short form of the phone script that still contained each of the four main components from the phone script.

The outreach was also designed to overcome basic language barriers in the community. In instances where the person called did not speak English, the caller ended the call and referred the number to a Spanish-speaking caller who called back using a Spanish version of the phone script. The first Spanish call counted as the first call in these cases. Voice mailboxes set up in Spanish also received a Spanish version of the voicemail message if there was no answer for either of the two Spanish calls. There was not a Spanish version of the letter mailed.

In spite of the two-attempt protocol, research assistants who placed the calls were unable to convey the information to every family in the Call Group. Because calls were made from the school district headquarters at specific times during the day, callers were unable to provide a callback number, and were not instructed to suggest that parents try to return the call. In some cases, voice mailboxes were full or had not been set up, so callers were unable to leave a voicemail message. Some numbers did not work at all, and appeared to have been disconnected. In those cases, callers were not able to make any contact at all with the parents.

Since eligible students were randomized at the individual level and not at the family level, some parents who received phone calls asked for the STN of a twin, sibling, or resident cousin who had not been randomized into the Call Group, unlike the child on whose behalf they were receiving the call. In these cases, because callers did not have the relevant STN data for children who were not randomized into the Call Group, parents were encouraged to call the child's school and request the STN. We recognize that there will therefore be some

small spillover effects represented in the results.

Observations from the nudge outreach staff confirmed the prevalence of an informational gap at play. Many parents were unaware of the 21C program, others had heard of the program but lacked basic information needed to fill out the program application, and others still had heard of the program but forgotten about the approaching deadline. Anecdotally, the callers reported overwhelmingly positive reactions from parents with whom they spoke on the phone. Some parents had never heard of the program before but seemed hopeful that college would be an option for their children. Those who had struggled with completing the application were thankful to be provided with the information needed to finalize their applications.

After the intervention, the participating school district matched the students in the study to 21C application and enrollment outcomes, and provided these matched data to us with anonymized individual identifiers. The South Bend Community School Corporation identified eligible students and provided all the data for our study. Table 1 outlines the sample descriptive statistics. All the students in our sample are eligible for free or reduced lunch, based on family income.[1] These students are generally at a high risk of failing to complete high school: more than half of them failed the 7th grade Indiana state language test and 71.5% of them did not pass the math standardized test.[2] They are also disproportionately minority: 29% are Latino and 43% are African American. We also collected data on gender, GPA, and the primary outcome of interest: 21C application status.

After random assignment of each student in our sample to either the control group (N=211), the call group (N=223), or the letter group (N=221), we checked for differences in the characteristics of these three groups and confirmed that they were statistically indistinguishable. As demonstrated in Table 2, balancing tests show p-values far greater than the threshold value of 0.05 for each of our measured characteristics.

[1]For the 2017-2018 school year, a family of four was FRL eligible if annual household income was no greater than $45,510 (USDA, 2018).

[2]These are components of the Indiana Statewide Testing for Education Progress (ISTEP) exams, given to all students in grades 3 through 8, as well as high school sophomores.

4 Empirical Strategy

The short-term outcomes of interest are (i) whether a student enrolled in 21st Century Scholars before the enrollment deadline, and (ii) whether a student's application was approved. [3] Each outcome is represented by a binary indicator: $Y_{ij} = 1$ if student i from school j had a positive outcome. We estimate the effect of the nudge intervention using a linear probability model (LPM), using two approaches.

4.1 Measuring the Joint Treatment Effect

First, as a way to maximize statistical power within the limits of the sample, the call and letter groups were also considered as one joint treatment arm, $TREAT_{ij} = 1$ if student i from school j was assigned to either of the two treatment arms.[4] Within this approach, we estimate the effect of being assigned to receive either form of nudge using the following simple model:

$$Y_{ij} = \alpha_0 + \alpha_1 TREAT_{ij} + \eta_{ij} \tag{1}$$

Our agreement with the school district allowed us to randomize the students based on anonymized ID numbers, but then the school district matched these ID numbers to contact information and provided the relevant lists of telephone numbers that our research assistants used to place calls from school district headquarters. After the nudge interventions had been

[3] As shown in Table 1, 10.5 percent of the full sample eventually submitted an application, but only 8.5 percent of the sample was ultimately approved, meaning that 19 percent of these late appliers were denied. As all students in the study sample appeared to be eligible for 21C enrollment, it was not clear why anyone in the group would have been denied. We followed up with the Indiana Commission for Higher Education (CHE), which administers the 21C program, about this high rate of denied applications. CHE told us that if students submitted an incomplete application, a CHE representative would typically reach out to the student's family to correct the information. It is possible these contact attempts were unsuccessful. As we were using fully deidentified data we were not able to track down individual denied application cases.

[4] Although the district did not maintain historical records on late-enrollers, they expected that very few additional students would enroll between June 1 and June 30. Assuming a baseline late enrollment rate of 5-8 percent of the eligible but unenrolled population, this meant that our sample was only powered to determine effect sizes for each individual nudge that were at least 7-8 percentage points. The limited power was likely to be the most problematic for identifying the effects of the lighter touch letter nudge.

completed, it became apparent that guidance counselors at three schools did not fully comply with the randomized assignment of students to treatment groups when they provided the call lists. Some treatment students in these schools were called, and some call group students in these schools were not called. Since we expect that the noncompliance resulted in a dampening of the estimated treatment effect, we employ a two-stage least squares model to estimate the effect given full compliance: being assigned to either treatment group is used as an instrument for actually receiving a nudge.[5] This 2SLS model is specified in Equation (2)

$$Y_{ij} = \alpha_0 + \alpha_1 \widehat{NUDGED}_{ij} + \eta_{ij} \tag{2}$$

where $\widehat{NUDGED}_{ij}$ is predicted by the following first stage regression:

$$NUDGED_{ij} = \psi_0 + \psi_1 TREAT_{ij} + \psi_{ij} \tag{3}$$

4.2 Measuring the Individual Letter and Call Effects

Secondly, we identify the the separate effects of each individual treatment arm using Equation (4):

$$Y_{ij} = \beta_0 + LETTER_{ij}\beta_1 + CALL_{ij}\beta_2 + \eta_{ij} \tag{4}$$

where $LETTER_{ij} = 1$ if the individual is assigned to the letter group, and $CALL_{ij} = 1$ when she is assigned to the call group.

The specification in 1 estimates the intent to treat effects rather than the actual treatment effect of information transfer. $(\hat{\beta}_1)$ and $(\hat{\beta}_2)$ equal the increased probability of signing up for the 21C program caused by assignment to the call or letter arms, respectively. There are two primary reasons why information may not actually reach the treatment group subjects. One of these is the noncompliance discussed in the previous subsection. The next is that some

[5]It should be noted that excluding these noncompliant schools in the analysis did not dramatically change the main results.

letters almost certainly remained unopened and some calls were unanswered. Although it was not possible to verify which letters were received and opened by parents, our team of research assistants did keep track of whether each call placed successfully reached a parent or a voicemail.

Accordingly, to estimate the magnitude of the Treatment-on-Treated (TOT) nudge effect, we focus on the telephone call nudge since we can observe which call attempts actually resulted in a conversation between the caller and an eligible student's parent. Approximately 50% of parents called answered the telephone on either the first or second attempted call. Another 30% were not spoken to directly but did have working voicemail; these parents were left a voicemail message containing the nudge reminder for 21C enrollment.

We employ another two stage least squares (2SLS) model to capture the Treatment on Treated (TOT) effect, using assignment to the CALL group as an instrument for whether or not a student's parent received the intended treatment: the transfer of information. We use two alternative definitions for identifying when the key application information was successfully transferred to a student's parent. We first determine that the information was transferred when a caller was able to speak to a student's parent, denoted as $SPOKE_{ij} = 1$. As the assignment to treatment groups was random, the instrument satisfies the usual exclusion requirement: there is no relationship between initial assignment and the probability of successful information transfer.

Accordingly, we run a 2SLS model using only students assigned to the CALL group or the control group. Using the completed conversation with a parent as the marker for successful treatment, our first stage regression takes the form:

$$SPOKE_{ij} = \delta_0 x_{ij} + \delta_1 CALL_{ij} + \epsilon_{ij} \tag{5}$$

And the 2SLS model is specified as:

$$Y_{ij} = \gamma_0 x_{ij} + \gamma_1 \widehat{SPOKE}_{ij} + \epsilon_{ij} \tag{6}$$

where $\widehat{SPOKE}_{ij}$ is the predicted probability of reaching the parent, estimated from Equation 5. In this 2SLS model, the assignment acts as an instrument for both the correct nudge as well as for the realized transmission of information to the parent. While this more correctly defines the true treatment on treated effect, some statistical power is lost as we can only apply this model within the subset of students applied to the call and control groups.

As a second option, we expand the definition of a successful information transfer to include either a conversation or a voicemail containing all relevant information left for a parent ($SPOKE/VM_{ij} = 1$). Equations (5) and (6) are also applied to this second treatment definition.

5 Results

Table 3 displays the effect of the joint nudge (either the call of the letter) on the probability of signing up for 21C. Panel A shows the results of the reduced form model (Equation (1)), and Panel B shows the 2SLS estimates (Equation (2)). Columns 1-3 use the application submission as the left hand side variable, and columns 4-6 estimate the treatment effect on the unconditional probability that an application is approved. For each outcome, we first estimate the model without any additional controls (columns 1 and 4), then with controls for race, gender, and school fixed effects (columns 2 and 5), and finally with additional covariates for standardized test scores (columns 3 and 6).

Assignment to the joint nudge increases the probability of submitting an application by about 6 percentage points, and is statistically significant across specifications. Although the magnitude is somewhat dampened with the inclusion of student test scores, the effect size is relatively stable. Notice that this corresponds to a 100% increase in enrollment relative to the control group mean. However, in columns 4-6 we see that the nudge assignment is

less successful at increasing the probability that a student is approved to join the program. Column 4 shows a statistically significant effect of 3.5 percentage points, about 56% of the control group mean–but the estimate becomes insignificant when controlling for student characteristics, in particular student test scores.[6]

The 2SLS results in Table 3, Panel B show that these treatment effects are estimated to be about 25% larger after correcting for the dampening effects of the noncompliance. The probability of application submission increased by 7.8 percentage points (column 2) and the percentage of students with approved application increased by 4.2 points. All specifications in the 2SLS model yield significant estimates for the treatment effect except for the column 6: estimating the effect for application approval becomes marginally insignificant when simultaneously controlling for test scores (p-value of 0.122).

It should be noted that 7th grade results in the Math ISTEP were positive and significant at the 5% level, while the corresponding English test results were both very small and insignificant (p-value greater than 0.9). As shown in Table 2, individual characteristics–including standardized test scores–are uncorrelated with the nudge assignments. Explicit tests of heterogeneity showed no differential effect of the nudge by student gender, race, and academic achievement.[7] Based on the data available to us, the results imply that programs to increase information about 21C should not be limited to any subset of eligible students: an outreach to all unenrolled and eligible students is likely to be the most effective strategy to increase enrollment.

We next estimated the individual treatment effects of the letter and the call nudges according to Equation (4) and the results are shown in Table 4. These results are very similar to the Panel A results in Table 3: both types of nudge appear to increase application approval by around 6 points, and application approval by around 3 points. However, once again the estimates for application approval are imprecise and we cannot rule out null ef-

[6]Restricting the sample to observations with available test scores and duplicating the specifications in columns 2 and 4 yields nearly identical results.

[7]These results are available upon request.

fects. Moreover, the effect of the letter nudge is only statistically significant in the baseline specification, and the standard errors widen when student characteristics are included.

To identify the treatment on treated effects of successful information transfer, we estimate Equation (6) and display the results in Table 5. This model is a refinement of the the treatment on treatment estimation shown in Table 3, Panel B, as it corrects for not only the noncompliance but also the imperfect success rates of placed calls. However, the nature of this refinement means that only the call treatment can be analyzed. In spite of difficulties encountered due to outdated contact information or non-functioning voicemail for many families, the correlation between the treatment assignment and actual information transfer was high, with successful conversations or voicemails recorded for 65% of the call group. The F-statistic for each specification is above the standard threshold of 10, indicating a sufficiently strong first stage. All regressions in Table 5 are the baseline model without additional covariates; standard errors are clustered at the school level. Column 1 shows the 2SLS coefficient on Spoke to Parent, using the call group assignment as an instrument for the occurrence of a direct conversation between the student's parent and the outreach staff. The results estimate that a conversation with a student's parent increased the probability of submitting an application from the control group mean of 6.2 percent to 28.6 percent. The broader definition of information transfer–either a conversation or a voicemail–increased the application probability fro 6.2 to 18.5 percent (Column 2 shows the coefficient at 0.123). While this is still a large increase, it is clear that the actual conversation was the driving factor in boosting applications.

Column 3 shows the causal impact of a successful conversation on the final enrollment outcome for a student. The control group showed a final approval rate of 6.1 percent. As with other regressions examining this outcome, estimates are not precise. However, the spot estimate suggests that a conversation between the intervention staff and a student's parent increased the probability of successful enrollment from 6.1 to 16.8 percent. Using the broader definition of information transfer $Spoke/VM_{ij} = 1$ shows a smaller coefficient of 5.9

additional percentage points, but this estimate is also statistically insignificant.

6 Discussion and Conclusion

Indiana's 21st Century Scholars Program is intended to increase post-secondary education for low-income students. However, many students and families miss the opportunity to benefit from this scholarship simply because of an information failure. As a result, the pipeline of students eligible for this scholarship experiences a sizeable leak at the enrollment deadline. This study evaluated the causal effect of simply providing the necessary information to parents at a critical time just prior to the enrollment deadline. Since we used a lottery to allocate students to the treatment and control groups, the difference in enrollment observed following the nudge represents the intent to treat effect of the information transfer. The impact of receiving either a telephone call or letter nudge was significant and quite sizable: the combined treatment group showed double the application rate of the control group: 12.6% compared to 6.1%. However, some of those who applied were not ultimately approved, suggesting they may have submitted applications with incomplete or invalid responses. While all of the late appliers in the control group were approved into the program (6.1 percent), the final late enrollment rate of the treatment group was 9.7 percent rather than the 12.6 percent who applied.

Importantly, this increased enrollment was reached by a simple outreach effort that required minimal infrastructure and was highly cost effective. The total cost of the intervention was $1,752. Of the 444 families assigned to one of the treatment arms, we estimate that 27 students would have enrolled in 21C before the deadline in the absence of the nudge. As a direct result of the call nudge, an additional 29 eighth graders in the school district submitted a 21C application and 16 of these were ultimately enrolled in the program: each additional enrollment cost approximately $109.50.

In determining cost effectiveness, we assume the following to estimate an upper bound

for benefits: We expect 70% of those who enrolled to complete the full 21C program, and students who complete the program exhibit about 6 percentage points advantage in college completion over non-scholar, low-income students (21st Century Scholars, 2016). Assuming lifetime returns to college are about $1 million (Tamborini et al., 2015), enrolling in 21C is associated with an expected lifetime benefit of $42,000–which well exceeds the $109.50 per-student cost of enrollment.

Our results demonstrate the severe informational hurdle faced by low income families who would like to send their children to college, and the substantial impact that can result from a simple intervention to connect students and their parents with the information they need. Many of these students would be first-time college students, and their parents lack the experience to navigate financial aid programs and college preparation generally. Not only were parents of our study subjects unaware of the scholarship enrollment deadline or key points of information needed to initiate enrollment, many of them were surprised to learn about the scholarship's existence in the first place. Other parents were influenced to enroll when we discussed the large financial return to a college degree. We found a comparable effect for all unenrolled students in receiving the informational nudge: this suggests that a broad range of students would benefit from future outreach efforts.

The results of this intervention, while promising, also reveal important limitations. While phone call nudges appeared to be much more impactful than letter nudges, a majority of placed phone calls were unanswered even after multiple attempts. Voicemails were also shown to be less effective than direct phone conversations. These findings suggest that many parents in the target population would need either a call outside of 9-5 business hours or potentially an in-person visit, dramatically increasing the costs of an intervention. Another concern was the relatively high rate of invalid applications among the treatment group: these were eligible students who submitted an application but were ultimately denied enrollment in 21C. In learning from this experiment, future interventions might consider pre-populated applications for eligible students, that parents would only need to sign and

return, or transpose into an electronic application. Alternatively, the state might consider a default enrollment: all eligible eighth graders would be automatically enrolled and informed of their enrollment status, which could be forfeited if they did not comply with ongoing 21C requirements. This research augments the existing evidence that lack of information, poor framing, and timing are crucial elements that prevent low-income families from accessing college scholarships, and are not always easily overcome.

The authors declare that they have no conflicts of interest.

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Figure 1: 21st Century Scholar Enrollment Rates of Eligible 8th Graders

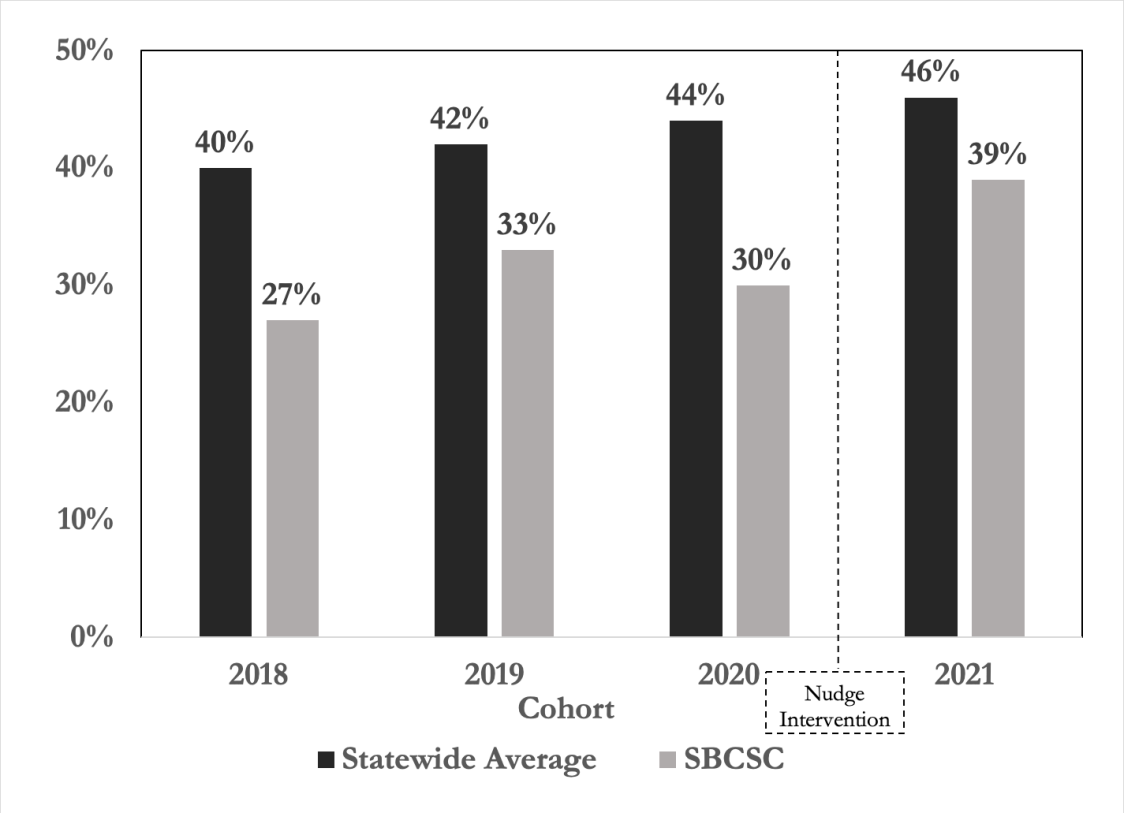

Table 1: Descriptive Statistics

Descriptive Statistics (full sample)

	Mean	SD	Min	Max	N
Applied	0.105	0.307	0	1	655
Application Approved	0.085	0.280	0	1	655
8th Grade GPA	2.686	0.639	0.667	4	623
Bottom 3rd GPA	0.318	0.466	0	1	623
Middle 3rd GPA	0.376	0.485	0	1	623
Top 3rd GPA	0.307	0.461	0	1	623
Black non-Hispanic	0.427	0.495	0	1	655
Other	0.388	0.488	0	1	655
Male	0.519	0.500	0	1	655
7th ISTEP ELA	497.711	54.748	240	650	551
7th ISTEP Math	497.138	43.145	270	618	557
DNP 7th grade math ISTEP	0.715	0.452	0	1	655
Pass on 7th grade math ISTEP	0.140	0.348	0	1	655
Pass plus on 7th grade math ISTEP	0.026	0.159	0	1	655
DNP 7th grade ELA ISTEP	0.550	0.498	0	1	655
Pass on 7th grade ELA ISTEP	0.298	0.458	0	1	655
Pass plus on 7th grade ELA ISTEP	0.031	0.172	0	1	655

Table 2: Balanced Treatment

	Treatment	Control	Δ	P-value	N_1	N_2
Male	0.52	0.517	0.004	0.93	444	211
8th Grade GPA	2.69	2.678	0.012	0.828	421	202
Bottom 3rd GPA	0.323	0.307	0.016	0.687	421	202
Middle 3rd GPA	0.361	0.406	-0.045	0.279	421	202
Top 3rd GPA	0.316	0.287	0.029	0.467	421	202
GPA<1.5	0.027	0.019	0.008	0.533	444	211
1.5<=GPA<2.5	0.347	0.351	-0.004	0.923	444	211
2.5<=GPA<3.5	0.464	0.46	0.004	0.919	444	211
3.5<=GPA	0.11	0.128	-0.018	0.512	444	211
7th ISTEP ELA	496.243	501.03	-4.786	0.344	382	169
7th ISTEP Math	495.984	499.765	-3.78	0.341	387	170
White non-Hispanic	0.191	0.171	0.021	0.522	444	211
Black non-Hispanic	0.423	0.436	-0.013	0.761	444	211
Other	0.385	0.393	-0.008	0.84	444	211

Table 3: Nudge Effect on Applications and Approvals

	Application Submitted (control mean=0.062)			Application Approved (control mean=0.062)		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Intent to Treat (reduced form)						
Assigned to Treatment	0.065**	0.061**	0.054*	0.035*	0.033	0.028
	(0.021)	(0.021)	(0.024)	(0.018)	(0.018)	(0.022)
	[0.010]	[0.015]	[0.050]	[0.075]	[0.104]	[0.235]
Panel B: Treatment on Treated (2SLS)						
Received Nudge	0.082***	0.078***	0.069***	0.045**	0.042**	0.036
	-0.02	-0.021	-0.024	-0.019	-0.019	-0.023
	[0.000]	[0.000]	[0.003]	[0.017]	[0.031]	[0.122]
N	655	655	549	655	655	549
FS	68.02	62.418	53.411	68.02	62.418	53.411
Demographics		X	X		X	X
Test Scores			X			X

Notes: Robust standard errors clustered at the school level reported in parentheses, and P-values reported in square brackets. Demographic controls: Female, black, other race (non-white and non-black), and school fixed effects. Test score controls: 7th grade ISTEP scores for language and math (raw scores divided by 10). *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Nudge Effect by detailed treatment arm (ITT)

	Application Submitted (control mean=0.062)			Application Approved (control mean=0.062)		
	(1)	(2)	(3)	(4)	(5)	(6)
Assigned to Call	0.068**	0.066**	0.052*	0.033	0.03	0.025
	(0.023)	(0.023)	(0.024)	(0.024)	(0.025)	(0.028)
	[0.013]	[0.017]	[0.056]	[0.210]	[0.255]	[0.380]
Assigned to Letter	0.061*	0.057	0.056	0.038	0.035	0.031
	(0.032)	(0.033)	(0.041)	(0.022)	(0.023)	(0.03)
	[0.088]	[0.117]	[0.204]	[0.119]	[0.159]	[0.324]
N	655	655	549	655	655	549
Demographics		X	X		X	X
Test Scores			X			X

Notes: Robust standard errors clustered at the school level reported in parentheses, and P-values reported in square brackets. Demographic controls: Female, black, other race (non-white and non-black), and school fixed effects. Test score controls: 7th grade ISTEP scores for language and math (raw scores divided by 10). ***p<0.01, **p<0.05, *p<0.1.

Table 5: Information Transfer Effect

	Applied (mean=0.097)		Approved (mean = 0.078)	
Call Group as IV for:	(1)	(2)	(3)	(4)
Spoke to a Parent	0.224***		0.107	
	(0.060)		(0.062)	
	[0.000]		[0.087]	
Spoke to a Parent/ Voicemail		0.123***		0.059
		(0.031)		(0.035)
		[0.000]		[0.096]
N	434	434	434	434
fs	12.664	21.812	12.664	21.812

Notes: Sample excludes those assigned to the letter treatment group. Robust standard errors clustered at the school level reported in parentheses, and P-values reported in square brackets. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Table A1: Balance: Call versus Control

	Call	Control	Δ	P-value	N_1	N_2
Male	0.511	0.517	-0.005	0.911	223	211
8th Grade GPA	2.693	2.678	0.015	0.809	216	202
Bottom 3rd GPA	0.329	0.307	0.022	0.634	216	202
Middle 3rd GPA	0.347	0.406	-0.059	0.216	216	202
Top 3rd GPA	0.324	0.287	0.037	0.414	216	202
GPA<1.5	0.031	0.019	0.012	0.411	223	211
1.5<=GPA<2.5	0.363	0.351	0.013	0.786	223	211
2.5<=GPA<3.5	0.466	0.46	0.007	0.89	223	211
3.5<=GPA	0.108	0.128	-0.02	0.512	223	211
7th ISTEP ELA	496.626	501.03	-4.404	0.449	195	169
7th ISTEP Math	494.749	499.765	-5.016	0.272	199	170
White non-Hispanic	0.202	0.171	0.031	0.406	223	211
Black non-Hispanic	0.43	0.436	-0.006	0.908	223	211
Other	0.368	0.393	-0.026	0.583	223	211

Table A2: Balance: Letter versus Control

	Letter	Control	Δ	P-value	N_1	N_2
Male	0.529	0.517	0.013	0.79	221	211
8th Grade GPA	2.687	2.678	0.009	0.893	205	202
Bottom 3rd GPA	0.317	0.307	0.01	0.826	205	202
Middle 3rd GPA	0.376	0.406	-0.03	0.532	205	202
Top 3rd GPA	0.307	0.287	0.02	0.657	205	202
GPA<1.5	0.023	0.019	0.004	0.79	221	211
1.5<=GPA<2.5	0.33	0.351	-0.02	0.656	221	211
2.5<=GPA<3.5	0.462	0.46	0.002	0.97	221	211
3.5<=GPA	0.113	0.128	-0.015	0.637	221	211
7th ISTEP ELA	495.845	501.03	-5.185	0.362	187	169
7th ISTEP Math	497.293	499.765	-2.472	0.568	188	170
White non-Hispanic	0.181	0.171	0.01	0.778	221	211
Black non-Hispanic	0.416	0.436	-0.02	0.679	221	211
Other	0.403	0.393	0.009	0.843	221	211