Predicting Transfer Student Success: Early Identification of At-Risk Students to Improve Time-to-Degree and Graduation Rates

Eric J. Cazares
Graduate Research Assistant, Institutional Research
California State University San Bernardino
cazae300@coyote.csusb.edu

Claudia Alvarado
Graduate Research Assistant, Institutional Research
California State University San Bernardino
alvac331@coyote.csusb.edu

Tanner Carollo
Assistant Director, Institutional Research
California State University San Bernardino
tanner.carollo@csusb.edu

Allan Taing
Research Analyst, Institutional Research
California State University San Bernardino
allan.taing@csusb.edu

Brandon Aragon
Research Technician, Institutional Research
California State University San Bernardino
brandon.aragon@csusb.edu

Qiana Wallace
Assistant Dean, Undergraduate Studies
California State University San Bernardino
qwallace@csusb.edu

Abstract: In recent years, transfer enrollments for California State University, San Bernardino (CSUSB) have nearly doubled with 2,443 transfer students arriving in Fall 2015. While 90% of transfer students return their second year, only 28% of transfer students graduate within two years, and only 73% graduate within four years. Similar to other four-year institutions, the predominant share of resources is allocated to first-time freshmen. It is clear that despite their prior collegiate experience, transfer students face challenges that may extend their time to graduation or influence their decision to continue pursuing a degree. The purpose of this study was to identify first-year predictors of transfer graduation in order to identify at-risk students for proactive supports. Binary logistic regression analyses were conducted on 8,284 transfer students who entered CSUSB from Fall 2008 to Fall 2013. Pell status, pre-transfer academic characteristics, and first-year academic measures contributed to the overall significance of the model and accounted for 32% of the variance in four-year graduation rates. Probability scores were calculated for each student to allow for targeted intervention strategies.

Introduction

Community colleges serve as a crucial pathway for students to earn bachelor's degrees. Often, students begin their higher education careers at community colleges with the intention of transferring to a four-year institution to attain a four year degree. Over the last 20 years, 81% entered with a goal of earning a bachelor's degree or higher (Horn & Skomswold, 2011; Wang, 2009). Many students begin their academic career at a community college because of capacity and affordability differences between two-year and four-year institutions (Townsend & Wilson, 2006). Federal and state policymakers have placed a priority on community colleges to serve as a cost-effective and viable route for students to earn bachelor's degrees (Kelderman, 2010). Moreover, community colleges serve larger proportions of students who are first-generation, low-income, and/or of color than their four-year counterparts (Monaghan & Attewell, 2015). In quasi-experimental studies, researchers found evidence to support that attending and graduating from a two-year college lowers the probability of attaining higher degrees, and close to 15% are less likely to attain a bachelor's degree than students who initially attend a four year college (Long & Kurlaender 2009; Reynolds & DesJardins, 2009). Studying community college students and the factors that help them succeed at four-year institutions are important given this context. This

study attempts to shed light on some of the underlying mechanisms that explain transfer student success when they transition to four-year institutions to complete their bachelor's degrees.

College experience for transfer students at four-year colleges and universities is different from those who matriculate as freshmen. The literature notes that transfer students sometimes experience transfer shock (Townsend & Wilson, 2006), which involves adjustment to a new campus, new academic demands, and new social and personal demands (Laanan, 2004). Unfortunately, many of the current practices designed to integrate and engage students in their academic and social environments (Kuh, 2008) are directed at native students, not transfer students (Townsend & Wilson, 2006). A recent study suggests that differences exist in the attempted amount of courses every year between native and transfer students, with transfer students taking less (Martinello & Stewart, 2015). Another study found that female students were two-and-a-half times more likely than male students to obtain a degree after transferring, and students from higher socio-economic standings were also more likely to obtain a degree than students from lower socio-economic status (Wang, 2009). Higher grade point averages prior to transferring were also suggestive of better chances of obtaining a degree (Wang, 2009). Researchers should not only look at these students before transfer, but also post-transfer. Responsibility for ensuring student success post-transfer ultimately rests with the receiving institution (Townsend & Wilson, 2006; Wang, 2009). Given that students who start at two-year institutions are less likely to earn degrees and pursue graduate degrees after graduating (Pascarella & Terenzini, 2005), more research is warranted into studying transfer student success.

One-hundred-and-thirteen community colleges in California make up the largest system of higher education in the United States. With more than 2.1 million students, the state of California enrolled 20% of all community college students nationwide (California Community Colleges Chancellor's Office [CCC], 2016). Many of these students transferred and completed their bachelor's degrees at one of the 23 campuses of the California State University (CSU) system. Fifty-one percent of CSU students who graduated also started their higher education career at one of these California community colleges (CCC, 2013).

California State University, San Bernardino

California State University, San Bernardino (CSUSB) is one of the 23 campuses in the CSU system. Established in 1965, it is a public, four-year university and post-baccalaureate degree awarding institution located in Southern California. CSUSB offers nearly 70 bachelor's and master's degree programs, credential programs in education, and one doctoral degree program. CSUSB serves more than 20,000 students with about 4,000 graduating annually (California State University, San Bernardino Office of Institutional Research, 2015). Of those students, 61% are female and 39% are male. The average age of students is 23.5. CSUSB serves a diverse student population, which very well reflects the population of the Inland Empire. About 66% of students that graduate from CSUSB are the first in their family to attain a degree (California State University, San Bernardino Office of Institutional Research Factbook, 2015). CSUSB has the second highest African American and Hispanic public university enrollment rates in California (California State University, San Bernardino, 2016a).

Transfer enrollments at CSUSB have almost doubled in the last few years with 2,443 transfer students arriving in Fall 2015. CSUSB primarily serves as a transfer school for five San Bernardino and five Riverside county community colleges. At CSUSB, students are considered upper division transfers when they have earned at least sixty transferable semester units or 90 transferable quarter units (CSUSB, 2016b). Additionally, students must have completed English composition, oral communication, critical thinking and college math (or equivalents) with a grade of C or better. Of the units completed before transfer, students must have completed at least 30 semester or 45 quarter units in general education with a grade of C or better (California State University, San Bernardino, 2016b). CSUSB also allows students to transfer with student transfer agreements. These agreements assist students in graduating within four years. Upon completing the aforementioned requirements, they transfer with junior standing. Similar to other four-year colleges and universities, CSUSB understands the importance of student engagement, programs, and high impact practices on increasing student success; the university has been devoting more

resources in these areas recently. And similar to other institutions, the predominant share of resources is allocated to first-time freshmen. For example, CSUSB offers an overnight student orientation advising and registration for first time freshmen where they get a chance to register for classes, plan academic schedules, make connections with other students, and go through workshops (California State University, San Bernardino, 2016c). Transfer students also go through an orientation; however, the experience is quite different. The CSUSB transfer SOAR is a one-day event in which students learn about graduation requirements, how to get around the campus, and a little about key resources on campus. Given that more than half of our bachelor's degree recipients were transfer students, there is an opportunity to expand the offering of targeted programming and support for transfer students beyond simply a mandatory orientation experience.

Data Collection and Sampling

Archival data from CSUSB were extracted for new upper division transfer students. Students who were identified as international, Educational Opportunity Program participants, or part-time were not included in subsequent analyses. The sample consisted of 8,284 students who enrolled as juniors and seniors in the fall quarter of 2008 to the fall quarter of 2013. The sample consisted of 62% females and 38% males with the average age of 26 years old. Thirty-eight percent of students identified as Hispanic, 24% as Caucasian, 6% as African American, 5% as Asian American, 3% as two or more races, 2% as Non-Resident, and less than 1% as Pacific Islander/Native Hawaiian or Native American; 22% percent of students were unknown. Two hundred and eighty seven cases (3%) of students from the original sample of 8,571 transfer students were excluded because they had missing values on the predictor variables.

Statistical Methodology

To examine potential predictors of graduation for transfer students, we decided to examine demographic, pre-transfer, and end of first-year characteristics as predictors for transfer student graduation. Two exploratory binary logistic regression models were estimated. First, two-year graduation was regressed on variables measuring transfer GPA, Pell Grant recipient status, STEM major standing, first-year GPA, passing all attempted first-year courses, first-year major change status, and earning 36 or more units during the first year. Second, for students who did not graduate within two years, four-year graduation was regressed on these same predictor variables, to examine if there were any of the relationships differed when examining this student subgroup. Based on the findings from these two models, a final binary logistic regression model was generated to regress four-year graduation on the predictor variables using the entire sample of all transfer students. Based on the results for this final model, probabilities were estimated for each transfer student, and students were assigned to one of 10 deciles according to their predicted likelihood of graduating within four years. Table 1 provides information and descriptive statistics for the outcome and predictor variables in this study.

Table 1: *Variable Information and Descriptive Statistics*

Name	Description	Mean (*SD*)
Two-year graduation*	Graduated within two academic years of matriculation	.25
Four-year graduation*	Graduated within four academic years of matriculation	.70
Transfer GPA	Grade point average for all transferable units attempted	3.02 (.45)
Pell Grant recipient*	Whether student received Pell Grant	.58
STEM major*	Whether student's initial major was in STEM	.13
First-year GPA	Grade point average during first year at CSUSB	2.88 (.83)
Passed all courses*	Whether student passed all courses attempted in first year	.70
Changed major*	Whether student changed major during first-year	.23
Earned 36+ units *	Whether student earned 36 or more units during first-year	.63

Note. N = 8571. Four-year graduation proportion only includes Falls 2008-2011 cohorts.
*Dichotomous variable coded 0 = No, 1 = Yes.

Exploratory Analysis: Two-Year Graduation

A binary logistic regression was conducted to predict two-year graduation rate using pre-transfer and end of first-year characteristics as predictors. A test of the two-year model against a constant-only model was statistically significant, $\chi^2(7) = 1525.89$, $p < .01$, $R^2 = .25$. The regression model explained 25% of the variance in the outcome variable. These results suggest that the predictors as a set reliably distinguish between those who graduated in two years and those who did not. Group classification success overall was 70.2%, with those who did not graduate at 72.4% and those who graduated at 63.8% (classification cut-off set at .37). Table 2 provides a summary of the model results.

Table 2: *Exploratory Analysis of Predictors of Transfer Student Two-Year Graduation*

				95% CI for Odds Ratio		
Variable	β	*SE*	Wald χ^2	Lower	*OR*	Upper
Constant	-3.81**	.21	317.97			
Transfer GPA	-.09	.07	1.81	.80	.91	1.04
Pell Grant recipient	-.17**	.06	9.35	.76	.84	.94
STEM major	-1.03**	.10	104.58	.29	.36	.44
First-year GPA	.53**	.06	92.19	1.52	1.69	1.88
Passed all courses	.19*	.08	5.38	1.03	1.21	1.42
Changed major	-.42**	.08	27.26	.56	.66	.77
Earned 36+ units	2.02**	.09	474.09	6.26	7.51	9.00

Note. N = 8284. R^2 = .25 (Nagelkerke). Model $\chi^2(7) = 1525.89$**. Sample includes Falls 2008-2013 new transfer student cohorts.
*$p < .05$. **$p < .01$.

Of the seven predictors, six significantly predicted two-year graduation. Pell Grant recipient significantly predicted two-year graduation, $\chi^2(1) = 9.35$, $p < .01$, results indicate that students who received Pell were less likely to graduate within two year than non-Pell students (*OR* = .84). STEM majors significantly predicted two-year graduation, $\chi^2(1) = 104.58$, $p < .01$, results indicate that students transferring in as STEM majors were less likely to graduate within two years than non-STEM majors (*OR* = .36). First-year grade point average significantly predicted two-year graduation, $\chi^2(1) = 92.19$, $p < .01$, results indicate that students with higher first-year GPAs were more likely to graduate within two years than students with lower GPAs (*OR* = 1.69). Passing all of the first-year courses significantly predicted two-year graduation, $\chi^2(1) = 5.38$, $p < .05$, results indicate that students who passed all of their first-year courses were more likely to graduate within two-years than students who did not (*OR* = 1.21). Changing major during their first-year significantly predicted two-year graduation, $\chi^2(1) = 27.26$, $p < .01$, results indicate that students who changed majors during their first-year were less likely to graduate within two-years than students who did not (*OR* = .66). Earning 36 or more units during their first-year significantly predicted two-year graduation, $\chi^2(1) = 474.09$, $p < .01$, results indicate those earning 36 or more units

during your first-year were more likely to graduate within two years than those who did not (*OR* = 7.51). Lastly, transfer grade point average was not statistically significant suggesting that transfer GPA did not impact two-year graduation.

Exploratory Analysis: Four-Year Graduation

A second binary logistic regression was conducted to predict four-year graduation rate using the aforementioned predictor variables, but only including students who transferred during the fall terms of 2008-2011 and excluding students who graduated within two years. A test of the four-year model against a constant-only model was statistically significant, $\chi^2(7) = 820.00$, $p < .01$, $R^2 = .25$. The regression model explained 25% of the variance in the outcome variable. These results suggest that the predictors as a set reliably distinguish between those who graduated in four years and those who did not. Group classification success overall was 70.2%, with those who did not graduate at 62.8% and those who graduated at 74.6% (classification cut-off set at .60). Table 3 provides a summary of the model results.

Table 3: *Exploratory Analysis of Predictors of Transfer Student Four-Year Graduation*

				95% CI for Odds Ratio		
Variable	β	*SE*	Wald χ^2	Lower	*OR*	Upper
Constant	-2.06**	.26	64.93			
Transfer GPA	.18	.09	3.71	1.00	1.20	1.43
Pell Grant recipient	-.08	.08	1.26	.79	.92	1.07
STEM major	-.35**	.10	11.81	.58	.70	.86
First-year GPA	.66**	.07	85.99	1.68	1.94	2.23
Passed all courses	.06	.10	.33	.87	1.06	1.29
Changed major	-.65**	.08	60.55	.44	.52	.62
Earned 36+ units	1.06**	.08	177.81	2.48	2.90	3.39

Note. $N = 4012$. $R^2 = .25$ (Nagelkerke). Model $\chi^2(7) = 820.00$**. Sample includes Fall terms 2008-2011 new transfer student cohorts and excludes students who graduated within two years.
*$p < .05$. **$p < .01$.

Of the seven predictors, four significantly predicted four-year graduation. STEM majors significantly predicted four-year graduation, $\chi^2(1) = 11.81$, $p < .01$, results indicate that students transferring in as STEM majors were less likely to graduate within four years than non-STEM majors (*OR* = .70). First-year grade point average significantly predicted four-year graduation, $\chi^2(1) = 85.99$, $p < .01$, results indicate that students with higher first-year GPAs were more likely to graduate within four years than students with lower GPAs *(OR* = 1.94). Changing major during their first-year significantly predicted four-year graduation, $\chi^2(1) = 60.55$, $p < .01$, results indicate that students who changed majors during their first-year were less likely to graduate within four-years than students who did not (*OR* = .52). Earning 36 or more units during their first-year significantly predicted four-year graduation, $\chi^2(1) = 177.81$, $p < .01$, results indicate those earning 36 or more units during your first-year were more likely to graduate within four years than those who did not (*OR* = 2.90). Lastly, transfer grade point average, Pell Grant, and passing all of the first-year courses were not statistically significant suggesting that these variables did not impact four-year graduation.

Final Model

The final binary logistic regression was conducted to predict overall four-year graduation rate using the aforementioned predictor variables, including all students who transferred during the fall terms of 2008-2011. Because of similarity in the results across both exploratory models, all of the predictor variables were retained in the final model. A test of the final four-year model against a constant-only model was statistically significant, $\chi^2(7) = 1327.85$, $p < .01$, $R^2 = .32$. The final four-year regression

model explained 32% of the variance in the outcome variable. These results suggest that the predictors as a set reliably distinguish between those who graduated in four years and those who did not. Group classification success overall was 74.1%, with those who did not graduate at 72.9% and those who graduated at 74.6% (classification cut-off set at .75). Table 4 provides a summary of the model results.

Table 4: *Final Model of Predictors of Transfer Student Four-Year Graduation*

				95% CI for Odds Ratio		
Variable	β	*SE*	Wald χ^2	Lower	*OR*	Upper
Constant	-2.06**	.25	69.41			
Transfer GPA	.14	.09	2.50	.97	1.15	1.37
Pell Grant recipient	-.10	.07	1.97	.78	.90	1.04
STEM major	-.50**	.10	24.55	.50	.61	.74
First-year GPA	.77	.07	119.44	1.88	2.16	2.48
Passed all courses	.06**	.10	.34	.88	1.06	1.28
Changed major	-.70**	.08	75.07	.42	.50	.58
Earned 36+ units	1.39**	.08	321.37	3.44	4.01	4.67

Note. $N = 5322$. $R^2 = .32$ (Nagelkerke). Model $\chi^2(7) = 1327.85$**. Sample includes Falls 2008-2011 new transfer student cohorts.
*$p < .05$. **$p < .01$.

Of the seven predictors, four significantly predicted four-year graduation. STEM majors significantly predicted four-year graduation, $\chi^2(1) = 24.55$, $p < .01$, results indicate that students transferring in as STEM majors were less likely to graduate within four years than non-STEM majors (*OR* = .61). First-year grade point average significantly predicted four-year graduation, $\chi^2(1) = 119.44$, $p < .01$, results indicate that students with higher first-year GPAs were more likely to graduate within four years than students with lower GPAs (*OR* = 2.16). Changing major during their first-year significantly predicted four-year graduation, $\chi^2(1) = 75.07$, $p < .01$, results indicate that students who changed majors during their first-year were less likely to graduate within four-years than students who did not (*OR* = .50). Earning 36 or more units during their first-year significantly predicted four-year graduation, $\chi^2(1) = 321.37$, $p < .01$, results indicate those earning 36 or more units during your first-year were more likely to graduate within four years than those who did not (*OR* = 4.01). Lastly, transfer grade point average, Pell Grant, and passing all of the first-year courses were not statistically significant suggesting that these variables did not impact overall four-year graduation.

Decile Model

Based on the results for the final model described earlier, students were placed in deciles ranging from one to ten, with one being students less likely to graduate (high risk) and ten being students most likely to graduate (low risk). As shown in Figure 1, the proportion of students who graduated within two years, students who did not graduate in two years but graduated within four years, and students who did not graduate at all, or were not captured in the graduation timeframes above, differ considerably across deciles. Students in deciles 1-4 were the least likely to graduate with 60% of students or greater not graduating in these deciles. In deciles 5 and 6, the overall graduation was about 50%, although the majority graduated within 3 or 4 years. In deciles 7 and 8, 60-70% of students graduated overall. Lastly, in deciles 9 and 10, over 85% of students in these deciles graduated overall, and a larger proportion graduated within 2 years of matriculation.

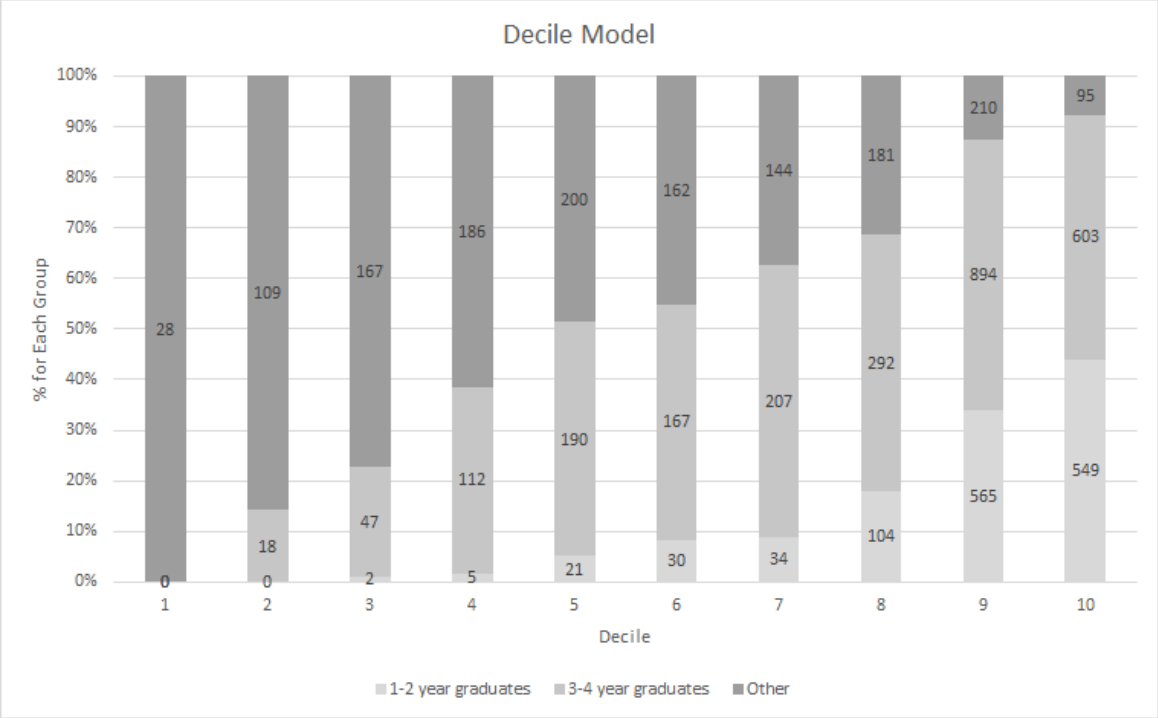

Figure 1. Graduation Outcomes by Decile, Fall 2008-2011 Transfer Student Cohorts

Data Preparation for Intervention Strategies

Assigned decile scores will be linked with student demographics and enrollment information. These data will be provided to the Office of Undergraduate Studies through a secure business intelligence platform to allow for the implementation of decile range specific intervention strategies.

Planned Targeted Intervention Strategies

Research based on national trends in higher education show that numerous institutions have successfully increased the availability of advising/support services through the development of peer advising/mentoring programs (Habley, 2004). At CSUSB, peer advising and peer mentoring interventions have also been used to support the success of students who have been identified as "at-risk." However, the students served through these programs typically are not transfer students. Given that the findings of this study suggest that there is a way to identify transfer students who are "at risk," and the institution has a trained cadre of students who can intervene, peer mentors and peer advisors at CSUSB can be deployed in various manners based on a students' probability of timely graduation. Additionally, the institution has purchased software to increase its capacity to provide and track evidence-based intrusive support to students. This would allow researchers and practitioners to monitor the success of the interventions and adjust supports/strategies based on the data.

High Risk (Low Probability of Graduating)

During the summer prior to the start of the second year, high risk transfer students (i.e., students with predicted probability of 1-4) will be contacted by upper-division peer mentors for intrusive support services. Peer mentors will engage in extensive outreach to students in this group to connect them with a professional advisor, the career center, and resources to address academic, social, and personal issues.

Moderate Risk

Between 50% and 70% of students in deciles 5-8 graduated within four-years, while only 18% graduated within two-years. Advising contacts to these students will seek to improve graduation rates and decrease years-to-degree by focusing on degree roadmaps, summer term enrollment, and timely paperwork submission (i.e., petition for graduation check). In support of their success, students in this group will be connected to peer mentors for referral to campus resources with an escalation path to a professional advisor when necessary, introduced to faculty in their major to initiate undergraduate research experiences, and connected service experiences to get them engaged outside of the classroom.

Low Risk (High Probability of Graduating)

Students in this group are likely to graduate. However, the timeframe in which they graduate is a possible area of focus for a potential intervention. This can be addressed through the use of low-cost "high-touch" interventions to expedite milestone completion.

Summary

Analyses were conducted using archival data to predict the likelihood of graduation for transfer students based on pre-transfer characteristics and first-year academic performance. Two exploratory binary logistic regression models were estimated. First, two-year graduation was regressed on variables measuring transfer GPA, Pell Grant recipient status, STEM major standing, first-year GPA, passing all attempted first-year courses, first-year major change status, and earning 36 or more units during the first year, second, for students who did not graduate within two years, four-year graduation was regressed on these same predictor variables. Results were similar for both models. Drawing from these two exploratory models, a final binary logistic regression model was generated to regress four-year graduation on the same set of predictor variables using the entire sample of all transfer students. Based on the results for this final model, predicted probabilities were estimated for each transfer student, and students were placed into deciles based on these predicted probabilities ranging from one (high risk, low probability of graduating) to ten (low risk, high probability of graduating).

Targeted intervention strategies have the potential to increase markers of transfer student success. For example, the current years-to-degree for Fall 2011 full-time transfer students is 2.78 years, with 545 students taking more than two years to graduate. Reducing years-to-degree for 150 of the students by one year would lower the average years-to-degree by 0.17 to 2.6. Furthermore, graduating an additional 50 students within four years would raise four-year graduation rates by four percent (73% to 77%).

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