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An Event History Analysis on the Effects of Academic Integration Factors on Degree Completion of Low-Income Underrepresented Minority Students

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AN EVENT HISTORY ANALYSIS OF THE EFFECTS OF

ACADEMIC FACTORS ON COLLEGE DEGREE COMPLETION

OF LOW-INCOME, UNDERREPRESENTED MINORITY STUDENTS

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ABSTRACT

Disparities in educational outcomes still exist for low-income and underrepresented students. Community colleges are an important entry point for student groups that have faced the most significant barriers to success. Community colleges account for almost half of all undergraduate enrollments in the United States and also enroll a higher proportion of low-income and minority students (American Association of Community Colleges, 2012; Aud, Hussar, Johnson, Kena, & Roth, 2012). The purpose of this study was to examine the timing of academic integration factors that contribute to degree completion of low income, underrepresented minority community college students over the course of seven years. In order to identify the temporal aspect of academic factors associated with degree completion and withdrawal, this study utilized Event History Analysis (EHA). EHA was used to characterize the probability that a student would graduate or drop out during the study period and model the probability as a function of targeted covariates using discrete-time logistic regression. Results indicated that students were most likely to graduate or drop out in year five and six; contrary to most studies that indicate that the first year is the most important retention time period. Variables found to increase chances of graduation included full-time enrollment, successful completion of college level English and math courses, completion of 20 credit hours, receiving an advanced or basic certificate, maintaining a high ratio of courses attempted to earned, earning a higher

GPA, taking online courses, and transferring to a four year institution. Factors that reduced the likelihood of graduation were being male, having a lower family income quartile, failing or withdrawing from multiple courses, and taking remedial math. Results of this study can be used to promote policies and practices within the community college system that lead to improved degree outcomes for low-income, underrepresented minority students.

CHAPTER ONE

INTRODUCTION

Importance of a College Degree

An individual's level of economic success is strongly related to educational

attainment level. Numerous studies have demonstrated the strong relationship

between educational attainment and earnings (Bureau of Labor Statistics, 2010a; Card,

1999; A. Carnevale, Jayasundara, & Hanson, 2012; Day & Newburger, 2002; Hansen,

1970; Juster, Beaton, Carnegie Commission on Higher Education, & National Bureau of

Economic Research, 1974; Kantrowitz, 2007; Kominski & Julian, 2010; Muller, 2002;

Newburger & Curry, 2000). College degree completion results in a substantial increase

in future earning potential. This relationship can be seen early in a working adult's life

(Figure 1).
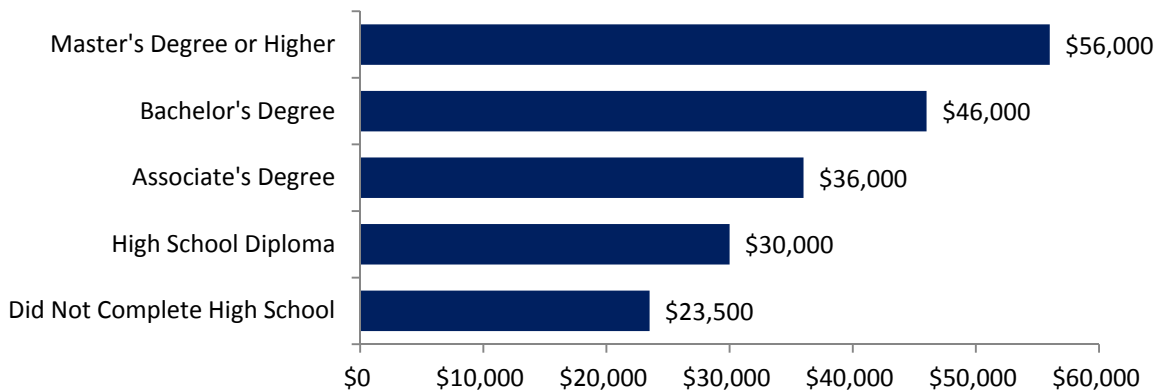
Figure 1.Median annual earnings of full-time workers. From Aud, S., Hussar, W., Planty,
M., Snyder, T., Bianco, K., Fox, M., & Hannes, G. (2010). The condition of education
2010. (NCES 2010-028). Washington, DC: United States Office of Education. p. 60.

The median annual earnings of full-time, full-wage and salary workers between the ages of 25 and 34 is $23,500 if they did not complete high school; $30,000 with a high school diploma; $36,000 with an associate's degree; $46,000 with a bachelor's degree; and $55,000 for a master's degree or higher (Aud et al., 2010). Individuals with a bachelor's degree earn approximately 28% more than those with an associate's degree; 53% more than high school graduates; and 96% more than those without a high school diploma.

Over the course of a lifetime, increased educational attainment levels translate into even higher financial gains (see Figure 2).
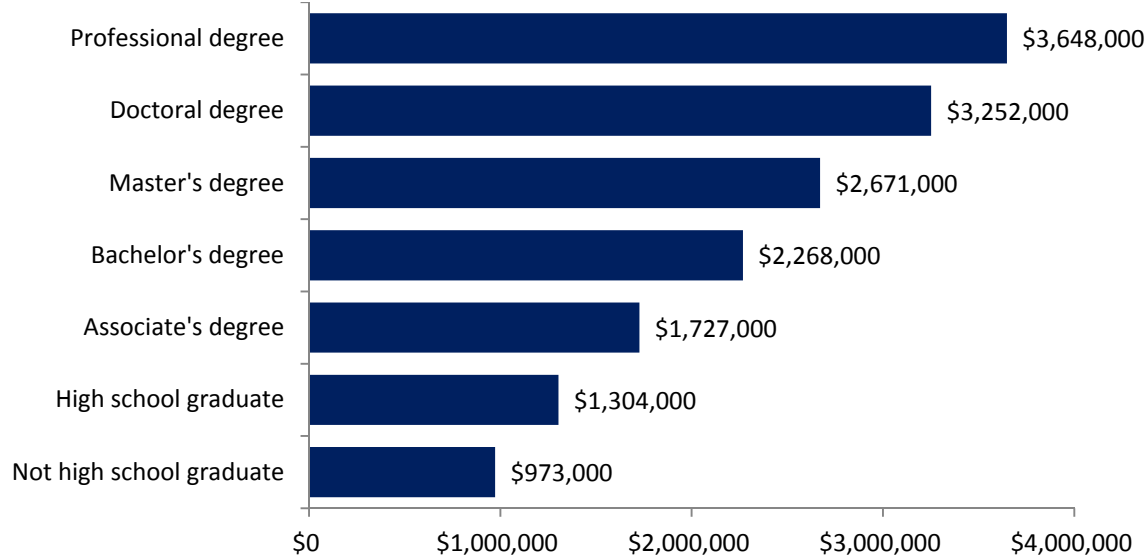
Figure 2. Median lifetime earnings by highest educational attainment level, 2009. From Carnevale, Rose, & Cheah (2011). The college payoff: Education, occupations, and lifetime earnings. The Georgetown University Center on Education and the Workforce. p. 3.

Assuming full-time, year-round employment over an estimated 40 year work life (from 25 to 64 years of age), individuals without a high school diploma can expect to earn $973,000; high school graduates can expect to earn $1,304,000; those with an

associate's degree earn $1,727,000, $2,268,000 with a bachelor's degree; $2,671,000 with a master's degree, $3,252,000 with a doctorate degree; and $3,648,000 for individuals with a professional degree, (A. P. Carnevale, Rose, & Cheah, 2011). Individuals with an associate's degree earn nearly one third more than those who just completed high school. The acquisition of additional educational credentials can be attributed to the economic incentive of higher income and better employment prospects during the course of one's working life.

A college degree contributes to lower poverty rates and greater labor force stability. College graduates are less likely to live in poverty and are able to move out of it quicker if they do (Lazear, 2006). In 2007, 16.5% of individuals without a high school diploma were living in poverty compared to only 1.3% of bachelor's degree recipients, 2.8% of associate degree recipients, and 6.3% of high school graduates (Bureau of Labor Statistics, 2009).

Unemployment rates decrease as educational levels increase. The unemployment rate for individuals without a high school diploma is 12.4%; 8.3% with a high school diploma; 6.2% with an associate's degree; 5.4% with a bachelor's degree; 3.5% with a master's degree; 2.5% with a doctorate, and only 2.1% with an advanced professional degree (Bureau of Labor Statistics, 2013). Postsecondary education promotes greater labor market participation and employability, irrespective of race or gender (Checchi, 2006).

There is a persistent and increasing demand among employers for college educated workers. Those without a postsecondary degree have decreased opportunities for economic success and social mobility. Individuals without training or education beyond high school have limited access to jobs as the need for an educated workforce continues to increase. Almost half of new jobs and one-third of total jobs projected from 2008 to 2018 require a postsecondary degree (Bureau of Labor Statistics, 2010). Occupations requiring a bachelor's degree are expected to grow by 17% (Bureau of Labor Statistics, 2010b). Occupations requiring an associate degree are expected to see the most growth of all education areas - by 19%. As people increase their educational attainment levels, they have access to better employment opportunities and an improved quality of life. In many ways, a college education has become the minimal entry point to the middle class. A college education will increasingly become a basic requirement for economic success as current and future labor market conditions necessitate a greater demand for college education.

In addition to the economic benefits of a college education, college graduates enjoy additional physical, social, and educational benefits for themselves and their families. College graduates are more likely to have employer provided health benefits, have dental insurance, consider themselves in better health, exercise more, smoke less, and have longer life expectancies (Baum & Ma, 2007; Bloom & Cohen, 2010; Rostron, Boies, & Arias, 2010). Increased educational attainment leads to improved social and civic benefits. College graduates are more likely to donate blood, participate in

organized volunteer work, vote, and attempt to understand the views of others (Baum & Ma, 2007; Bureau of Labor Statistics, 2010c; Kantrowitz, 2007).

Family members of college graduates also reap benefits. Spouses of college graduates tend to have more education and their children perform better in school (Jenks & Edlin, 1995; Murphy & Welch, 1993). Children of college degree recipients are more likely to attend college themselves. Young children of adults with a college education have higher cognitive skills and engage in more extracurricular, religious, cultural, and athletic activities than children without college educated parents (P. A. Attewell & Lavin, 2007; Baum & Ma, 2007). Parental educational attainment is also positively correlated with improved health status of their children and lower mortality rates (Cohn & Geske, 1992).

The United States is facing a need for a more educated workforce amidst an increasingly more diverse population. The association between educational attainment and economic and social benefits underscore the importance of improving college completion rates for all members of society. Attention to the success of low-income and minority individuals is particularly important given their substantial increase in the population. Without addressing gaps in the educational attainment levels of key demographic groups, America will lose the anticipated economic boost and global dominance that an educated workforce can generate.

Statement of the Problem

For many years, the United States was the undisputed leader in producing

college educated adults, with a significantly higher rate of college completion than any

other country in the world. Now, the United States ranks 16th in the percentage of

young adults with a college degree (Organization for Economic Cooperation and

Development, 2011). This is a dramatic drop from preceding years when the United

States ranked 5th in 2001 and 3rd in 1998 (Bowen, Chingos, & McPherson, 2009).
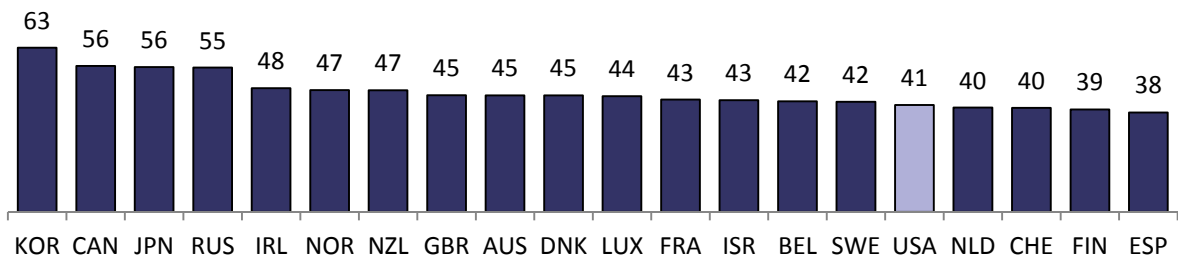
Figure*3*. Educational Attainment: Percentage of the Population with College Credentials.
From Organization for Economic Cooperation and Development (2011). Education at a
glance 2011: OECD indicators. p.40.

While educational attainment levels have increased throughout the world, college

completion rates have remained fairly constant in the United States since 1970. The

proportion of the U.S. population with a college degree (an associate's degree or above)

is about 40%, regardless of age. (Matthews, 2010; The Lumina Foundation, 2010a,

2010b). In Korea, Canada, Japan, and Russia, over 55% of young adults have a college

degree (Organization for Economic Cooperation and Development, 2010).

Additionally, the United States is falling behind other countries in the percentage

of students who complete college. At 57%, the United States is ranked second to last in

the percentage of students graduating with a college degree (Organization for Economic

Cooperation and Development, 2010). The average among all participating OECD

countries is 70%. The United States also leads the world in the proportion of students

who start postsecondary education, but do not graduate (Organization for Economic

Cooperation and Development, 2010).

As global competition increases, the United States is losing dominance in many

important fields. In 1975, the United States was second only to Japan in the proportion

of degrees earned in the Natural Sciences and Engineering (Bowen, et al., 2009). Now,

the United States ranks 27th out of 29 wealthy countries in the proportion of college

students with degrees in science or engineering and 48th out of 133 countries in math

and science instruction (Brisbane, 2010). Many countries now outperform American

students in math and science, and also earn more degrees in Science and Engineering.

Half of all individuals with a doctorate in the United States are foreign born; 39% of

Science and Engineering PhD graduates are foreign born (Bowen, Kurzweil, & Tobin,

2005).

A disturbing trend has become clear. The United States is losing ground in

educational attainment levels on a global scale. As other nations are advancing at a

faster rate, the United States continues to slip behind other countries in improving

college opportunities, economic, and social outcomes for all residents. There is a

growing concern about the deficit in the growth rate of human capital. Increasing the

supply of college educated workers is central to the health of the U.S. economy. The

inability of the U.S. educational system to increase the number of individuals with

college credentials has repercussions for the future of the American labor force.

Michelle Rhee (2010), former Chancellor of the public school system in Washington, DC

explains,

> We are on a path to be in some serious trouble in this country. Over the next 20
> years, there will be 123 million high skilled and high paying jobs in this country.
> At the pace that we are moving right now, Americans will only be able to fill 50
> million of those jobs. We are not preparing the next generation of kids to be
> competitive . . . The only way we are going to be able to regain our position in
> the marketplace is if we fix our education system (Rhee, 2010).

Unless there are profound changes in the educational system, the United States will

continue to lose ground to foreign competitors.

Without improving college completion rates, the United States will be short

three million college graduates needed for jobs by 2018 (Nunez, 2013). A recent

analysis of wage and unemployment data by Carnevale and Rose (2011) indicates that

the United States has been under producing college educated workers since 1990. From

1990 to 2010, the demand for a college educated workforce has grown at least 2% every

year. However, the supply of college educated workers has only grown by 1%. The

undersupply of a college educated workforce led to a problem of efficiency and of

equity. Without enough skilled workers to meet demand, the United States is losing out

on the productivity that college educated workers would bring to the economy. If the

supply of college educated workers is less than the demand of the employers, the wage

premium for college workers increases relative to less educated workers, exacerbating

income inequality. Carnevale and Rose (2011) explain, "The result is that we lose our

global lead position in percentage of the workforce with postsecondary credentials, but we also have become the global industrialized leader in income inequality" (A. Carnevale & Rose, 2011, p. 8).

President Obama and other leaders have focused their attention on developing solutions to regain a competitive advantage. Increasing college success has emerged as an important national strategy for ensuring a strong global economy and workforce for the future. Many policy makers, state and federal government officials, national higher education associations, foundations, economists, and academics have issued a call for raising the educational level in the United (Bernanke, 2008; Bowen, et al., 2009; Matthews, 2010). Since 2008, Lumina Foundation for Education has invested millions of dollars in trying to realize their goal of increasing higher education attainment rates to 60% in the United States (Matthews, 2010). Along with Lumina Foundation for Education, the Bill and Melinda Gates Foundation, Carnegie Corporation of New York, Ford Foundation, and W.K. Kellogg Foundation, joined the effort in 2009 to increase the number of Americans with a college degree or credential. Their goal is to close the attainment gaps for traditionally underrepresented populations through the creation of a nonprofit group called Complete College America (Complete College America, 2010). Create College America works to increase college completion rates through state policy change. They also work to build consensus among state policy makers, leaders in higher education, and the national education policy community. President Obama set an

ambitious goal of the United States regaining its position in producing the highest

number of college graduates in the world by 2020 (The White House, 2010a).

Disparities in Educational Attainment Rates

According to many educational experts and policy makers, it is not possible for

the United States to significantly increase educational attainment rates without

addressing disparities in outcomes for low-income and underrepresented minorities.

There are persistent and troubling gaps in the educational attainment levels by

race/ethnicity among underrepresented minorities compared to their peers (Figure 4

and 5). In 2011, 56% of Asians ages 25 to 29 and 39% of Whites obtained a bachelor's

degree compared to 20% of Blacks, and 13% of Hispanics (Aud, et al., 2012). Overall,

32% had a bachelor's degree.
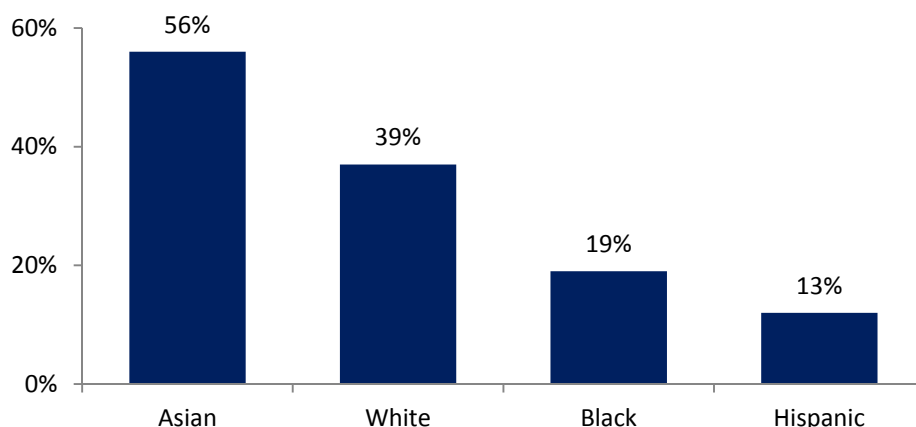
Figure 4. U.S. bachelor's degree attainment by race and ethnicity, Ages 25 to 29. From
The condition of education 2012. (NCES 2012-045). Washington, DC: United States
Office of Education. Table A-48-1.

There is also a persistent gap in the rate at which educational attainment levels are

increasing among underrepresented minorities compared to their peers (Figure 5).

Between 1971 and 2011, the overall percentage of 25 to 29 year olds with a bachelor's

degree increased from 17% to 32.2% (Aud, et al., 2012; Aud, Hussar, et al., 2010). For

Whites, bachelor's degree attainment increased from 19 to 39%; from 7% to 20% for

Blacks; and from 5% to 13% for Hispanics from 1971 to 2011 (Aud, et al., 2012; Aud,

Hussar, et al., 2010). Educational attainment rate was not available for in 1971 for

Asians. During this time period, the gap in bachelor's degree attainment between

Whites and Blacks increased from 12% to 19%; for Hispanics, the gap increased from

14% to 26% (Aud, et al., 2012; Aud, Hussar, et al., 2010). Statistics for Asian/Pacific

Islanders were not available before 1990, but the percentage of 25 to 29 year olds with

a bachelor's degree in 2011 was 56%, the highest of any racial/ethnic group (Aud,

Hussar, et al., 2010).
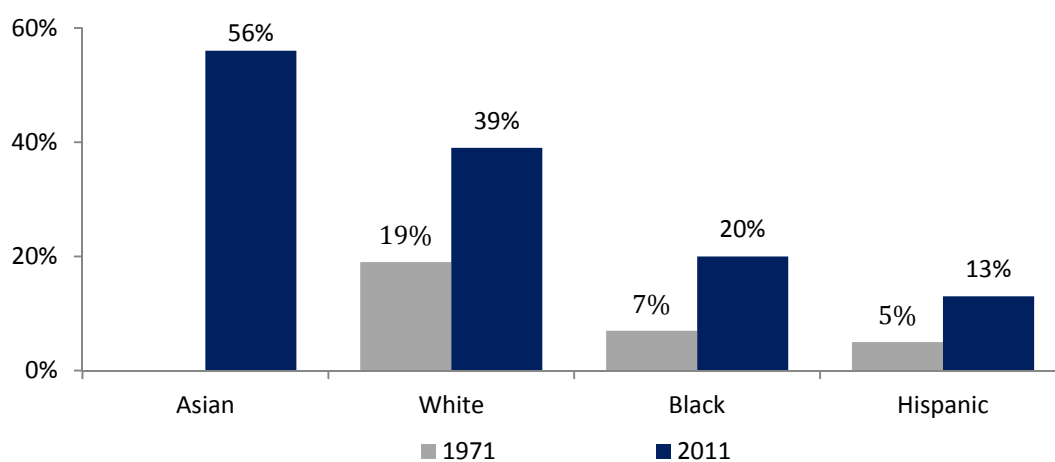
* Data for Asian/Pacific Islanders was not available in 1971

Figure 5. Educational attainment growth by race and ethnicity from 1971 to 2011, ages 25 to 29. From The condition of education 2010. (NCES 2010-028); The condition of education 2012. (NCES 2012-045). Washington, DC: US Department of Education.

Demographic Trends

The educational attainment gap among underrepresented minorities is alarming given the country's demographic trends. The population of the United States will continue to get more diverse as the minority population continues to grow, most notably for Hispanics and Asians, the primary immigrant groups to the United States (Ortman & Guarneri, 2009). By 2043, minorities are projected to be the new majority (U.S. Census Bureau, 2012). By 2060, minorities will account for 56% of the total U.S. population (U.S. Census Bureau, 2012). One in three people will be Hispanic (Figure 6).

2060	Hispanic 31	Black 15	Asian 8	Other 8	Non-Hispanic White 43
2012	Hispanic 17	Black 13	Asian 5	3	Non-Hispanic White 63
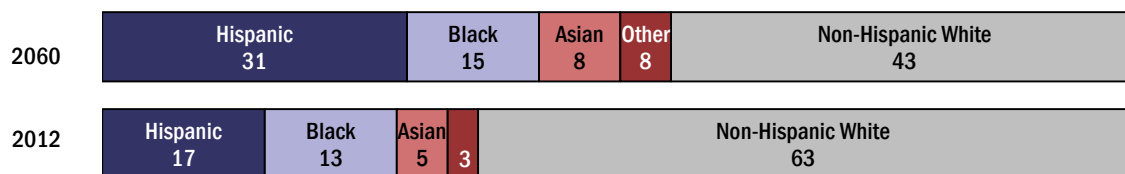
Figure 6. Population by race and Hispanic origin for the United States: 2012 to 2060. From U.S. Census Bureau. *Population Projections* (2012)*.

As the minority population is projected to increase, so is the proportion of the U.S. population living in poverty. Greater percentages of minorities are living in poverty compared to their White peers. The poverty threshold is defined as less than $11,702 for an individual and $23,201 for a family of four and in 2011 (DeNavas-Walt, Proctor, & Smith, 2012). In 2011, more than 46.2 million Americans were living in poverty, the highest number since record keeping began over 50 years ago, and the poverty rate increased to 15.0%; the highest level since 1994 (DeNavas-Walt, et al., 2012).

Poverty rates are higher for minority groups. In 2011, the poverty rate for non-

Hispanic Whites was 9.8%, compared to 12.3% for Asians, 25.3% for Hispanics, and

37.6% for Blacks (DeNavas-Walt, et al., 2012). Similarly, poverty projections for minority

children are concerning as they will represent an increasing majority of the population.

By 2040, minority children are projected to account for 76.2% of all children in poverty;

Hispanic children will account for nearly half of the children in poverty by 2040

(Murdock, Zey, Cline, & Klineberg, 2010). It is projected that there will be an 85.2%

increase in the concentration of minority children in households with a parent that has

less than a high school education (Murdock, et al., 2010). The demographic changes

underway in the United States ensure that higher education institutions will be

increasingly called to respond to low income populations. As T.G. Mortenson (2007)

noted,

> The low-income population represents a growing share of our country's future
> workers and producers, taxpayers, citizens, voters, consumers and parents. How
> well this population is higher educated today will have a great deal to say about
> our country's future social, civic and economic welfare and security. (Mortenson,
> 2007, p. 1)

The educational implications of population projections in the United States are

concerning. If current trends continue, it is projected that there will be a decrease of

five percent in the nation's overall educational attainment rate by 2022 (Bowen, et al.,

2009). The decrease would be greater if not for the projected increase in Asian high

school graduates who have the highest college completion rates of any racial group.

Without addressing the educational gaps of low-income and minority students, national

postsecondary attainment goals will not be achieved, the United States will continue to lose dominance globally, and workforce demand will not be met.

The convergence of the demographic shift in the United States, along with the disparities in educational attainment suggest that some underrepresented minorities will be increasingly marginalized and deprived of economic, social, and democratic opportunities if disparities are not addressed. Group differences in educational attainment along socioeconomic and racial/ethnic lines contributes to the persistent economic and social stratification of American society (Perna, 2007). As some racial/ethnic groups such as Hispanics will become the ascendant majority, this is a matter of great concern. Attention to the educational outcomes of low-income and minority groups in the United States is particularly important given their substantial representation in the overall population. Those who will form a greater portion of the U.S. economy are less likely to have a college education. This will weaken the supply of human capital in the United States and decrease American economic competitiveness. From a social justice perspective, if the educational disparities in educational outcomes continues to persist, progress made in the U.S. after the civil rights movement will wear away, leaving more divisions along racial/ethnic lines, socially and economically.

Disparities of educational outcomes along racial/ethnic lines and socioeconomic backgrounds have devastating consequences for the loss of human capital, as well as lost opportunities for social mobility. Equality in educational attainment enhances social mobility, which contributes to lowering long-term inequality (Checchi, 2006).

Educational attainment gaps by income and race/ethnicity represent an opportunity gap. It limits the ability of the United States to remain competitive globally. If we can reduce the disparities in outcomes of targeted populations, national levels of educational attainment can improve.

College Enrollment and Participation Rates

In order to meet the goal of increasing the educational attainment level in the United States, it is important to examine college enrollment and completion rates. Although educational attainment levels have remained constant, more Americans have aspirations of earning a college degree. The number of American youth with aspirations of being a college graduate is higher now than ever before (Alfonso, 2004; Kirst & Venezia, 2004). A study by the U.S. Department of Education (2005) found that nearly 90% of high school sophomores wanted to attend college and over 70% expected to complete a bachelor's degree (Ingels, Burns, Chen, Cataldi, & Charleston, 2005). The percentage of high school seniors that expected to earn a college degree has doubled over the past 30 years from 35% in 1981-82 to 69% in 2003-04 (U.S. Department of Education & National Center for Education Statistics, 2006). The rising high educational aspirations are consistent across students of all racial/ethnic and economic backgrounds.

As Americans' goals of attaining a college degree increased, so has enrollment in postsecondary education institutions. The United States has made great progress in expanding access to higher education. Similarly, the overall college participation rate

has increased over the past 35 years. The rate of college enrollment immediately after high school increased from 50.7% in 1975 to 68.1% in 2010 (Aud, et al., 2012). In 1975, over 9,600,000 million students were enrolled in degree granting higher education institutions, compared to over 18,079,000 million in 2010 (Aud, et al., 2012). Postsecondary educational enrollment is expected to increase to almost 21 million in 2019 (Aud, et al., 2012).

Although the overall college participation rates of all 18 to 24 year olds has increased for all racial/ethnic groups, the gap continues to increase between underrepresented minorities and their counterparts (Figure 7). In 1980, 28% of White 18 to 24 year olds enrolled in college, compared to 20% of African Americans, and 16% of Hispanics (Aud, Fox, & KewalRamani, 2010). By 2008, 44% of White 18 to 24 year olds enrolled in college, compared with 32% of Blacks, 26% of Hispanics, and 22% of American Indian/Alaska Natives. In 2008, 58% of Asian/Pacific Islanders enrolled in college, the highest college participation rate of any other racial/ethnic group.

Data for Asians and American Indian/Alaska Natives was not available in 1980.
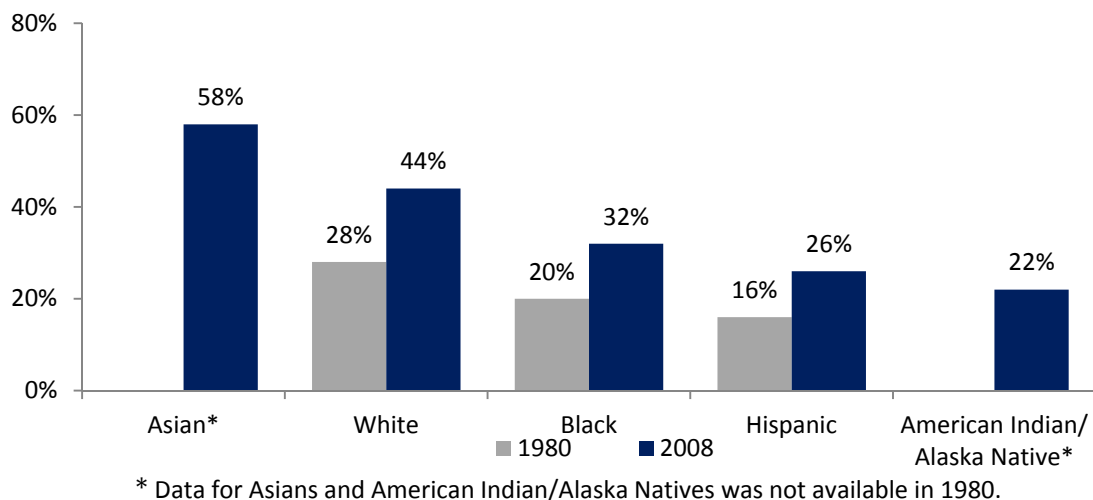
Figure 7. College participation rates by race & ethnicity, ages 18 to 24, 1980 to 2008. From Aud, S, Fox, Mary Ann, & Kewal Ramani, Angelina. (2010). Status and trends in the education of racial and ethnic groups. (NCES 2010-015). Washington, DC: National Center for Education Statistics. p. 120.

The gap in college participation rates between White and Black 18 to 24 year olds increased from 8% in 1980 to 12% in 2008 (Aud, Fox, et al., 2010). The gap in college participation rates from White and Hispanic 18 to 24 year olds was even greater at 11.4% in 1980 to 18.4% in 2008. The gap between White and American Indian/Alaska Native 18 to 24 year olds was greatest in 2008 at 22.3% (author calculations). This trend is problematic as the U.S. population continues to diversify.

Young adults from low-income backgrounds are entering college at ever increasing rates (Goldrick-Rab & Roska, 2008), but gaps still persist along socioeconomic lines. The percentage of low-income high school graduates enrolled in college immediately following high school increased from 32% in 1980 to 51% in 2010 (Aud, et al., 2012). Yet, participation lags behind middle and high income groups (Figure 8).
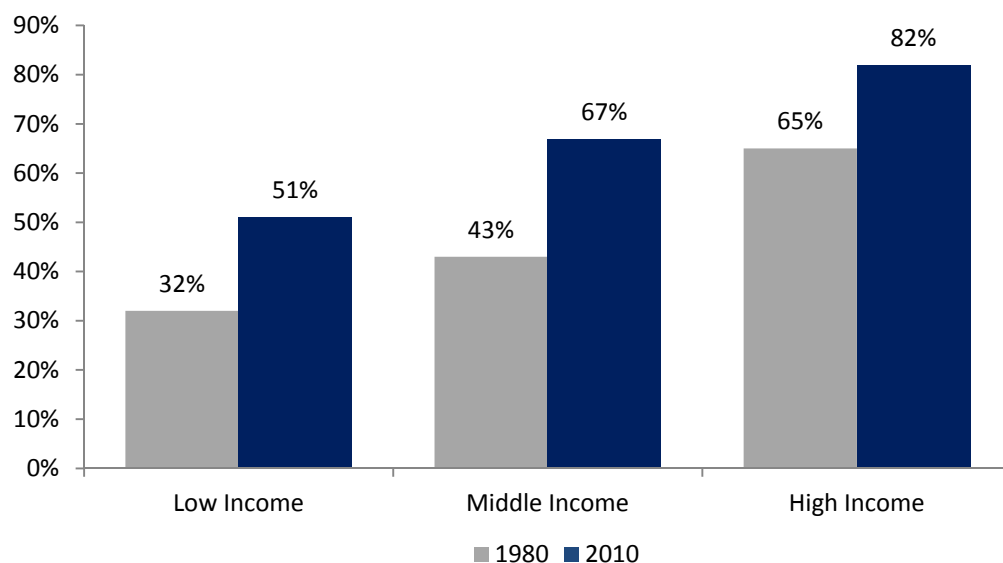
Figure 8. College participation rates by income, 1980 to 2008. From Aud, S, Fox, Mary Ann, & Kewal Ramani, Angelina. (2010). Status and trends in the education of racial and ethnic groups. (NCES 2010-015). Washington, DC: National Center for Education Statistics. p. 120.

College attendance rates of low-income students are low regardless of their level of academic preparation. Low-income high school graduates who score in the top quartile on standardized tests have similar college enrollment rates as high income high school graduates who score in the bottom quartile of standardized tests (Gladieux, 2004).

Completion Rates

While the proportion of individuals enrolling in college has grown since the 1970's, the proportion completing college has not. Among high school students who enter college, the percentage of those who complete in eight years is lower now than it was in the 1970's (Bound, Lovenheim, & Turner, 2009; U.S. Department of Education, 1999). Almost 58% of students who start a four-year bachelor's program and attend full-time finish in 6 years (Aud, et al., 2012). Completion rates for bachelor's degree

programs vary by institutional control. Students at private not-for-profit four year

institutions have the highest six year graduation rate at 65%, compared to 56% at public

four-year institutions, and 28% at private for-profit institutions.

Graduation rates at community colleges are even lower. At community colleges,

only 30% of full-time students who start at community colleges graduate with an

associate degree in 3 years (Aud, et al., 2012; Knapp, Kelly-Reid, & Ginder, 2010).

Associate degree and certificate completion rates also vary by institutional control.

Private for-profit institutions have the highest completion rate at 60%, compared to 51%

at private not-for-profit, and 20% for public community colleges (Aud, et al., 2012).

Trend data indicate that completion rates at two-year institutions are actually

decreasing. For the cohort starting in 2000, almost 24% of full-time students graduated

within three years compared to the most recent cohort that started in 2007 at 20%

(Aud, et al., 2012). Bound, Lovenheim, and Turner (2009) also found that the eight year

graduation rate for specific cohorts of community college students also decreased from

20.2% for 1972 high school graduates to 17.6% for 1992 high school graduates. This

trend was deemed "unacceptable" by Secretary of State, Margaret Spellings in the

Commission on the Future of Higher Education report (U.S. Department of Education,

2006, p. vii).

Students who would benefit from a college degree in term of upward mobility do

not graduate at the same rate as their peers. Completion rates vary along demographic

and socioeconomic lines. Completion rates for Black, Hispanic, Native American and

low-income students are lower than the overall numbers at all higher education

institutions (Adelman, 2006; P. A. Attewell & Lavin, 2007; Aud, Fox, et al., 2010; Aud,

Hussar, et al., 2010; T. Bailey, Jenkins, & Leinbach, 2005; Bowen, et al., 2009; Complete

College America, 2010). The six year college graduation rate is only 40% for American

Indians/Alaska Native students, 42% for Blacks, and 48% for Hispanics, compared with

Whites at 60% and Asian/Pacific Islanders (Aud et al, 2012).
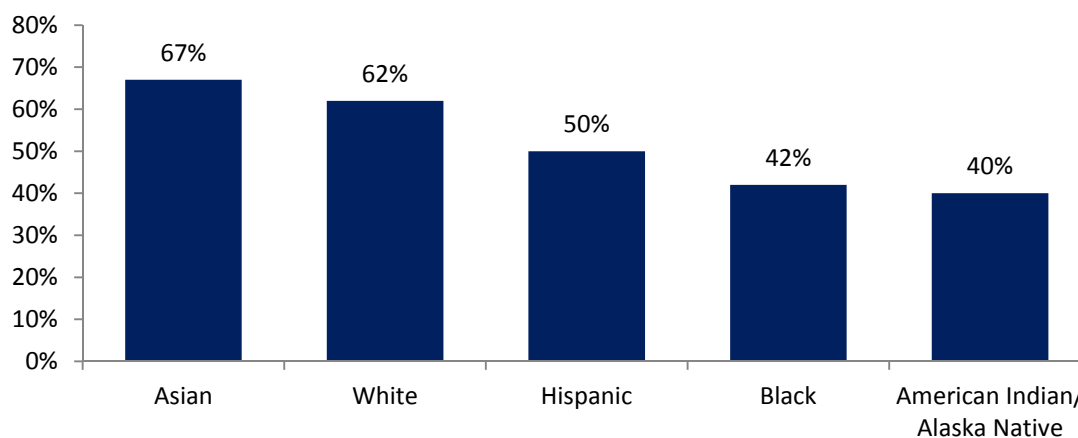
Figure 9. Six-year bachelor's degree completion rates by race & ethnicity. From Aud et al, 2012. The condition of education 2012. (NCES 2012-045). Washington, DC: United States Office of Education.

The completion of an associate degree or certificate within 150% of "normal"

time does not vary much by race/ethnicity as it is low for all ethnic groups. For the 2007

starting cohort attending full-time, Asian and Hispanic students had similar completion

rates: 34% of Asian community college students and 33% for Hispanic students (Aud, et

al, 2012). For the same 2007 cohort, 30% of White students, 26% of American

Indian/Alaska Native students, and 25% of Black students complete an associate degree

or certificate within 150% of expected time (Figure 10).
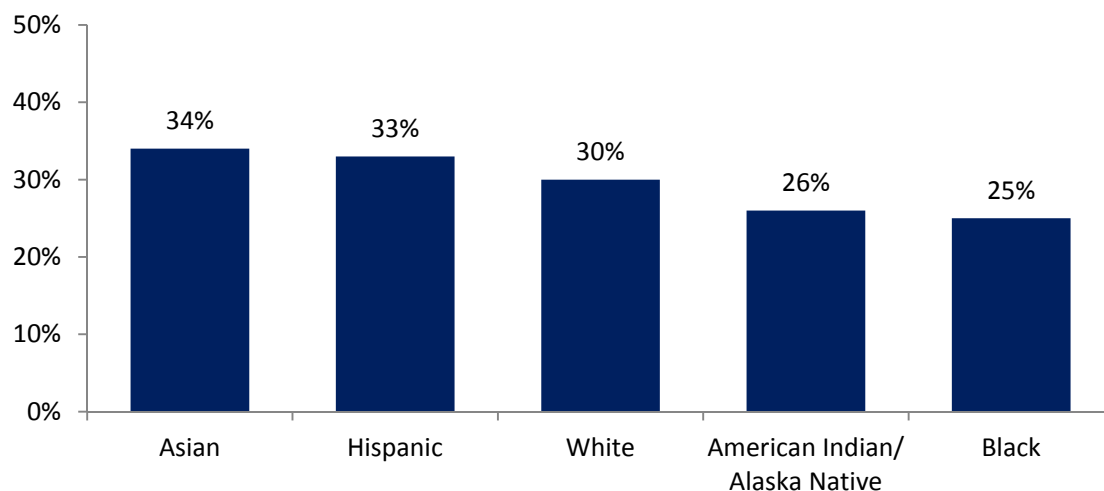
Figure 10. Community college associate and certificate completion rates within 150% of expected time by race/ethnicity. From Aud, et al, 2012. The condition of education 2012. (NCES 2012-045). Washington, DC: United States Office of Education.

Disparities in transfer rates exist for community college students by race/ethnicity. Among beginning community college students, only 4% of Black students and 10% of Hispanic students transferred to a four year institution and earned a bachelor's degree in eight years, compared to 17% of White students (T. Bailey, Jenkins, et al., 2005).

College completion rates among low-income students continue to lag behind their peers. Six year graduation rates for low-income students have remained at 6% for over 20 years (Sacks, 2007). In 2004, 71% of bachelor's degrees were awarded to students in the top income quartile compared to only 10% of students from the bottom income quartile (Selingo & Brainard, 2006). Only 40% of beginning college students from low-income families complete a two or four year college degree within seven years, compared to 62% of students from high income families (Goldrick-Rab & Roska,

2008). Only 36% of college ready low-income students complete a bachelor's degree within eight and a half years, compared to 81% of students from higher income families (Adelman, 2006; cited in U.S. Department of Education, 2006). Bailey, Jenkins, and Leinbach (2005) also found that 18% of beginning community college students in the highest income quartile earned a bachelor's degree in seven years compared to 5% in the lowest income quartile. Students in the highest income quartile also transferred at a higher rate, 23%, compared to just 8% in the lowest income quartile group (T. Bailey, Jenkins, et al., 2005).

Role of Community Colleges in Decreasing Educational Disparities

It is evident that going to college does not correspond closely with completing a degree. This trend must change if overall educational attainment levels are to increase. To address this goal, college completion rates need to increase while inequalities along socioeconomic and racial/ethnic lines decrease. If the goal is to increase educational attainment rates by increasing college completion rates, particularly among low-income and minority students, it is important to recognize the critical role of community colleges. Over 1,200 community colleges in the United States account for nearly half of all undergraduates in higher education (American Association of Community Colleges, 2012). Compared to baccalaureate degree institutions, students at community colleges are significantly more underprepared, come from low-income families, are racial and ethnic minorities, and are first-generation college students.

Community colleges play an important role in the equity agenda of higher education. They are an important entry point to higher education for many Americans traditionally excluded from other higher education opportunities due to a lack of preparation, financial resources, language skills, or workforce focus. The low cost and accessibility of community colleges make them especially important higher education institutions for low-income students. Students from lower socioeconomic backgrounds are more likely to start their postsecondary education at a community college, enroll part-time, and less likely to transfer and complete a bachelor's degree (Goldrick-Rab, 2006). Almost 30% of community college students have a family household income of less than $20,000 (National Center for Education Statistics, 2006).

Community colleges serve a diverse group of students, including those who have academic, financial, and personal challenges. Public community colleges accounted for 54% of all Native American students enrolled in postsecondary education, 51% of all Hispanic students, 44% of all Black students, and 45% of all Asian/Pacific Islander students (American Association of Community Colleges, 2012). Close to 20% of community colleges have minority enrollments that were 50% or more of their total enrollment (Provasnik & Planty, 2008). Additionally, the majority of undocumented immigrants enrolled in postsecondary education attend community colleges (Russell, 2011). Students at community colleges tend to be older and have a larger portion of students who do not enroll in college immediately after high school. Students at community colleges also have substantial time commitments to their families and jobs

in addition to their studies. Close to 80% of community college students work, with 41%

working full-time while enrolled in school (National Center for Education Statistics,

2006).

To accomplish the goal of increasing college completion rates and strengthening

the education pipeline, President Obama recognizes the importance of community

colleges. Obama's 2020 education goals include increasing the number of community

colleges graduates by an additional five million graduates. To help accomplish this goal,

the American Graduation Initiative was proposed to increase investments in community

colleges. The Health Care and Education Reconciliation Act included $2 billion over four

years to achieve this goal (The White House, 2010a). According to President Obama,

"Jobs requiring at least an associate degree are projected to grow twice as fast as jobs

requiring no college experience. We will not fill those jobs – or keep those jobs on our

shores – without the training offered by community colleges" (The White House,

2010b).

Economists have recognized the significant role community colleges play in

addressing educational inequalities and increasing educational attainment levels in the

United States. Ben Bernanke, Chairman of the Federal Reserve Board stated:

> The best way by far to improve economic opportunity and to reduce inequality is
> to increase the educational attainment and skills of American workers. . .
> Inequalities in education and in access to education remain high. As we think
> about improving education and skills, we should also look beyond the traditional
> K-12 and 4-year-college system - as important as it is - to recognize that
> education should be lifelong and can come in many forms. Early childhood
> education, community colleges, vocational schools, on-the-job training, online

courses, adult education--all of these are vehicles of demonstrated value in increasing skills and lifetime earning power. (Bernanke, 2008)

Americans turn to community colleges to provide access to greater economic opportunities and an enhanced quality of life through educational programs available to a diverse student body. Community colleges, by design, are open door institutions that serve anyone wishing to continue their education at an affordable price. Diverse mission areas, open admission policies, and lower cost tuition enable community colleges to provide educational access to people who may not otherwise have the chance to attend college. Access is an important starting point, but the majority of students leave community colleges without completing their degree or successfully transferring to a four-year institution. When students do not achieve their educational goals, they lose the opportunity to get a better paying job and enhanced quality of life. As a society, we lose our ability to compete in a rapidly changing global marketplace and develop an educated, competitive workforce.

The greatest concern lies with the fact that community colleges continue to enroll the majority of low-income and underrepresented minorities and struggle with turning enrollments into graduates and successful transfers. Estela Bensimon at the Center for Urban Education at the University of Southern California explains, "These institutions were already diverse; they didn't have a problem with access. The problem was with success – and no one was really looking at that" (Connell, 2008, p. 6). Marshall Drummond, Chancellor of the Los Angeles City Colleges also explains, "Our 'back door' is much less diverse and equitable than our 'front' door" (Connell, 2008, p. 6). For many

years, federal and state lawmakers, as well as educators and researchers, have focused

on achieving equity for low-income and underrepresented minorities in terms of access.

However, as Cliff Adelman proclaims, "degree completion is the true bottom line"

(Adelman, 1999, p. v), and many students never complete their degrees.

Community college graduation rates continue to be low and advocates urge

community colleges to improve their degree outcomes (Ashburn, 2007; T. Bailey et al.,

2004; T. Bailey & Morest, 2006; Roska & Arum, 2004; R. Stuart, 2010). According to

former Department of Education Secretary, Margaret Spellings, this is "at least in part

because most colleges and universities don't accept responsibility for making sure that

those they admit actually succeed" (U.S. Department of Education, 2006, p. vii). It is

important for community colleges, critical members of the postsecondary enterprise, to

devise ways to preserve the principle of universal access and still provide successful

outcomes.

Conceptual Underpinnings for the Study

Examining Factors Related to Persistence and Completion

Instead of continuing to point out inequalities in educational outcomes, action

must be taken to correct it. The problem does not stem from an absence of data, but

from a lack of understanding what factors contribute to successful outcomes and filter

out points. Extensive research exists on persistence and completion of students in

higher education. Most of the research focuses on identifying variables which may

contribute to student departure. The studies usually fall into the following categories:

student demographics, pre-college student characteristics, student enrollment

characteristics, enrollment pathways, student intent, academic and social integration,

and financial aid.

Despite the significant amount of studies designed to examine attrition factors

and strategies for reducing student departure, graduation rates have not improved.

There remains an inability to make sense of all of the variables and how they relate to

any specific group of students (V. Tinto, 1993). This provides an impetus for

understanding risk factors related to college attrition and positive factors related to

degree completion. If risk factors can be identified, then intervention programs can be

designed to increase retention rates. Similarly, if positive factors related to degree

completion can be identified, then programs and policies can be put in place to increase

degree attainment. Individual, environmental, and academic factors that affect the

educational persistence of low-income, underrepresented community college students

must be identified so that policies and practices can be implemented to increase the

educational attainment of this important demographic, as well as increasing the

educational attainment overall.

Many studies of student attrition and persistence focus on student

characteristics as predictors of success. Student demographics may have an impact on

graduation rates, but it is important to examine what other factors can be addressed

such as student behaviors, attitudes, enrollment characteristics, institutional policies,

and financial aid policies. There is limited research on how such factors contribute to

student departure from community colleges, and specifically for low-income and underrepresented minorities. Most studies focus on the disparities in attrition and completion rates of minority and low-income students, instead of focusing on institutional and policy changes which may increase the likelihood of success. Educators, administrators, and policy makers must understand the structural barriers faced by underserved students after they begin their studies at the community college.

As low-income and underrepresented minorities comprise a large proportion of community college enrollments, it is important for administrators and educators to know what kinds of academic characteristics, enrollment patterns, and institutional practices encourage students to complete their degree. Low-income and underrepresented students frequently do not complete a college preparatory curriculum in high school and often take lower level math and English courses (Noeth & Wimberly, 2002). Low-income and underrepresented minority students often score lower on college entrance exams and take lower level math and English courses (Adelman, 2006). As a result, they are less prepared for college level work and are more likely to take remedial coursework. They are more likely to delay college attendance after high school, attend a community college, attend part-time, and follow a non-linear pattern of enrollment than their higher income and White and Asian peers (Aud, Fox, et al., 2010; Aud, Hussar, et al., 2010; X. Chen, 2005).

Without understanding the challenges low-income, underrepresented minority students face, community college administrators and educators are at a disadvantage

when they try to develop appropriate retention programs. Given the growing

significance of this important demographic group in the United States and in higher

education, it is critical to understand factors that contribute to student attrition,

persistence, and graduation. It is important to understand what structural elements of

the educational environment and process require change.

While it is critical to continue to study and address issues in the pipeline that

contribute to educational access and outcome disparities, it is also important to

understand what open door institutions such as community colleges can do to increase

degree completion success among students with reduced cultural and social capital.

Can improvements be made in advising, course sequences, the content of remedial

courses, institutional policies, requirements, etc, that impact the academic integration

of students and their overall success? Do external commitments, part time enrollment

status, working full-time, have an impact on social integration and the student's overall

success? By increasing understanding in these areas, interventions and strategies can

possibly be improved to improve students' educational attainment.

Additionally, too many research studies on low-income, underrepresented

minority students focus on a deficit model that emphasizes students' inabilities and lack

of skills, rather than their abilities (Green, 2006). Many colleges and universities

encourage policies and programs that view underserved students as being less than

their peers. The deficit model creates additional obstacles for these students as some

teachers, mentors, and staff have lower expectations, and encourage a self-fulfilling

prophesy that underserved students will fail regardless of their skills and potential

(Green, 2006). Educators, administrators, and policy makers must move towards an

asset model focusing on the strengths of different student populations and create a

student-centered paradigm where all students can succeed. Moving toward an asset

model requires that researchers examine the circumstances under which low-income,

underrepresented minority students succeed. Which enrollment characteristics and

enrollment pathways are more likely to lead to success? Which programs and course

sequences result in more positive outcomes?

The overwhelming majority of persistence research focuses on four-year

institutions. In the widely cited research conducted by Pascarella and Terenzini (1991)

which reviewed over 2,600 studies on "how college affects students", results were

based almost exclusively on samples of traditional college students ages 18 to 22,

attending four-year institutions full-time and living on campus. In the second edition of

their book published in 2005, Pascarella and Terenzini discussed how community college

were "largely ignored" in their first volume as only about "five to ten percent" of the

literature covered community colleges (Pascarella & Terenzini, 2005, p. 3). Townsend,

Donaldson, and Wilson (2003) examined the visibility of community colleges in five

mainstream higher education journals and found that only 8% of the 2,321 articles

published between 1990 and 2003 mentioned community colleges. Since then, there

has been an increase in the amount of attention given to community colleges; however,

there is still a serious lack of research for a system that represents almost half of all

college enrollments (American Association of Community Colleges, 2010; Aud, Hussar, et al., 2010; Provasnik & Planty, 2008). Community colleges are still significantly underrepresented in the total body of evidence on the impact of college on students (Pascarella & Terenzini, 2005).

<div align="center">Examining the Temporal Aspects of Persistence</div>

It is useful for community college leadership to know more about when students are most likely to drop out. By understanding the timing of dropouts, community college administrators, faculty, and staff would be able to target their precious resources to help students complete the program or facilitate transfer to a four-year institution. For example, if students are more likely to drop out after their first semester, intervention strategies could be specifically targeted to a new student's first semester. The timing of student departure, or more importantly, the point at which students are at the highest risk of dropping out, is important to consider. Much emphasis is placed on examining the first year of enrollment as an important focus of study. Several researchers have demonstrated that academic achievement during the first semester or first year of study has a strong influence on persistence and graduation into the second year and beyond (Allen & Robbins, 2008; Boyer, 2005; Elkins, Braxton, & James, 2000; Fike & Fike, 2008; Goodman & Pascarella, 2006; L. S. Hagedorn, Siadat, Fogel, Nora, & Pascarella, 1999; Halpin, 1990; Hausmann, Ye, Schofield, & Woods, 2009; Kahn & Nauta, 2001; Pascarella, 1995; Pascarella, Seifert, & Whitt, 2008; X. Wang, 2009). Additional research has found that student departure in subsequent years may

be attributed to different factors depending on the time point of study. Horn (1998)

found that when persistence is studied at the second year, student pre-enrollment

characteristics such as gender, race/ethnicity, age, and socioeconomic status had less

impact on persistence than studies that focus on the first year only.

Factors that influence attrition and persistence to graduation can be difficult to

determine. The issue lies with not only identifying the factors, but also the timing of

when these factors have the greatest impact. Literature is limited on specific time

frames attached to variables that are time-dependent and variant by nature (number of

credit hours taken per semester, GPA, enrollment status patterns). Pascarella and

Terenzini (2005) describe the use of a "promising new analytical approach called Event

History Analysis" that demonstrate a "promising step toward increasing the

sophistication of models and theories . . of how college affects students" by modeling

variations over time (Pascarella & Terenzini, 2005, pp. 397-398). Event History Analysis

(EHA) is a method that identifies time specific variables that may have an impact on

graduation. The use of EHA can provide significant insight about the timing of factors

that affect attrition and persistence to graduation. Ishitani and DesJardins (2002)

explain:

> Event History Models are particularly useful for examining the relationship
> between the timing of events and the factors thought to affect these events. By
> focusing on the time dimension of the events, one can focus attention on the
> time periods when students are most at-risk of leaving the institution. Knowing
> more about the specific times at which students are at-risk is important if
> institutions hope to implement effective retention programs. (Ishitani &
> DesJardins, 2002, p. 7).

Event History Analysis, also referred to as survival analysis, has been extensively utilized in the biomedical sciences, engineering, and in a relatively small number of studies examining undergraduate persistence (Bahr, 2008a; Chae, 2000; R. Chen, 2007; Stephen L. DesJardins, 1996; Stephen L. DesJardins, McCall, Ahlburg, & Moye, 2002; Gross, 2008; Gross & Hossler, 2010; Han & Ganges, 1995; S. A. Lesik, 2005; S.A. Lesik, 2007; Murtaugh, Burns, & Schuster, 1999; Threat-Milton, 2005). EHA models the time it takes for a specific event to take place such as the time to death of a patient or laboratory animal, the breakdown of a machine, or student departure.

When focused on the temporal aspects of student attrition and persistence to graduation, EHA has advantages over other techniques typically used in the literature. Most studies utilize a pre-post design where a cohort of students is selected, a specified period of time elapses, and outcomes are compared by the variables of interest. The dichotomization disregards the temporal nature of student persistence by collapsing factors across time, which may conceal factors influencing departure or graduation. EHA allows for the changing circumstances of students as they move through their academic careers. Selecting an arbitrary point in time to identify student enrollment or other outcomes fails to examine differences in student departure that may exist at various times. With other methods, such as structural equation modeling, some of the explanatory factor values are held constant, yet the effects of those factors may change over time. EHA offers enhancements over other methods which overlook the temporal aspects of persistence.

Willet and Singer (2003) outline the benefits of using EHA over other types of more traditional approaches to studying change. First, the outcome of traditional methods is linked to the time frame chosen for the analysis. For example, if studying graduation over a six year time period, the resulting graduation rate simply gives the cumulative difference without regard to timing. Second, results can vary for the same covariates depending on the time frame chosen. If, for example, the outcome of attrition is studied over a one semester time frame, and the other study uses a six year time frame, the conclusions can be different and could be a result in the timing of graduation. Third, traditional methods fail to account for censored observations, or those study participants who do not experience the targeted event during the study period. EHA allows for the inclusion of censored cases. Fourth, traditional methods do not offer a way to account for the inclusion of time dependent variables, or variables that vary from one time period to another. In persistence studies, a student's GPA, enrollment intensity (full or part time) and financial aid varies. Important information can be lost by ignoring timing differences.

Purpose and Research Questions

The purpose of this study was to examine the timing of academic factors that contribute to degree completion and attrition of low-income, underrepresented minority community college students. The specific research questions of interest were:

1. When are low-income, underrepresented minority degree seeking first-time community college students most likely to graduate with an associate's

degree or bachelor's degree or to drop out? How does this compare to other students?

2.   To what extent do academic integration factors affect timing to graduation and drop out for low-income, URM community college students?

This study examined degree seeking, first time, urban community college students over the course of seven years (20 semesters). It characterized the probability that low-income, URM students would experience graduation or drop out during the study period, compared the distribution of different groups who experienced the targeted event and those who did not, and modeled the probability of an event as a function of targeted covariates using discrete-time logistic regression.

Significance of the Study

The study took a *system departure* perspective rather than a strictly *institutional departure* perspective. Tinto (1993) distinguishes between the departure of students from individual institutions (institutional departure) and departure from the wider higher education system (system departure). If a student left one college but entered another, the student was not a drop out as he or she did not leave the higher education system, but departed from the institution. Most persistence studies use an institutional approach to persistence, instead of a system approach. Fifty-seven percent of undergraduates attend more than one institution (Adelman, 2006; Kuh, 2001); an institutional approach underreports the student degree completion rates. As Cliff Adelman, senior associate with the Institute for Higher Education Policy and former

senior analyst at the U.S. Department of Education states, "Institutions may "retain" students, but its *students* who complete degrees, no matter how many institutions they attend. So follow the student, not the institution" (Adelman, 1999).

Much of the existing research on transfer and graduation comes from single institution studies that rely on the records of select four-year institutions, student surveys, or state level datasets, resulting in a limited view of student movement across the system. Student surveys often have low response rates and are reliable as they are not based on actual registration, but student self-reported data. Results improve with the use of statewide longitudinal data system, which covers the entire system of public higher education within a state from high school through college. Currently, 44 states plus the District of Columbia now have student unit record level statewide database that tracks the actual registrations of students in a central database (Garcia & L'Orange, 2011). The majority of the statewide longitudinal data systems include only public colleges and universities within a state. The shortcoming of the statewide longitudinal databases is that they only track enrollments within a state and most do not comprehensively include private institutions, resulting in an undercount of transfer rates by at least 25% (Romano & Wisniewski, 2005).

Through the use of the National Student Clearinghouse (NSC), subsequent enrollment at other higher education institutions was tracked. Additionally, through the NSC, degree completion was examined beyond the college of first enrollment. If a student earned an associate's degree or bachelor's degree at another institution, it was

accounted for in the model. Differences in outcomes at the institutional level were also examined.

Most studies of student persistence focus on student characteristics as determinants of success. This study examined the impact of student characteristics through a lens of environmental factors that impact graduation and attrition. The focus of the study was not on measuring failure on the part of the student, but to understand what interventions can be developed at the colleges to encourage success. As open door institutions, community colleges take underprepared students from a variety of challenging circumstances. Since the past cannot be changed, what can the institution do with at-risk students to increase the probability of successful degree completion and decrease attrition?

After inclusion and exclusion criteria, the study included over 3,000 first time students who entered an associate degree program at one of seven urban community colleges in the fall term of 2000. The study tracked students over 20 semesters resulting in a longitudinal database containing student background characteristics, student course-taking and academic performance data, enrollment patterns, and student outcomes, such as graduation and attrition. Data from the National Student Clearinghouse was used to track attendance patterns of students who enrolled or graduated at other institutions.

Definitions of Key Terms

This section provides definitions of key terms used in the study. It is organized into four

sections: (1) Institution Type; (2) Outcomes: Persistence and Attrition; (3) Student

Demographics: Race/Ethnicity and Traditional/Non-traditional; and (4) Enrollment

Pathways and Transfer.

Institution Type

Two-Year Institution

A postsecondary institution that offers programs less than four years in length,

including associate and certificate degree programs. Excludes bachelor degree granting

institutions.

Four-Year institution

A postsecondary institution that offers programs at or above the baccalaureate

level and tend to be at least four years in duration. Also referred to as a baccalaureate

institution and includes both publically controlled and privately controlled institutions.

Control

Institutions are classified as being operated by publically elected or appointed

officials (public control) or by privately elected or appointed officials with the majority

of funds coming from private sources (private control).

Community College

Community college is defined as any public two-year college. Two-year

institutions with private control and for profit status are excluded from this definition.

Outcomes: Persistence and Attrition

Persistence

Persistence is the progressive reenrollment in college, whether continuous or interrupted and then resumed. Persistence is "a necessary, if not sufficient, condition for degree attainment" (Pascarella & Terenzini, 1991, p. 370). Most definitions of persistence focus on the institution and reflect the research conducted at four-year institutions. Defining persistence at the community college level uncovers the need for an expansion of the definition of persistence beyond the institution, as the goal of many community college students is to stay within the system of higher education and complete a bachelor's degree. For the purpose of this study, persistence encompasses enrollment in any postsecondary institution at the end of the six year time period. Similarly, graduation at any higher education institution is included in the definition of persistence and successful degree completion.

Retention

Retention is usually defined in terms of students remaining at an institution or graduating during a specified period of time period.

Attrition

Attrition is defined as student departure from the higher education system within the study period. Since student movement through the higher education system can include periods of stopping out and returning, it is recognized that some of the

students included as leaving the higher education system within the seven year period may return in subsequent years.

Drop Out or Withdrawal

Drop out or withdrawal typically refers to student departure from the institution. For the purposes of this study, withdrawal is defined as student departure from the system of higher education. Withdrawal from the institution will also be noted. Withdrawal will also be tracked in the context of a stop out verses a true withdrawal within the study period.

Graduate/Degree Completion

A student graduates when they complete an associate or bachelor's degree. Other credentials earned, such as basic and advanced certificates, are noted, but not included in graduation and degree completion statistics. This differs from the Integrated Postsecondary Education Data System (IPEDS) system from the National Center for Education Statistics where both certificate and associate degrees are counted in their graduation counts.

Graduation Rate

Graduation rate is typically defined as the percentage of first-time, full-time students who began in the fall semester of a particular year and complete their program of study within 150% of the program length at that institution. The graduation rate is generally defined with regard to the institution, not the student. For the purpose of this study, the graduation rate is expanded to part-time students and includes degree

completion at any higher education institution within a seven year time period. IPEDS

counts certificates in the rate, but this study just examines associate or bachelor's

degrees. Typically, retention is defined as the percentage of first-time, full-time, degree

seeking undergraduate students who are enrolled or complete their program within

150% of the expected time to completion. In this study, first-time, degree seeking

community college students were the target population, but also included part-time

students who comprise a large portion of the community college population. Associate

degree programs are typically viewed as two year programs if pursued full-time. Due to

the amount of remedial work required and the high proportion of students pursuing an

associate degree part-time, the time period for this study was expanded to seven years.

Additionally, bachelor's degree completion will also be tracked and included in the

outcomes. For this study, retention is defined as the percentage of first-time, degree

seeking community college students who are enrolled or completed a degree within the

higher education system (not just at the institution) within seven years.

Student Demographics: Race/Ethnicity and Traditional/Nontraditional

Ethnicity

Ethnicity is an affiliation to a specific group of people historically connected by a

culture, national origin, language, and community.

Race

Race is a self-identified social-political construct used to classify people based on

social and cultural characteristics, common ancestry, nationality, or history. Race and

ethnicity are considered to be separate entities and identified through two distinct questions by the U.S. Census and U.S. Department of Education. Respondents are first asked to categorize themselves by ethnicity in terms of *Hispanic or Latino* or *not Hispanic or Latino*, then by race.

Underrepresented Minority

Students who have self-disclosed that that are from at least one of the following ethnic and/or racial groups: Hispanic/Latino, American Indian or Alaska Native, Black or Black, or Native Hawaiian or Pacific Islander. Different from many other government and higher education institutions, this definition is not exclusive to U.S. citizens or permanent residents due to the high number of undocumented students at community colleges. The exclusion of the citizenship criteria is a current practice of many community colleges and will be maintained in this study.

Hispanic/Latino

A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race.

American Indian or Alaska Native.

A person having origins in any of the original peoples of North , South or Central America and who maintain tribal affiliation or community attachment.

Black or African American

A person having origins in any of the black racial groups of Africa.

Native Hawaiian or Pacific Islander

A person having origins in any of the original peoples of Hawaii/Guam/Samoa/or other Pacific Islands.

White

A person having origins in any of the original peoples of Europe/the Middle East/or North Africa who are of Hispanic/Latino ethnicity.

Asian

A person having origins in any of the original peoples of the Far East/Southeast Asia/or the Indian subcontinent (Includes Cambodia, China, India, Japan, Korea, *Malaysia, Pakistan, the Philippine Islands, Thailand and Vietnam).*

Traditional Students

Students enrolled at a residential four-year institution, pursuing their studies full-time, between the ages of 18 to 24.

Nontraditional Students

Nontraditional students may have any of the following characteristics: older, pursing their studies part-time, attending a commuter institution.

<div align="center">Enrollment Pathways and Transfer</div>

Stopout

A stopout is a temporary delay in education in contrast to a dropout as a permanent departure. It is important to define the timeframe involved in the definition of stopout as this will differentiate between a temporary or more permanent departure

within the specified time period. For the purpose of this study, a stopout is defined as a student's temporary departure from higher education within the 20 semester study period, with a return to enrollment during the same time frame. Students who left but did not return until after the end of the study period will be counted as a drop out.

Continuous Enrollment

Progressive re-enrollment in coursework without interruption, with the exception of time off in the summer semester.

Transfer

Students who depart the institution to attend another; cannot be concurrently enrolled, but no longer enrolled at the original institution. Students can transfer from a two-year institution to another two-year institution (horizontal transfer), from a two-year institution to a four-year institution (baccalaureate transfer) or from a four-year to a two-year institution (reverse transfer).

Horizontal Transfer

Horizontal transfer occurs when a student at a two-year institution stops enrollment and enrolls at another two-year institution. Also referred to as lateral transfer. Excluded are students who attend multiple colleges within the same community college system.

Baccalaureate Transfer

Transfer from a community college to a four-year institution. This transfer is the desired outcome for community college students.

Reverse Transfer

Reverse transfer occurs when a student attending a four-year baccalaureate degree granting institution stops their enrollment and enrolls at a two year institution. Reverse transfers were excluded from this study, approximately 20% of the cohort. Enrollment at a two-year institution during the summer is excluded.

Concurrent Enrollment

Concurrent enrollment occurs when a student is simultaneously enrolled in multiple higher education institutions at the same time. Concurrent enrollment is sometimes referred to as double-dipping.

Limitations and Assumptions

This study was delimited to community college students enrolled in an urban community college district comprised of seven colleges in the Midwest. Institutional datasets were utilized in order to incorporate the academic integration and performance variables of interest for this study. Results may not be generalizable to other community college populations.

Researchers have studied many factors that impact degree completion and attrition. It is difficult to account for the complex myriad of factors that could influence a student's decision to persist. This study focused on academic integration factors, while also trying to account for student background characteristics, academic preparation, and external commitments. Many other factors were not incorporated into the model that other research studies have incorporated. Due to data issues,

financial aid was not part of the research study. Other institutional characteristics may also influence student attrition and completion including institution size, control, location, faculty and staff composition, class size, institutional policies and requirements, sources of revenue, and expenditures per student.

An assumption made by the researcher for the study population of low-income, underrepresented students is that there is nothing inherent in their race/ethnicity or income status that leads to lower success rates. This study was not based on a deficit model in which there are lower expectations for degree completion for low-income, URM students, but instead on an asset model that was student centered where all students can succeed with the right structural interventions put in place. The assumption was that if a successful model of academic integration variables were identified, interventions could be put in place to increase success for all students and decrease inequalities for certain student groups.

Summary

This chapter discussed the importance of the study by presenting the economic and social significance of a college degree, recent trends in the overall level of educational attainment in the United States, the reasons why we should be concerned about the pace of college degree attainment over the past 40 years, the overwhelming disparities in educational outcomes, and why it is cause for serious concern. Also discussed was the significance of the study, the conceptual underpinnings of the study,

the purpose, research questions, and methodology. Definitions of key terms were

presented, along with delimitations, limitations, and study assumptions.

Chapter 2 will present a review of the literature by presenting an overview of

college persistence models, factors that impact attrition and persistence in higher

education, selected persistence research on community colleges, and persistence

studies that utilized EHA methodology. Chapter 3 will discuss the research questions,

research methodology, the study population, data analysis procedures, data sources

and variables used, data analysis, and key concepts in EHA. Chapter 4 will discuss the

study results. Chapter 5 will discuss the results, study limitations, implications, and

conclusions.

CHAPTER TWO

REVIEW OF THE LITERATURE

The purpose of this study was to examine the timing of academic factors that

contributed to degree completion and attrition of low-income, underrepresented

community college students using EHA. The objective of this chapter was to present an

overview of theoretical models of student persistence, to examine factors related to

student persistence and degree completion, and to discuss the relevant persistence

research utilizing EHA. Also discussed was how well each persistence theory applies to

the community college population and potential differences in persistence factors for

low-income and underrepresented minority students.

Overview of Theories of Student Persistence

Retention and graduation rates have become standard institutional effectiveness

measures of higher education institutions. Since the 1970's, researchers have

attempted to discover how to retain and graduate more students by proposing models

to examine the relationship of students with their postsecondary institution by

examining various student, institutional, and external variables and concepts such as

academic and social integration, and human and cultural capital. Past retention and

persistence research studies focused primarily on individual institutions and transfer to

other colleges and universities. The factors of influence varied depending on the target population and type of institution being studied.

Numerous studies have attempted to address the attrition and persistence patterns of residential, full-time students, between the ages of 18 to 24 years at predominantly White four-year baccalaureate institutions. Comparatively, fewer studies have specifically addressed the needs of community colleges. Additionally, several researchers have questioned the utility of these models for minority students (Biggs, Torres, & Washington, 1998; Kraemer, 1997; A. Nora & Crisp, 2008; Rendon, Jalomo, & Nora, 2000; Valasquez, 1997). While many of the models that utilized a traditional college student population provide some understanding that can be broadly transferred to community college and minority students, it may not adequately explain the attrition and persistence phenomenon among these students.

The discussion of theoretical models of attrition and persistence are organized chronologically as the models progressed. It includes some of the major models of student persistence most widely utilized in persistence research and discusses adaptations for community college students and minority students. After presenting an overview of the attrition and retention models, implications for community college students and minority students are discussed.

Astin's Input-Environment-Outcome Model

Astin (1970a, 1970b, 1991, 1993) developed one of the first college persistence models; the Input-Environment-Outcome (I-E-O) model. Pascarella and Terenzini

describe it as one of "the most durable and influential college impact models" (Pascarella & Terenzini, 2005, p. 53). Astin's model was based on John Holland's (1959) theory of vocational choice where certain career choices are most likely to lead to job success and satisfaction. Astin proposed that a college student tends to conform to the values of the college environment, which depend on the characteristics of the student body composition.

The I-E-O model (Figure 11) highlights the interdependence among three components: inputs, environments, and outputs, which may impact college outcomes. Astin (A. W. Astin, 1970a, 1970b) defined *inputs* as the student's pre-college characteristics (family background, academic and social experience prior to college, demographic variables) that may affect the student's performance at college. Student inputs include background characteristics (such as family socioeconomic status), personal characteristics (race/ethnicity, sex), academic talent prior to college (H.S. GPA), and other aspirations (college choice and major). The *environment* is defined as the college characteristics that may influence student outcomes. The college environment may include the people, programs, institutional characteristics, administrative policies, curriculum, support, culture, and experiences that students encounter in college. Astin (A. W. Astin, 1970a, 1970b) defined *outputs* as the examined student performance outcomes after a student exits college. Outcomes include graduation, career choice, and knowledge or skills gained (A. W. Astin, 1970a).

Inputs and outputs relate to the individual and are examined at two points in time. The influence of the environment becomes the method by which changes are identified and explained (A. W. Astin, 1993). Astin's I-E-O Model suggests the existence of the main effect (B) on the college environment with regard to student outputs, but that there is an interaction between the student inputs and the college environment (A), and the direct effect of the inputs on the outputs (A. W. Astin, 1970a).

Figure 11. Astin's I-E-O model. From Astin, A.W. (1970a). The methodology of research on college impact, part one. *Sociology of Education*, 43 (3), P. 225.

Astin's I-E-O model became the starting point for many future persistence models. The idea that student outcomes depend on student inputs and the interaction with the college environment became a foundation for many other models. Astin (1965) emphasized the importance of pre-college characteristics such as student and family background (SES, race/ethnicity, gender, parent's educational level), and high school GPA, when examining the effect of an institution on student academic success. Following Astin, all major theories and models also include pre-college characteristics.

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Astin's (1970a, 1970b; 1997) I-E-O model was the first to emphasize student inputs or pre-college characteristics as it relates to the college environment and outputs. Inputs could include demographic information such as age, gender, and race/ethnicity, socioeconomic status, parental education, and previous academic performance such as high school scores and college entrance exam test scores. Many researchers since have examined the relationship between a student's pre-college characteristics, other factors while in college, and the influence on attrition and persistence. Researchers such as Adelman (1999, 2006) have shown that the strongest predictor of college degree attainment is a rigorous high school curriculum. Pre-college characteristics appear to be important for all populations and should be included in models of attrition and persistence.

Astin's I-E-O model was developed with baccalaureate residential higher education institutions in mind. Limitations with Astin's I-E-O model are that it does not adequately take into account social integration variables and external influences on student persistence which are important for community college students and nontraditional students. Additionally, it does not account for part-time students and transfer to another institution. If students leave the original institution, they are considered to be a dropout. This is a limitation for application to the community college population.

Spady's Model of Student Dropouts

Spady (1970, 1971) applied the work of Emile Durkheim (1951) to his

development of a student attrition conceptual model. In 1897, Durkheim (1951)

explored the different rates of suicide among Protestants and Catholics, suggesting that

suicide rates were higher for those not sufficiently integrated socially. Durkheim (1951)

defined social integration as having an attachment to a social group, accepting their

values (moral consciousness), and interacting with members of that societal group

(collective affiliation). The likeliness of suicide increases when there is low moral

consciousness and insufficient collective affiliation. Using the same definition of social

integration as Durkheim, Spady (1970, 1971) proposed that attrition among college

students was also due to a lack of integration into the social environments of the

institution. Most literature at the time suggested that student attrition was simply due

to low academic performance.

According to Spady (1970), college is a society where students are members and

voluntary withdrawal from college is like suicide. Attrition occurs when a student does

not share values similar to other students, interact socially with other students, or feel

congruent with others in the college social system. A student can become integrated

into the college society through interactions with others and with participation in

activities that are compatible and reflective of the college culture. Similar to other

theorists at the time, Spady (1970) proposed that attrition could also be the result of

academic failure or a lack of academic integration. Spady proposed that family

background is also influential in a student's level of academic and social integration. The decision to persist or to withdraw was influenced by the rewards found within the social and academic systems of the college. A low level of social and academic integration led to a low level of commitment to the institution.

In 1970, Spady developed a model to illustrate the components of the process of entering college and coming to a decision to withdrawal. At the point of entry, a student has characteristics and abilities influenced by family background. The student also comes with a certain amount of academic potential. Spady also included the concept of normative congruence. Normative congruence is defined as "the diffuse patterns of interaction" (Spady, 1971, p. 38) that take place while in college. Spady's (1970) initial model included four variables: normative congruence, friendship support, intellectual development, and grade performance, which influence the fifth variable of social integration. The five variables then connect to two additional variables: satisfaction and institutional commitment, which then influence the dependent variable, dropout decision. In 1971, Spady wanted to test his theory and analyze how each component explained student attrition, so he applied his model to a longitudinal study of 683 first year students at the University of Chicago in 1965. Although academic performance was the dominant factor in attrition, he proposed that social integration was also a factor. Based on his findings, Spady (1971) retained much of his original model, but developed a revised model (Figure 12) to further illustrate how the social

components, combined with the academic components can lead to the drop out

decision.
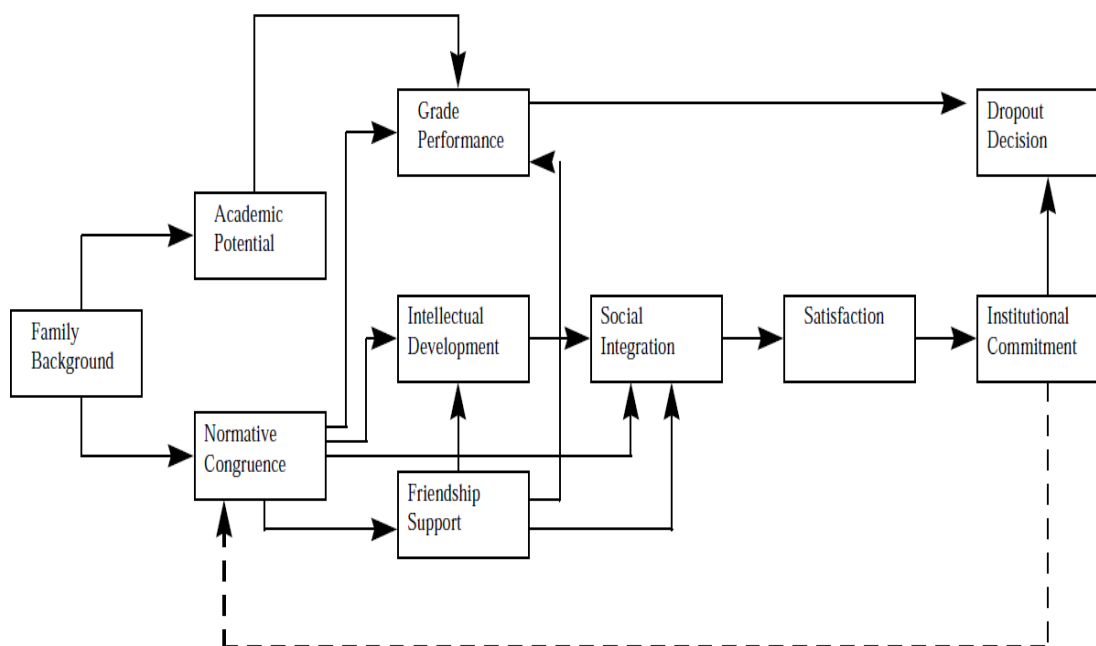
Figure12. Spady's model of student dropout. From Spady, W.G. (1971). Dropouts from higher education: Toward an empirical model. Interchange, 2, p. 39.

Tinto's Theory of Student Interaction

Tinto expanded on the work of Spady (1970, 1971) by applying exchange theory

to Durkheim's theory of suicide. Exchange theory is based on the understanding that

people seek rewarding interactions and that social behavior has economic

underpinnings (Homans, 1958). According to Tinto (1975), students apply exchange

theory, interpreted as goals and institutional commitment, in determining their level of

academic and social integration. If a student perceived that the benefits of college are

higher than the costs, the student will persist in college. If other activities outside of college are perceived as having greater rewards and less cost, the student may decide to withdraw from the institution.

Tinto's 1975 model (see Figure 13) built upon Astin's I-E-O Model in that it describes the process of interaction between a student with certain attributes and the various factors of a student's college life experience. According to Tinto, a student enters college with specific pre-college attributes such as family background, individual attributes, skills, and abilities, and pre-college schooling. These characteristics combine to influence the initial commitment level to the college and to goal of attaining a degree. The college has academic and social systems comprised of formal and informal experiences. The experiences of the student while in the academic and social environment, both positive and negative, serve to strengthen or weaken the student's commitment, resulting in the decision to either persist to graduation or to withdraw. The match between an individual's pre-college attributes and the characteristics of the institution share two underlying commitments: goal commitment (a commitment to complete college) and institutional commitment (a student's commitment to his or her respective institution). As the strength of the goal commitment and institutional commitment increases, there is a greater probability of persistence. Tinto proposed that as the student's academic and social integration at the college increases, so does the probability that the student will persist (1975,1987, 1993).
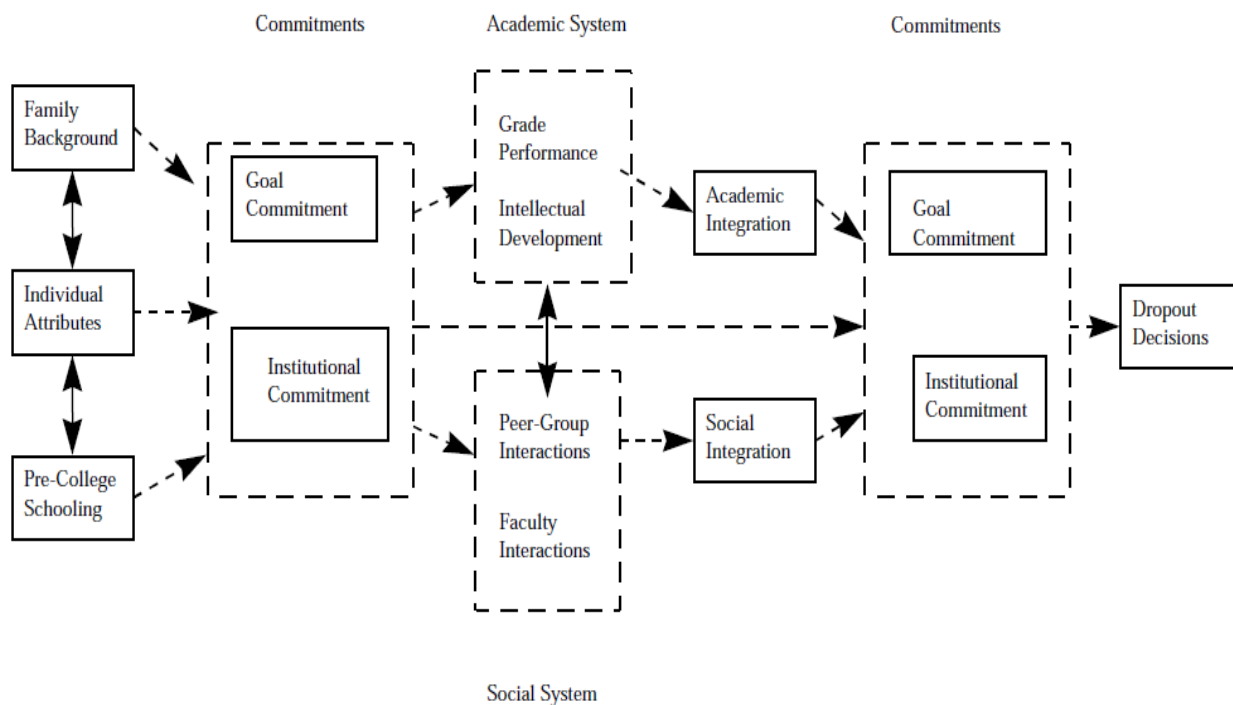
Figure 13. Tinto's 1975 conceptual model for college dropout. From Tinto V. (1975). Dropout from higher education: A theoretical synthesis of recent research. Review of Educational Research, 45 (1), p.95.

Tinto (1987, 1993) refined his model in subsequent publications to include external factors (see Figure 14) in recognition of the influence of factors external to the social and academic environment of the college. In 1987, Tinto added *external commitments* and *intentions* to the second set of goals and commitments in the model (V. Tinto, 1987). In 1993, he added *external commitments* to the first set of goals and commitments in the model (Tinto, 1993). He also added the overall social system (dotted lines in Figure 14) to the external community.
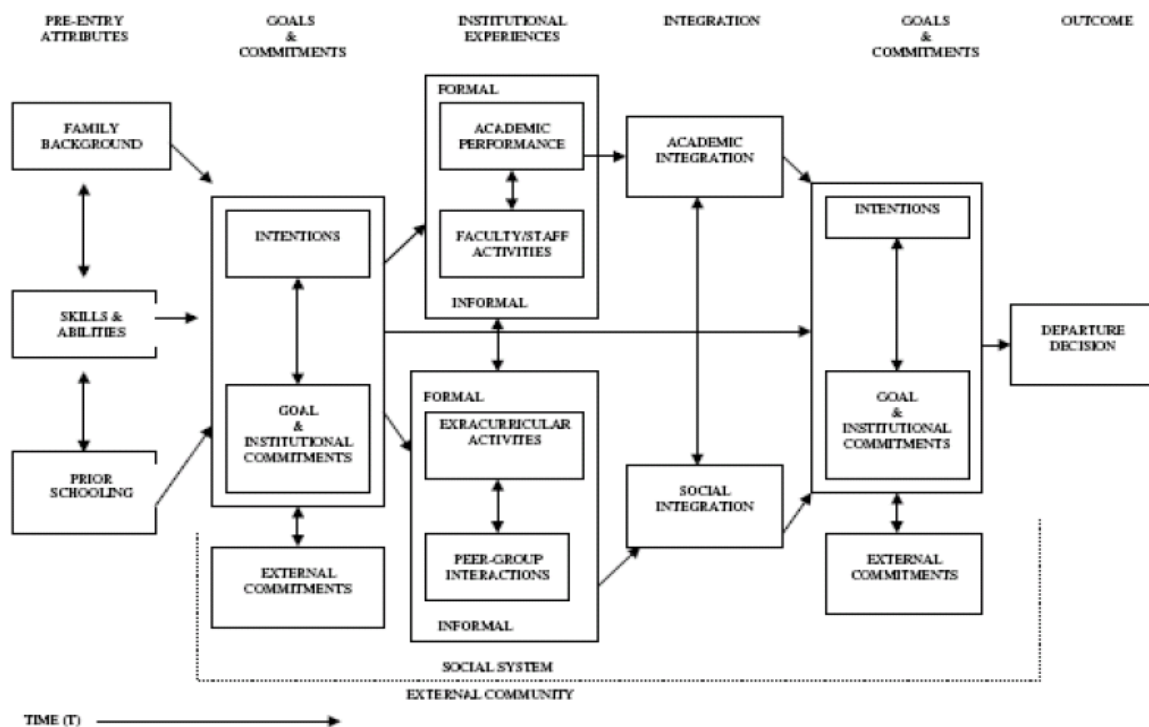
Figure 14. Tinto's 1993 longitudinal model of institutional departure. From Tinto, V. (1993). Leaving college: Rethinking the causes and cures of student attrition (2nd ed.), p. 114.

In Tinto's (1987, 1993) later models, he proposed that the college integration process had three stages: (a) separation from the past community, (b) transition into the new college community, and (c) incorporation into the college community. In the first stage of separation, students disassociate themselves to a certain extent from the communities they belonged to in the past (V. Tinto, 1988). The communities of the past could include family and friends, but can also include values and beliefs. The first stage of separation may be stressful and success may be influenced by the value that the old community places on college (V. Tinto, 1988). The second stage of transition begins when the student first enters college and is completed when the student is integrated

into the institution. The student's adaptation of the college's values and norms is the third stage of incorporation. According to Tinto, students go through the three stages throughout their time in college until they ultimately decide whether to persist or withdraw.

Tinto's model of Student Integration has served as the conceptual framework for a great number of college persistence studies in the last three decades. Tinto's research is valuable in explaining the complexity of the student persistence over time to degree completion. Tinto examined the interaction between the academic experience of students in the classroom and the other attributes of student life that help to determine engagement levels. Tinto's analysis addresses how policies and practices of a higher education institution influence the process of student departure. There are many individual characteristics that contribute to departure including intention, commitment, adjustment, difficulty, congruence, obligations, finance, and isolation (Tinto, 1993).

Braxton, Sullivan, and Johnson (1997) provide an extensive overview of the validity of Tinto's model. Bowen, Chingos and McPherson (2009) propose that Tinto's principles apply well to low-income and minority students at public four-year institutions because of the emphasis on interactions between classroom experiences and other aspects of student life that are important to student engagement, such as faculty and student interactions. Matsumoto (2010) found that Native Hawaiians were more likely to complete college if they were engaged with their peers and faculty and resided on campus.

However, numerous studies have cast doubt on whether Tinto's model is relevant to students of all racial and ethnic groups at different types of institutions. Results were mixed when the theory components of goal and institutional commitment, and academic and social integration are applied to different types of colleges, such as commuter institutions (Bers & Smith, 1989; A. F. Cabrera, Castañeda, Nora, & Hengstler, 1992; A. F. Cabrera & Nora, 1993; Munro, 1981; A. Nora, 1987; A. Nora & Rendon, 1990; Pascarella & Chapman, 1983; Pascarella, Duby, & Iverson, 1983; Pascarella, Smart, & Ethington, 1986; Voorhees, 1987).

Social and academic integration may be important factors in predicting persistence, but they do not appear to be equally important to all types of students. Tinto emphasized social integration over academic integration, but many research studies of students at commuter institutions and of older students indicate that social integration is not an important factor in deciding to persist or dropout (Bean & Metzner, 1985; Ethington, 1990; Pascarella, et al., 1983; Pascarella, et al., 1986; Pascarella, 1995; Voorhees, 1987; Zea, et al., 1997). Pascarella and Chapman (1983) compared student attrition at commuter institutions (four year and two year), and at a residential four-year college. Predictive validity was established for all three institution types, but academic integration had the strongest influence on attrition at commuter schools, whereas social integration had a stronger influence at the residential institution.

Other studies by Pascarella and associates found similar results when focusing specifically on two-year commuter institutions (Pascarella, et al., 1983; Pascarella, et al.,

1986). Academic integration had the greatest influence on persistence. Halpin (1990) examined persistence of first semester freshman at a community college and found that academic integration had a greater influence on persistence than social integration. Several studies that focused on community college students found social integration to be less of an influence on persistence than academic integration (Byrd & MacDonald, 2005; Miller, Pope, & Steinmann, 2005; Moore, 2006).

Another criticism of Tinto's (1987, 1993) model was the assumption of a four-year residential college for traditional age college students. Later, Tinto (1993) suggested that the external commitments role would be to be more prominent when applied to nontraditional students. Tinto's model also assumed entry and exit from a single higher education institution. Community college and low-income students tend to display various forms of mobility patterns among higher education institutions (Crisp & Nora, 2010; Goldrick-Rab, 2006; Goldrick-Rab & Roska, 2008; Gross & Hossler, 2009, 2010; Karabel & Astin, 1975; Townsend & Denver, 1999) which need to be accounted for in a persistence model of degree completion. In Tinto's model, a student who transferred to another institution was considered to be a dropout. Tinto's model would need to be modified to take into account the mobile, nontraditional community college population.

Other studies have not found Tinto's theory to be as applicable for community college students. Webb (1988) used Tinto's 1975 model as well as the 1993 model to a study of freshman attrition and persistence at community colleges. Webb concluded

that Tinto's model was not adequate for the community college population. Bean and

Metzner (1985) explain the limitations with the research conducted by Tinto as well as

many others, on commuter students since a separate analysis was not conducted for

part-time students, and for older students, confounding their results. Out of the 56

attrition studies using commuter populations, only four included a separate analysis for

part-time students, and only five for older students (Bean & Metzner, 1985). For

example, family responsibilities may play a key role in older part-time students, but may

play less of a role for traditional, younger students. Similar criticisms are given to

Spady's (1971) model of student dropout.

Bean and Metzner's Model of Nontraditional Student Attrition

The theoretical models of student attrition developed by Spady (1970, 1971),

Tinto (1975), and Pascarella (1980) relied heavily on the social integration of the student

to explain student attrition. Bean and Metzner's (1985) student attrition model includes

some features of their models; particularly the emphasis on academic achievement,

socialization, and the interpersonal outcomes of socialization and institutional selection.

However, social integration variables did not play as prominent a role as in Tinto's

(1975) original model. Bean and Metzner (1985) proposed that student interactions

with peers are more important socialization agents than informal contact with faculty.

Environmental factors, such as finance, opportunity to transfer, hours of employment,

and outside friends have a greater influence on a student's decision to withdraw,

particularly with nontraditional students.

According to Bean and Metzner (1985), older, part-time, commuter college students (nontraditional) do not have the same opportunity to become socially integrated into higher educational institutions as traditional younger, full-time, residential students. Bean and Metzner (1985) sought to develop a conceptual model specifically for nontraditional students, particularly at commuter institutions such as community colleges. The model was based on earlier research by Bean (1980), as well as several behavioral theories (Bentler & Speckart, 1979; Lewin, 1935; Locke, 1976; cited in Bean & Metzner, 1985) and incorporates the models of Spady (1970), Tinto (1975), Fishbein and Ajzen (1975) and Pascarella and Chapman (1983). Bean and Metzner's (1985) model recognizes the smaller influence social integration has for nontraditional students. Nontraditional students have less interaction with peers or faculty in the college environment, less interactions through extracurricular activities, use campus services less, and have a much greater interaction with the external environment (Bean & Metzner, 1985). After reviewing relevant studies available at the time, Bean and

Metzner developed their model of nontraditional student attrition (Figure 15).
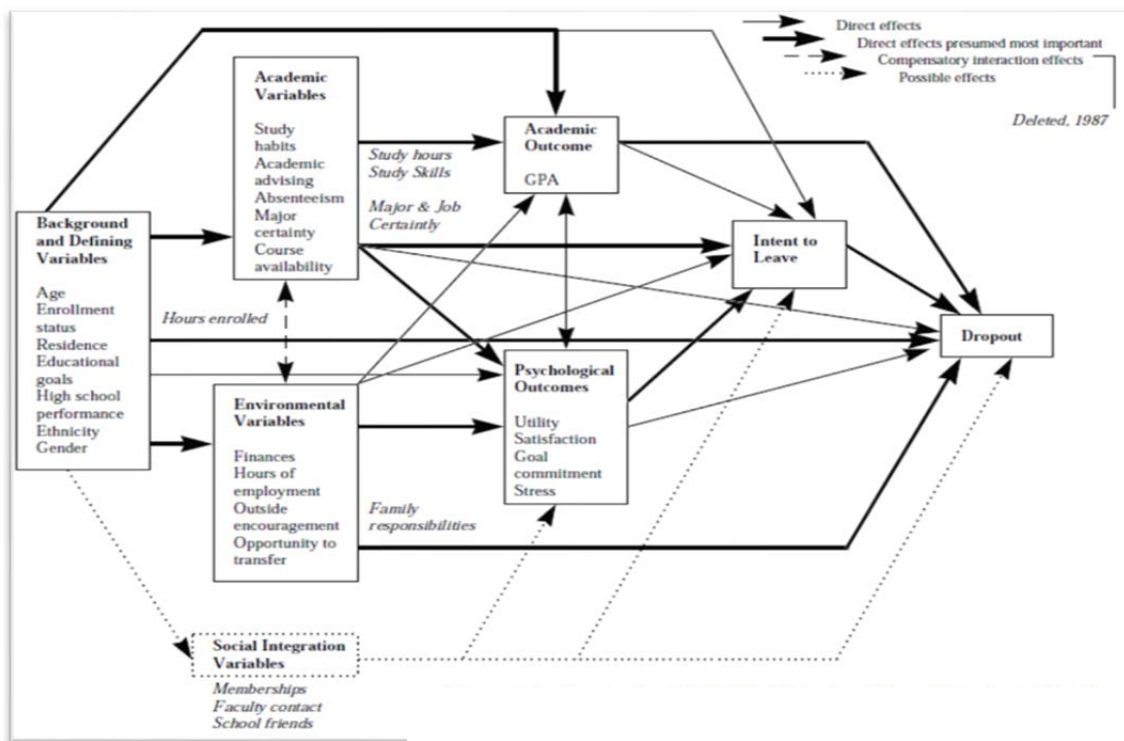
Figure 15. Bean and Metzner's model of nontraditional undergraduate student attrition. From Bean and Metzner (1985). A Conceptual Model of Nontraditional Undergraduate Student Attrition. Review of Higher Education. 55 (4). p. 491.

Bean and Metzner (1985) proposed that a student's decision to withdraw from college is based primarily on four sets of variables: (a) academic variables, largely based on high school GPA, (b) intent to leave, which is influenced by psychological outcomes and academic variables, (c) background and defining variables, and (d) environmental variables, proposed to have a substantial impact on a student's decision to leave. Two "compensatory effects" that interact with other variables are included in the model (Bean & Metzner, 1985, p. 491), but were taken out the 1987 subsequent revision of the model. Environmental and academic variables interact and result in different outcomes.

For example, when both environmental and academic variables are favorable, students will persist in college. When both environmental and academic variables are poor, students will most likely dropout. When environmental variables (support) are favorable, and academic support is poor, the student will most likely persist in college as environmental factors compensate for low academic variables. When environmental variables are poor, but academic variables are favorable, students are likely to dropout.

The second compensatory effect is between the variables of academic outcome (GPA), and psychological variables (Bean & Metzner, 1985). Students with high values for both variables will most likely persist in college; students with low values for both will most likely dropout. Despite a high GPA, a student may decide to dropout if they perceive low levels of utility, satisfaction, or goal commitment or have high levels of stress. A student with low GPA, but high levels of psychological outcomes may decide to persist because non-academic factors may compensate for the low academic achievement.

Bean and Metzner's (1985) model was designed specifically for nontraditional students. Similar to traditional attrition and retention models, they try to predict persistence in terms of student and institution fit and integration socially and academically. They propose that persistence is influenced by academic performance, intent, background variables such as age, ethnicity, and gender, and environmental variables not controlled by the institution. Bean and Metzner (1985) found that attrition among nontraditional students is more influenced by the external environment than

social interaction variables. In later research, they found that grade point average and institutional commitment had an impact on attrition for nontraditional students. As a result, they emphasize academic integration over social integration, and the model appears to be more suitable for commuter institutions like community colleges.

A drawback to Bean and Metzner's (1985) Conceptual Model of Nontraditional Student Attrition is that there are so many variables with complex relationships to each other. While the complexity of the model demonstrates the complexity of the various constructs and their interactions and relationships with each other, it also makes it difficult to test. Some aspects of the model may be useful in understanding persistence and attrition at community colleges, but it would be very difficult for the purpose of this study to replicate.

Another limitation to Bean and Metzner's (1985) model is their incorporation of a narrow definition of persistence and student departure instead of a system departure definition that does not allow for the complex patterns of enrollment that college students, particularly among community college students, display. Bean and Metzger (1985) defined dropout as a student who was enrolled for one semester, then did not enroll in the subsequent semester.

Weidman's Model of Undergraduate Socialization

Like most of the other theories and models presented so far, Weidman's model (1989) has sociological roots, but is distinct in that he focuses on non-cognitive changes such as career preferences, aspirations, and values. Also included in his model are

lifestyle preferences. Weidman's model is based on his own research, as well as

sociological literature on adult socialization. His model also incorporates aspects of

models by Astin (A. W. Astin, 1970a, 1970b), Tinto (V Tinto, 1975) and Pascarella's

(Pascarella & Terenzini, 2005). According to Weidman (1989), student background

characteristics, such as socioeconomic status, aptitudes, career preferences, aspirations,

and values, as well as non-college reference groups such as parents, peers, employers,

and community organizations, shape students' choice in the college setting (Figure 16).

The formal and informal experiences of the student in college, including interpersonal

interactions, intrapersonal processes, and the expectations of the faculty, contribute to

the normative pressure of the college setting.
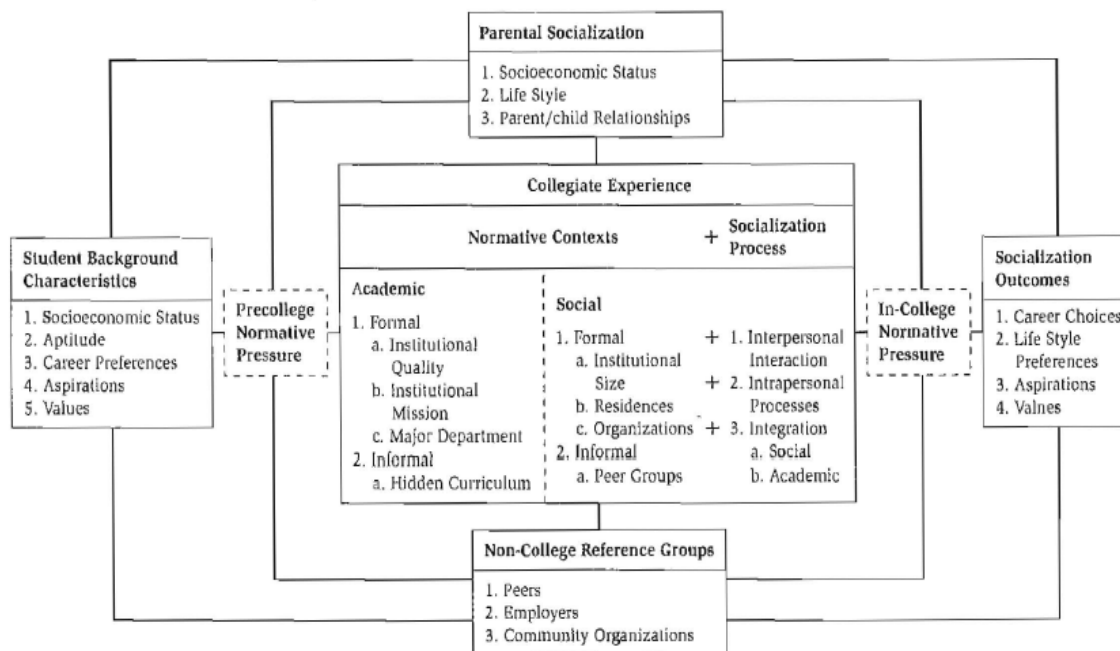
Figure 16. Weidman's model of undergraduate socialization. From Weidman (1989).
Undergraduate Socialization: A Conceptual Approach. In J. Smart (Ed). Higher Education:
Handbook of Theory and Research. p.299.

Weidman's model highlights the influence of others outside of the college

setting. Weidman's model is designed to explain the social processes of student

aspirations (such as interactions with a mentor, parent, and peer) and how their

aspirations changed or stayed the same, rather than how the student's aspirations are

supported by the institution. The model defines the reference groups students are most

likely to come into contact with (peers, parents, employers, community organizations),

and how each of the reference groups influence the student. Parents continue to have

an influence on a student's college experience through their socioeconomic status,

lifestyle choices, as well as the relationship a student has with his or her parents.

Similarly, other external reference groups, such as peers outside of college, employers,

and their community, influence a student's college experience and choice of persisting

or dropping out. Weidman proposes that the socialization process that occurs in

college, with parents and with the non-college reference groups, encourages students

to evaluate their influences and come to a decision about attaining their goals. Students

also decide whether to maintain or change the values, attitudes, career choices, and

lifestyle preferences that they came in with pre-college. Inherent in this model is the

temporal aspects of the influences upon a college student, and how the various

components and influences may change the socialization process. This is an important

consideration to the current study.

Weidman's (1989) model incorporates a much more complex set of variables

into the college socialization process. Although the focus of Weidman's (1989)

Conceptual Model of Undergraduate Socialization was designed for traditional age

college students, many aspects of the model are conducive to community college

students. However, Weidman's model highlights the influence of others outside of the

college setting. Weidman proposes that the socialization process that occurs in college,

with parents, and with the non-college reference groups encourages students to

evaluate their influences and come to a decision about attaining their goals. Non-

college reference groups include peers, employers, and community organizations.

Although Weidman's model includes components specific to a traditional age college

student in parental socialization (includes socioeconomic status, lifestyle, and

parent/child relationships), the model could be adapted to family relationships,

including family responsibilities, such as care of dependent children, and SES in general,

which can be an important consideration in the decision to persist or withdraw from

college.

Another interesting aspect of Weidman's model is his focus on non-cognitive

outcomes, including career choices, lifestyle preferences, aspirations, and values.

Weidman describes theories of learning and why these outcomes are important to

include in a persistence model (Weidman, 1989). The college environment is an

appropriate place for students to think about career choice and occupational training as

the securement of employment after graduation is an important outcomes of college.

His selection of career choice as a primary variable of interest in the background

characteristics and in the socialization outcomes is useful for the community college

population because of the emphasis on workforce development. Many students come

to community college to receive occupational training in a specific field to gain access to

a particular job (Miller, et al., 2005). For example, 60% of all U.S. educated registered

nurses receive their education at the associate degree in nursing level and are trained at

a community college (Viterito & Teich, 2002).

Cabrera, Nora, and Castanada's Integrated Model of Student Retention

Cabrera, Castanada, Nora and Hengstler (1992) and Cabrera, Nora, and

Castanada (1993) used Tinto's Student Integration Model (1975) and Bean's (1980)

Student Attrition Model to create their Integrated Model of Student Retention. They

saw a major gap in Tinto's (1975) theory with the lack of external factors in shaping

perceptions, commitments, and preferences (A. F. Cabrera, Nora, & Castaneda, 1993).

Bean's (1980; 1985) models took external factors into account. Cabrera, et al. (1993)

cited Bean and Vesper's (1990) work where they found that only six environmental,

personal, and organizational variables accounted for most of the variance in attrition

among freshman at a Midwestern college. Given the amount of social and institutional

programs developed to encourage persistence, they thought this was an important area

to address.

Cabrera et al. (1992; 1993) proposed that environmental factors influence the

academic and social integration of college students. Variables with the greatest

influence on persistence (in order of importance) include: intent, academic

performance, institutional commitment, encouragement from family and friends, goal

commitment, academic integration, and social integration (A. F. Cabrera & Nora, 1993;

A. F. Cabrera, et al., 1993). GPA was found to have a direct effect on persistence

decisions as well. Also included in the model is the role of significant others in the

decision process to persist. In the Integrated Model of Student Retention, persistence is

viewed as a longitudinal process that results from complex interaction over time (Figure

17).
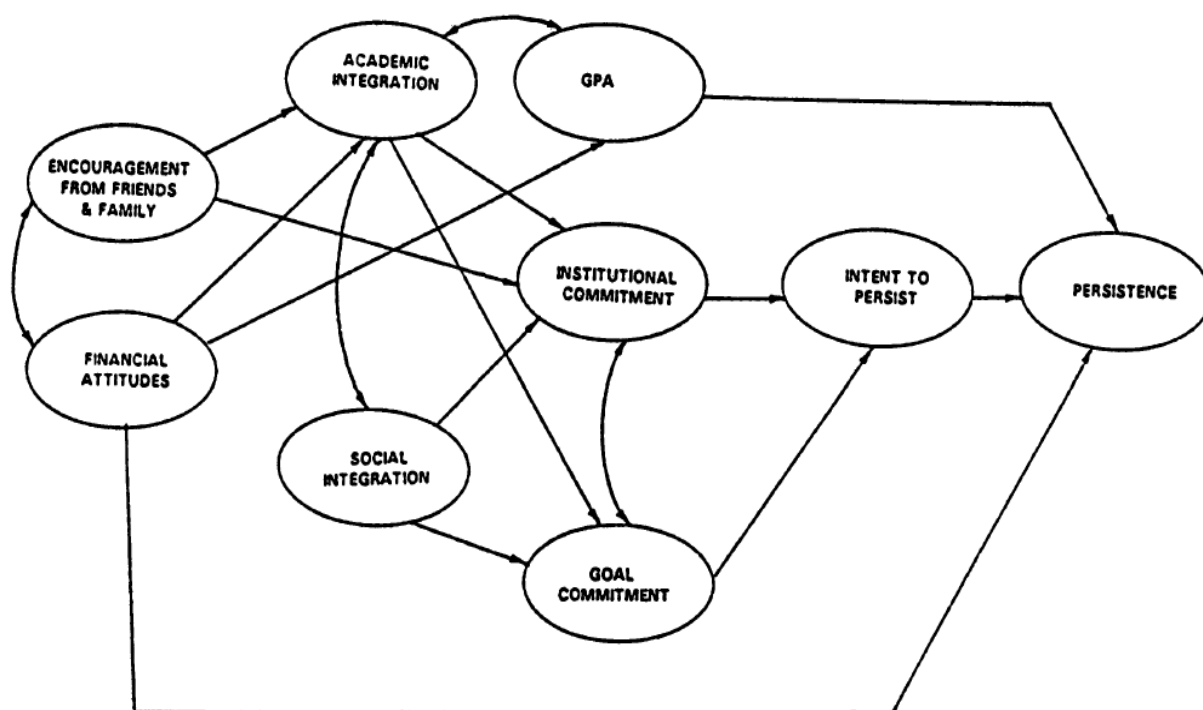
Figure 17. Cabrera, Nora, and Castaneda's (1993) integrated model. From Cabrera, Nora, and Castaneda's (1993). College Persistence: Structural Equations Modeling Test of an Integrated Model of Student Retention. The Journal of Higher Education, 64(2), 123-139.

Cabrera, Castanada, Nora and Hengstler (1992) and Cabrera, Nora, and

Castanada (1993) used Tinto's Student Integration Model (1975) and Bean's (1980)

Student Attrition Model to create their Integrated Model of Student Retention. They

developed an integrated model with Tinto's (1975) Student Integration Model and

Bean's (1980) Model of Student Departure. Cabrera et al. (1992; 1993) saw the lack of

external factors as a major flaw in Tinto's model. The integration of external factors into

the model was important in the analysis and can be easily adaptable to minority and

community college students.

Braxton, Hirschy, and McClendon's Model of Student Departure

Recognizing the importance of academic integration over social integration at

commuter colleges, Braxton, Hirschy, and McClendon (2004) modified Tinto's theory to

create two separate models for residential colleges and for commuter colleges like

community colleges. Braxton, Hirschy, and McClendon (2004) incorporated the social

factors into the internal campus environment because they proposed that social factors

were influential in an academic context (in learning communities and classroom

activities) to encourage more meaningful interaction often missing at commuter

institutions. They also removed the social integration construct from Tinto's model

(1987, 1993).

Braxton and Hirschy (2005) also emphasized external factors and the college

environment (see Figure 18). Since commuter students have more obligations and

spend more time outside of the college campus, environmental factors were considered

to have a larger influence. Braxton and Hirschy (2005) expanded Tinto's environmental

factors to include finances, support, work, family and community (Bean & Metzner,

1985; J. Braxton & Hirschy, 2005). They proposed that external factors (finances,

support, work, family, community) had a direct impact on persistence. In addition to

emphasizing learning communities within the internal campus environment, they also

included institutional environment variables such as cost, institutional integrity, and

institutional commitment to student welfare. Braxton and Hirschy (2005) also proposed

that student entry characteristics (motivation, control, self-efficacy, empathy, affiliation

needs, parental education, and anticipatory socialization) had a direct impact on

persistence, instead of an indirect effect as proposed by Tinto (1993).
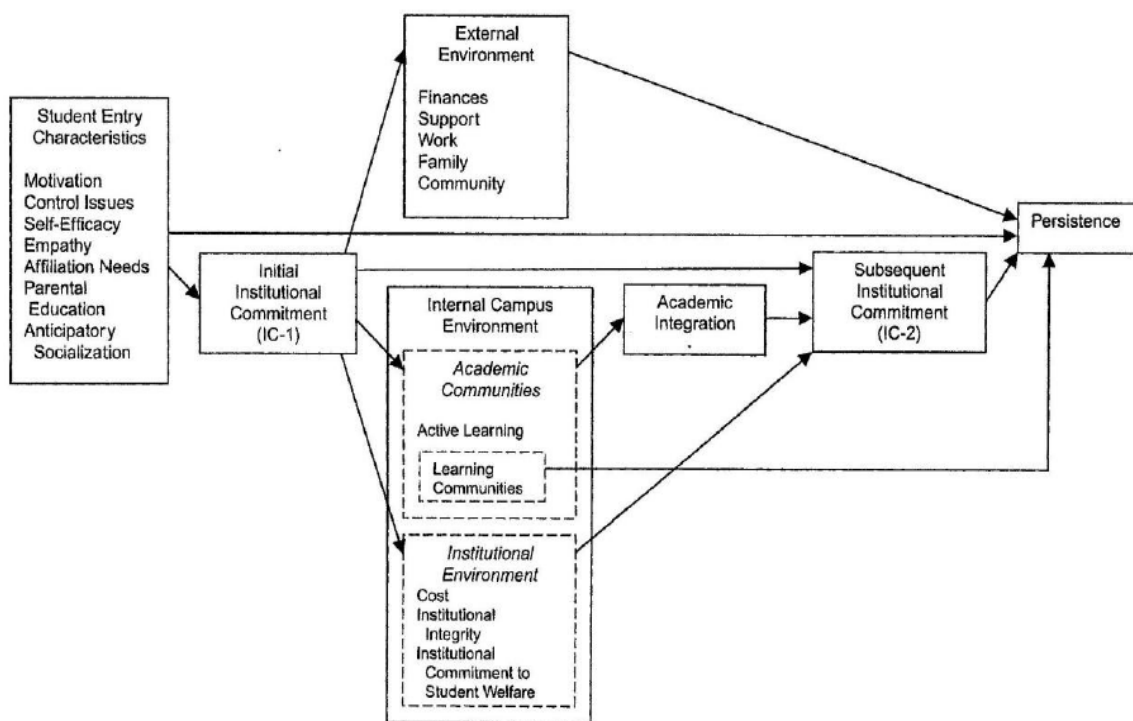
Figure 18. Braxton, Hirschy, and McClendon's (2004) model of student departure at commuter colleges. From Braxton & Hirschy (2005). In A. Seidman (Ed.), College student retention. Formula for student success. Westport, CT: Praeger Publishers, p. 75.

Braxton, Hirschy, and McClendon's (2004) theory of student departure in

commuter colleges and universities was the first model developed specifically for

commuter colleges. It went beyond Tinto's (1993) and Bean and Metzner's (1985) model in that persistence was thought to increase through the incorporation of social factors in the internal campus environment and academic community.

Both Bean and Metzner's (1985) model and Braxton, Hirschy, and McClendon's (2004) model were developed for populations outside of the traditional, younger, residential colleges typically used in persistence and retention studies. The models were essentially adaptations of Tinto's model of individual persistence. As suggested by Astin (1970a), both models begin with pre-entry characteristics which directly or indirectly have an impact on persistence. Instead of emphasizing social factors, Bean and Metzner (1985), and Braxton et al. (2004) emphasized environmental and academic factors.

The Braxton, Hirschy, and McClendon (2004) model is specific to a single institution and does not allow for mobility among several institutions. Like many of the models, it does not make a distinction among students who dropout, stopout, or transfer to another institution. This is a major limitation in dealing with community college students. The present study seeks to study persistence or graduation from any institution.

Perna's Integrated Conceptual Model of Student Success

Perna (2006) proposed a conceptual framework of student success that synthesized a variety of theoretical and methodological approaches for college choice and success. Perna (2006) expands the framework beyond social and academic

integration and integrates economic theory of human capital with cultural capital. It is a

longitudinal model that is applicable to non-traditional students of diverse background

that attend community colleges. The four layers of context in Perna's (2006) model

include the individual's habitus, the family context, higher education context, and the

social, economic and policy context (Figure 19).
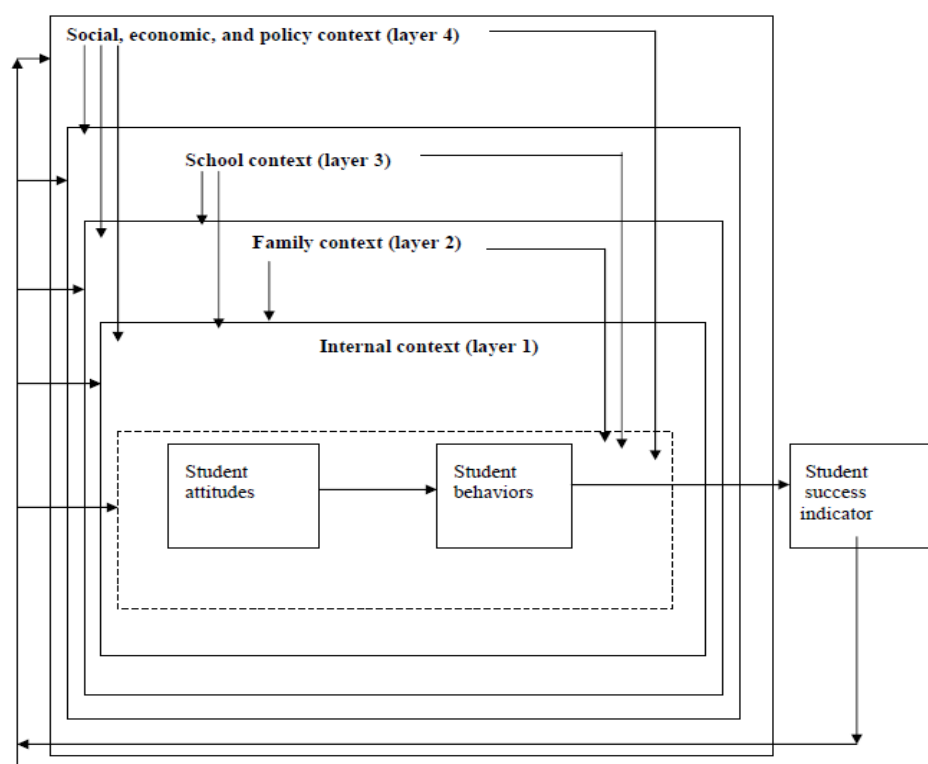
Figure 19. Perna (2006). Studying access and college choice: A proposed conceptual
model. In J.C. Smart (Ed.), Higher education: Handbook of theory and research, Vol XXI.
New York: Springer.

In calculating expected costs and benefits in attending college, an individual's

level of academic preparation is taken into consideration in terms of resources to pay

for the cost of attendance (Perna, 2006). Critical to the model is the integration of both

academic and social contexts, along with economic and sociological perspectives.

Multiple forms of capital – economic, human, social, and cultural - are utilized in the

higher education enrollment and decision making process (Perna, 2007).

Perna's (2006) conceptual model of is based on a comprehensive literature

review across several disciplines (Education, Psychology, Sociology, and Economics) and

includes six main assumptions. The first three assumptions deal with the concept of

student success: it is a longitudinal process, multiple theoretical approaches contribute

to understanding it, and it is shaped by multiple levels of context. The last three

assumptions deal with how student indicators are studied: the contribution of different

disciplinary and area perspectives to student success varies, multiple methodological

approaches contribute to our understanding of student success, and student success

processes vary across groups.

Perna and Thomas' (2006) proposed a larger framework to situate key

transitions and articulate the indicators of student success in Perna's (2006) model. It

incorporates ten indicators of student success across four different key transition areas:

college readiness, college enrollment, college achievement, and post-college attainment

(Figure 20). The ten indicators are educational aspirations, academic preparation,

college access, college choice, academic performance, transfer, persistence, post-

baccalaureate enrollment, income, and educational attainment. The conceptual model

incorporates many of the indicators used in the National Center for Education Statistics

annual Condition of Education book, as well as the National Center for Public Policy and

Higher Education state report cards. Perna and Thomas (2006) designed the framework

to guide policymakers, practitioners, and researchers on the maximization of the ten

indicators throughout each transition area.

College Readiness	College Enrollment	College Achievement	Post-college attainment
Educational aspirations	College access	Academic performance	Post-BA enrollment
Academic preparation	College choice	Transfer	Income
		Persistence	Educational attainment
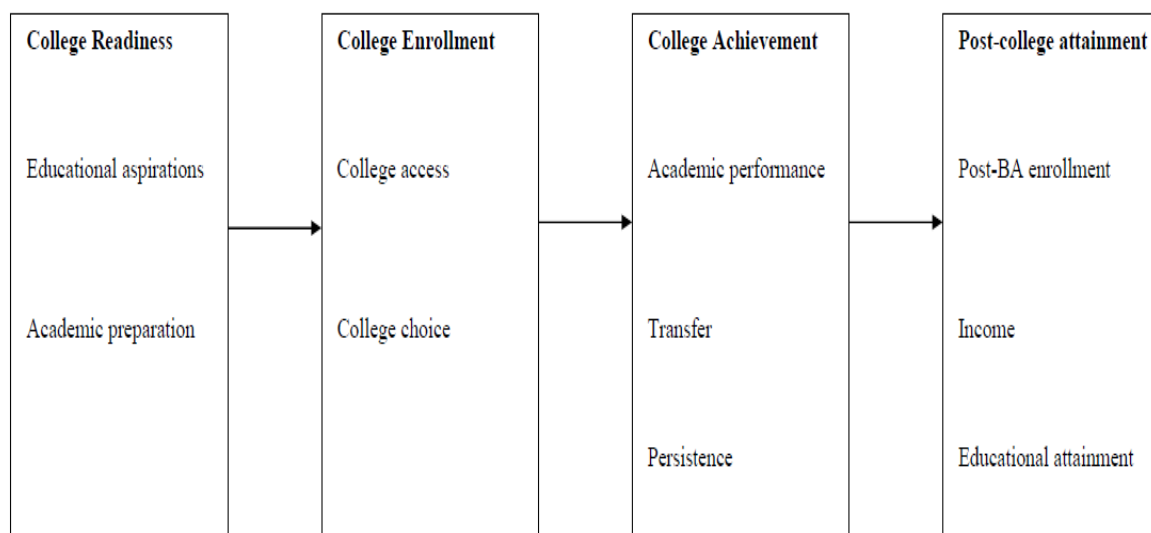
Figure 20. Perna and Thomas (2006) key transitions and indicators of student success.
From A framework for reducing the college success gap and promoting success for all.
National Postsecondary Education Cooperative. July 2006. p. 5.

Perna's (2006) model is particularly useful for understanding racial and ethnic

group differences in higher education and incorporating SES differences. An approach

that takes economic, as well as sociological and cultural constructs is well suited for

studying such group effects. Perna (2006) specifically applied her conceptual model to

examine the racial and ethnic group differences in college enrollment (Perna, 2007). By

incorporating quantitative methods that address the economic perspective, such as how

financial aid and SES impacts college enrollment, and qualitative sociological attainment

methods that study how interactions with a students and parents, peers, faculty, and

community impact college choice and enrollment, the importance of organizational

context and cultural and social capital for minority students is highlighted.

Perna's research supports the use of her integrated conceptual model. Using

data from the National Educational Longitudinal Study, Perna (2000) found that an

expanded model that adds measures of cultural and social capital to an economic model

significantly improves the model fit for Whites, Blacks, and Hispanics. After controlling

for other variables in the model, Black students were 11 percentage points more likely

to attend a four year institution, and rates for White and Hispanics were similar (Perna,

2000). She also found that the predictors of enrolling at a four-year institution

immediately after high school were different for Blacks and Hispanics compared to

Whites.

Adaptation of Models for Minority and Community College Students

Since community colleges account for nearly half of all undergraduate enrollments in

the United States, it is important to understand what makes this population different

from four-year residential students and to develop a persistence model that is

appropriate. Community colleges serve a diverse group of students. Community college

students tend to be older and do not enroll immediately after high school. They have

substantial time commitments to their families and jobs in addition to their students.

Community colleges enroll a larger proportion of minority and low-income students.

Many community college students are under-prepared for college and must take

remedial coursework in English, reading, and math before they begin college level

courses. Additionally, many community college students have focused occupational and

workforce development career goals (Bailey, 2006; Dougherty & Townsend, 2006; Gill &

Leigh, 2009; Levin, 2001; McPhail, Johnson, McPhail, & Pressley, 2006; Pusser & Levin,

2009).

Most of the major persistence models were developed for four-year residential

higher education institutions comprised of mostly 18 to 24 year old students. Bailey and

Alfonso (2005) of the Community College Research Center explain,

> The dominant theoretical perspective on retention and completion, the student
> integration or engagement model, was developed based primarily on four-year
> college models with particular emphasis on full-time, traditional-aged, residential
> students. Empirical tests of these models have not yielded strong support for their
> application to community colleges. Researchers have begun to take into account
> commuter students, but the particular characteristics of community colleges and
> their students are still neglected. (Bailey & Alfonso, 2005, p. 2)

More research needs to be done to address the gap in persistence models that

specifically focus on the unique needs of the community college population.

Most research on persistence fails to account for student mobility. Previous

research on attrition and persistence is limited because of an inability to track students

across multiple institutions. It is important to assess the importance of different

ascriptive characteristics that predict college behavior and to examine the full range of

students' movement in the system of higher education, not just the institution

(Goldrick-Rab, 2006; Goldrick-Rab & Roska, 2008). Popular retention models may

fail to address the emerging pattern in higher education of students attending more

than one institution. The prevailing focus on colleges and universities, instead of

students has led to too much emphasis on the institution and not the student. If the goal is to increase college attainment rates, it is important to study outcomes of the student, not just the institution. Approaches to degree completion must be student-centered.

Theoretical models of college student persistence and attrition have been developed to identify and analyze the numerous variables that may impact a student's decision to stay in college or dropout. Many of the studies described have been used in persistence research for higher education institutions, as well as for community college students. A student's decision to persist or withdraw appears to be the result of a student's interaction with the institution; social factors internally and externally, academic integration, and mediated by economic, as well as sociological and cultural constructs. Overall, these models provide a conceptual framework for understanding the relationships among the variables examined. A wide variety of variables have been studied as they relate to college student persistence and attrition.

Integrated Conceptual Framework of Community College Persistence

Figure 21 below describes the variables of study as it relates to the integrated conceptual model of attrition and persistence for community college students for the study. The conceptual framework for the study uses Astin's Input-Environment-Outcome (I-E-O) model, with adjustments and additions of components from Bean and Metzner's (1985) Model of Nontraditional Undergraduate Student Attrition, Weidman's (1989) Model of Undergraduate Socialization, Braxton and Hirschy, and McClendon's

(2004) Model of Student Departure at Commuter Colleges proposed for nontraditional student populations, and Perna's (2006) model of Access and College Choice.
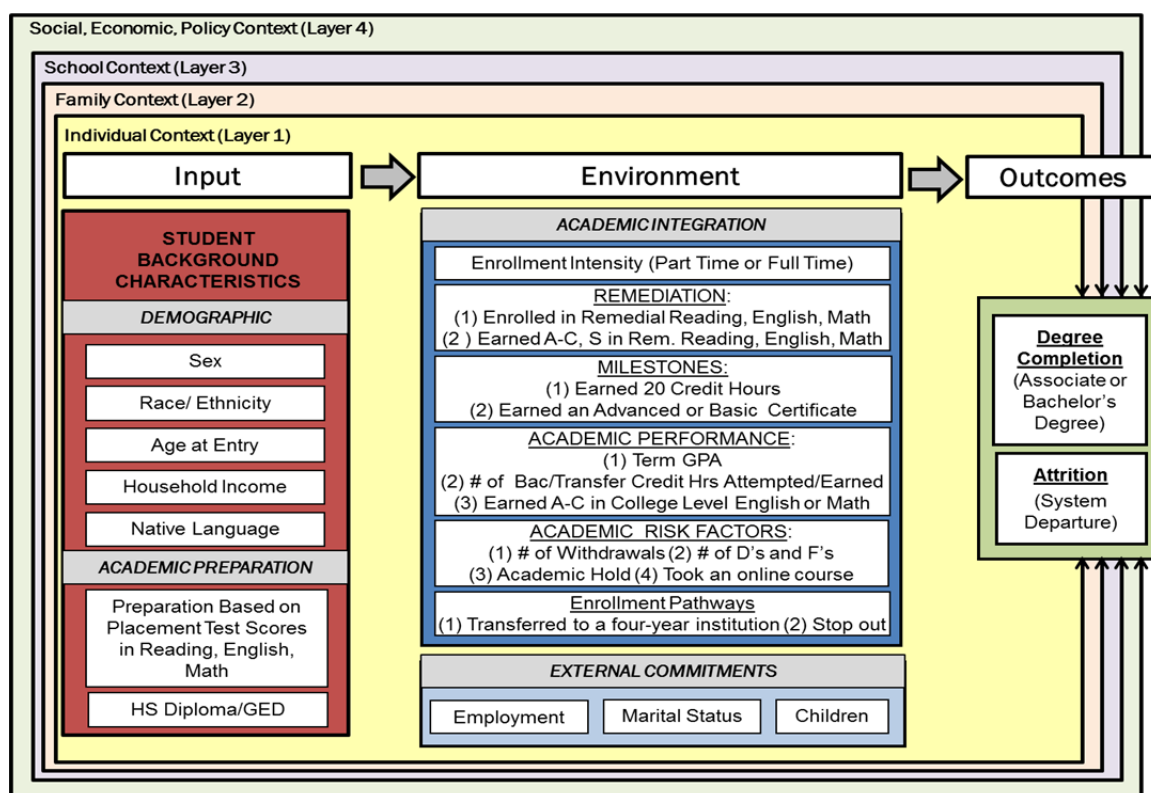
Figure21. Integrated conceptual framework of community college persistence

The I-E-O model is a person-environment model that addresses the interdependence between the individual and the environment (A. W. Astin, 1970b). Inputs in the I-E-O model are the demographic characteristics, and the social and academic experiences students bring to college. Environmental measures include the full range of social and academic experiences a student encounters at college. The outcomes component of the model refers to the skills, knowledge, or behavior

experienced when a student exits college. Bean and Metzner's (1985) model incorporates academic performance variables such as GPA and environmental variables such as hours of employment. Similar to Bean and Metzner's (1985) model, Braxton et al. (2004) emphasizes academic integration. Weidman's (1989) model highlights the influence of others outside of the college setting, such as other peers, employers, members of the community, and family. Students have to evaluate their influences and come to a decision about attaining their educational goals. External characteristics, such as work, marital status, and number of children are part of the model. This is also part of Perna's (2006) integrated conceptual model of student success where multiple contexts (individual, family, school, and social, economic, and policy) influence student attitudes and behaviors that ultimately influence student success.

In the conceptual framework, pre-college characteristics such as academic preparation are taken into consideration in the input model. Academic integration variables are heavily emphasized and include course taking behavior patterns by semester such as developmental coursework and credit hours attempted and earned, course completion ratio, enrollment status, baccalaureate/transfer courses attempted and earned, GPA, number of withdrawals, number of D's and F's, and academic holds placed on the student due to poor performance.

In the proposed Integrated Model, the inputs and environment variables take place within the framework of individual, family, school, and social/economic contexts; taken from Perna's (2006) model. The student's individual background characteristics

and college preparation influence their educational and career goals and choices (layer 1). This also takes place within the context of a student's family background and influences (layer 2), school environment and institutional characteristics (layer 3), and the social, economic, and policy context (layer 4). All of these layers work together to influence the educational outcomes of the students.

Factors Impacting Attrition and Persistence

Student Demographics

Some researchers view factors related to the persistence of URM students as similar, if not the same, to those of all students. Much of the research that attempts to refine traditional paradigms of students retention to fit minority students are "scattered and unconnected" (Rendon, et al., 2000, p. 130). Consequently, a coherent vision of college persistence for minority students has failed to evolve. However, numerous studies indicate that college completion rates are lowest for underrepresented minority groups.

What accounts for these differences? Many researchers have examined whether differences in student outcomes are directly related to or contingent upon factors other than race/ethnicity such as socioeconomic status, academic preparation, academic performance, external commitments, enrollment characteristics, enrollment pathways, financial aid, and institutional characteristics. Many factors can have a significant impact on persistence and degree completion that is not a direct result of race or ethnicity. The historical disparity in educational performance URM and Whites and Asians may be the result of many factors, such as socioeconomic status, inadequate

school resources, high school curriculum, as opposed to a lack of intellectual ability

(Jenks & Phillips, 1999).

Several studies support the positive association between SES and degree

completion (Adelman, 1999, 2006; Aud, Hussar, et al., 2010; Blair, Legazpi-Blair, &

Madamba, 1999; A. Cabrera, Burkum, & La Nasa, 2005; Titus, 2006a) and race/ethnicity.

Conversely, many studies have found that differences in socioeconomic status and

race/ethnicity can be attributed to a myriad of other factors including high school

preparation, external factors (such as work, number of children), enrollment pathways

(part-time attendance, delayed entry to college, community college attendance),

academic performance in college, increased need for remediation, and financial factors.

Sawyer (2008) reported that differences in college success among racial/ethnic groups

and socioeconomic status narrowed when students had acquired the necessary

academic skills for college.

There can be differences among all of the factors discussed in this section by

race and socioeconomic status. Therefore, this section will address different factors

studied in the persistence and degree completion overall, with special emphasis on race

and socioeconomic status where applicable. However, any differences by race or

socioeconomic status may need to be interpreted with caution. Pascarella and Terenzini

(2005) discuss the issues with such differences:

> A substantial amount of research has suggested the possibility that different
> between and within college experiences may have a differential influence on
> educational attainment for different kinds of students. This body of research,
> however, has at least two problems that make it difficult to synthesize and even

harder to draw firm conclusions from. First, most of the research erroneously infers conditional effects from differences found between various subgroups in the factors significantly associated with educational attainment. For example, a study that found that grades have a statistically significant influence on persistence for Blacks but not for Whites might conclude that grades are more important in the educational attainment process for Blacks than for Whites. Unfortunately, differences in sample size and simple change sampling errors across independent samples can produce an artificial situation in which a variable has a statistically significant association with outcomes in one subsample but not in another. More often than not, such differences are due to chance. . . A second problem, likely caused in part by the first, is the paucity of replicable conditional effects across different studies. The interpretation of chance differences as though they are real will often increase the probability of this phenomenon in the body of evidence (Pascarella & Terenzini, 2005, p. 430)

Sex

Results are mixed when examining the role of gender in college persistence.

Many studies indicate that women, particularly Asian women, attain a bachelor's degree

at a higher rate than their peers (Adelman, 2004; Stephen L. DesJardins, Ahlburg, &

McCall, 2002; L Horn, 2006). In a study specifically examining urban community college

students, Jones (1997) found that women had higher levels of academic achievement

and enrollment persistence. Other studies found that men outperformed women or

that there was no gender difference in achievement outcomes (Adelman, 2004; A. Astin,

1972; T. Bailey, Calcagno, Jenkins, Leinbach, & Kienzl, 2005; Stephen L. DesJardins,

Ahlburg, et al., 2002; L. Hagedorn, Maxwell, Chen, Cypers, & Moon, 2002; Linfante,

2002). Using IPEDS data, Bailey, Calcagno, Jenkins, Leinbach, and Kienzl (2005) found

that colleges with more female students tended to have lower graduation rates. Using

the Cooperative Institutional Research Program (CIRP) surveys, Astin (1972) found that

after holding academic abilities constant, men were more likely to persist.

Several studies indicate that minority women are more likely to complete their degree than minority men. Arbona and Nora (2007) found that minority women were 33% more likely to obtain a degree than men. Threatt-Milton (2005) explored the factors that contribute most to minority student persistence at three four-year institutions and found that gender and residency had the greatest impact on graduation rates of minority students. Minority women were more likely to graduate than minority men (Threat-Milton, 2005). Other studies found that gender differences in degree attainment are a result of higher high school graduation rates for women because of higher high school grades, standardized test scores, and greater participation in rigorous coursework (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007).

Age

Age can influence persistence in college. According to several research studies, older students have better educational outcomes or higher academic achievement than younger students (Juan Carlos Calcagno, Crosta, Bailey, & Jenkins, 2007; Darkenwald & Novak, 1997; Jones, 1997; Laanan, 1999; Linfante, 2002). Calcagno, Crosta, Bailey, and Jenkins (2007) used event history analysis to examine transcript data of first-time community college students in Florida in order to compare the educational outcomes of older students compared to traditional age students. After controlling for cognitive math ability, they found that older students were more likely to graduate from the community college, though less likely to transfer to the Florida State University system. Hagedorn et al. (2002) found that older Latino students at the Los Angeles Community

College District achieved higher GPA's and completed their courses at a higher rate than their younger counterparts.

Feldman (1993) examined factors that impact one year persistence among community college students and he found a curvilinear relationship between age and attrition. Students age 25 years or older were the least likely group to drop out, students between the ages of 20 to 24 were at the greatest risk, and students ages 19 and under were at less risk (Feldman, 1993). Feldman (1993) proposed that this may be attributed to the ability of older students to balance work and family responsibilities better than younger students with similar responsibilities. Additionally, older students may possess greater maturity and motivation. Older students may be more vocationally oriented and have a clearer sense of the economic payoff of completing their degree.

Calcagno, et al. (2007) used human capital theory (Becker, 1964) to explain an adult's decision process to complete a degree. Individuals will examine their remaining years of work, and weigh the costs and benefits of enrolling and completing a postsecondary degree. Adults may return to work for economic and labor markets reasons and an increased demand for more skills. Students over the age of 25 may be more actively engaged in learning and more focused on education as preparation for a career or as a means of supporting their dependents.

However, some researchers found that older students are less likely to complete a postsecondary degree or certificate (Lutz K. Berkner, Cuccaro-Alamin, & McCormick, 1996; Choy, 2002; Choy & Premo, 1995; Moore, 2006). Using NCES 1990 Beginning

Postsecondary Student Longitudinal Study – Second Follow-Up (BPS:90/94) data,

Berkner, Cuccaro-Alamin, and McCormick (1996) found that 68% of students who

entered college at the age of 18 earned an associate's degree after five years compared

to 6% of students who entered at age 30 or above. Using more recent BPS data,

Calcagno, Crosta, Bailey, and Jenkins (2006) found that 40% of older first time

community college students earned a degree or certificate within seven years,

compared to 60% of younger, first-time students.

Similarly, Horn and Carroll (1996) found that older students are less likely to

complete college within five years than younger students. Jacobs and Berkowitz King

(2002) also found that women over the age of 25 were at a disadvantage in completing

their degree. They found that over 30% of students completed their degree by age 23

compared to just over 10% for students over the age of 30. However, Jacobs and

Berkowitz King (2002) found that differences in college completion rates was likely due

to their part-time enrollment status, as older students were more likely to be enrolled

part-time and faced more competing demands for their time.

Older students possess several additional risk factors that may have an impact

on persistence. Compared to students who begin at age 18, students over the age of 30

are much more likely to be financially independent (98% vs. 14%), have children (78%

vs. 1%), be a single parent 20% vs. 1%), enroll part-time (62% vs. 11%), and work full-

time (45% vs. 20%) (Lutz K. Berkner, et al., 1996). A much greater proportion of the

students' age 30 years or older went to a community college instead of a four-year institution (71% vs. 12%).

Parents' Education and First Generation Students

Students who are the first in their families to attend college have lower persistence and completion rates than their peers (T. Bailey, et al., 2004; Bragg, Eunyoung, & Barnett, 2006; Byrd & MacDonald, 2005; X. Chen, 2005; Green, 2006; Ishitani, 2006; Lohfink & Paulsen, 2005; Pascarella, Pierson, Wolniak, & Terenzini, 2004; Stieha, 2010). Using NELS 92/00 data, Chen (2005) found that over an eight year period, 43% of first generation college students left without a degree and only 24% completed. Of the students whose parents were college graduates, 68% completed a degree and only 20% left without a degree.

It is difficult to study the persistence of first generation college students without understanding characteristics of the population that also tend to have an impact on college completion rates (Nuñez & Cuccaro-Alamin, 1998). First generation college students tend to have more risk factors that impact college completion rates. They are more likely to attend a community college, delay entry into college and attend part-time while working full-time (X. Chen, 2005). First generation community college students are more likely to be older, female, come from lower income families, have more dependents and are more likely to be Hispanic or Black (L. Horn & Nunez, 2000; Inman & Mayes, 1999; Ishitani, 2003). They also tend to be less prepared academically for college since due to lower rates of taking upper-level math courses in high school, lower

achievement test scores as a senior, and lower college entrance exam scores (X. Chen, 2005). Since first-generation college students tend to be less prepared for college than their peers, this is another possible barrier for college degree completion.

Additionally, research indicates that first generation college students display lower levels of academic performance while in college. Pascarella, Pierson, Wolnick, and Terenzini (2004) found that first generation college students tend to complete fewer credit hours and work more hours per week than their peers. They also tend to have lower grades and need more remedial coursework (X. Chen, 2005; Pascarella, et al., 2004). These attributes are also associated with lower graduation rates.

Native Language

The ability to understand, speak, and write the English language is an important aspect of academic life and successful performance when studying at any level of American education. For recent immigrants with a native language other than English, academic performance and persistence can be negatively impacted. Gerardi (1996) examined first year students at the New York City Technical College and found that recent immigrants had a lower GPA than native students, and that they had a lower persistence rate after ten semesters. Santa Rita (1981) found that English-as-a-Second-Language (ESL) students at Bronx Community College had lower persistence rates than native English speaking students, but had similar grade point averages.

However, some studies have shown that native language appears to have less of an influence on academic performance than the student's amount of English usage (L.

Hagedorn, et al., 2002; Nakatsu, 2004). Hagedorn et al. (2002) examined students from the Los Angeles Community College District, and found that different measures of English language ability did not have an impact on a student's GPA or course completion. Using the BPS/95 dataset, Dugan (2001) found that being from a family where the native language was not English had a positive influence on the probability of persisting.

Academic Preparation

Several studies have found that high school preparation and performance are important indicators of college outcomes (Adelman, 1999, 2006; Martinez & Klopott, 2005; Sawyer, 2008; U.S. Department of Education, 2006). Adelman (2006) used the National Center for Education Statistics NELS:88/00 database to track the postsecondary outcomes of eighth graders over a 12 year period and found that the academic intensity of the student's high school curriculum provides the best predictor for bachelor's degree attainment than any other pre-entry variable. Sawyer (2008) found that prior academic achievement and cognitive ability demonstrated in eighth grade and in high school surpassed all other factors in their influence on student performance and persistence in college.

Many researchers have found that the rigor of the high school curriculum plays a critical role in the persistence of college students. High school students who completed a rigorous high school curriculum with four years of English, math, and science had an 87% graduation rate compared to a 62% graduation rate for students who did not

complete a college preparatory curriculum (Kuh, et al., 2007). Along with strong social and academic support, Martinez and Klopott (2005) found that academic rigor in high school was one of the most crucial predictors of a student's successful completion of postsecondary education. Researchers propose that participation in rigorous high school courses exposes students to challenging content and higher expectations (Roderick, Nagaoka, & Allensworth, 2006).

Research on minority students is mixed on the influence of the high school curriculum on college completion rates. Arbona and Nora (2007) examined Hispanic students at community colleges and found that completing a rigorous high school academic curriculum increased the likelihood of completing a bachelor's degree in eight years by 59%. However, Cardoza (1991) found that participation in college preparation courses had less of an impact on college persistence among Hispanic women than educational aspirations and sex roles.

Additionally, Desjardins, McCall, Ahlburg, and Moye (2002) found that while the academic resources a student brings to college are an important indicator of college success, this variable changes over time. The impact of prior academic resources on graduation also depends on other factors, such as college GPA. When actual college performance variables are included, some of the effects of prior academic resources appear to operate indirectly through GPA (Stephen L. DesJardins, McCall, et al., 2002). Desjardins et al. (2002) argue that academic resources utilized in college are more important than the prior academic resources students bring with them to college.

External Commitments

Family and work responsibilities pull students away from full academic and social integration at college and influence their decisions to persist or leave (Arbona & Nora, 2007). As previously indicated, several studies indicate that student attrition from community colleges may be attributed to the external commitments of the student population. Students at community colleges also have substantial time commitments to their families and jobs in addition to their studies. A higher proportion of community college students have external commitments outside of college compared to students at four-year institutions. Close to 80% of community college students work, with 41% working full-time while enrolled in school (National Center for Education Statistics, 2006). The percentage of community college students employed was higher than the percentage of those attending a four-year institution (Aud, Hussar, et al., 2010; Planty, 2009).

Work

Research on the impact of employment on college degree completion indicates that the more hours a student works, the more likely they are to shift from full-time to part-time enrollment and the less likely they are to complete a bachelor's degree program (Pascarella & Terenzini, 2005). Perna, Cooper, and Li (2007) found that working more than 15 hours a week and working off campus decreases the likelihood of completing a degree. Students who work more hours report issues with course scheduling, choice of courses, the number of courses they take, access to the library,

and academic performance (L.J. Horn & Berktold, 1998). The negative impact on persistence and degree completion remains constant in numerous national studies despite accounting for factors such as age, race/ethnicity, full-time or part-time enrollment status, income level, or financial aid (Pascarella & Terenzini, 2005). Community college students who work, however, differ from their peers on other factors that might account for differences in persistence and completion, such as working full-time, being a single parent, and not having a standard high school diploma (National Center for Education Statistics, 2002).

Marital and Parental Status

Does marital status have an impact on persistence and degree completion? An earlier study conducted by Teachman and Polonko (1988) found that marriage was detrimental to women of the National Longitudinal Study of the High School Class of 1972. Timing may have had a negative impact as individuals who enter family responsibilities tend to have lower levels of education, have fewer resources, and are less likely to complete a program of study. However, some more recent studies indicate that it may enable students to concentrate on their studies and persist to graduation. Among older students, married women are significantly more likely than unmarried women to complete a degree (Jacobs & Berkowitz-King, 2002). This could be attributed to the extra financial support spouses may provide for covering college tuition and associated expenses, as well as assisting with other household responsibilities so the student can focus on their studies.

Parenthood requires many added responsibilities which can deter college completion. Children require care on a financial, physical, and emotional level. Teachman and Polonko (1988) found that having children deterred both men and women from attending college. Other researchers have also found that parenthood decreases the likelihood of degree completion. Horn (1998) found that students with children are more likely than students without children to drop out. DesJardins, McCall, Ahlburg, and Moye (2002) also found that students with parents have a lower likelihood of graduating. Adelman (2006) found that the only demographic variable that had a strong negative association with degree completion was becoming a parent by age 20. Taniguchi, Hiromi, and Kaufman (2005) found that being divorced and having young children decreased the likelihood of degree completion for both sexes. However, Hegedorn et. al (2002) found that responsibilities for child care among students in the Los Angeles Community College district had no impact on GPA or course completion. Completing a degree may be particularly challenging for single parents with less financial and caregiving support. At community colleges, nearly 30% had children and 13% were single parents (National Center for Education Statistics, 2006).

Research on minority populations also demonstrate the influence of external commitments on a student's decision to remain in college (A. Nora, Cabrera, A. F., Hagedon, L. S., & Pascarella, E. T. , 1996). Using Beginning Postsecondary Students Longitudinal Study 1996-98 (BPS:96/98) data, Brown (2007) found that demographic and enrollment characteristics did not directly have an impact on persistence, but

indirectly through environmental factors such as working full-time, having dependent children, and having high levels of unmet financial need. Cardoza (1991) studied factors that influenced college participation and persistence among Hispanic women. She found that women who delayed marriage and having children tended to persist longer in college than those women who did not delay marriage and children.

The responsibilities of care giving for one's parents may also have an impact on persistence and completion rates among college students. This may be more of an issue for students that are older, immigrants, and are racial and ethnic minorities. Certain racial and ethnic groups may possess greater level of filial responsibilities toward their parents and other family members at a higher rate than non-Hispanic Whites (Goldschieder & Lawton, 1998). For example, Mexican-American undergraduates feel that children should lie close to their parents, monitor the quality of care given to their parents, familiarize parents with health services, and visit their parents weekly (Rudolph, Chavez, Quintana, & Salinas, 2011). Nora et al. (1996) found that Black and Hispanic women who were taking care of a family member were 83% more likely to withdraw from college than their peers without care taking responsibilities. Minner et al. (1995) found that Native American students dropped out of college because of family influences and responsibilities, along with a lack of financial resources.

Academic Integration Variables

Remedial Coursework

Remediation, also referred to as developmental education, is coursework

offered at a postsecondary institution that is below college level. Students are typically

tested to determine their level of academic proficiency in areas such as reading, writing,

and math before they can enroll in college level work. Deficiencies are typically

addressed through supplemental instruction before a student can go on to enroll in

college level courses in those areas. The demand for remedial courses, particularly at

community colleges, continues to be high. Community colleges are more likely to enroll

students that are underprepared for college.

Many community college students are older, low-income, minority, and

immigrants that enroll at community colleges but without the academic skills necessary

to enroll in college level courses (Perrin, 2005). Low-income students are

underprepared for college level work compared to their higher income peers. Warpole

(2007) found that less than one third of high school students from disadvantaged

socioeconomic background complete coursework in high school that meets the

minimum requirements for college admissions. Some minority groups are also

underprepared for college level work. The American College Testing Program (2006)

found that only 21% of Black high school graduates and 33% of Hispanic high school

graduates had college level reading skills. Roderick, Nagaoka, and Allensworth (2006)

examined Chicago Public School students and found that only 9% had taken rigorous

coursework that prepared them for college level work.

Using National Center for Education Statistics NELS:88/00 data, Bailey, Jenkins, &

Leinbach (2005) examined the enrollment patterns and the highest eight year outcome

of minority, low-income, and first generation college students. They found that 60% of

the NELS:88 cohort enrolled at community colleges took remediation during the first

year, compared to 26% at four-year institutions. Bailey, Jenkins, & Leinbach (2005) also

found that the majority underrepresented minorities took remedial coursework.

Seventy-six percent of Black students and 78% of Hispanic students that enrolled at

community colleges took remedial courses. Bailey, Jenkins, & Leinbach (2005) found

that socioeconomic status did not play a role in terms of remediation. However,

students enrolled in associate degree programs (over occupational type programs), who

did not need remediation, and had a higher socioeconomic status had higher success

rates.

Using the National Longitudinal Study of the High School Class of 1972 followed

through 1986 (NLS:72), the High School and Beyond Longitudinal Study of 1980

sophomores followed through 1992 (HS&B/80-92), and the National Education

Longitudinal Study of 1998 (NELS: 88/00), Cliff Adelman (2004) was able to study college

transcript data of the high school graduating classes of 1972, 1982, and 1992. At four-

year institutions, there was a considerable decline in the proportion of student enrolling

in remedial coursework from the high school graduate classes of 1972 to 1992 (from

44% to 25%). However, the proportion of community college students in remedial coursework was higher than four-year institutions. The proportion of students starting out at community college requiring at least one remedial course stayed constant for 1972, 1982, and 1992 high school graduates in the 61 to 63% range. Adelman (2004) found that the list of courses with the highest percentages of failures or withdrawals and course repeats were in remedial English and math.

Many students needing remediation do not successfully complete their coursework, deterring their ability to eventually enroll in college level courses and complete their degree. Attewell, Lavin, Domina, and Levey (2006) found that 70% of the students in the NELS dataset passed the reading and writing remedial courses that they enrolled in, but only 30% passed the remedial math courses. Data collected from 35 community colleges participating in the Achieving the Dream initiative indicated that 51% of students needing remedial math courses successfully completed within two years (Clery, 2006a).

Peter Bahr (2012a) found that the majority of California's community college students enrolled in remedial math completed the remedial math sequence and ultimately left without a credential or transferring to a four year institution. Bahr (2012b) also found that the majority of students enrolled in remedial coursework in math, Writing, and reading within California's community college system did not attain college-level competency in those subject areas. He categorized attrition into three categories: skill-specific attrition, course-specific attrition, and nonspecific attrition.

Though there is a clear need for remediation, there is an ongoing debate about its effectiveness. Does the successful completion of remedial coursework result in better educational outcomes? Results are mixed. Some studies indicate that students who successfully complete remediation have better outcomes than similarly prepared students who do not take remediation or students who do not require remediation. Other studies indicate that remedial students have less favorable outcomes.

Some researchers have found improved retention and graduation rates for students who successful complete remedial coursework. Bahr (2008b) examined the outcomes of students taking remedial math at 107 community colleges. He found that students who successfully completed math remediation and acquired college level math skills graduated and transferred at the same rate as students who did not need remediation. Lavin, Alba, and Silberstein (1981) examined underprepared students at the City University of New York scoring similarly on placement exams. Some students took remedial courses and others did not. They found that success in remedial courses increased the probability that students would return for a second year by seven to eight percent, and the probability of transferring to a four year institution or graduating was increased by two to three percent (Lavin, et al., 1981). Morris (1994) found that among students only needing remediation in one area, 28% of students who completed remedial coursework graduated within five years compared to seven percent of those who did not complete remedial coursework. For students who needed remediation in more than one area, 16% of remedial coursework completers graduated in five years

compared to only five percent of students who did not complete the remedial

coursework (Morris, 1994).

Bettinger and Long (2005b) examined traditional age college students at Ohio

public colleges, and found that students who completed remedial coursework were

more likely to persist in college and complete a bachelor's degree compared to similar

students who did not take remedial coursework. They found that when student

background variables are controlled, graduation and transfer rates for remedial

education students were essentially the same as for academically prepared students.

Bettinger and Long (2005a) also examined community college students in Ohio and

found that students that students who completed math remediation courses were 15%

more likely to transfer to a four-year institution that similar students who did not.

Remedial courses may have different effects for students, depending on their

background characteristics. For example, remedial courses may be more beneficial for

older students needing to brush up on certain reading, English, or math skills. Jepsen

(2006) found that remedial classes are positively associated with retention to the

second term and successful completion of a transfer level course at California

community colleges. However, when outcomes were calculated for older and younger

students, he found that remedial classes were negatively associated with transferring,

but were positively associated to the probability of a younger student receiving a degree

or certificate.

However, several researchers have found that remediation had no impact or had a negative impact on college persistence and completion rates. Wirt, Choy, Ronney, Provasnik, Sen, & Tobin (2004) examined the extent of remedial course taking patterns and degree attainment by institution type using the National Center for Education Statistics NELS:88/00 dataset. Sixty one percent of community college students took at least one remedial course compared to 25% of four-year institutions (Wirt, et al., 2004). They found that remediation was a barrier to degree completion. Sixty-nine percent of students who did not take remedial coursework earned a degree or certificate compared to 30% to 57% with remedial coursework. Remedial reading was the most significant barrier to degree completion. It accounted for more total remedial coursework and with lower rates of degree attainment than any other remedial course-taking pattern (Wirt, et al., 2004). Postsecondary students who took remedial reading were half as likely as students who did not take any remedial course work to earn a degree or certificate. Using the NELS:88 dataset, Wang (2009) found that remediation in reading did not have an effect on bachelor's degree completion among community college transfers. Wang (2009) also found that math remediation had a negative impact on bachelor's degree attainment.

Adelman (2006) found that remediation did not make a difference in degree completion rates. Although Calcagno (2007) found a positive causal relationship on remediation and the likelihood of re-enrolling the following fall, he found that there is no statistically significant difference between similar students assigned to remediation

(just below the state cut-off score) and those just above the cut-off score (college level).

There was no difference in terms of passing the first level college course, associate

degree completion rates, or transfer rates.

Academic Performance

Grade performance is one of the most widely studied variables in college

persistence research. College grades may be the "single best predictor of student

persistence and degree completion" (Pascarella & Terenzini, 2005, p. 396). Academic

performance in college, as measured by GPA has been found to be one of the most

important determinants of degree attainment (Adelman, 2004, 2006; A. W. Astin, 1997;

Bennett, 2003; Pascarella & Terenzini, 2005; Titus, 2006a; X. Wang, 2009; Xueli Wang,

2009). In How College Affects Students, Pascarella and Terenzini (2005) state, "the

research is unwavering in finding that grade performance, even when controlling other

factors, is a statistically significant and positive predictor of persistence and graduation"

(Pascarella & Terenzini, 2005, p. 438).

Many national studies indicate the importance of grade point average to degree

completion. Wang (2009) found that the community college grade point average is the

single best predictor of bachelor's degree completion. Students who went on to earn

their bachelor's degree had a higher GPA after the second year (2.91) versus students

who did not earn a bachelor's degree (2.13) (Adelman, 2006). For those students who

dropped out in the first or second year, their GPA was below the threshold required for

degree completion (Adelman, 2006). Okun, Benin, and Brandt-Williams (1996) found

that semester GPA, credit load, as well as commitment, encouragement from others, and intention, had the most impact on college persistence.

Academic performance in the first year has been shown to be an important predictor of degree attainment. Adelman (2006) also found that if a student's first-year GPA falls into the top two quintiles, the probability of earning a degree increases by nearly 22%. Nora and Cabrera (1996) found that students' GPA at the end of the first year was three times more important for Black and Hispanic students' persistence than for White students. Adelman (1999, 2006) also found that earning less than 20 credits in the first calendar year decreases the probability of completing a bachelor's degree by 30%. Additionally, taking remedial courses in the first year appears to have a positive effect on degree completion (Adelman, 2006).

Other course taking behaviors appear to influence successful degree completion. Adelman (2006) found that enrollment in the summer terms demonstrated a positive relationship to degree completion, particularly for Black students. Adelman and others (Adelman, 1999, 2006; A. Cabrera, et al., 2005) have found that withdrawing from a courses without any penalty and then attempting to repeat it has a significant negative influence on degree completion.

Credit momentum also factors into successful degree completion. The more credit hours a student accumulates in the first two years, the more likely they are to graduate. Students who earned a bachelor's degree completed 25 more credits by the end of the second year than those who did not earn a bachelor's degree (Adelman,

2006). However, this appears to be related to attendance patterns. Students earning less credit hours in the first two years also tended to attend college part-time, stop out, and earn less than 20 hours in the first year.

Certain courses also serve as gateway courses to degree completion. Adelman (2006) examined the course categories of students enrolled in their first two years of college (at both community colleges and four-year institutions). Students who went on to complete their bachelor's degree completed college-level writing, math, and English composition in the first two years at a higher rate than students who did not complete their bachelor's degree.

Program of Study

Does the type of program a student enrolls in make a difference in persistence and completion? Different from four-year universities, community colleges have diverse mission areas including adult basic skills, ESL, GED preparation, workforce preparation, community education, and also transfer oriented associate degree programs. Not all students at the community college have a goal of completing an associate's degree or even a bachelor's degree. There are many courses and certificate programs that fulfill the other mission areas of the community college.

Using National Center for Education Statistics NELS:88/00 data, Bailey, Jenkins, & Leinbach (2005) examined the enrollment patterns and the highest eight year outcome of minority, low-income, and first generation college students. They found that 40% of the NELS:88 cohort first enrolled at a community college. Twice as many Hispanics

enrolled at a community college than at a four-year institution. First generation college

students were more likely to enroll in in certificate program. Black, Hispanic, low-SES,

and first generation students were more likely to declare an occupational major.

Romano and Wisniewski (2005) studied community college transfer rates to

four-year institutions and found that students in transfer programs like the Associate of

Arts (AA) and Associate of Science (AS) programs are significantly more likely to transfer

than non-transfer programs associate degree programs. Similarly, community college

students in certificate programs are much less likely to complete a bachelor's degree.

Leinbach and Bailey (2006) studied students at the colleges of the City University

of New York (CUNY) to see whether Hispanics and Hispanic immigrants enroll at

different rates by institution and program type and if their completion rates were similar

to other populations. Hispanic students were more likely to enroll in community college

programs and in certificate programs than White and Asian students. Hispanic students

earned less credits and were less likely to complete bachelor's degrees than other

racial/ethnic groups (Leinbach & Bailey, 2006). Also, Hispanic immigrants were not as

educationally successful as other minority immigrant groups.

Late Registration

Research on the impact of late registration on community college students is

relatively limited. This is surprising when considering the open door policies of

community colleges and their generous policies in allowing new students the ability to

register as late into their first semester. Additionally, there is a financial advantage as state funding is based, in part, on enrollment.

Research indicates that late registration appears to be a deterrent to persistence and student performance at community colleges. Sova (1986) examined English students at Broome Community College and found that students who registered late were less likely to pass the class and much more likely to drop out than regular registrants. Stein (1984) examined new students at Minneapolis Community College and found that only 23% of late registrants re-enrolled the d semester, compared to 63% for the whole student body. Street, Smith, and Olivarez (2001) examined students at a west Texas community college. Results indicated that students who registered late were much less likely re-enroll the next semester; 42% of late registrants re-enrolled compared to 80% of early registrants and 64% of students who registered during the regular registration period. Additionally, 21% of late registrants withdrew compared to 10% of regular registrants. Late registrants also had lower academic success as measured by grade point average (Street, et al., 2001).

Enrollment Pathways

Enrollment at multiple institutions has risen dramatically over the last three decades with students following a variety of attendance patterns. Goldrick-Rab (2006) studied the relationship of different educational pathways and mobility patterns of students and compared persistence and degree completion by socioeconomic status. Specifically, she examined what the relationship of a student's social class in specific

non-traditional postsecondary pathways (discontinuous enrollment, multiple institutions) rather than a traditional, linear pathway. She also examined whether a student's high school preparation mediated the effects of social class on the probability of following a nontraditional pathway. Results indicated that lower SES students are more likely to follow interrupted movement pathways (multiple institutions with stop out) than students with a higher SES, which results in a lower likelihood of bachelor's degree completion (Goldrick-Rab, 2006). This research indicates that there are differences in college attendance patterns after they enter college, not just where they start as previous research has shown.

Continuous Enrollment, Stop Outs

Some research indicates that students who continuously enroll, as well as enroll full-time, have higher levels of persistence and graduation rates than their peers with less traditional mobility patterns and attend part-time (Wassmer, Moore, & Shulock, 2004). Arbona and Nora (2007) found that community college students who started college immediately after high school and who were continuously enrolled for the first year years were 93% and 67% more likely respectively to have earned a bachelor's degree than their peers.

Enrollment Intensity

Many studies have indicated that part-time enrollment has a negative effect on degree completion (Adelman, 2006; Lutz K. Berkner, He, & Cataldi, 2002; Carroll, 1989; X. Chen, 2007; Laura J. Horn & Carroll, 1996; Stratton, O'Toole, & Wetzel, 2007;

Taniguchi & Kaufman, 2005; Wang, 2010). Part-time students may have a lower chance

of completing a degree because it takes longer to fulfill course and credit requirements

than if attending full-time. Prolonged enrollment can be interrupted by more frequent

stop out enrollment patterns which can interfere with the student's continuity of

learning. As a result, students may have more academic difficulties progressing from

beginning level courses to more advanced courses, creating an additional barrier to

degree completion. Additionally, students who attend part-time may not be as

integrated socially into the college culture as they have limited interactions with

classmates and faculty.

Many researchers have found how part-time enrollment decreased the

likelihood of completing a degree, while increasing the likelihood of dropping out.

Adelman (2006) found that part-time status reduced the probability of degree

completion by over 35%. Using data from the National Longitudinal Study of Youth,

Taniguchi and Kaufman (2005) found that part-time enrollment significantly decreases

the likelihood of completing college. Horn and Carroll (1996) examined nontraditional

college students from the National Postsecondary Student Aid Study (NPSAS: 87, NPSAS:

90, and NPSAS: 93), and the Beginning Postsecondary Students (BPS: 90/94) datasets

and found that part-time enrollment contributed significantly to the lower completion

rates of non-traditional students within five years.

Chen (2007) used BPS 96/01 data to examine persistence and degree completion

within six years. Part-time enrollment was associated with lower persistence rates and

degree attainment. Only 15% of exclusively part-time students had earned a certificate

and none had earned a bachelor's degree compared to 64% of full-time students

earning a certificate or bachelor's degree. Chen (2007) also found that part-time

enrollment was negatively associated with persistence and degree attainment outcomes

even after controlling for a variety of factors, including students' demographic and

family background, academic preparation, employment, and other enrollment patterns.

Students who attended college both full-time and part-time over the six year period also

lagged behind their full-time counterparts in terms of bachelor's degree attainment.

Stratton, O'Toole, and Wetzel (2007)) found that factors predicting attrition and

persistence differed for full-time students compared to part-time students. Though

part-time students tend to be less socially and academically integrated, Stratton,

O'Toole, and Wetzel (2007) found that part-time students who were more integrated

socially into campus life had higher persistence rates. Parental education, the time of

enrollment, GPA in college, and the local unemployment were significantly associated

with attrition for full-time students, but not for part-time students. Academic

performance as measured by grades received appears to be less important for part-time

students as it is for full-time students. Part-time students with low grades are no more

likely to drop out than part-time students with low grades (Stratton, et al., 2007). This is

in sharp contrast to full-time students where low grades have a significant impact on

attrition. However, high grades for both full-time and part-time students increased the

likelihood of persistence. However, racial/ethnic differences appeared to be more

significant for attrition with part-time students.

Starting at a Community College or Baccalaureate Institution

Many research studies have demonstrated the negative effect of completing a

bachelor's degree and beginning postsecondary study at a community college (Lutz K.

Berkner, et al., 2002; K. J. Dougherty, 1994; Whitaker & Pascarella, 1994). Pascarella

and Terenzini (2005) reviewed numerous studies related to initial entry at a four-year

institution versus a community college and found that even after taking into account

students' precollege degree goals, abilities, and other background characteristics, initial

attendance at a community college reduced the likelihood of completing a bachelor's

degree by 15 to 20%. Additionally, community college students who transfer and

complete their bachelor's degree are twice as likely as students who begin at a four-year

institution to take more than six years to graduate (Curraro-Alamin, 1997).

Other factors may have a greater role in bachelor's degree attainment than

simply beginning at a community college. Cabrera, Burkum, and La Nasa (2003) found

that the majority of students in the lowest SES group first enrolled at a community

college and only 3.3% earned a bachelor's degree. Cabrera et al. (2003) found that

bachelor's degree completion is most impacted by SES, high school academic resources,

degree aspirations, enrollment patterns, taking college courses in math and science,

financial aid, and having children. Wang (2009) examined factors that predict bachelor's

degree completion among community college transfer students at four-year institutions

using the NELS:88 dataset. The probability of earning a bachelor's degree among community college transfers was a function of demographic variables, such as sex and socioeconomic status, high school curriculum, college grade point average, involvement on campus, and math remediation (X. Wang, 2009).

Many students who begin at a community college never transfer to a four-year institution, but several studies show that those who do show no difference in their degree completion rates compared to students who began at a four-year institution. Persistence rates among community college students who successfully transferred were similar to four-year matriculants (76% versus 78%) (Lutz K. Berkner, et al., 2002). Lee, Mackie-Lewis, and Marks (1993) used data from the High School and Beyond study and found that graduation rates were similar for community college transfer students and four-year matriculants after taking into account student background characteristics such as gender, race/ethnicity, and socioeconomic status, enrollment intensity (part-time attendance), living on campus, college GPA, social and academic satisfaction, and institutional characteristics such as size, control, and location. Adelman (1999) also found that transferring from a community college was positively associated with degree completion after taking into account precollege characteristics, socioeconomic status, race/ethnicity, and gender.

Using an earlier NCES High School and Beyond dataset, Lee and Frank (1990) also found that community college students who transferred to a four-year institutions had similar precollege characteristics as students who enrolled directly into a four-year

institution. Transfer students were also just as likely to have completed a college

preparatory curriculum and demonstrated high academic achievement.

Financial Aid

Several studies indicate the importance of financial aid to college persistence

(Alon, 2005; R. Chen, 2007; R. Chen & DesJardins, 2010; S. L. DesJardins, Ahlburg, &

McCall, 1999; Stephen L. DesJardins, Ahlburg, et al., 2002; Dowd & Coury, 2006; Gross,

2008; Gross & Hossler, 2009; A. Nora, Barlow, & Crisp, 2006; Perna, 1998; Price & Davis,

2006; Prince, 2006; St. John, Hu, & Weber, 2001; Titus, 2006a). There is considerable

evidence in support of human capital theory; more aid leads to increased access and

completion. Financial aid can have a direct effect on persistence to degree completion

in that it enables students to pay their college tuition and all other associated costs. The

cost of attending college has been found to be negatively associated with persistence

and degree completion when students lack the ability to pay.

Financial need is associated with lower levels of persistence, particularly among

low-income students (Paulsen & St. John, 2002). Many students that are otherwise

qualified to attend college may not because of the prohibitive costs associated with

college attendance. Many low to moderate income students who do enroll in college

may struggle each year to cover their tuition and associated costs (Ficklen & Stone,

2002). Human capital investments, such as college savings plans, are not available to

many students. Using data from the 2002 Educational Longitudinal Study, Engberg and

Allen (2011) found that only 26% of the college going population indicated that their

families saved for college.   Although, students from low-income families who would

most likely qualify for aid would fail to even apply (Goldrick-Rab, Harris, & Trostel,

2009). They may not have the knowledge needed to navigate the financial aspects of

applying to college. Higher income students received information from a variety of

sources, including their family, while lower income students, whose parents did not

attend college, mostly received information about college from high school counselors

(A. Cabrera & La Nasa, 2000).

The likelihood of degree completion is negatively associated with unmet

financial need and working more than 10 hours per week (Titus, 2006a). Susan

Dynarkski (2003), an economist studying the effect of financial aid on degree

completion, found that financial aid had a causal impact on degree completion. Titus

(2006) shows that college completion is positively associated with an institution's tuition

revenue. DesJardins et al. (2002) also found that the negative effect associated with

being in a minority racial/ethnic group becomes less pronounced when controlling for

financial aid and GPA.

There is also evidence that different types of financial aid have different effects

on persistence and degree completion. The standard human capital model asserts that

if students have access to credit, they will make college decisions to maximize the net

value of their potential lifetime income opportunities (Goldrick-Rab, et al., 2009).

Research indicates that grants have a positive influence on persistence (Alon, 2005;

Perna, 1998). Loans also appear to be positively associated with greater persistence

(DesJardins, et al., 2002; Perna, 1998), though, since they have to be repaid with interest, they are not worth as much to the borrower (Goldrick-Rab, et al., 2009). Additionally, DesJardins and McCall (2010) examined the impact of different financial aid packages on student mobility patterns of stopping out, re-enrollment, and likelihood of graduating. They found that stopping out is negatively correlated to graduating. Providing aid reduces stop out behavior and increases degree completion. Frontloading financial aid in the first two years also appears to reduce the likelihood of graduation.

While Cliff Adelman (2007) writes of financial assistance as "the easy part," it is important to understand the relationship between financial aid and other factors found to negatively impact persistence, such as academic preparation, other external commitments, and academic performance. The interplay of financial aid, SES, and other cultural and social capital factors can be complicated to tease out. Perceived economic benefits of attending college can be moderated by other variables beyond SES including academic preparation and access to college information (Paulsen, 2011).

Institutional Characteristics

Titus (2006b) examined institutional characteristics that could influence student attrition and persistence including institution control (public or private), residential/commuter, college size, sources of revenue, and patterns of expenditure. Student persistence was found to be positively related to the percentage of revenue derived from tuition, and negatively related to higher administrative expenditures

(Titus, 2006b). Higher expenditures per student were associated with greater

persistence.

Bailey, Calcagno, Jenkins, Leinbach, and Kienzl (2006; 2005) used the U.S.

Department of Education's IPEDS national dataset of first-time, full-time community

college students to examine how institutional characteristics effect the community

college Student Right to Know (SRK) three year graduation rates. Institutional

characteristics included race, sex, and full-time/part-time status composition, college

resources, enrollment size, and location. They found that there is a negative

relationship between enrollment size and graduation rates (T. Bailey, et al., 2006).

Larger community colleges, particularly those with more than 2,500 full-time equivalent

students, have 9 to 13% lower graduation rates than smaller community colleges.

However, larger colleges also have a higher proportion of underrepresented minority

students (Clery, 2006b). Bailey et al. (2006) also found that community colleges with a

higher share of minorities, part-time students, and women have lower graduation rates.

Institutions with greater instructional expenditures are related to a greater likelihood of

graduation (T. Bailey, et al., 2006).

Toutkoushian and Smart (2001) found that certain institutional characteristics

had a greater impact on graduation rates that individual characteristics. They found

that colleges with high proportions of women, students with higher socioeconomic

status, and students pursuing their studies full-time had higher graduation rates, even

after controlling for individual characteristics (Toutkoushian & Smart, 2001).

Selected Persistence Research on Community Colleges

It is important to examine persistence among community college students. Students who enroll at community colleges are different than students who enroll at baccalaureate four-year institutions. McPhee (2006) looked at the National Center for Education Statistics (NCES) Baccalaureate and Beyond 2000/2001 dataset to see if bachelor's degree recipients who enrolled at community colleges were different than those who did not in terms of demographics, student aid, debt, work and educational aspirations, and income level after college. McPhee (2006)found that students who enrolled at a community college were demographically different from bachelor's degree recipients who did not.

Halpin (1990) examined Tinto's (1987) model of persistence to a community college in New York. Freshman students were given questionnaires before the end of the fall semester to gauge their level of academic and social integration and institutional commitment. Information was collected on the following variables: demographic characteristics (sex, parent's educational background, and highest expected degree), student environment (worked, commuting distance, involvement in college organizations, perceived cost burden of attending college, and number and length of informal conversations with faculty), social integration (peer group relationships and informal relationships with faculty), academic integration (academic and intellectual development from questionnaire scores, faculty concern for student development), commitments (institutional and goal commitment scores from questionnaire), and

outcome (voluntary withdrawal, dismissed for academic reasons, subsequent

enrollment for the next semester).

Halpin found that over 76% of the population was going to persist to the next

semester, 15% were going to be academically dismissed, and 9% were going to

voluntarily withdraw. Using a series of three-group discriminant function analysis with a

sample of each outcome group, Halpin found that 24% of the variance could be

accounted for with background characteristics. Student environment accounted for an

additional 28% of the variance in outcomes. By adding social and academic integration

variables, another 30% of the variables were accounted for in the outcomes. Eight-two

percent of the variance in student outcomes could be explained by the background

characteristics, student environment variables, and the integration variables (Halpin,

1990). Halpin (1990) found that the pre-entry characteristics were a significant factor in

persistence. After controlling for background characteristics, Halpin found that the

academic integration variables accounted for the majority of the variance in the

discriminating variables.

Miller, Pope, and Steinmann (2005) set out to profile the level of integration and

future plans of community college population using a national representative of six

community colleges. They sought to identify student characteristics, beliefs, attitudes,

and patterns of behavior, utilization of services, as well as their level of involvement at

the community college. Students in introductory math courses were administered a

survey and indicated their level of involvement using a Likert-scale of 1 for "never" to 6

"always" (Miller, et al., 2005). Results indicated that students had low levels of involvement (a mean score of 2 or below) on such items as attending a college cultural event, participating in social clubs and social activities, using campus food services, dating a fellow student, and attending college athletic events. The service that received the highest involvement rating was for utilization of campus computing resources with a mean score of 3.3 (Miller, et al., 2005). Additionally, students indicated that they worked while attending school (mean score of 4.5), were planning a career for after completion at the community college (mean score of 4.5) and were planning on transferring to a four-year college (mean score of 4.5). Although Miller, Pope, and Steinmann (2005) utilized a small sample of six colleges, the findings were consistent with other research that found a low level of social integration of community college students outside of the classroom.

Moore (2006) examined factors related to attrition and persistence at three Midwestern community colleges. The following factors were examined: age, first year GPA, grades in orientation courses, grades in developmental math courses, first year GPA, financial aid received during the first year, course hours completed while in high school, and the number of hours attempted and completed during the first semester. Moore (2006) also examined gender, race, marital status, HS diploma or GED attainment, enrollment in developmental courses, and enrollment in orientation courses. Moore (2006) found significant positive correlations between persistence and the following variables: developmental course grades, orientation course grades,

number of credit hours attempted and earned, amount of financial aid received, and GPA. Students who enrolled in developmental math courses and orientation courses were more likely to persist. Using discriminant analysis and logistic regression, Moore (2006) found that enrollment in an orientation course, GPA, and amount of financial aid were the strongest predictors of persistence. Moore (2006) also found a negative correlation between persistence and age.

Bailey, Calcagno, Jenkins, Kienzl, and Leinbach (2005) examined institutional characteristics that affect the probability of community college students completing a certificate or degree or transferring to a four-year institution. They used the NELS:88 cohort and individual data from the Integrated Postsecondary Education Data System (IPEDS) to measure the individual student probability across multiple institutions, not just at a single institution. Bailey et al. (2005) attempted to account for unobserved institutional effects and attendance at multiple institutions. The institutional characteristics examined were categorized into four groups: *general institutional characteristics* (the size of the community college, the proportion of part-time faculty, and the extent to which the institution focuses on certificates or workforce preparation compared to associate degrees and the transfer mission), *compositional characteristics* (percent part-time students, overall household income,% female, and% underrepresented minority students), *financial variables* (federal student aid per student, average in-state tuition, and average expenditures per student in instruction,

academic support, student services, and administration), and *fixed locational characteristics* (urban, suburban, or rural college location).

Bailey et al. (2005) found that community college students enrolled in a medium size college (enrollment between 1,001 and 5,000 students) are 13% to 15% less likely to complete a certificate or degree or transfer than students at smaller institutions. Additionally, students enrolled in institutions with a large proportion of part-time faculty and underrepresented minorities were also less likely to attain a degree (T. Bailey, Calcagno, Jenkins, Kienzl, et al., 2005). Students enrolled at a community college with a student body comprised of 75% underrepresented minorities were 9% to 28% less likely (depending on the model) to success than students enrolled in community colleges with only 25% underrepresented minorities. They also found that individual student characteristics have a greater impact on individual graduation rates than the institutional characteristics examined in the study (T. Bailey, Calcagno, Jenkins, Kienzl, et al., 2005).

Persistence Research Studies that Utilized Event History Analysis

There have not been a large number of research studies that utilized event history analysis when examining student persistence (Pascarella & Terenzini, 2005). Researchers have recently begun to apply EHA to longitudinal data populations, along with other traditional research methods. This section presents a selected overview of persistence studies in postsecondary education that utilize event history analysis.

Ronco (1995)

Ronco (1996) used a competing risks model to examine the role of factors such as admission status, full time and part time enrollment, major, GPA, and ethnicity, in determining how a student will exit: transfer, drop out, or graduate. Ronco (1996) studied an entering class of freshman at the University of Texas in fall 1987 and followed them for seven years through spring 1994. He found that the risk of transfer to a two-year institution was almost as high as the risk of drop out and students with low GPA's and provisionally admitted students were at the highest risk. Hispanic students were much more likely to transfer to a two-year institution than to graduate or drop out.

Taniguchi and Kaufman (2005)

Taniguchi and Kaufman (2005) used data from the National Longitudinal Survey of Youth (NLSY79) to examine factors affecting "nontraditional" student college degree completion. NLSY79 is a national sample of men and women born between 1957 and 1964 and tracked every year from 1979 to 1994, and every other year from 1996 on. Taniguchi and Kaufman (2005) defined a nontraditional student as anyone entering a four-year institution at age 21 or older. Traditionally, researchers use age 25 as the cut-off; different results from the Taniguchi and Kaufman (2005) study may be attributed to the inclusion of younger students in the non-traditional category. College graduates going back to school were excluded. A total of 1,703 students were included in the sample. Forty-seven percent were male and fifty-three percent were female. The study sample included 1,052 non-Hispanic Whites, 385 Blacks, and 266 Hispanic students.

Race was run as a control variable with the effect of being Black or Hispanic not being statistically significant.

In the Taniguchi and Kaufman (2005) study, the outcome variable was bachelor's degree completion for nontraditional students. Independent variables included part-time enrollment, though it used as a time-invariant covariate due to data limitations. Other independent variables included the duration since the start of enrollment, receipt of a college loan, and the number of prior enrollments. Human capital variables included age (at the time of the interview), cognitive ability (based on the Armed Forces Qualification Test), and occupational background (coded into major occupations). Age and background were time varying variables, and cognitive ability was time invariant.

Taniguchi and Kaufman (2005) found that the characteristic of nontraditional students that most influenced the probability of completing a bachelor's degree was part-time enrollment. This may be a result of their often interrupted enrollment patterns and limited access to financial aid. It may also be the result of reduced social integration with classmates and faculty. Multiple prior enrollments also had a negative impact on degree completion. Additionally, students with high cognitive ability and in managerial and professional occupations were more likely to complete their degree. Marriage did not appear to have an impact on degree completion when compared to students who have never been married. However, divorce had a negative influence on degree completion for both sexes. The presence of young children had a negative impact on degree completion for both men and women.

Calcagno, Crosta, Bailey, and Jenkins (2006)

Calcagno, Crosta, Bailey, and Jenkins (2006) developed a discrete-time hazard model to examine the impact of certain enrollment pathways (such as remediation) and enrollment milestones (such as completing a certain number of credit hours) on the educational outcomes of older students and traditional age students. In this study, older students were defined as those who entered college for the first time at age 25 or later. Younger students were defined as entering college between age 17 and 20. Calcagno et al. (2006, 2007) examined longitudinal transcript data of 40,000 first-time degree seeking students at 28 of Florida's community colleges. Students were tracked for 17 trimesters, from fall 1998 to spring 2004.

The longitudinal data included demographics (age, gender, race/ethnicity, previous education, and college placement scores), basic transcript information (credits attempted and completed by term), full and part-time status, program of study, credentials earned (if any), and the amount and type of financial aid received in the first semester. First semester variables were compared for younger and older students to see if there were significant differences between the two groups. A larger proportion of the older students were female, had a GED instead of a high school diploma, scored lower on the mathematics placement exam, received more financial aid, and enrolled part-time in the first trimester.

Four categories of milestones and pathways were included in the model. The first was the number of credit hours earned. For the second, Calcagno et al. (2006)

calculated the percentage of the program completed, or the proportion of non-remedial credits earned for a student's given program. The third category was remedial pathways. The remedial pathways tested different impacts of remedial coursework. The fourth category was whether the student passed the first college-level course in math and writing after remediation and if it had an impact of the probability of program completion.

Calcagno et al. (2006) used a single risk discrete time event history analysis methodology to find that older and younger students respond differently to reaching credit milestones, taking remedial courses, and passing college-level English and math courses after remediation. In terms of outcomes, traditional age students were more likely than older students to graduate with a degree or certificate in 17 trimesters. Only 19% of older students completed their programs compared to 30% of younger students. Completing 20 credit hours increases the probability of completing a degree or certificate for all students, but has a greater impact on younger students. Older students enrolled in remedial math courses are affected less negatively than younger students. Additionally, Calcagno et al. (2006) found that after controlling for ability (measured by placement test scores), older students have a higher probability of completing an associate's degree or certificate in any given trimester.

Chae (2000)

Chae (2000) used a competing risks discrete time event history analysis on 588 first-time public community college students from the Beginning Postsecondary

Longitudinal (BPS 89/94) dataset to determine when they were most likely to drop-out,

stop out, transfer, or graduate with an associate degree. Chae (2000) also examined

whether the community college students' academic integration level was associated

with different modes of departure after controlling for other student characteristics.

Excluded from the analysis were foreign students and students attending private two-

year institutions.

Four outcome measures were included in the study: drop-out, stop-out, transfer,

and graduation. The time period unit was determined to be seven months, which was

interpreted as an academic year. Five academic periods of seven month increments

were used as time periods for the study (Chae, 2000).

Four variables from the BPS dataset were used to measure academic integration:

how often the student attended career-related lectures, participated in study groups,

discussed academic matters with professors, or met with academic advisors about

academic plans. They were combined to create an academic integration composite by

averaging responses within each year. The academic integration variable was a time-

varying variable since it can fluctuate over time.

Student background and environmental characteristics were used as controls on

the risk of first leaving college. Background characteristics included age, ethnicity, and

gender as time invariant variables. Enrollment intensity was included as a student

background characteristic and was a time-varying variable. In most studies, enrollment

intensity would not be included as a student background characteristic. Environmental

characteristics included socioeconomic status as a time invariant characteristic and the average number of house of weekly employment as a time-varying variable.

Results indicated that the students were most likely to drop out, stop-out, or transfer during their first year (Chae, 2000). Students were also most likely to graduate during their fifth academic year. Only 21% of the students graduated in five years, 27% transferred (includes transfer to other community colleges and four-year institutions), 14% stopped out, and 19% dropped out. Chae (2000) found differences in the modes of departure by selected background characteristics. Older, White students attending part-time were more likely to drop out. Younger, minority, male students were more likely to transfer. Younger, female students attending full-time were more likely to graduate. Chae (2000) also found that socioeconomic status accounted for variation in all four different types of departure. Academic integration was a significant predictor of all four forms of student departure. As academic integration increased, the risk of dropout and stop-out decreased, and the risk of transfer and graduation increased.

Stuart (2009)

Stuart (2009) examined factors that lead to success at community colleges. Using event history analysis, Stuart (2009) studied the likelihood and the timing of achieving three different outcomes: dropping out, transferring to a four-year institution, or completing an associate's degree. He used a hybrid model of student persistence using Tinto's theory of student dropout behavior along with human capital theory.

Stuart (2009) tracked close to 4,000 students at a large, multi-campus community college that began in the fall of 1998. After eight years, Stuart (2009) identified some successful outcomes: 18% transferred, but did not complete an associate's degree, 8% completed an associate's degree or certificate, but did not transfer, 5% completed an associate degree and transferred, and 9% were still enrolled or transferred to another two year institution. The majority of the community college students in the cohort had an unsuccessful outcome: 59% left without completing a degree or certificate or transferring to another institution.

Stuart (2009) examined the enrollment behavior of the community college students with respect to three different outcomes: dropouts, transfers, and completing an associate's degree. The first two outcomes, dropping out and transferring, were examined independently with just a single outcome. Stuart also combined all three outcomes and assessed the students' likelihood of the college through dropping out, transferring, or completing an associate's degree by utilizing a competing risks analysis.

For dropouts, Stuart (2009) examined the relative impact of several different costs and benefits on students' likelihood of dropping out, and whether the jobs for which students are preparing for in college have an impact on their chances of dropping out. Stuart (2009) found that the major of study had an impact on the likelihood that students' would drop out of college. Students in the health careers programs that required a credential were .20 times as likely to drop out as students in public service technologies. Students in health career programs that did not require a credential were

about as likely as those in the public service technologies to drop out of college. Odds

ratios for credentialing business technology programs, arts and sciences, and

engineering technologies were about .6 times as likely to drop out as those enrolled in

public service technologies. Students who tested at a higher level of math were less

likely to drop out than students who placed at the lowest level of math. Stuart (2009)

also found in this analysis that older students were more likely to drop out. A higher

grade point average also reduced a student's likelihood of dropping out. A one unit

increase in grade point average reduced the chances of dropping out by a factor of .46.

Switching from full-time attendance status to part-time status increased the chances of

dropping out by a factor of 1.57. Students who received financial aid were also 19% less

likely to drop out than those who do not.

Stuart (2009) also found that students in different programs tend to drop out of

college at different rates. Students in public health technology programs are much

more likely to drop out in terms one through 3 than later terms. By contrast, students in

engineering programs tend to drop out later, after seven semesters or more. This

confirms Stuart's hypothesis that students consider the training requirements of the

jobs they are preparing for when deciding whether or not to continue in their studies or

drop out. For example, students who take courses in law enforcement are primarily

interested in successfully completing a state certifying exam, which can be

accomplished with one or two semesters of coursework at the community college. The

dropout rate for students in this type of program is greatest during terms one and two.

By contrast, students in the health careers cannot improve their benefit/cost ratios by dropping out of college. Results of this analysis are consistent with a human capital theory approach to student persistence at community colleges. Students decide to enroll in college by comparing the costs and benefits of completing an education.

Stuart (2009) examined the enrollment behavior of community college students on the likelihood of transferring. Stuart (2009) found that transfer was impacted by the students' major, age, proficiency in English, proficiency in math, income level, and educational goals. Students majoring in the arts and sciences were 2.26 times as likely to transfer as those in public service technology programs. Stuart (2009) also found that there was an interaction between student age and major. For example, a 17 year old business major is much more likely to transfer than a 32 year old business major. Younger students who majored in business may have intended to obtain a bachelor's degree, whereas older students majoring in business may have taken courses in the hopes of obtaining skills applicable to the job market.

Additionally, Stuart (2009) found that regardless of major, students who were well-prepared for college were much more likely to transfer than those who were not well-prepared. Students that placed into college level English courses were 1.58 times as likely to transfer as those in the lowest level of English. Students who placed at the college level in math were 2.05 times as likely to transfer as students who placed at the lowest level of math. Student grade point average also had a significant impact on

transfer probability. A one unit increase in students' grade point average increases their likelihood of transferring by a factor of 1.11.

Other factors appeared to have an influence on student transfer to a four-year institution. Stuart (2009) found that income is a factor in transfer to a four-year institution. Low-income students were less likely to transfer than their higher income peers. Lower income students tended to pursue alternative educational goals than completing a bachelor's degree. Older students were less likely to transfer. There was no significant relationship between attendance status and transfer. Full-time attendance did not yield a statistically significant difference in the likelihood of transfer compared to part-time enrollment.

In the final analysis, Stuart (2009) examined the relationship between the students' major of study and the likelihood of achieving one of three outcomes: dropping out, transferring to a four-year institution, or completing an associate's degree. Each of the three competing outcomes was treated as competing risks and they were mutually exclusive. Due to the results of the previous two analyses, Stuart (2009) controlled for age and grade point average. Analysis was conducted for students aged 19 or younger and students aged 20 years and up. Analysis was also conducted on students who had a grade point average above 2.0 as of their final semester at the college.

Results indicate that students did consider the job market when deciding on whether to persist in college and that a connection exists between a students' major of

study and their chances of experiences one of the three outcomes under examination.

Students preparing for jobs that emphasized a particular credential, such as in the

health professions, tended to complete that credential. For example, a student's

cumulative risk of completing an associate's degree in the health career after 16

semesters of enrollment was 76%, the risk of dropping out was 21%, and the incidence

of transfer was 0%. In contrast, students in the non-credentialing health careers, such

as emergency medical technicians not requiring an associate's degree, were more likely

to drop out (59% after 17 semesters). Students in the arts and sciences programs were

not necessarily preparing for a specific occupation upon completion of their degree, but

were trying to complete the first two years of a bachelor's degree. The cumulative risk

of transferring for a four-year institution after 18 semesters was 51%, the risk for

completing an associate's degree was 22%, and the risk of dropping out was 27%.

Though Stuart's (2009) definition of younger and older differs from most of the

literature on the topic, the outcome and timing of departure differed for the two age

groups in the study. Older students (aged 20 years and above) had higher dropout rates

and lower transfer and graduation rates. However, there were important differences

with respect to timing. The risk of dropping out was higher than younger students

during semesters 1 through 10, but actually lower in semesters 14 to 16. As of semester

17, the cumulative risk of completing an associate's degree was 85% for older students

compared to 76% for younger students. For students in the arts and sciences, the

marginal probability of transferring among older students was 27% compared to 51% for younger students.

Stuart (2009) also found that students with a cumulative grade point average of 2.00 or higher as of their last semester at the college differed in their profile of placement in college level English. Dropout rates were considerably higher for students who started in developmental English compared to students who placed at college level English.

Bahr (2008)

Peter Bahr (2008a) examined the effect of academic advising on student success with regard to the concept of cooling out using EHA. Cooling out is the process of dissuading underprepared community college students from goals perceived to be overly ambitious in favor of less rigorous academic trajectories. Using data from California's 107 community colleges, Bahr (2008a) examined if cooling out was occurring and if advising differed by level of academic preparation or race/ethnicity. Bahr sought to study the effect of the timing of advising in year one and three.

One of the methodological concerns in studying the effect of timing of academic advising is that all students would need to have been retained for all periods addressed by the variables of interest, otherwise the effect of advising would be confounded. To account for variation in the timing of predictors and student's entry and exit from the community college, he used EHA to allow for the variation and to take censoring into account.

Results indicated that cooling out was not occurring among academically underprepared students (Bahr, 2008a). Additionally, baccalaureate transfer seeking students in college level English and math courses experienced significant, positive effects of advising. Students with the lowest levels of preparation, particularly in math, experienced significant, positive effects from advising. Advising seems to be beneficial for academically underprepared students. In his examination of racial/ethnic differences, there were no significant differences between White, Black, and Hispanic remedial math students and successful remediation. The effect of advising for Asian students is less clear, though it does not appear to be detrimental. However, when examining the impact of advising on transfer seeking students, as there was a significant negative impact on Hispanic transfer seeking students, indicating that advising was less beneficial for them.

Summary

This chapter presented an overview of theoretical models of student attrition and persistence and the factors related to student persistence. Also discussed was how well each persistence theory applied to the community college population and underrepresented minorities and low-income students.

Researchers developed theoretical persistence models to identify and analyze the numerous factors that influence a student's decision to remain in college or to leave. Persistence theories were discussed chronologically and included the following researchers: Astin (1970), Spady (1970, 1971), Tinto (1975, 1987, 1993), Bean and

Metzner (1985), Weidman (1989), Cabrera, Nora, and Castanada (1993), Braxton,

Hirschy, and McClendon (2004), and Perna (2006). Early models were developed with a

focus on traditional students attending four-year residential colleges and focused on

social integration over academic integration and external factors and commitments.

Researchers found that pre-entry characteristics also influenced college persistence.

More recent models were developed with a focus on nontraditional students attending

community colleges and minority students. These models theorized that a student's

decision to persist or leave college is the result of a complex interaction of variables that

include academic and social factors, academic performance, pre-college characteristics,

external factors and commitments, as well as economic and cultural capital.

A wide variety of variables have been studied as they relate to student

persistence and attrition. In this chapter the following variables were examined:

student demographics (race/ethnicity, socioeconomic status, sex, age, parent's

education, and native language), academic preparation, academic performance,

external commitments (work, marital status, parental status), student enrollment

characteristics (remedial coursework, program of study, and late registration),

enrollment patterns (student mobility patterns, enrollment intensity, starting a

community college or a four-year institution), financial aid, and institutional

characteristics. In most cases, student attrition and persistence is a complex

phenomenon that cannot be understood with a single variable explanation.

Additionally, the persistence research on minorities and students of low socioeconomic

status at community college students was contradictory and lacked a coherent vision.

An understanding of the multiple variables and their interactions is required in order to

develop comprehensive strategies to improve retention rates.

Several researchers have utilized event history analysis, to study the effects of

any of the examined variables over time. Event history analysis (EHA) identifies the

temporal aspects of persistence. Modeling variations over time will increase the

sophistication of persistence models and help design appropriate interventions to

increase college completion rates. Previous EHA studies outlined in this chapter helped

inform the research methodology and design discussed in the next chapter. Variables

analyzed in Chapter 4 were driven by the existing literature presented in this chapter.

Chapter 5 will discuss the results, study limitations, implications, and conclusions.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

Introduction

This research study utilized archival data to examine the academic factors that affect the timing of graduation and attrition. The population of focus was degree seeking, low-income, URM students that began at one of the community colleges in an urban district. The purpose of this chapter is to discuss the methods used in the research study. First, the research questions are presented. Next, an overview of the community colleges and the target study population are presented. Inclusion and exclusion criteria and procedures are described. EHA concepts and terms are discussed. Then, data sources and ethical considerations are presented. Next, an explanation of the data analysis by research question and the model specification is discussed. Last, an overview of the data variables and sources are provided.

Purpose and Research Questions

The purpose of this study was to examine the timing of academic integration factors that contribute to degree completion and attrition of low-income, underrepresented minority community college students. The specific research questions of interest are outlined below:

1. When are low-income, URM degree seeking first-time community college students most likely to graduate with an associate's degree or bachelor's degree or to drop out? How does this compare to other students?

2. To what extent do academic factors affect timing to graduation and drop out for low-income, URM community college students?

The research questions in this study attempt to identify factors related to when low-income, URM community college students graduate and when they drop out. The research addresses the need to identify the timing of academic factors that contribute most significantly to timely degree completion and attrition.

In order to identify the temporal aspect of academic integration factors associated with degree completion and withdrawal, this study used Event History Analysis (EHA). EHA is a longitudinal methodology that characterizes the probability that an individual will experience a targeted event during a specified period of time, compares the distribution of different groups who experienced the targeted event and those who did not, and then models the probability of an event as a function of targeted covariates using discrete-time logistic regression. This study examined degree seeking, first time, urban community college students over the course of seven years (20 semesters) and examined graduation and attrition outcomes with academic variables.

Overview of Community Colleges Included in the Study Population

The students in this study were enrolled in a community college system located in an urban area in the Midwest. It is one of the largest in the country, and consists of seven independently accredited colleges. During the 2000 – 2001 academic year, the starting time period of the cohort utilized in this research study, the total unduplicated headcount enrollment was close to 150,000 students. The district accounted for nearly 20% of the total enrollments at community colleges in the state with a wide range of programs in diverse mission areas. Over 250 programs of study were offered in four mission areas: liberal arts (baccalaureate transfer), workforce development (occupational/vocational career training), adult education (adult basic education, English-as-a-Second-Language, General Education Development or GED), and continuing education/personal development courses. Of the total number of students enrolled, 31% were in baccalaureate transfer programs, 36% were in adult education programs, 18% were in workforce development/occupational training programs, and 15% were in continuing education courses.

The students are racially and ethnically diverse and comprise a large proportion of minority enrollments in the state. In academic year 2000 – 2001, 80% of the overall student body within the community college district was a racial or ethnic minority, with 73% a member of an underrepresented minority group. The racial/ethnic composition was as follows: 36% Black, 36% Hispanic, 20% White, 7% Asian, and 1% American Indian. Enrollments at the community college district utilized in the study accounted for 42% of

the total minority headcount in the state in academic year 2000 – 2001. The community

college district represented 44% of Hispanic enrollments, 43% of Black enrollments, 30%

of Asian students, and 27% of American Indian students.

The overall student demographic profile of the community colleges in the study

indicates the economic challenges and external commitments students faced. Almost

half (49%) of the students with reported family incomes were below $6,000. Only 13%

of students reported a family income over $30,000. The average age of students was 31

years with 57% being over the age of 25 years. Nearly 50% of students worked full or

part-time. Nearly 40% had children and 10% were single parents. Fifty percent of

students reported that their native language was other than English.

Target Population in the Study

Community colleges are complex institutions serving a multitude of

constituencies in diverse educational mission areas. The most commonly accepted way

to categorize mission type is based on curriculum: (1) academic transfer, liberal arts, or

collegiate education; (2) vocational, occupational, workforce development or career

education; (3) remedial or developmental education for underprepared students; and

(4) personal development, continuing education, or community service education

(Cohen & Brawer, 2003; Kevin J. Dougherty & Townsend, 2006; Gill & Leigh, 2009;

McPhail & McPhail, 2006). There is much debate on which mission area community

colleges should focus on in providing education to meet the needs of the community.

Should community colleges focus on providing transfer education so that students can

eventually earn a baccalaureate degree or should they focus on career training and workforce development programs to meet the employment needs of students and business and industry? With the increased economic pressures of decreased or stagnant state funding for community colleges, this question becomes even more pressing. Evidence suggests that little consensus exists within the colleges on which direction is most appropriate (T. Bailey & Morest, 2006).

The focus of this research study was on students enrolled in associate degree programs, where much of the attention in the community college accountability debate resides. Community colleges have an important role in providing access to bachelor's degrees through their associate degree programs. As previously noted in chapter 1, the educational aspirations of high school seniors continues to rise. A study by the U.S. Department of Education (2005) found that nearly 90% of high school sophomores wanted to attend college and over 70% expected to complete a bachelor's degree (Ingels, et al., 2005). Community colleges are an entry point of access to a baccalaureate degree.

Additionally, the increased growth in enrollment at community colleges can be attributed to the baccalaureate transfer programs, as higher numbers of first generation middle and low-income students have an educational goal of attaining a bachelor's degree enroll at community colleges as a starting point (Adelman, 2005). Four year baccalaureate degree institutions have not kept pace with the demand. As the tuition for four year colleges and universities continues to rise, community colleges have an

increasing responsibility to provide transfer education to students who could otherwise not afford to pursue their postsecondary educational aspirations. It increases the importance of the role of community colleges in the educational pipeline for underserved students. Community colleges are an important point of access for low-income and minority students trying to attain their educational goals. Focus away from this important mission area could pose a threat to equity and access in higher education.

Students in the liberal arts/baccalaureate transfer mission area include students enrolled in five different degree programs: the Associate in Arts (A.A.), Associate in Science (A.S.), Associate in Engineering Science (A.E.S.), the Associate in Fine Arts (A.F.A), and the Associate in Arts in Teaching (A.A.T.). All of these programs are intended for students planning to transfer to a four-year college or university to complete their baccalaureate degree. For a description of each degree program, see Appendix A.

Students can also enroll in the numerous Associate in Applied Science (A.A.S.) degree programs that are designed primarily for students interested in acquiring technical/occupational skills to enter the job market. Along with advanced and basic certificate offerings, they constitute an important share of the occupational/career programs at community colleges and comprise a growing share of projected jobs in the U.S. job market outlook. A number of A.A.S. degree students do, indeed, transfer and graduate with a bachelor's degree. A number of four-year colleges and universities offer baccalaureate degrees designed for A.A.S. degree graduates.

Inclusion and Exclusion Criteria

In order to be included in the initial study cohort, students had to be first-time

associate degree seeking students enrolled at one of the seven community colleges in

the urban community college district. This included students enrolled in the A.A., A.S.,

A.A.T., A.E.S., A.F.A. and A.A.S. degree programs in the fall of 2000. Over 6,700 students

were enrolled in associate degree programs in the fall of 2000.

To prevent left censoring (failing to observe a student's first point of entry at a

postsecondary institution), additional procedures with the NSC data were utilized.

Using NSC data, students who were previously enrolled at another higher education

institution or concurrently enrolled at four-year institution were excluded from the

analysis (approximately 1,500 students). Students who previously earned a college

degree were also excluded (close to 200 students).

Additional exclusion criteria were added to ensure that the target population of

first time, degree seeking students was maintained. Using criteria set up by Adelman

(2006), students who earned fewer than six credits during the course of their first

academic year were excluded from the sample to exclude casual course takers (over

1,200 students). Students enrolled in high school and college dual degree programs

were also excluded. Students under the age of 16 and over the age of 65 were excluded

from the analysis (approximately 40 students). Students with missing ethnicity and

income information were excluded from the analysis as these two variables are the

focus of the study (close to 600 students). After study exclusions, a total of 3,127

students were included in the study cohort. Out of 3,127 associate degree students

remaining, 1,566 students were low-income, URM students; the focus of the study.

Comparison statistics will also be calculated for the 1,561 students in the non-target

group of low-income and URM students.

Concepts in Event History Analysis

This study utilized a discrete time event history analysis using logistic regression

with indicator variables for each of the time units (semesters) that occurred during the

study observation period (seven years or 20 semesters). By applying EHA to the study

population, the temporal process can also be examined with the outcomes. It is a

valuable tool to study persistence in higher education by addressing the issue of when

students are most at risk of attrition and what factors are the most significant in

retaining students.

Event History Analysis emphasizes the targeted event occurrence. Event

occurrence represents an individual's transition from one status to another, such as

being an enrolled student to being a graduate or drop out. EHA allows for the

measurement of specific factors during a student's college enrollment to be measured

over a period of time.

EHA requires that three methodological considerations are met: (1) there is a

target event, or clearly defined event occurrence; (2) there is beginning of time state or

initial starting point when no one in the study population have experienced the target

event; (3) there is a metric for clocking time or a meaningful unit of time when the

target event is recorded, and it can be continuous or discrete (Singer & Willett, 2003, p.

310).

Event history models can be divided into two different types: continuous and

discrete (Aalen, Borgan, & Gjessing, 2008; Allison, 1982; Singer & Willett, 2003). This

study utilized a discrete-time method to account for the differences in the timing of the

targeted event occurrences and to control for time-varying factors. Data recorded in

precise units of time, such as the number of days or hours when the target event

occurred can be considered continuous. Discrete-time data are recorded in a series of

infinite intervals, such as semesters or years. Discrete-time methods are more easily

adaptable to the higher education environment because time is most often measured in

discrete time units, instead of precise records. A discrete time method also takes into

account the magnitude of the baseline hazard rate, which is not possible to calculate in

a continuous-time model. The discrete-time method will examine how the risk of the

target event occurrences (graduation and attrition) varies over time.

The temporal nature of event history analysis is useful for the study of student

retention and persistence in higher education. College student attendance is a

longitudinal process, so applying a longitudinal methodology to study student outcomes

is beneficial. Reference to time permits the assessment of stability and the

developmental trajectories in the area of study (Yaffee & Austin, 1995). This approach

reframes the question in retention and persistence research beyond just *whether* a

student drops out or graduates to *when* a student drops out or graduates. Repeated

observations that occur during a student's course of college study permit an estimation of the rate of change and the likelihood of occurrence. Although EHA is well suited for the study of student persistence in higher education, it is not widely used in education.

Some researchers suggest that EHA is a better method to use when studying student persistence and attrition. Ishitani and DesJardins (2002) explain that when taking temporal considerations into student attrition and persistence, event history models can be more appropriate than logistic regression since logistic regression alone fails to incorporate variables whose effect and values vary over time, such as GPA. EHA allows for the inclusion of time-varying variables in which all time periods can be incorporated into one model.

Below are definitions and explanations of some of the EHA concepts to be utilized in the study.

<div align="center">Definitions</div>

Change

In longitudinal studies, change is measured, and event history analysis is a useful framework for studying change over time (Singer & Willett, 2003). Change refers to variation and differences that occur over time. Pascarella and Terenzini (2005) define change as a descriptive term that "implies no directionality, whether regression or progression. It simply means that a condition at time 2 is different from what was at time 1"(Pascarella & Terenzini, 2005, pp. 17-18).

Life Table

The life table is the "fundamental tool for summarizing the sample distribution of event occurrence" (Singer & Willett, 2003, p. 326). The life table tracks the event histories (the "lives") of the risk set (students) from the first observation period (when the target event has not been experienced) to the end of the study observation period. Life tables can be described statistically in the form of the hazard rate, survivor probabilities, and the median lifetime.

Hazard

In EHA, the hazard is the quantity used to assess the risk of the target occurrence for each semester. The hazard is the conditional probability that a student will graduate or drop out in a given semester given that the student has not achieved the target occurrence in any prior semester.

Hazard Rate

The hazard rate is the conditional probability that an individual will experience a targeted event during the observation period because they are at risk of experiencing the event.

Hazard Function

A hazard function is a plot of the hazard probabilities over time. It is expressed as a proportion determined by the number of individuals in the study population who experienced the targeted event divided by the number of individuals at risk. The magnitude of the hazard at each time interval indicates the risk for that time period.

The shape of the hazard function determines whether the risk increases, decreases, or remains constant over time.

Median Lifetime

The median lifetime is the length of time it takes for one half of the sample to complete their degree or drop out (adjusting for right-censored cases). It characterizes the distribution's center. A measure of central tendency that incorporates both censored and non-censored cases is called the median lifetime. The median lifetime is the length of time until one half of the sample attains the target event after accounting for censored cases. The median lifetime corresponds to a survival probability of 0.50 and can be considered the length of time it takes a typical student to graduate or drop out.

Censoring

A censored observation is one with incomplete information, or an individual with an unknown event time. Some students may not experience any of the target event occurrences; they may not experience the hazard of graduating or dropping out during the observation period. For example, in this study, some students may still be enrolled at the end of the six year time period. Students who do not experience the target event but remain in the sample are described as censored (specifically, right censored; see below).

Right Censoring

Right censoring occurs when an event time is unknown because the event occurrence was not observed. A student's observed time is right censored if he or she does not complete the degree or drop out by the end of the observation period used in the study. For example, if the study measures the proportion of students who complete their degree in seven years, 20% of the students may have not graduated during the six year observation period. Therefore, students who did not experience the event of interest (graduation) would be right-censored. The information is incomplete because the student did not experience the target event during the time period that he or she was part of the study due to still being enrolled. Students that become right-censored cannot be excluded from study results. An example of right censoring for the targeted event of graduation is depicted below:
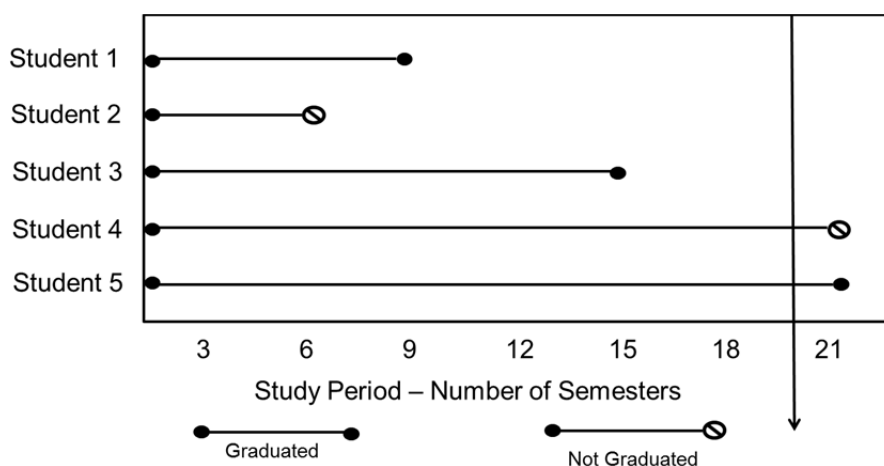
Figure 22. Example of right censoring

In the example depicted in Figure 22, the records for students four and five would be right censored. The students are still enrolled in the study sample beyond the 20 semesters examined in the study period and did not experience the target event of graduation.

Risk Set

A risk set is a group of students who did not complete their degree in a given observation period and are at risk of completing their degree by the end of that period. All students in this study are included in the risk set because they are all at risk of experiencing the targeted event (completing their degree or dropping out).

Survivor Probability

The survival probability represents the proportion of the study sample that did not experience the target event by the end of the study period. For the current study, the data are available by academic term or semester, so the numerator of the survivor probability would be computed by summing the number of students who did not experience the target event (graduation) at the end of the semester and then dividing it by the denominator or the total number of students in the study cohort. For example, the probability of experiencing the target event, gradation, in the first semester would be zero since no students should be graduating in one semester.

Survivor Function

A survivor function is a plot of the survival probabilities over the study observation period. The survivor function is the plot of the survival probability for each

semester over the study period. It provides a temporal listing of survival probabilities and decreases as a function of time.

Time Independent

Covariates that do not change over time during the study period are time independent. They have the same value at each time interval for the same study participant. An example can be someone's sex and race/ethnicity.

Time Dependent

Covariates that can change over the course of the study time period are time dependent. For example, semester GPA and enrollment intensity (full-time or part-time) may change at certain time intervals during the study period.

Competing Risks

Competing risks are variables that function as competitors of the target event occurrence of interest. All sample members begin in one state (enrolled) and then it is examined whether and when a target event occurs (drop out or graduated). In a competing risks model, all sample members begin in one state, and the study examines whether and when one of several events occur. A student may graduate or drop out of school. Dropping out is a competing risk with graduation.

<div align="center">

Data Sources and Ethical Considerations

</div>

Data for use in this study was provided by the community college district. Permission for the use of the institutional datasets was granted by the Chancellor of the community college district and came from the college district's central student

information system. All personal identifiers were removed from the datasets and case

ids were created to protect the identity of the students. Data were de-identified and

used in aggregate to protect the confidentiality of the students.

Demographic data and information on external commitments, such as work

status, number of children, was self-reported by students at the time of registration.

Testing data came from the college district's central student information system.

Course data files contained most of the academic variables for the 20 semesters

included in the study period. Additionally, an annual graduate file indicating student

completions was also utilized.

A diagram of the data sources utilized in the study is depicted in Figure 23. In

total, 48 institutional data files were utilized, along with four data files acquired through

the community college district from the National Student Clearinghouse.
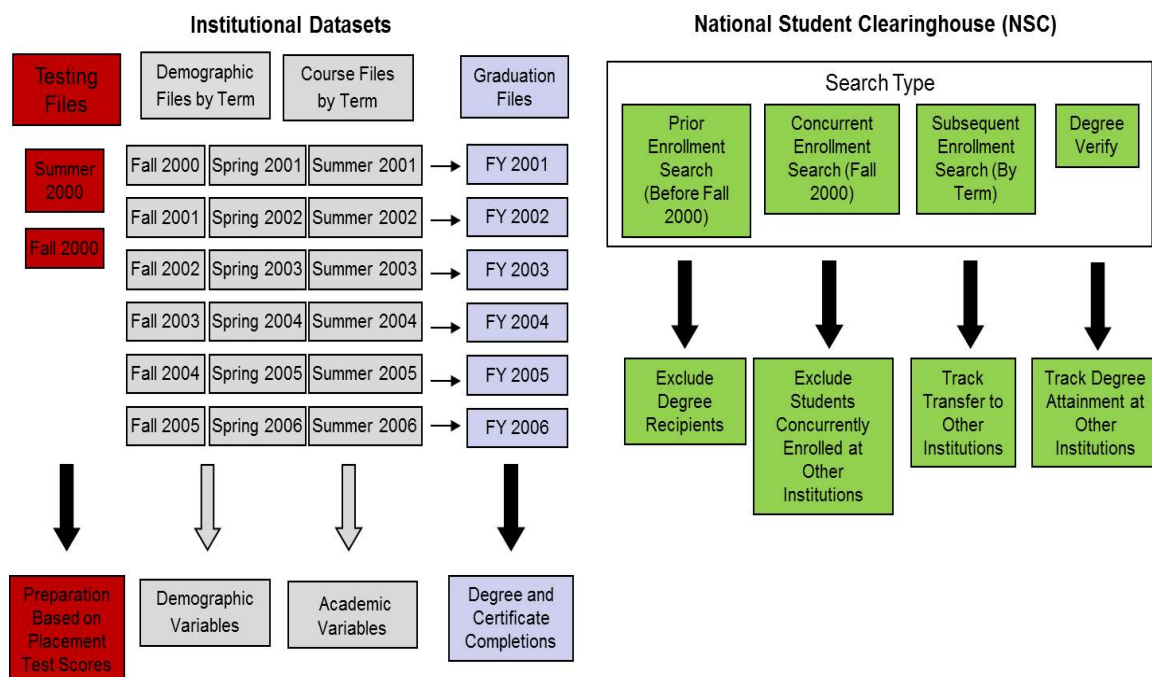
Figure 23. Data sources.

Since this study utilized a systems departure approach instead of an institutional

departure approach, it was important to try to track the students longitudinally on a

national level. In order to account for transfers, enrollment, and graduates from other

institutions, data from the National Student Clearinghouse (NSC) was utilized. The NSC

is a non-profit organization that was created in 1993 as a method for confirming the

enrollment status of financial aid recipients. It serves as a central data repository for

the collection and exchange of enrollment and degree records for all participating

institutions.

The NSC enrollment tracker function provides access to a database containing

more than 110 million current and historical enrollment records for postsecondary

students at more than 4,100 colleges, covering 93% of all U.S. college enrollments

(National Student Clearinghouse, 2011a, 2011b). The use of the NSC was expanded to include enrollment and graduation verification for higher education institutions, government organizations, and researchers. Additionally, the NSC database is available for third party recipients requesting verification of enrollment and degree attainment, such as employers, health insurers, or background screening firms. Participating colleges and universities provide NSC with regular updates throughout the year on all students enrolled in credit courses.

NSC also has additional search types. By using the NSC student tracker service, subsequent enrollment at other institutions can be used to determine transfer activity. It can also be used to determine concurrent enrollment through the concurrent enrollment search function. Prior enrollments at other institutions can also be attained through the prior attendance search function. These features allow for the exclusion of students who were previously enrolled at a four year institution or concurrently enrolled at a four year institution at the onset of the study. It also allows for the inclusion of students who continued their enrollment at other participating institutions. Response files also include enrollment intensity status (part-time or full-time enrollment) information. The degree-verify service can also be utilized to verify degree completion from subsequent institutions.

A limitation with NSC degree data is that not all schools that participate in the student enrollment function (student tracker) also participate in the degree verify service. Currently, 3,300 colleges and universities participate in the degree verify

service. Additionally, the participation start date does not necessarily cover the whole

observation period of this study, but the vast majority of institutions did.

Building the Dataset

Forty-eight institutional datasets were merged into one longitudinal data set to

represent most of the covariates and outcomes. The longitudinal data sets were

transformed into a person-period data set in which every semester that an individual

student was enrolled was represented by a separate row. The number of records in the

dataset were based on the number of variables included and the number of time

intervals. In the example in Table 1, data for two students are displayed, but there are 7

records; one row per term.

Table 1. Example of Person Period Data Set Organization

Student	Term	COVARIATES				OUTCOME
		Sex	Race/ Ethnicity	Enrollment Intensity	Term GPA	Grad, Drop, Still Enrolled
1	1	F	Black	FT	3.1	0
1	2	F	Black	FT	2.8	0
1	3	F	Black	PT	2.7	1
2	1	M	Hispanic	PT	3.8	0
2	2	M	Hispanic	PT	3.7	0
2	3	M	Hispanic	PT	3.2	0
2	4	M	Hispanic	FT	3.8	2

The target event variables are used to measure the occurrences and timings of

graduation and withdrawal.

A person-period data set was developed by transforming the longitudinal records of the 3,127 students in the present study into 20,581 person-period records. A total of 1,566 students met the criteria of being low-income and a member of an underrepresented minority group. A total of 1,561 students did not meet the criteria of being low-income and an URM.

Data Analysis and Model Specification

This section describes the data analysis procedures used to answer the research questions. SPSS Statistics, version 21 was used for the data analysis.

Research Question 1

When are low-income, URM degree seeking first-time community college students most likely to drop out or graduate? How does this compare to other students*?*

To answer the first research question, a baseline discrete-time hazard model was fitted for each target outcome of dropouts and graduates. Students were coded as leaving higher education in one of the following mutually exclusive ways: (1) dropping out (system departure); or (2) graduating with an associate's degree or bachelor's degree. If a student first receives an associate's degree before earning a bachelor's, only the first degree was used for this analysis. The cumulative incidence of achieving these outcomes was calculated for each student and time interval. Two different hazard functions were calculated for the target outcomes of graduation and drop out. Each of the baseline models describe the conditional probability that a student will experience the event during each time period, given that the event did not occur in any earlier time

period. The following discrete-time hazard model describes the risk that a student will graduate or drop out:

$$\text{Equation 1: Logit } [h(t_j)] = [\alpha_1 D_1 + \alpha_2 D_2 + \ldots \alpha_{20} D_{20}]$$

Equation 1 provides the general form of the model where $h(t_j)$ represents the hazard rate at a discrete point in time, D represents the baseline intercept parameter at time periods one through twenty. The α parameters are multiple intercept terms representing the log-odds that the student will first depart in each period, given that the student did not depart during any prior period.

The life table describes the event occurrence over the 20 semester time period. It provides an overview of whether the target events of graduation or drop out were achieved and when it was achieved by semester (see Figure 24).

Semester	Time Interval	NUMBER			PROPORTION	
		Students at the Beginning of Semester	Completed their degree during the semester	Censored at the end of the semester	Students at the beginning of the semester who completed their degree during the semester (Hazard)	Students still enrolled at the end of the semester (Survival)
0	[0,1)	4,863	-	-	0	1.000
1	[1,2)	4,863	922	0	0.1896	0.8104
2	[2,3)	3,941	456	0	0.1157	0.8843
3	[3,4)	3,485	384	0	0.1102	0.7869
4	[4,5)	3,101	359	0	0.1158	0.6958
5	[5,6)	2,742	295	0	0.1076	0.6209
6	[6,7)	2,447	218	0	0.0891	0.5656 ← MEDIAN LIFETIME
7	[7,8)	2,229	184	0	0.0825	0.5189
8	[8,9)	2,045	123	280	0.0601	0.4877
9	[9,10)	1,642	79	307	0.0481	0.4642
10	[10,11)	1,256	53	255	0.0422	0.4446
11	[11,12)	948	35	265	0.0369	0.4282
12	[12,13)	648	16	241	0.0247	0.4177

RISK SET   HAZARD FUNCTION   SURVIVOR FUNCTION

Figure 24. Example of life table describing the time to degree completion

It indicates the number of students still enrolled at the beginning of each

academic term and who are eligible to experience the target event during that time

interval (risk set). The life table displays the hazard probabilities or the proportion of

students enrolled at the start of the term that earned their degree during the term. The

survival function or the probability that the student did not complete their degree was

also calculated. Also, the median survival lifetime was calculated to characterize the

distribution's center for the target event of drop out. Since less than 50% of students

graduated, it was not possible to calculate the medial survival lifetime for that target

event.

Research Question 2

To what extent do academic integration factors affect timing to graduation and

drop out for low-income, URM community college students?

In order to test what academic integration covariates had an impact on the

probability of graduation for low-income, URM students, it was necessary to fit the

discrete time hazard model to the data with logistic regression. Odds ratios were

derived from maximum likelihood estimation of logistic regression parameters. The

following equation was used:

$$\text{Logit }[h(t_j)] = [\alpha_1 D_1 + \alpha_2 D_2 + \ldots \alpha_{20} D_{20}] + [\beta_1 x_1 + \beta_2 x_2]$$

In this model, the logit of the hazard was used where $h(t_j)$ indicates the hazard rate at a

discrete point in time; the transformed version of the hazard. A linear relationship was

defined between the data and the logit hazard. The α represents baseline logit hazard

function. D represents the baseline intercept parameter at time periods one through

twenty. β_1 and β_2 represent the slope coefficients for the block of predictor variables.

β_1 represents the input variables or the student background (SB) characteristics.

β_2 includes the environmental variables or the academic integration (AI) variables.

The equation is referred to as the link function in that it links the predictor

covariates to the outcome (Singer & Willet, 2003). The right side of the equation has

two sets of brackets. The first set of terms, $[\alpha_1 D_1 + \alpha_2 D_2 + \ldots \alpha_{20} D_{20}]$, the α are

multiplied by the time indicators and serve as multiple intercepts by time period. It

represents the value of the logit hazard when all predictor covariates are 0. The second

set of terms, $[\beta_1 x_1 + \beta_2 x_2]$, represents the shift in the baseline logit hazard function that

correspond to the predictor variables and controls for the effects of other predictors in

the model.

An inverse transformation of the logit back to the raw hazard was used to create

a nonlinear relationship between predictors and the hazard:

$$h(t_j) = \frac{1}{1 + e^{-[a1D1+a2D2+\ldots a20D20]+[b1x1+b2x2]}}$$

The statistical logit model was fit to the person-period dataset in order to represent the

log-odds of attaining the degree as a function of the covariates. The parameters were

estimated to maximize the likelihood of observing the data assuming a logistic

regression.

It was determined that a non-parametric specification of time was the best fit for the data. Twenty time dummy variables were created to allow for the examination of time as a predictor. No explicit functional restrictions were defined for how the probability of graduation is affected by time.

To get the maximum likelihood estimates of the population parameters in the discrete-time hazard model, logistic regression was conducted to regress the target events on the time indicators D_1 thorough D_{20}, and the selected time independent and time dependent covariates in the person period dataset. Variables were organized into two conceptual blocks (Table 2).

Table 2. Variables Included in the EHA Models by Conceptual Block

BLOCK ONE: STUDENT BACKGROUND CHARACTERISTICS (Time Independent)	BLOCK TWO ACADEMIC INTEGRATION VARIABLES (Time Dependent)
DEMOGRAPHIC	**ENROLLMENT INTENSITY**
Sex	Part Time or Full Time Enrollment
Race/ Ethnicity	**REMEDIATION**
Age at Entry	Enrolled in Remedial Reading, English, Math
Household Income	Earned A-C, S in Rem. Reading, English, Math
Native Language	**MILESTONES**
ACADEMIC PREPARATION	Earned 20 Credit Hours
	Earned an Advanced or Basic Certificate
Preparation Based on Placement Test Scores in Reading, English, Math	**ACADEMIC PERFORMANCE**
	Term GPA
	# Credit Hrs Attempted/Earned
HS Diploma/GED	Earned A-C in College Level English or Math
EXTERNAL COMMITMENTS	**ACADEMIC RISK FACTORS**
Employment	(1) # of Withdrawals (2) # of D's and F's (3) Academic Hold (4) Took an online course
Marital Status	**ENROLLMENT PATHWAYS**
Children	(1) Transferred to a 4 Yr Institution (2) Stop out

Using the two conceptual blocks and the time variables, four models were created:

$$\text{Model A:} \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + \ldots + \alpha_{20} D_{20}\right]$$

$$\text{Model B:} \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + \ldots + \alpha_{20} D_{20}\right] + \beta_1 SB$$

$$\text{Model C:} \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + \ldots + \alpha_{20} D_{20}\right] \qquad + \beta_2 AI$$

$$\text{Model D:} \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + \ldots + \alpha_{20} D_{20}\right] + \beta_1 SB + \beta_2 AI$$

The first model, Model A, includes only the main effect of the time indicators; the simple baseline hazard with the time dummy variables. Since no predictive covariates are included in Model A, it describes the baseline for the entire sample. Model B includes the main effect of time and the vector of all student background (SB), pre-enrollment characteristics ($\beta_1 SB$). Model C includes the main effects of time and the vector of academic integration (AI) variables ($\beta_2 AI$). Model D includes the main effects of time, student background characteristics, and academic integration covariates.

Overview of Study Variables

The study included time dependent variables (course taking behavior, enrollment pathways, financial aid indicators), as well as time independent variables (demographic characteristics). Below is a listing of all of the variables and their time dependent or independent status:

Student Background Characteristics: Demographics

Sex

Sex classification is self-identified on the student registration form as "gender" and can be either male or female. Students were not given other options, but could leave it blank. If left blank, it was coded as missing.

Race/Ethnicity

Ethnicity is an affiliation to a specific group of people historically connected by a culture, national origin, language, and community. Race is a self-identified social-political construct used to classify people based on social and cultural characteristics, common ancestry, nationality, or history. Race and ethnicity are considered to be separate identities and identified through two distinct questions by the U.S. Census and U.S. Department of Education. U.S. Census respondents are first asked to categorize themselves by ethnicity in terms of *Hispanic or Latino* or *not Hispanic or Latino*, then by race. However, when students in the study cohort began college, in 2000, race and ethnicity was asked as a single question on the student registration card. Students were asked to identify their *ethnic group* and were given the following five choices: (1) White; (2) Black; (3) Hispanic; (4) Asian/Pacific Islander; (5) American Indian/Alaskan Native. Additionally, students could only choose one racial/ethnic group and were not given the option of belonging to more than one group. Some students chose not to answer this question and were coded as missing. Therefore, for the purpose of this study, race/ethnicity was treated as a single construct self-identified through the student registration card. Students belonged to one of the five racial/ethnic groups provided on the form. Students with missing ethnicity were excluded from the study.

Underrepresented Minority

Students who have self-disclosed on their student registration card that that are from one of the following ethnic and/or racial groups: Black, Hispanic, American

Indian/Alaskan Native were considered an underrepresented minority. Different from many other government and higher education institutions, this definition is not exclusive to U.S. citizens or permanent residents due to the high number of undocumented students in the community college. The exclusion of the citizenship criteria is a current practice of many community colleges. If race/ethnicity is missing, they were excluded in this category as well.

Age at Entry

Date of birth is collected on the student registration form and is a required field. Age of entry is calculated by subtracting the date of birth from the registration form from the date of the first day of class at the start of the study period. Students under the age of 16 and over the age of 65 were excluded from the analysis. On occasion, students incorrectly enter the current date instead of their date of birth. In these instances, the date of birth will be recoded as missing and were excluded.

Household Income

Household income is self-disclosed on the student registration form. Household income reported at the beginning of the study period (first semester) will be utilized for this study. Household income is collected from the student registration form as *family income*. If household income is missing or *not indicated,* they were excluded from the URM low-income analysis.

Low-Income

Low-income students is defined as students who fall within 150% of the federal

poverty guidelines in 2000 (U.S. Department of Health and Human Services, 2000).

Federal poverty guidelines are dependent upon the number of people in the household,

so the low-income levels depends on the marital status and number of dependents

disclosed on the students' first semester registration card. The 2000 US Department of

Health and Human Services Federal Poverty Guidelines can be found in Table 3.

Table 3. U.S. Department of Health and Human Services Federal Poverty Guidelines

Size of Family Unit	Poverty Threshold	150% of the Poverty Threshold
1	$ 8,350.00	$ 12,525.00
2	$ 11,250.00	$ 16,875.00
3	$ 14,150.00	$ 21,225.00
4	$ 17,050.00	$ 25,575.00
5	$ 19,950.00	$ 29,925.00
6	$ 22,850.00	$ 34,275.00
7	$ 25,750.00	$ 38,625.00
8	$ 28,650.00	$ 42,975.00
9	$ 31,550.00	$ 47,325.00
10	$ 34,450.00	$ 51,675.00
11	$ 37,350.00	$ 56,025.00

From U.S. Department of Health and Human Services. (2000). 2000 Annual Update of
the Human Health Services Poverty Guidelines Retrieved March 15, 2005, from
http://aspe.hhs.gov/poverty/00computations.htm

Household size was calculated from the marital status and number of children variables

from the student registration card. The low-income variable was calculated by using

the household size and household income from the student registration card.

Native Language

Native language information was collected from the students' first semester

registration card. Students were asked, "*Is English your native language?*" Responses

were coded as yes or no. For this analysis, students were coded as either native English

language speakers or not native English speakers.

Student Background Characteristics: Academic Preparation

At the time of entry, students take various placement tests to determine if they

are at college level in reading, writing, and mathematics. Placement test scores were

categorized as at college level or below in reading, writing, and math according to the

district's placement test policy guidelines.

Environment: External Commitments

Employment

Employment status was collected from students' first semester registration

form. On the student registration form, students were given the following

employment status options: (1) full-time (over 30 hours); (2) part-time (over 15 hours);

(3) part-time (15 hours or fewer); (4) homemaker; (5) unemployed; (6) other.

Employment status will be recoded as: full-time, part-time, unemployed, and other.

Although employment status can change over the course of one's college enrollment,

employment status was used as a time independent variable based on the first point of

entry. The institutional practice was not to update this field consistently in subsequent

semesters of enrollment across all semesters included in the study.

Marital Status

Marital status is the condition or being married or unmarried. Marital status was collected from the students' first semester registration form. Students were given two choices for marital status: single or married. Although marital status can change over the course of one's college enrollment, for the purpose of this study, marital status was used as a time independent variable since it was not regularly updated by all of the colleges after the first semester entry.

Number of Children

Number of children was collected from the student's first semester registration form. It is an open text field.

<div align="center">Academic Variables by Term: Remediation</div>

Developmental Coursework

Using the institutional data files that contain course level data on students enrolled during the study period, grades attempted and earned in remedial coursework were identified. For any remedial course attempted in reading, English, or math, course outcomes were coded to indicate whether the student successfully completed the coursework or did not. It was coded for each student if they successfully completed remedial coursework overall, in reading, English, and in mathematics by semester.

Academic Variables by Term: Academic Performance

Number of Baccalaureate/Transfer Credit Hours Attempted/Earned

Using the institutional data files, the cumulative number of

baccalaureate/transfer credit hours attempted and earned was calculated for each

student by term.

Grade Point Average

Using the institutional data files, the student's semester grade point average was

indicated, along with the cumulative grade point average.

Academic variables by term: Academic integration, academic risk factors.

Number of Withdrawals

Using the institutional data files, the cumulative number of withdrawals was

calculated by term.

Number of Ds and F's

Using the institutional data files, the cumulative number of D's and F's earned was

calculated by term.

Grade Point Average Below 2.5

Using the institutional data files, when a student's grade point average falls

below 2.5, it was noted by the applicable academic term.

Academic Hold

Using the institutional data files, the cumulative number of withdrawals was

calculated by term.

Academic Variables by Term: Milestones

Twenty Credit Hours Earned

Using the institutional data files, when a student reaches twenty credit hours

earned, it indicated in the data file by semester.

Academic and financial variables by term: Enrollment intensity.

Enrollment Status

Using the number of credit hours attempted each term in the institutional data

files and the NSC files (if the student transferred and was attending college outside of

the community college system), it was noted if the student was attending full-time (12

or more credit hours) or part-time (less than 12 credit hours) for each academic term.

Stop out, Continuous Enrollment

Using the institutional data files and the NSC files, it was noted if the student was

continuously enrolled in the higher education system by academic term.

Degree Completion

Institutional associate degree completion was indicated in the data file through

the use of the institutional completion file. Through the use of the National Student

Clearinghouse (NSC), subsequent enrollment at other higher education institutions was

tracked. If a student earns an associate's degree or bachelor's degree at another

institution, it was indicated in the data file and accounted for in the model. Differences

in outcomes at the institutional level will be discussed in chapter 4.

Summary

The purpose of this chapter was to discuss the methodology of the study. The purpose and research questions were presented. An overview of the community colleges and the target study population was presented, along with study inclusion and exclusion criteria. EHA concepts and terms were discussed. Data sources and ethical considerations were discussed, along with an explanation of how the dataset was constructed and coded. Data analysis procedures were presented, along with model specifications. In Chapter 4, the analysis and study results will be presented.

CHAPTER FOUR

DATA ANALYSIS

Introduction

This chapter provides descriptive statistics of the study population; the variables

used in the analysis, the results of the analysis, and how the research questions were

answered. This study examined associate degree seeking, first time, urban community

college students over the course of seven years (20 semesters) and examined their

outcomes. The purpose of this study was to examine the timing of academic integration

factors that contribute to degree completion of underrepresented minority and low-

income community college students using Event History Analysis.

Organization of Data Analysis

First, descriptive statistics are presented for the student background

characteristics, then academic integration variables utilized in the conceptual model.

Descriptive data are presented for low-income, URM students. To serve as a

comparison, descriptive data were also presented for students that did not meet both

criteria of being low-income and of an underrepresented minority group – referred to as

all others. Chi-squares and t-tests were run to check for statistically significant

differences among low-income, URM students and all other students.

Next, the criterion and coding are presented, along with a discussion and rationale on the decision to conduct separate analyses for graduation and dropout outcomes instead of a competing risks methodology. Missing data are discussed, as well as the methodological approaches used in dealing with it. Then, data on transfer activity and outcomes at the end of the seven year study period are presented for low-income, URM students and all other students. Outcomes include the two target events – graduation and drop out – and counts of students still enrolled.

In order to address the research questions, analysis using EHA methodology is presented. Life tables that summarize the timing distribution of event occurrence of graduation and drop out for low-income, URM students are displayed. Baseline hazard functions and hazard probabilities, baseline survivor functions and survivor probabilities for graduation and withdrawal are presented for low-income, URM students. The same EHA results are then displayed for the comparison group (all other students) – life tables, baseline hazard functions and hazard probabilities, baseline survivor functions and survivor probabilities for graduation and drop out.

Data transformations were discussed and parameter coding was provided. In order to test what academic integration covariates impacted the probability of graduation for low-income, URM students graduate, it was necessary to fit the discrete time hazard model to the data with logistic regression. Odds ratios were derived from maximum likelihood estimation of logistic regression parameters.

Four models were examined. The first model, Model A, included only the main effect of the time indicators; the simple baseline hazard with the time dummy variables. Model B included the main effect of time and the vector of all student background (SB), characteristics (β_1SB). Model C included the main effects of time and the vector of academic integration (AI) variables (β_2AI). Model D included the main effects of time, student background characteristics, and academic integration covariates. After checking for goodness of fit, the complete model was determined to be the most appropriate.

Descriptive Statistics

Student Background Characteristics

Demographic Characteristics

After study exclusions, a total of 3,127 students were included in the study cohort. Low-income, URM students accounted for 1,566 students, or 50% of the degree seeking students. Demographics of the low-income, URM students, and the comparison group (all others) can be found in Table 4. Of the low-income, URM group, 69% were Black, 30% were Hispanic, and less than 1% were American Indian. Sixty-seven percent were female. The mean age was 22.8 years. The majority of students, 76%, were less than 25 years of age; 15% between the ages of 26 to 35; 6% between the ages of 36 to 45 years; and 2% were over the age of 45. The majority of students, 76%, had a family income of under $9,000. The native language was English for 80% of students. Most students, 80%, had a high school diploma.

The comparison group was comprised of the remaining group of students, or individuals who do not meet the both criteria of being low-income and an underrepresented minority. Of those students, 42% were White, 22% were Black, 20% were Hispanic, 17% were Asian, and 0.2% were American Indian. The majority, 57%, were female. The mean age was 23.8 years. The majority of students, 72%, were under 25 years of age (SD = 7.8), 17% between the ages of 26 to 35, 8% between the ages of 36 to 45 years, 4% were over the age of 45. Income levels were fairly distributed: 24% had a family income of under $9,000, 7% was between $9,000 and $14,999, 16% between $15,000 and $20,999, 24% between $21,000 and $29,000, and 30% making over $30,000. The native language was English for 63% of students.

Table 4. Demographic Characteristics

Demographic Variables	Low-income, URM Students	All Others
Number of Students	1,566	1,561
Race/Ethnicity*		
Asian	-	16.9%
American Indian	.9%	.2%
Black	68.8%	21.7%
Hispanic	30.3%	19.6%
White	-	41.6%
Sex*		
Female	67.4%	56.6%
Male	32.6%	43.4%
Age*		
25 years and under	76.2%	72.0%
26 to 35 years	15.3%	16.8%
36 to 45 years	6.3%	7.5%

Over 45 years	2.1%	3.7%
Mean	22.8	23.8
Income*		
Under $9,000	76.4%	23.6%
$9,000 to $14,999	16.9%	6.92%
$15,000 to $20,999	4.3%	15.8%
$21,000 to $29,999	1.9%	23.7%
Over $30,000	0.4%	30.0%
Native Language*		
English	79.8%	62.7%
Other	20.2%	37.3%

* Statistically significant

A chi square goodness of fit test indicated that the differences among the groups for the demographic variables were significant: race/ethnicity, X^2 (4, N = 3127) = 1341.3, p < .001; sex, X^2 (1) = 38.7, p < .001; income, X^2 (4) = 1356.2, p = .001; and native language English, X^2 (1) = 111.6, p < .001. There was also a significant difference in age between the low-income, URM students (M = 22.8, SD = 7.8) and the comparison group (M = 23.8, SD = 8.7), t(3125) = -3.3, p < .001.

External Commitments

Community college students tend to have more external commitments than traditional students attending four year baccalaureate institutions. A larger proportion of community college students have full-time jobs, are married, and/or have children. The majority of the low-income, URM students in this study were employed; 32% were employed full time, 28% were employed part-time, and 36% were not employed. About 10% were married, but the majority of students were single. One third of low-income,

URM students had children; 81% of them were single parents. Nearly 20% of the low-

income, URM students had more than one child; 10% had three or more children.

External commitments of the low-income, URM students, and comparison group can be

found in Table 5.

Table 5. External Commitments

External Commitment Variables	Low-income, URM Students	All Others
	%	%
Employment Status*		
Full-time	32.4%	44.8%
Part-time	28.0%	27.4%
Not employed	35.9%	25.4%
Other/Unknown	3.7%	2.4%
Marital Status*		
Married	9.5%	17.8%
Single	90.5%	82.2%
Parental Status*		
No Children	67.3%	82.3%
Has Children	32.7%	17.7%
Single Parent	80.7%	43.1%

* Statistically significant

Chi square goodness of fit tests and a two sample t-test were performed to see if

there was a difference in any of the external commitment variables between the low-

income, URM group and all other students. Low-income, URM students reported higher

levels of unemployment, single status, and having children compared to all other

students. Results indicated significant differences among the groups. Differences in

employment status were significant, X^2 (3, N = 3127) = 63.4, p < .001. A higher

proportion of low-income, URM students were not employed (36%) compared to the all

other students (25%); more students in the comparison group worked full-time (45%)

compared to the low-income, URM group (32%). Differences in marital status were

significant, X^2 (1) = 45.6, p < .001. A higher proportion of low-income, URM students

were single (91%) compared to all other students (82%). Differences in being a single

parent were also significant, X^2 (1) = 194.7, p < .001. Of the students with children, a

higher proportion of low-income, URM students were single parents (81%) compared to

all other students (43%). There was a significant difference in the number of children

reported by low-income, URM students (M = .69, SD = 1.27) and the comparison group

(M = .31, SD = .79), t(3125) = 10.06, p < .001. Low-income, URM students had a higher

number of children compared to other students.

Academic Preparation

As previously discussed, many community college students are underprepared

for college and scored below college level on entrance exams in English, reading, and

math. The majority of low-income, URM students scored below college level in all

areas: 57% in reading, 74% in English, and 95% in math. Most low-income, URM

students, 81%, earned a high school diploma and 20% earned a GED. Academic

preparation of the low-income, URM students, and comparison group of all other

students can be found in Table 6.

Table 6. Academic Preparation

Academic Preparation	Low-income, URM Students	All Others
	%	%
Academic Preparation: Below College Level (Of Those Tested)		
Reading*	57.3%	40.2%
English*	73.9%	59.5%
Math*	94.9%	85.1%
All Areas*	28.8%	13.4%
HS Diploma or GED		
High School Diploma	80.5%	87.3%
GED	19.5%	12.7%

* Statistically significant

Low-income, URM students were less prepared in all subject areas. A chi square goodness of fit test indicated that the differences among the groups for the academic preparation variables were significant. On the entrance exams, 57% of low-income, URM students scored below college level in reading compared to 40% for all other students, X^2 (2, N = 3127) = 114.5, p < .001. More low-income, URM students scored below college level in English (74%) compared to the comparison group (60%), and the differences were statistically significant, X^2 (2) = 134.2, p < .001. In math, 95% of low-income, URM students scored below college level in math compared to 85% for all other students and the difference was significant, X^2 (2) = 81.5, p = .001. A higher proportion of low-income, URM students scored below college level in all three subject areas (29%) compared to all other students (13%), and the difference was significant, X^2 (1) = 111.5, p < .001. Additionally, a higher proportion of low-income, URM students earned a GED

(20%) compared to all other students (13%), and the difference was significant, X^2 (1) = 26.7, p < .001.

<div align="center">Academic Integration Variables</div>

With the exception of remedial coursework, most of the academic integration variables were time dependent. However, for the sake of providing some basic descriptive statistics on academic integration, overall or first semester values were provided in this section.

Remedial Courses

The community college district in this study did not have a mandatory placement policy. However, the majority of students did take a remedial level course in reading, English, and/or math. A total of 86% of the low-income, URM students enrolled in remedial course of any kind. At any point in the seven year tracking period, 43% of low-income, URM students enrolled in a remedial reading course, 57% enrolled in a remedial English course, and 86% enrolled in a remedial math course. Many students took more than one course in each subject area or had to repeat the same course. Of the low-income, URM population, 7% took more than one remedial course in reading, 5% took more than one remedial course in English, and 10% took more than one remedial course in math. More information on remedial coursework can be found in Table 7.

Many students successfully completed a remedial course. Of the low-income, URM students, 77% earned an A, B, or C in at least one remedial course. Of the total low-income, URM population, 58% earned an A, B, or C in a remedial math course, 48%

earned an A, B, or C in a remedial English course, and 36% earned a satisfactory grade

(grade S) in a remedial reading course. Many students did not successfully complete a

remedial course. A large portion of low-income, URM students, 46%, earned grades of

D or F in at least one of the remedial courses. Of the total low-income, URM population,

37% earned a D or F in a remedial math course, 17% earned a D of F in a remedial

English course, and 10% earned an F in a remedial reading course.

Table 7. Remedial Coursework

Remedial Courses	Low-income, URM Students	All Others
	%	%
Reading		
Enrolled in a remedial reading course*	43.0%	28.1%
Enrolled in more than one course (includes repeats; % of total pop)*	6.8%	4.5%
Earned S (Satisfactory) in any remedial reading course*	36.0%	24.5%
Earned F in any remedial reading course*	10.4%	5.8%
English		
Enrolled in a remedial English course*	56.7%	38.4%
Enrolled in more than one course (includes repeats; % of total pop)*	4.7%	3.2%
Earned A, B, or C in any remedial English course (% of total pop)*	48.0%	33.1%
Earned an F in any remedial English course (% of total pop)*	16.9%	9.2%
Math		
Enrolled in a remedial math course*	80.5%	62.1%
Enrolled in more than one course (includes repeats; % of total pop)*	10.3%	6.6%
Earned A, B, or C in any remedial math course (% of total pop)*	58.4%	48.9%
Earned D or F in any remedial math course (% of total pop)*	36.7%	19.6%
All Areas		
Enrolled in a remedial course in reading, English or math*	85.8%	70.0%
Earned A, B, or C in any remedial course (% of total pop)*	76.8%	61.9%
Earned D or F in any remedial course (% of total pop)*	45.8%	26.1%

* Statistically significant

In terms of remediation, low-income, URM students enrolled in more remedial

reading (43%), English (57%), and math (81%) courses than all other students (28%, 38%,

62%, respectively). Chi square goodness of fit tests indicated that the differences

among the groups for enrollment in remedial courses were significant: enrolled in a

remedial reading course, X^2 (1, N = 3127) = 75.9, p < .001; enrolled in a remedial English

course, X^2 (1) = 105.4, p < .001; math, X^2 (1) = 130.7, p = .001. A higher proportion of

low-income, URM students enrolled in any remedial course (86%) than all other

students (70%), and the difference was significant, X^2 (1) = 114.1, p < .001.

Low-income, URM students were less successful in their remedial coursework.

They earned a lower percentage of grades of A's, B's, or C's or Satisfactory and more D's

and F's in all subject areas. Differences among the groups in terms of grades earned

were significant: earning a S grade in a reading course, X^2 (1, N = 3127) = 48.9, p < .001;

earning an A, B, or C in a remedial English course, X^2 (1)= 71.4, p < .001; earning an A, B,

or C in a remedial math course, X^2 (1) = 29.1, p < .001; earning an A, B, or C in any

remedial course, X^2 (1) = 81.9, p < .001; earning an F in a reading course, X^2 (1) = 22.1, p

< .001; earning a D or F in a remedial English course, X^2 (1) = 40.3, p < .001; earning a D

or F in a remedial math course, X^2 (1) = 113.3, p < .001; and earning a D or F in any

remedial course, X^2 (1) = 132.0, p < .001.

Successful Completion of College Level English and Math Courses

Successful completion of a college level English or math course can be an

important factor in a student's decision to persist to graduation. In this study, almost

half (46%) of all low-income, URM students earned a grade of A, B, or C in a college level

English course. However, only 13% successfully completed a college level math course.

More information on the successful completion of English and math courses can be

found in Table 8.

Table 8. College Level English and Math Courses

College Level English or Math	Low-income, URM Students	All Others
	%	%
English*		
Successfully completed a college level English course (Grades A – C)	46.0%	51.5%
Math		
Successfully completed a college level Math course (Grades A – C)	14.2%	18.3%

* Statistically significant

A lower proportion of low-income, URM students successfully completed a

college level English course (46%) compared to all other students (52%). A chi square

goodness of fit test indicated that the differences among the groups in terms of

successfully completing a college level English course was significant, X^2 (1, N = 3127) =

9.4, p = .002. A lower proportion of low-income, URM students successfully completed

a college level math course (14%) compared to all other students (18%). A chi square

goodness of fit test indicated that the differences among the groups in terms of

successfully completing a college level math course was significant, X^2 (1, N = 3127) =

9.403, p = .002.

Credit Hours Attempted/Earned

For the purpose of this section, only the first semester credit hours attempted

and earned was presented. In the first semester, the ratio of credit hours attempted to

credit hours earned was 0.79. The majority of students completed all courses that they

attempted (57%), earning a ratio of 1.0. Eighteen percent earned a ratio of 0.7 to 0.9,

20% earned a ratio of 0.4 to 0.6, and 5% earned a ratio of 0 to 0.3. More information on

the successful completion of English and math courses can be found in Table 9.

Table 9. Credit Hours Attempted/Earned Ratio

Credit Hours Attempted and Earned, First Semester	Low-income, URM Students	All Others
	%	%
Ratio of Credit Hours Attempted /Earned*		
0 to 0.3	5.4%	3.5%
0.4 to 0.6	19.6%	13.6%
0.7 to 0.9	18.3%	13.6%
1.0	56.8%	69.3%
Average	0.79	0.84

* Statistically significant

T-tests were conducted to test for differences in the ratio of credit hours

attempted and earned between the low-income, URM group and the comparison group.

There was a significant difference in the ratio of credit hours attempted to credit hours

earned by low-income, URM students (M = 0.79, SD = 0.25) and the comparison group

(M = 0.84, SD = 0.23), t(3127) = -6.127, p < .001. Low-income, URM students attempted

more credit hours than the comparison group, but ended up earning less credit hours at

the end of the semester.

Term GPA

For the purpose of this section, only the first semester term GPA values were presented. For the EHA regression analysis, term GPA was included as a time dependent variable examined on a by term basis. In the first semester, the average GPA for low-income, URM students was 2.22. Forty-four percent of students had a GPA over 2.5 and 36% had a GPA under 2.0. More information on first semester GPA can be found in Table 10.

Table 10. First Semester GPA

GPA	Low-income, URM Students	All Others
	%	%
Under 2.0*	35.5%	18.9%
Over 2.5*	43.3%	64.8%
Average*	2.22	2.76

* Statistically significant

A T-test was conducted to test for group differences in first term GPA, indicating a significant difference in the first semester GPA earned by low-income, URM students (M = 2.22, SD = 1.00) and the comparison group (M = 2.76, SD = 1.03), t(3127) = -14.634, p < .001. A chi square goodness of fit test indicated that the differences among the groups in terms of first term GPA under 2.0 was significant, X^2 (1, N = 3127) = 106.55, p < .001. Differences among groups for GPA over 2.5 was also significant, X^2 (1, N = 3127) = 140.00, p < .001.

Academic Integration Risk Factors

For the purpose of this section, only the first semester risk factors were

presented. In the first semester, 31% of low-income, URM students withdrew from at

least one course. Ten percent withdrew from more than one course. The average

number of withdrawals was 0.49. In terms of F grades earned, 28% of low-income, URM

students received at least one F grade in the first semester. An additional 17.6% earned

two or more F grades.   Also, 20% of low-income, URM students had a financial hold

placed on their record. More information on first semester risk factors can be found in

Table 11.

Table 11. First Term Risk Factors

Risk Factors	Low-income, URM Students	All Others
	%	%
Number of Withdrawals*		
0 – no withdrawals	69.0%	73.0%
Withdrew from at least one course	31.0%	27.0%
1 course only	20.6%	17.8%
2 courses	6.0%	5.6%
3 or more courses	4.4%	3.5%
Average	0.49	0.42
Number of F Grades Earned*		
0 – no F grades earned	71.8%	84.8%
F in at least one course	28.2%	15.2%
1 course only	18.4%	10.3%
2 courses	7.9%	3.9%

3 or more courses	1.9%	1.0%
Average	0.40	0.21
Financial Hold*		
Yes	19.5%	10.8%

* Statistically significant

Although a lower percentage of low-income, URM students withdrew from courses in the first semester (69%), the withdrawal average was higher (0.49) since they withdrew from more courses. A t-test indicated a significant difference in the number of withdrawals by low-income, URM students (M = 0.49, SD = .93) and the comparison group (M = 0.42, SD = 0.874), t(3127) = 2.053, p = .040. Low-income, URM students also earned a higher percentage of F grades in the first term than the comparison group. A t-test indicated a significant difference in the number of F grades earned by low-income, URM students (M = 0.40, SD = .724) and the comparison group (M = 0.21, SD = 0.554), t(3127) = 8.193, p < .001. A chi square goodness of fit test indicated that the differences among the groups in terms of first term financial hold was significant, X^2 (1, N = 3127) = 45.113, p < .001.

Enrollment Intensity

One-third of low-income, URM students were enrolled part-time in the first semester. The lower than normal rate of students attending part-time can be partially attributed to one of the exclusion criteria. Students enrolled in less than 6 credit hours in the first term were excluded from the analysis to try to exclude casual course takers. When looking at enrollment intensity over the course of the 20 semester period, it is

common for many students to go back and forth between part-time and full-time

enrollment. In later semesters, the percentage of students enrolled part-time increases.

For example, in semester 20, the percentage of low-income, URM students enrolled

part-time increased to 62%. This makes sense as more people who were enrolled full-

time graduate or transfer. Information on enrollment intensity by group can be found in

Table 12.

Table 12. First Semester Enrollment Intensity

Enrollment Intensity	Low-income, URM Students	All Others
	%	%
Part-time	33.3%	41.8%
Full-time	66.7%	58.2%

* Statistically significant

A lower percentage of low-income, URM students attended college part-time

(33%) compared to all other students (42%). A chi square goodness of fit test indicated

that the differences among the groups in terms of enrollment intensity was significant,

X^2 (1, N = 3127) = 24.225, p < .001.

Milestones

According to Adelman (2001), the acquisition of 10 credit hours is a major

milestone for persistence to graduation. However, the majority of students in this study

achieved this milestone without graduating, so the acquisition of 20 credit hours was

used instead.

Another milestone en route to an associate's degree is earning a basic or advanced certificate. Only 10% of low-income, URM students received a basic or advanced certificate en route to completion of their associate degree program. More information on milestones by group can be found in Table 13.

Table 13. Milestones Achieved

Milestones	Low-income, URM Students	All Others
	%	%
20 Credit Hours*	85.2%	77.3%
Earned a basic or advanced certificate	10.4%	8.6%

* Statistically significant

A higher percentage of low-income, URM students also successfully achieved the milestone of earning 20 credit hours (85%) compared to all other students (77%). A chi square goodness of fit test indicated that the differences among the groups was significant, X^2 (1, N = 3127) = 32.299, p < .001. A higher percentage of low-income, URM students also successfully achieved the milestone of earning a basic or advanced certificate (10%) compared to all other students (9%). A chi square goodness of fit test indicated that the differences among the groups were not significant, X^2 (1, N = 3127) = 2.849, p = .091.

Criterion

Graduation is the main outcome of interest in this study as this is the goal of students when they enroll in associate degree programs. In the person-period dataset, two variables were created to examine both graduation and drop out as the target

event. GRAD was coded as 1 if the student graduated (GRAD = 1).   DROP was coded as

1 if the student dropped out (DROP = 1). Table 1 in Chapter 3 provides an example of

the person-period record dataset structure.

Due to the complex mobility patterns of community college students (Adelman,

1999; Goldrick-Rab, 2006; Kuh, 2001), this study utilized a systems departure approach.

If a student leaves one college but enters another, the student is not a drop out as he or

she did not leave the higher education system, but departed from the institution. The

criterion coding for a student who attended multiple institutions was coded the same as

a student who attended only one institution since the focus was on the outcome of the

student, not the institution. However, institution type can vary semester by semester,

so institution name, type, control (public or private), and location was coded accordingly

by semester. Students were coded as a drop out if they drop out of the higher

education system all together and did not return during the study period of seven years.

A student who stops out, but then returns at any point during the study period was not

coded as a drop out, but as a stop out. If the stop out student was still enrolled at the

end of the study period, they were censored. In the case of students that graduated

with multiple degrees during the study period, only the first degree was used in the

regression analysis. Allison (2010) suggests that if the average number of events per

individual is less than 2, the best approach is to restrict attention to the first event.

Allison (1995) provides a method that allows for separate analyses for each

event without biasing parameter estimates and with minimal loss of precision. Allison

(1995) outlines the benefits of conducting the analysis separately, as opposed to simultaneous analysis of the events in a competing risks analysis in order to focus on the events of interest. One model could be estimated for graduates, treating the drop outs and those still enrolled as censored observations. Then, a model could be estimated for drop outs with the graduates and those still enrolled treated as censored observations.

Missing Data

An important consideration for this study was how to handle missing data. Since the focus of this study was on low-income, URM students, it was critical for the ethnicity and income data to be accurate. Since the sample size was fairly large, the decision was made to exclude cases where data for ethnicity and income were missing. As noted in the inclusion/exclusion section, this accounted for over 600 students being excluded from the analysis. For missing data in the predictor variables, missing data were coded as unknown, otherwise listwise deletion was used in the analysis. The percentage of missing data was less than 10%, so the use of listwise deletion, when applicable, was appropriate.

Transfer Activity

In many EHA studies, transfer is also included as an outcome for the community college population. Transfer activity was tracked, but was ultimately excluded as a target event as results indicated that the majority of transfer students dropped out of their transfer institution shortly after transferring. The goal for students is degree

completion, and within this study period, many of transfer students had already dropped out of the higher education system.

Descriptive results, found in Table 14, provide information on transfer activity and information on the transfer institutions. Nearly 28% of low-income, URM students transferred to another higher education institution; 15% transferred to a four year institution. Low-income, URM students transferred to over 120 different institutions in over 27 different states. Out of transfers, the majority transferred to a four year institution (54%), an in-state institution (82%), and to a public institution (70%).   Only 20% earned their associate degree before transferring to a four year institution. Most students transferred in their 9th term, or the end of the third year.

Table 14. Transfer Activity

Transfer Outcomes	Low-income, URM Students		All Other Students	
	Number	%	Number	%
Transferred	431	27.5%	550	38.5%
Institution Type (% of transfers)				
Two Year College (outside of the study district)	198	45.9%	231	42.0%
Four Year College	233	54.0%	319	58.0%
Institution Location (% of transfers)*				
In state institution	354	82.1%	478	86.9%
Out-of-state institution	77	17.9%	72	13.1%
Number of states	27	-	31	-
Institution Type (% of transfers)				
Public	302	70.1%	370	67.3%

Private	129	29.9%	180	32.7%
Transfer Timing				
Transferred after earning an associate degree in district	84	19.9%	96	17.5%
Average term transferred*	9.37	-	8.66	-

* Statistically significant

Although the majority of students transferred to a four-year institution (54% for low-income URM students, 58% for all others), slightly more low-income, URM students transferred to a two-year institution (46%) compared to all other students (42%). A chi square goodness of fit test indicated that the differences among the groups for institution type was not significant, X^2 (1, N = 981) = 1.669, p = .196. More low-income, URM students transferred out-of-state (18%) compared to all other students (13%). A chi square goodness of fit test indicated that the differences among the groups for institution state was significant, X^2 (1, N = 981) = 4.634, p = .031. Slightly more low-income, URM students transferred to public institutions (70%) compared to all other students (67%). A chi square goodness of fit test indicated that the differences among the groups for institution type was not significant, X^2 (1, N = 981) = .876, p = .349.

In terms of transfer timing, a slightly higher percentage of low-income, URM students transfer after earning an associate degree (20%), compared to all other students (18%). A chi square goodness of fit test indicated that the differences among the groups for institution state was not significant, X^2 (1, N = 981) = 0.668, p = .414. Low-income, URM students also transferred a semester later than the comparison group. A t-test indicated a significant difference in the semester that low-income, URM

students transferred (M = 9.37, SD = 4.274) and the comparison group (M = 8.66, SD = 4.247), t(979) = 2.618, p < .009.

Outcomes

Table 15 presents the percentage of students who graduated, dropped out, or were still enrolled at the end of the study period. After 7 years, only 15% of the 1,566 low-income, underrepresented minority students of the students earned a college degree (associate or bachelor's) at a higher education institution. Most students that graduated (90%) earned an associate degree, and an additional 9% earned a bachelor's degree without earning an associate's degree first. The majority of students, 78%, dropped out and did not return to any higher education institution. A portion of the students, 7%, were still enrolled after 7 years.

Table 15. Overall Outcomes: Graduated, Dropped Out, Still Enrolled

Outcome*	Low-income, URM Students		All Other Students	
	Number	%	Number	%
Graduated	234	14.9%	304	19.5%
Dropped Out	1,224	78.2%	1,191	76.3%
Still Enrolled	108	6.9%	66	4.2%

 * Statistically significant

Students that did not meet the low-income and URM criteria had higher rates of graduation, 20%. However, like the low-income, URM students, the majority, 76% dropped out. A smaller percentage of students were still enrolled, 4%, compared to the low-income, URM group. A chi square goodness of fit test indicated that the differences

among the groups was significant, X^2 (1, N = 3127) = 19.689, p < .001. To see outcomes

by student background characteristics, see Appendix B.

Life Table

The fundamental tool for summarizing the distribution of event occurrence is the

life table (Singer & Willet, 2003). It tracks the event histories of the study cohort from

the first time interval, before anyone has experienced the event, to the end of the study

period. Table 16 provides the life table for the target event of graduation, indicating the

event occurrence of graduation of the low-income, URM students over a 20 semester

period. Table 17 provides the life table with drop out as the target event over the 20

semester time period. Taken together, the event histories and outcomes of the 1,566

low-income, URM students that enrolled in the community college district in the fall of

2000 are displayed.

In the life table, the first four columns deal with time. Column one provides the

annual context, columns two through four provide the term information. Columns five

and six provide information on the survivors. The number entering each interval refers

to the number of students that returned for each semester. The number exposed to risk

is the number of students counted as starting at that time interval for the purposes of

EHA. It is adjusted for censored data; the number of surviving cases minus one half the

censored cases.   Columns seven, eight, and nine provide information on the graduates

for the target event of graduation. The number of graduates indicates the number of

students that experienced the terminal event during the interval, graduation. When the

target event is drop out, columns seven, eight, and nine provide information on the

cumulative number of drop outs, the number of drop outs by term, and the number of

drop outs for the year. The last two columns provide the hazard rate and survival

probability; to be discussed in the next section. The hazard rate and survival probability

are not calculated for the last term as the calculations for the last interval are

meaningless in SPSS (Singer and Willett, 2003; Bian, 2012).

Table 16. Life Table, Graduation as the Target Event for Low-income, URM Students

Year	Term			Survivors		Graduates			Hazard Rate	Cumulative Survival Probability
				Entering Time Interval (Did not Graduate)	Number Exposed to Risk (Adjusted for censored data)	Cum # of Grads	# of Grads by Term	Total Grads by Year		
	0	(0,1)	NA	1,566	1566.0	0	0		.00	1.00
1	1	(1,2)	Fa 00	1566	1515.5	0	0		.00	1.00
	2	(2,3)	Sp 01	1465	1387.5	0	0		.00	1.00
	3	(3,4)	Su 01	1310	1304.0	0	0	0	.00	1.00
2	4	(4,5)	Fa 01	1298	1253.5	0	0		.00	1.00
	5	(5,6)	Sp 02	1209	1193.5	5	5		.00	1.00
	6	(6,7)	Su 02	1173	1130.5	11	6	11 (0.7%)	.01	.99
3	7	(7,8)	Fa 02	1082	1046.0	15	4		.00	.99
	8	(8,9)	Sp 03	1006	965.0	47	32		.03	.95
	9	(9,10)	Su 03	892	882.5	54	7	43 (2.7%)	.01	.95
4	10	(10,11)	Fa 03	866	837.0	70	16		.02	.93
	11	(11,12)	Sp 04	792	760.5	115	45		.06	.87
	12	(12,13)	Su 04	684	674.5	123	8	69 (4.4%)	.01	.86
5	13	(13,14)	Fa 04	657	627.0	145	22		.04	.83
	14	(14,15)	Sp 05	575	542.0	173	28		.05	.79
	15	(15,16)	Su 05	481	475.0	180	7	57 (3.6%)	.01	.78
6	16	(16,17)	Fa 05	462	431.0	193	13		.03	.75
	17	(17,18)	Sp 06	387	330.5	207	14		.04	.72
	18	(18,19)	Su 06	260	231.0	210	3	30 (1.9%)	.01	.71
7	19	(19,20)	Fa 06	199	165.5	219	9		.06	.67
	20	(20,21)	Sp 07	123	69.0	234	15	27 (1.7%)	*	*
Total Graduates						234 (14.9%)			-	

Table 17. Life Table, Drop Out as the Target Event for Low-income, URM Students

Year		Term		Survivors		Drop Outs			Hazard Rate	Cumulative Survival Probability
				Entering Time Interval (did not drop)	Number Exposed to Risk (adjusted for censored cases)	Cum # of Drop Outs	# of Drop Outs by Term	Total Drop Outs by Year		
	0	(0,1)	NA	1566	1566.0	0	0		0.00	1.00
1	1	(1,2)	Fa 00	1566	1566.0	101	101		.07	.94
	2	(2,3)	Sp 01	1465	1465.0	256	155		.11	.84
	3	(3,4)	Su 01	1310	1310.0	268	12	268 (17.1%)	.01	.83
2	4	(4,5)	Fa 01	1298	1298.0	357	89		.07	.77
	5	(5,6)	Sp 02	1209	1206.5	388	31		.03	.75
	6	(6,7)	Su 02	1173	1170.0	473	85	205 (13.1%)	.08	.70
3	7	(7,8)	Fa 02	1082	1080.0	545	72		.07	.65
	8	(8,9)	Sp 03	1006	990.0	627	82		.09	.60
	9	(9,10)	Su 03	892	888.5	646	19	173 (11.0%)	.02	.58
4	10	(10,11)	Fa 03	866	858.0	704	58		.07	.54
	11	(11,12)	Sp 04	792	769.5	767	63		.09	.50
	12	(12,13)	Su 04	684	680.0	786	19	140 (8.9%)	.03	.49
5	13	(13,14)	Fa 04	657	646.0	846	60		.10	.44
	14	(14,15)	Sp 05	575	561.0	912	66		.13	.39
	15	(15,16)	Su 05	481	477.5	924	12	138 (8.8%)	.03	.38
6	16	(16,17)	Fa 05	462	455.5	986	62		.15	.33
	17	(17,18)	Sp 06	387	380.0	1099	113		.35	.23
	18	(18,19)	Su 06	260	258.5	1157	58	233 (14.9%)	.25	.18
7	19	(19,20)	Fa 06	199	194.5	1224	67		.42	.12
	20	(20,21)	Sp 07	123	61.5	1224	0	67 (4.3%)	*	*
	Total Drop Outs						1,224 (78.2%)		-	

Target Events

Graduation

As shown in Table 16 with the target event of graduation, only 0.7% of the low-income, URM students had graduated at the end of two years, 7.9% graduated within 4 years, and 14.9% graduated after 7 years or 20 semesters. This is well below the national average graduation rate of 30% for community colleges. Of the students that graduated, the majority did so in the fourth year (69 students total), semester 11 (45 students). Conversely, the smallest number of graduates on an annual basis was from year 2; only 11 students. After year 2, the least amount of students to graduate in a semester was 18 (3 students), in year 6.

Drop Out

As shown in Table 17 with the target event of drop out, 1,544 (78.2%) of low-income, URM students dropped out after 7 years or 20 semesters. The majority of students who drop out did so in the second semester of year one (155 students), and in term 17, the second semester in year six (113 students). As can be seen in the table, there is a fairly steady number of drop outs over the 20 semester period. Additionally, 11% of the population had not dropped out at the end of the study period.

Baseline Hazard Function and Hazard Probabilities, Low Income URM

Graduation

The hazard is the unobserved rate at which events occur during the time to event. The baseline hazard function provides a plot of the term by term hazard probabilities over the study period. Figure 25 represents the baseline hazard function for low-income, URM students with the target event of graduation. The hazard is bounded by 0 and 1 in discrete time probability. Within these parameters, the hazard can vary widely, but the greater the hazard, the greater the risk. Lower hazard values indicate less risk.
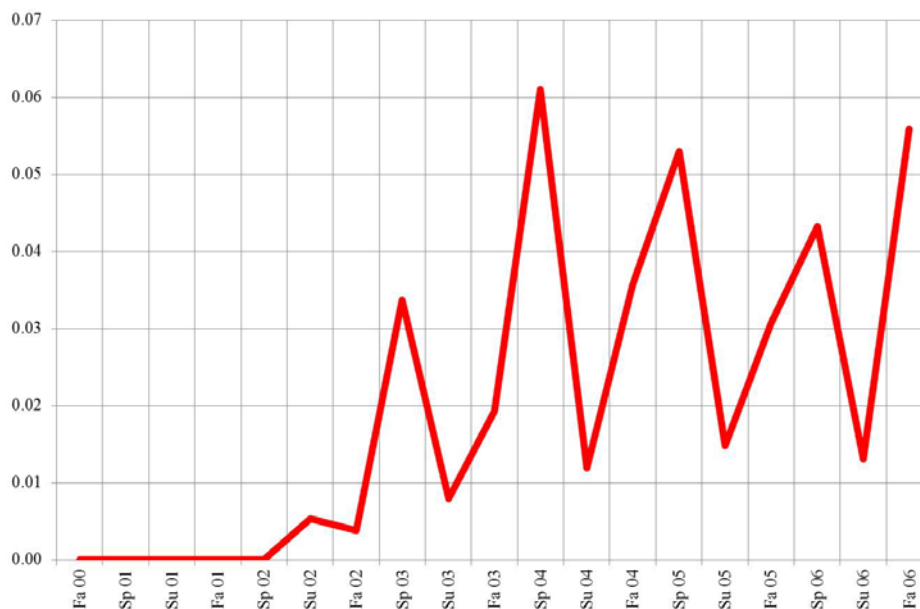
Figure 25. Baseline hazard function, target event of graduation for low-income, URM students

Variation in magnitude of the hazard function is described in terms of the peaks and troughs. High points, or peaks, indicate periods of elevated risk whereas troughs or low points indicate periods of lower risk (Singer & Willet, 2003). There were multiple distinctive peaks and troughs throughout the study period indicating a nonmonotonic shape to the hazard function. The highest peak occurred in year 4, term 11 (Spring 2004) and in year 7, term 19 (fall 2006) with a hazard rate of .06. The lowest troughs appear during the first five terms at zero. This indicated that the hazard of graduation was very low in the beginning of the study period and increased at the middle in year 4 and again at the end of the study period in year 7.

The fundamental numerical value used to assess risk in EHA is the hazard rate. Singer and Willet (2003) use the following notation to conceptualize the definition of hazard rate:

$$h(t_{ij})=\Pr\{T_i= j/T_i \geq j\}$$

T represents a discrete variable with a value of T_i indicating the time period *j* when individual *i* experienced the target event. The hazard rate is the probability of event occurrence that student i will experience the target event of graduation in time period *j* ($T_i = j$) given that student i did not experience it in any earlier time period ($T_i \geq j$). The set of discrete-time hazard probabilities expressed as a function of time, $h(t_{ij})$, is the population discrete-time hazard function.

The hazard rate is determined by dividing the number of students who have not graduated by those who did graduate. It can be denoted as follows:

$$\hat{h}(t_j) = \frac{n \ events_j}{n \ at \ risk_j},$$

In the equation, *n events* represent the number of students who experience the target event of graduation in timer period j; n at risk represents the number of students at risk during time period j.

For example, Table 17 and Figure 25 indicate that the highest hazard rate, or the time that we see the greatest risk of graduation is in term 11, year 4, with a hazard rate of 6% and term 19 (year 7) with a 6% hazard rate. It can be expressed as follow:

$$\hat{h}(t_{11}) = \frac{45}{761} = 0.06$$

Results from this study indicated that graduation was typically four years or 200% of what is traditionally expected from a two year associate degree.

Drop Out

Figure 26 represents the baseline hazard function for low-income, URM students with the target event of drop out.   Different from the hazard function for the target event of graduation, the highest hazard rates were at the end of the study time period. The shape of the hazard function was monotonic as there was a distinctive peak and trough. The highest hazard rate occurred in term 19, year 7 (Fall 2006) with a hazard rate of .42. The second highest hazard rate with the target event of drop out occurred at term 17, year 6 (Spring 2006). The lowest hazard rates occurred in semester 3 (.01) in year one and semester 9 (.02) in year three.
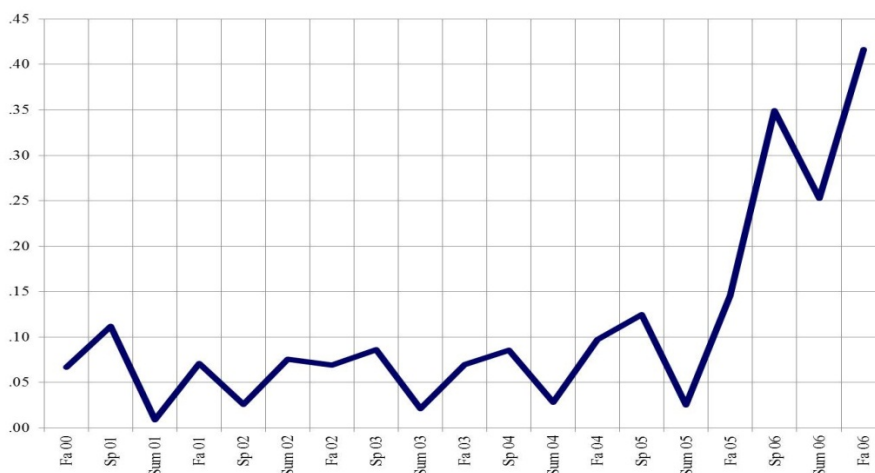
Figure 26. Baseline hazard function, target event of drop out for low-income, URM students

Baseline Survivor Function and Survival Probabilities, Low-Income URM

Graduation

The survivor function is the plot of the survival probability for each term and

provides the chronological listing of survival probabilities decreasing over time. It

represents the proportion of the original sample that has not experienced the target

event during each time interval. With the target event of graduation, the survival

function identifies students who have not graduated. They are considered to be

survivors or non-graduates. Different from the hazard function that fluctuates, the

survivor function cumulates time interval risks of event nonoccurrence to calculate the

probability that a student will not experience the event. There is an inverse relationship

between the hazard rate and the survivor probabilities. As the survivor probability goes

down, the hazard rate goes up.

Figure 27 represents the baseline survivor function for low-income, URM

students with the target event of graduation. The baseline survivor function for

graduation indicates a small, slow decrease in the sample population as the graduation

rate slightly increases each term. For the first six terms, the cumulative survival

probability was 1.0 and remained unchanged.
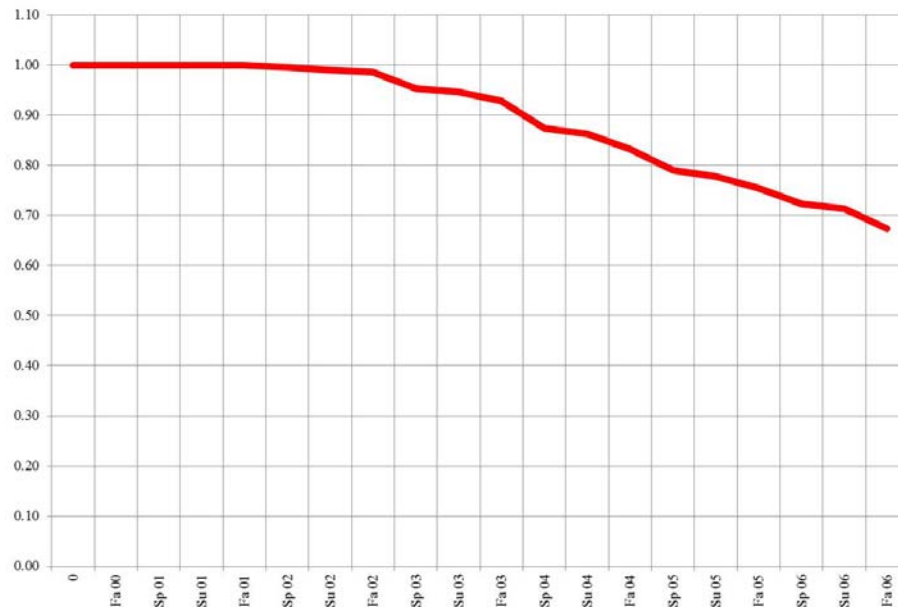
Figure 27. Baseline survivor function, target event of graduation for low-income, URM students

There are two different methods that can be used to compute maximum likelihood estimates of the population survivor function: direct and indirect. Singer and Willet (2003) denote the direct method of survival probability in the following way:

$$S(t_{ij})=Pr\{T_i > j\}$$

$S(t_{ij})$, is the probability that student i will survive or not graduate beyond time interval j ($T_i > j$). T represents the unknown time period it will take individual i to experience the event occurrence greater than the study time period. J intervals can be expressed as 1, 2, 3 . . . 20 for terms 1 through 20. Individual i cannot experience the event during time period j or during any prior time period. The beginning of time can be indicated as $S(t_{i0})=1.0$. Survival probability is bounded by 0 and 1.

The direct method can only be used in intervals that precede the censoring.

Event times of censored events are unknown. While the direct method is useful

because of its' pedagogical value, the indirect method is more practical. The indirect

method estimates values of the survivor function, even in the presence of censoring

(Singer & Willet, 2003). Using the indirect method, the estimated survival probability

for time interval j is the estimated survival probability for the previous year multiplied

by one minus the estimated hazard probability for that time interval or term:

$$\hat{S}(t_j) = \hat{S}(t_{j-1})[1 - \hat{h}(t_j)]$$

For example, Table 17 and Figure 27 indicate that at the end of year four, term 11,

(Summer 2004), 86% of the students are survivors. It can be expressed as:

$$\hat{S}(t_{11}) = 0.87\,[1 - 0.01] = 0.86$$

Since so few students graduated during the study period, a median lifetime

value, or the point in time when 50% of the sample had experienced the target event

was not calculated.

Drop Out

With the target event of drop out, the survival function identifies students who

did not drop out. Figure 28 represents the baseline survivor function for low-income,

URM students with the target event of drop out.
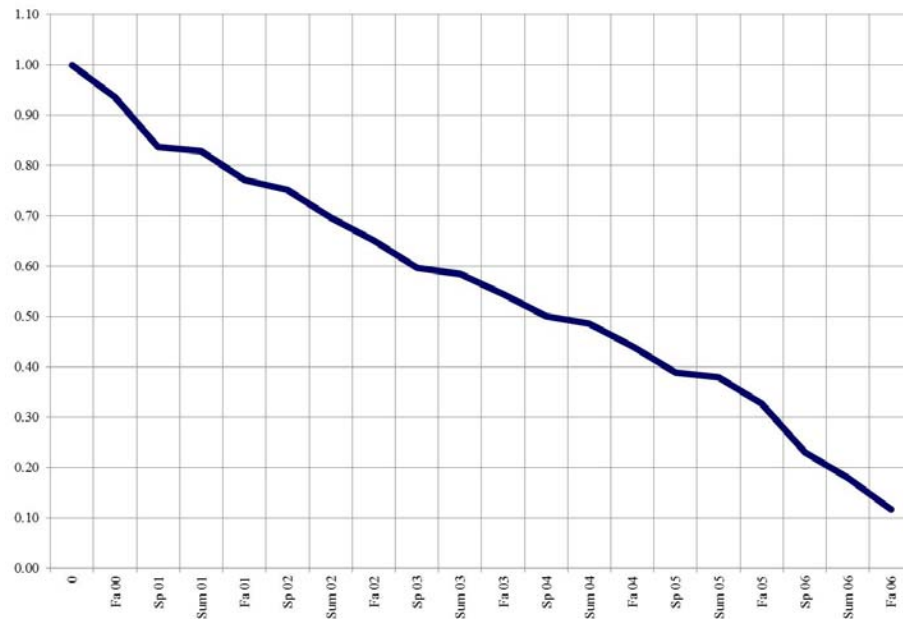
Figure 28. Baseline survivor function, target event of drop out for low-income, URM students

The baseline survivor function for dropping out indicated a steady decrease over time, almost a straight line. Different from the baseline survivor function for graduation, the cumulative survival probability decreased after the first term as 101 students had already dropped out. The majority of students dropped out during the study period. At the end of the year 1, term 3, (Summer 2001), 83% survived. By the beginning of year 7, term 19, (Fall 2006), 12% of students survived.

The estimated median lifetime value for dropout was semester 11 in year 4. Fifty percent of low-income, URM students had experienced the event of dropping out by semester 11 (Spring 2004).

Comparison to All Other Students: Life Table

In order to see if the timing to the target events was different for low-income, URM students compared to all other students, a life table was generated for all other students. Table 18 displays the life table with hazard rate and survival probabilities.

Table 18. Life Table, Graduation as the Target Event for All Other Students

Year	Term			Survivors		Graduates			Hazard Rate	Cumulative Survival Probability
				Entering Time Interval (Did not Graduate)	Number Exposed to Risk (Adjusted for censored data)	Cumulative # of Grads	# of Grads by Term	Total Grads by Year		
	0	(0,1)	NA	1561	1561.0	0	0		.00	1.00
1	1	(1,2)	Fa 00	1561	1491.5	1	0		.00	1.00
	2	(2,3)	Sp 01	1422	1357.5	1	1		.00	1.00
	3	(3,4)	Su 01	1292	1285.5	1	0	1 (<1%)	.00	1.00
2	4	(4,5)	Fa 01	1279	1236.0	1	0		.00	1.00
	5	(5,6)	Sp 02	1193	1148.0	15	14		.01	.99
	6	(6,7)	Su 02	1089	1085.5	20	5	19 (1.2%)	.00	.98
3	7	(7,8)	Fa 02	1077	1044.5	27	7		.01	.98
	8	(8,9)	Sp 03	1005	969.5	62	35		.04	.94
	9	(9,10)	Su 03	899	893.5	70	8	50 (3.2%)	.01	.93
4	10	(10,11)	Fa 03	880	847.0	96	26		.03	.90
	11	(11,12)	Sp 04	788	752.0	138	42		.06	.85
	12	(12,13)	Su 04	674	664.5	146	8	76 (4.9%)	.01	.84
5	13	(13,14)	Fa 04	647	619.5	165	19		.03	.82
	14	(14,15)	Sp 05	573	545.5	217	52		.10	.74
	15	(15,16)	Su 05	466	457.5	226	9	80 (5.1%)	.02	.72
6	16	(16,17)	Fa 05	440	415.0	247	21		.05	.69
	17	(17,18)	Sp 06	369	313.0	284	37		.13	.61
	18	(18,19)	Su 06	220	189.0	289	5	63 (4.0%)	.03	.59
7	19	(19,20)	Fa 06	153	117.0	292	3		.03	.58
	20	(20,21)	Sp 07	78	45.0	304	12	15 (1.0%)	*	*
Total								304 (19.5%)	-	

The comparison group of all other students was at the greatest risk of graduating in year six, term 17 (Spring 2006) with a hazard rate of .13. The second highest risk time for graduation is in year 5, term 14 (Spring 2005) with a hazard rate of .13. Students were at the lowest risk of graduation in term 1, 2, 3, 4 and 6. Similar to the low-income, URM students, not enough students graduated to report a median lifetime estimate.

Similarly, a life table was constructed for the target event of drop out for all

other students in Table 19. The comparison group of all other students was at the

greatest risk of dropping out in year 7, term 19 (Fall 2006) with a hazard rate of .62.

Other terms when students were at high risk of graduating were in year six, terms 17

(Spring 2006) and 18 (Summer 2006), year 6, with hazard rates of .38 and .33

respectively. The estimated median lifetime value for all other students was in year 4,

term 11 (Spring 2004). This was similar to low-income URM students estimated median

lifetime value: semester 11, year 4. Differences among the groups will be further

explored in the next section.

Table 19. Life Table, Drop Out as the Target Event for All Other Students

Year	Term			Survivors		Drop Outs			Hazard Rate	Cumulative Survival Probability
				Entering Time Interval (did not drop)	Number Exposed to Risk (adjusted for censored cases)	Cumulative # of Drop Outs	# of Drop Outs by Term	Total Drop Outs by Year		
	0	(0,1)	NA	1561	1561.0		0		.00	1.00
1	1	(1,2)	Fa 00	1561	1561.0	139	139		.09	.91
	2	(2,3)	Sp 01	1422	1421.5	268	129		.10	.83
	3	(3,4)	Sum 01	1292	1292.0	281	13	281 (18.0%)	.01	.82
2	4	(4,5)	Fa 01	1279	1279.0	367	86		.07	.76
	5	(5,6)	Sp 02	1193	1186.0	457	90		.08	.71
	6	(6,7)	Sum 02	1089	1086.5	464	7	183 (11.7%)	.01	.70
3	7	(7,8)	Fa 02	1077	1073.5	529	65		.06	.66
	8	(8,9)	Sp 03	1005	987.5	600	71		.07	.61
	9	(9,10)	Sum 03	899	895.0	611	11	147 (9.4%)	.01	.60
4	10	(10,11)	Fa 03	880	867.0	677	66		.08	.56
	11	(11,12)	Sp 04	788	767.0	749	72		.10	.51
	12	(12,13)	Sum 04	674	670.0	768	19	157 (10.1%)	.03	.49
5	13	(13,14)	Fa 04	647	637.5	823	55		.09	.45
	14	(14,15)	Sp 05	573	547.0	878	55		.11	.40
	15	(15,16)	Sum 05	466	461.5	895	17	127 (8.1%)	.04	.39
6	16	(16,17)	Fa 05	440	429.5	945	50		.12	.34
	17	(17,18)	Sp 06	369	350.5	1057	112		.38	.23
	18	(18,19)	Sum 06	220	217.5	1119	62	224 (14.3%)	.33	.17
7	19	(19,20)	Fa 06	153	151.5	1191	72		.62	.09
	20	(20,21)	Sp 07	78	39.0	1191	0	72 (8.0%)	*	*
	Total						1,224 (78.2%)			-

Baseline Hazard Function and Hazard Probabilities, Comparison

Graduation

Figure 29 displays the hazard function and probabilities of both the low-income, URM group and all other students for the target event of graduation. The baseline hazard was nonmonotonic for both groups of students and followed a similar pattern – almost identical through the first thirteen terms. In terms fourteen and seventeen, the comparison group of all other students had a much higher hazard rate of graduation.
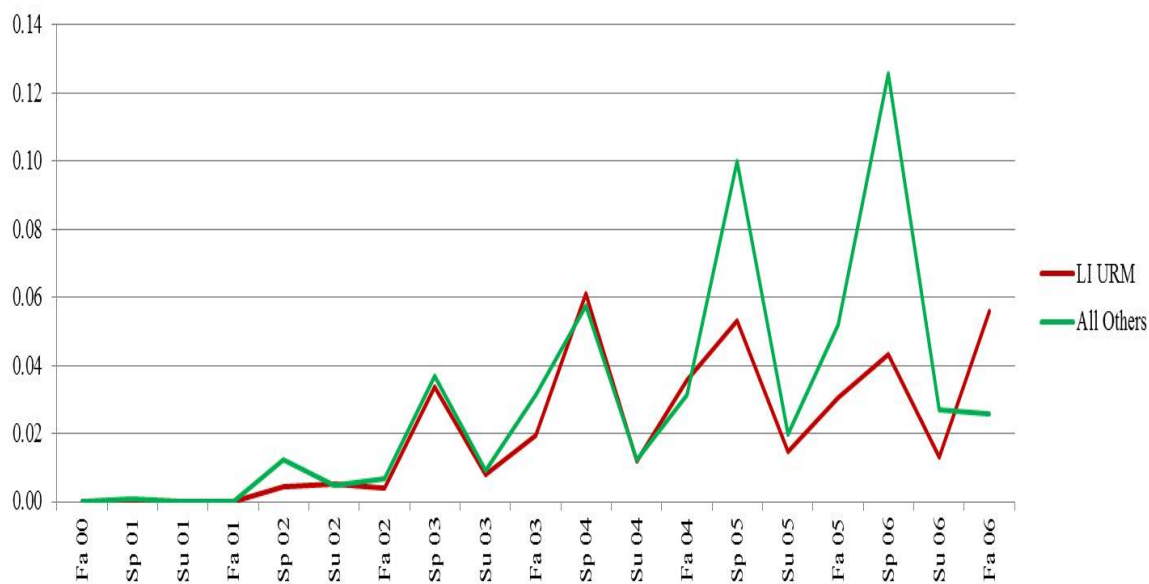
Figure 29. Baseline hazard function, target event of graduation, comparison

Drop Out

Figure 30 displays the baseline hazard function of the low-income, URM group compared to all other students for the target event of drop out. The shape of the baseline hazard function was monotonic for both groups and they followed a similar pattern in that the hazard of dropping out was greatest at the end of the study period.

The hazard rate of dropping out was lower for low-income, URM students at the end of the study period, but they both were high in term 17, dropped in term 18, then increased again in term 19.
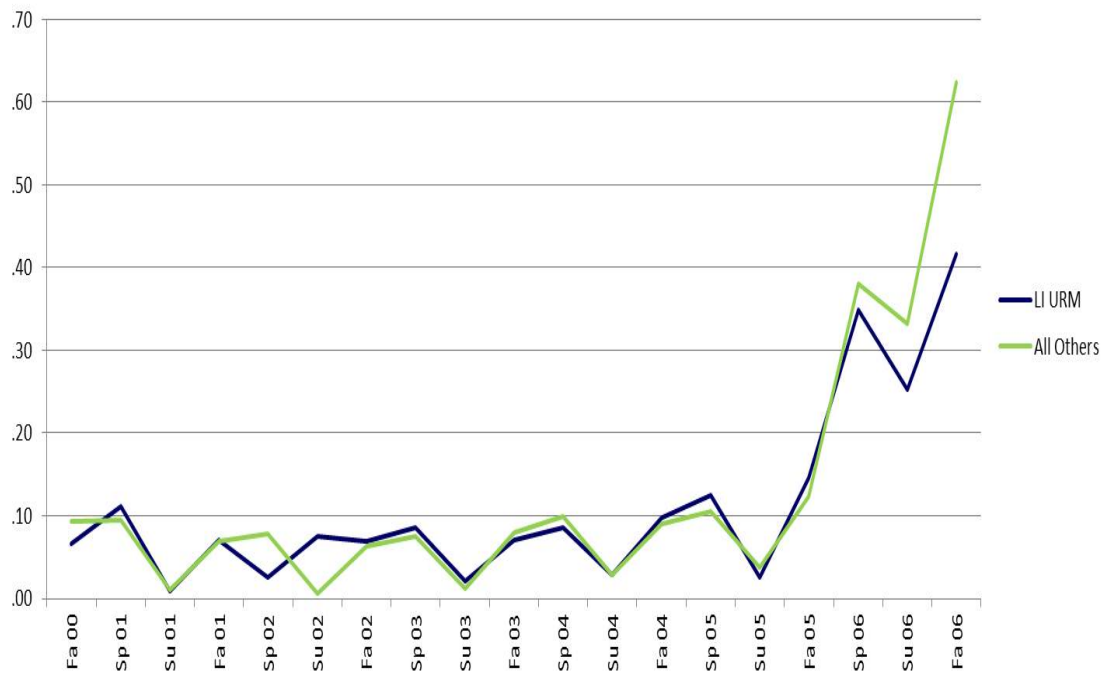
Figure 30. Baseline hazard function, target event of drop out, comparison

Baseline Survivor Function and Survivor Probabilities, Comparison

Graduation

Figure 31 displays the baseline survivor function of the low-income, URM group compared to all other students for the target event of graduation. The survivor functions were almost the same for the first three years, but then the low-income, URM student group had higher survivor rates in years four through seven, with the largest gap in term 19. This indicates that more low-income, URM students were surviving graduation towards the end of the study period.
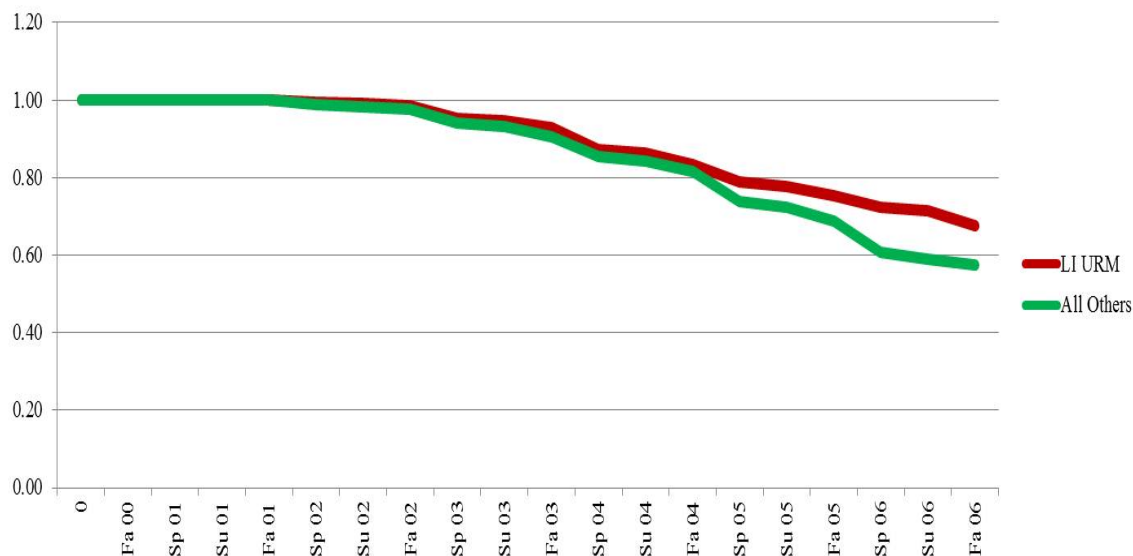
Figure 31. Baseline survivor function, target event of graduation, comparison

Drop Out

Figure 32 displays the baseline survivor function of the low-income, URM group

compared to all other students for the target event of drop out. The survivor rates were

similar for both groups, with the exception of term 5 (Spring 2005) when the low-

income, URM group survivor probability was slightly higher, and term 19 (Fall 2006)

when the low-income, URM group survivor probability was slightly lower. This indicates

that the low-income, URM group was slightly more inclined to survive dropping out in

term 5, but slightly less inclined at the end.
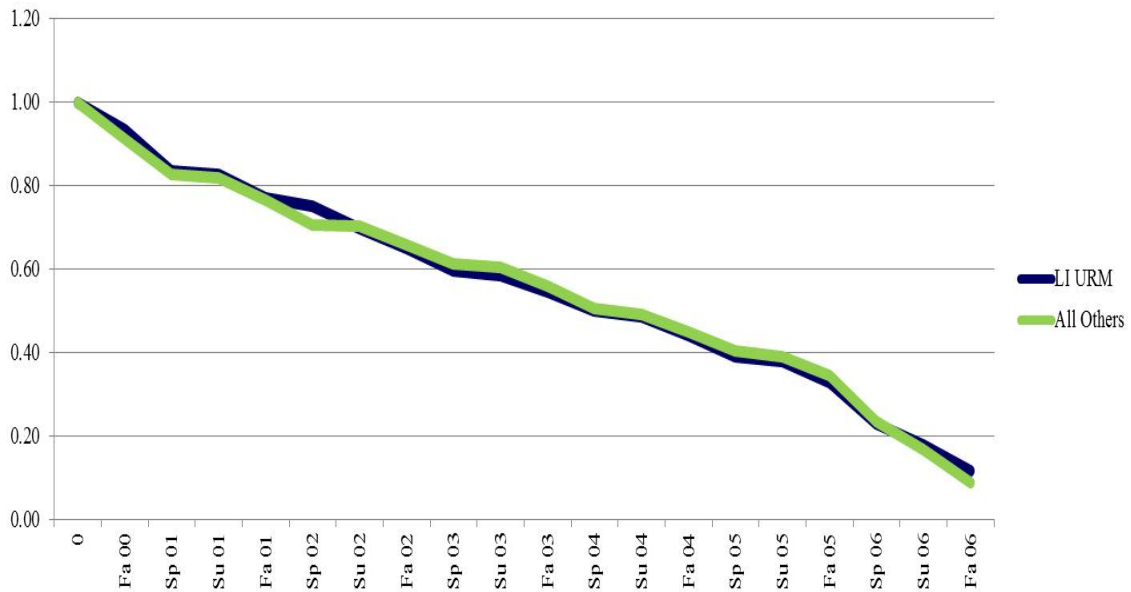
Figure 32. Baseline survivor function, target event of drop out, comparison

Modeling Time to Graduation

The life tables that describe the hazard rates and survival probabilities are useful

in summarizing the event histories of the students over the duration of the study period.

The remainder of this chapter will examine the effect of the covariates on the timing of

graduation and drop out. This is addressed by fitting statistical models of hazard to the

person-period data by specifying an appropriate model for hazard, estimating the model

parameters, interpreting the results in relation to the second research question, and

evaluating the model fit.

Data Transformations: Odds and Log Odds (Logit)

The EHA model risk was calculated as a weighted linear combination of

predictors. The data needed to be transformed as the outcome is a probability of

derived fitted values of <0 or >1. Two transformations were needed: the odds and the

log odds (logit). When the probability is the outcome, the logit function is the most

appropriate function (Willet & Singer, 2003). To calculate the odds, the probabilities of

the hazard function were transformed by the following equation:

$$odds = \frac{hazard}{1 - hazard}$$

Odds compared the magnitude of two complimentary probabilities: that an event would

occur and that it would not. If the probability of an event occurring was .80, then the

probability that it would not occur was .20, and the odds were .80 to .20 or 4 to 1.

Next, the natural log of the odds was computed, resulting in the logit hazard or

the log odds:

$$\textbf{\textit{logit}}$$

$$\log(odds) = \log\left(\frac{hazard}{1 - hazard}\right)$$

This function was the one modeled in this analysis and was the result of regressing the

covariates on the outcome variables of GRAD and DROP.

Figure 33 displays the raw hazard and Figure 34 and Figure 35 display the

transformations to the odds scale and the logit scale. When the raw hazard is

transformed in to the odds scale, distance between the hazard functions depends on

the magnitude of the hazard, and minimal change occurs. When the hazard is small,

taking odds has little effect. The effect of the logit transformation also depends on the

magnitude of the hazard, but when the distance between the hazard the hazards is

small, the logit transformation increases the distance. When the hazards are large, the

logit transformation decreases the distance.
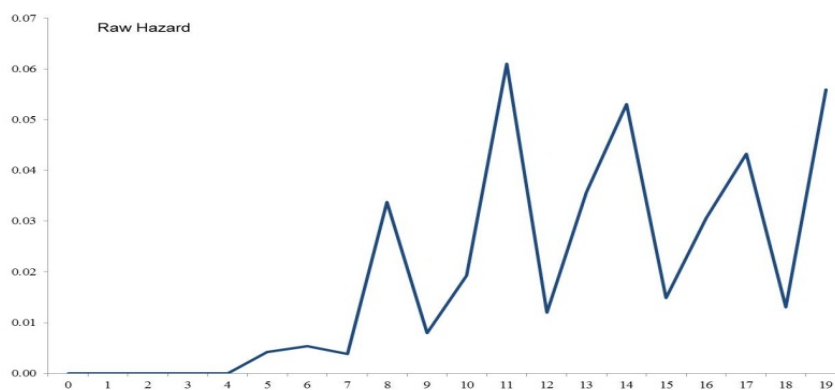
Figure 33. Raw hazard, target event graduation
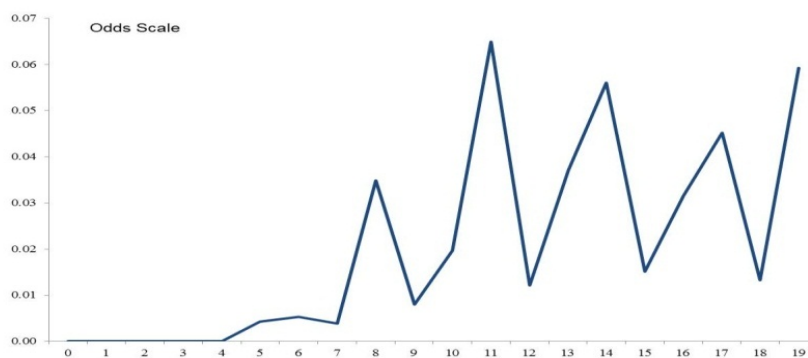
Figure 34. Raw hazard transformed to odds scale, target event graduation
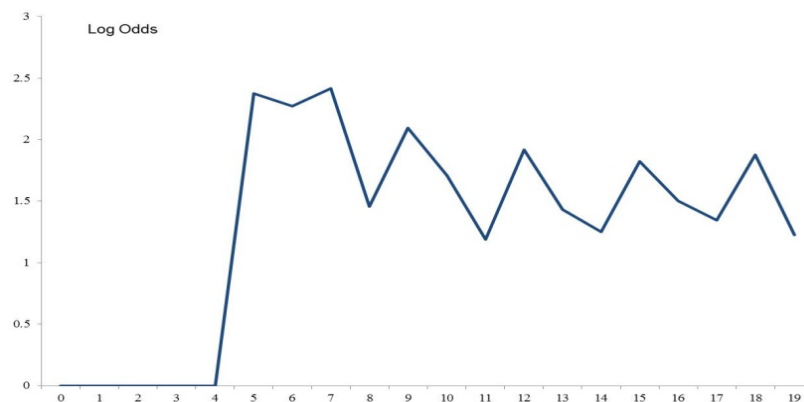
Figure 35. Raw hazard transformed to log odds scale, target event graduation

Assumptions

Assumptions pertaining to discrete-time hazard analysis were explored in

relation to the covariates: *the linearity of the logit, the proportionality of the odds,* and

no unobserved heterogeneity (Singer & Willett, 2003). The assumptions were used to

help form suitable models, estimate the parameters, and check for goodness of fit.

Interactions were checked and incorporated into the models when appropriate. In

terms of linearity, the differences in the value of the covariates were equal in the logit

profile. In terms of the proportionality of the odds (parallel slope), the interaction term

was examined and was found to be constant at all time points; the logit-hazard profiles

did not intersect. Additionally, it was found that a good portion of the variation in the

logit hazard profile was accounted for by value variation in the covariates included,

indicating no unobserved heterogeneity.

Focus on Low-income, URM Students for Regression Analysis

Two different options were explored in specifying the most appropriate model to

examine the impact of academic integration variables on timing to graduation for low-

income, URM students. The first option was to use a simple baseline hazard model with

time predictor dummy variables and an indicator of whether a student was in the low-

income, URM group or in the comparison group. After the baseline, controls for student

background characteristics were to be added into the model. The second option was to

just use the low-income, URM students in the regression analysis without the

comparison group. After testing both approaches, goodness of fit tests, assumption

testing, and other model specification tests were used to determine that just using the

low-income, URM students without the comparison group in the analysis yielded better

models. The remainder of this chapter focuses exclusively on the low-income, URM

students.

Parameter Coding for Student Background Variables

The covariates used included both continuous and categorical variables.

Parameter coding was created for the categorical variables. Table 20 provides

parameter coding for the student background categorical variables. Table 21 provides

parameter coding for the academic integration variables including enrollment intensity,

remedial coursework, milestones, academic performance, and risk factors.

Table 20. Parameter Coding for Student Background Characteristics

STUDENT BACKGROUND CHARACTERISTICS		Frequency	Parameter Coding		
			(1)	(2)	(3)
DEMOGRAPHIC CHARACTERISTICS					
Ethnicity	American Indian/Alaskan Native	134	1.000	0.000	
	Black	9286	0.000	1.000	
	Hispanic	4124	0.000	0.000	
Sex	Male	4214	1.000		
	Female	9330	0.000		
Income Quartiles	0 to $11,999	11350	0.000	0.000	0.000
	$12,000 to $20,999	1865	1.000	0.000	0.000
	$21,000 to $30,000	258	0.000	1.000	0.000
	Over $30,000	71	0.000	0.000	1.000
Age	26 Years and Over	3160	1.000		
	25 Years or Younger	10384	0.000		
English Language	Native Language English	10726	1.000		
	Native Language Not English	2818	0.000		
EXTERNAL COMMITMENTS					
Employment	Employed	8555	0.000	0.000	
	Unemployed	4584	1.000	0.000	
	Unknown	405	0.000	1.000	
Marital Status	Single	12236	1.000		
	Married	1308	0.000		
Parental Status	No Children	8828	1.000		
	Has Children	4716	0.000		
Single Parent	Not a single parent	9743	1.000		
	Single Parent	3801	0.000		
ACADEMIC PREPARATION					
Reading Test Score	College Level in Reading	4374	0.000	0.000	
	Below College Level in Reading	5686	1.000	0.000	
	Not Tested in Reading	3484	0.000	1.000	
English Test Scores	College Level in English	2648	0.000	0.000	
	Below College Level in English	6652	1.000	0.000	
	Not Tested in English	4244	0.000	1.000	
Math Test Scores	College Level in Math	629	0.000	0.000	
	Below College Level in Math	9842	1.000	0.000	
	Not Tested in Math	3073	0.000	1.000	
All Areas Combined	Not Below College Level in All Areas	9931	0.000		
	Below College Level All Areas	3613	1.000		
High School Diploma or GED	High School Diploma	10970	1.000		
	GED	2574	0.000		

Table 21. Parameter Coding for Academic Integration Characteristics

Academic Integration Variables		Frequency	Parameter Coding (1)
ENROLLMENT INTENSITY			
Enrollment Status	Full-time	4592	1.000
	Part-time	5460	0.000
REMEDIAL COURSEWORK			
Earned S in Remedial Reading	Did Not Earn S in Remedial Reading	9323	1.000
	Earned S in Remedial Reading	729	0.000
Earned A-C in Remedial English	Did not Earned A, B, or C in Remedial English	9110	1.000
	Earned A, B, or C in Remedial English	942	0.000
Earned A-C in Remedial Math	Did not Earned A, B, or C in Remedial Math	8645	1.000
	Earned A, B, or C in Remedial Math	1407	0.000
MILESTONES			
More than 20 Credit Hours	Did not Complete More than 20 Credit Hours	3306	1.000
	Completed 20 Credit Hours	6746	0.000
Received an Advanced or Basic Certificate	Did not Receive Adv Cert or Basic Cert	9889	1.000
	Received Adv Cert or Basic Cert	163	0.000
ACADEMIC PERFORMANCE			
Term GPA Over 2.5	Term GPA Below 2.5	6532	1.000
	Term GPA Above 2.5	3520	0.000
Completed College Level Math Grades A – C	Did not Earn A-C in College Level Math	9266	1.000
	Earned A-C in College Level Math	786	0.000
Completed College Level English Grades A – C	Did not earn A-C in College Level English	9832	1.000
	Earned A-C in College Level English	220	0.000
RISK FACTORS			
Withdrew from Any Course	Did Not Withdraw	6701	1.000
	Withdrew	3351	0.000
Earned an F in Any Course	Did not Earn an F	7852	1.000
	Earned an F	2200	0.000
Academic Hold	Does Not Have Academic Hold	9811	1.000
	Has Academic Hold	241	0.000

Fitting the Discrete Time Hazard Model to the Data

To what extent do academic integration factors affect timing to graduation for low-income, URM community college students? In order to test what academic integration covariates impacted the probability of graduation for low-income, URM students graduate, it was necessary to fit the discrete time hazard model to the data with logistic regression. Odds ratios were derived from maximum likelihood estimation of logistic regression parameters.

Previous research was used to inform the variables used to have an impact on student outcomes including student background characteristics, (β_1) and academic

integration, (β_2). Refer to Table 2 in Chapter 3 for the full list of variables by conceptual

block.

An inverse transformation of the logit back to the raw hazard was used to create

a nonlinear relationship between predictors. The statistical logit model was fit to the

person-period dataset in order to represent the log-odds of attaining the degree as a

function of the covariates. The parameters were estimated to maximize the likelihood

of observing the data assuming a logistic regression. A non-parametric specification of

time was determined to be the best fit for the data. Twenty time dummy variables were

created to allow for the examination of time as a predictor. No explicit functional

restrictions were defined for how the probability of graduation is affected by time.

To get the maximum likelihood estimates of the population parameters in the

discrete-time hazard model, logistic regression was conducted to regress the target

events on the time indicators D_1 thorough $D_{20,}$ and the selected time independent and

time dependent covariates in the person period dataset. The models can be

represented as:

$$\text{Model A}: \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + ... + \alpha_{20} D_{20}\right]$$
$$\text{Model B}: \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + ... + \alpha_{20} D_{20}\right] + \beta_1 SB$$
$$\text{Model C}: \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + ... + \alpha_{20} D_{20}\right] \qquad + \beta_2 AI$$
$$\text{Model D}: \quad \text{logit } h(t_j) = \left[\alpha_1 D_1 + \alpha_2 D_2 + ... + \alpha_{20} D_{20}\right] + \beta_1 SB + \beta_2 AI$$

The first model, Model A, includes only the main effect of the time indicators; the simple

baseline hazard with the time dummy variables. Since no predictive covariates are

included in Model A, it describes the baseline for the entire sample. Model B includes

the main effect of time and the vector of all student background (SB), pre-enrollment

characteristics (β_1SB).   Model C includes the main effects of time and the vector of

academic integration (AI) variables (β_2AI). Model D includes the main effects of time,

student background characteristics, and academic integration covariates.

Overview of the Models

Table 22 provides a summary of Models A, B, C, and D that examined the

covariates effects on the conditional probability of graduating during the study period.

Model A presents results for the effect of time only. In the following sections,

procedures, analysis and results will be discussed for Model B, (Student Background

Characteristics), Model C (Academic Integration), and Model D (Student Background

Characteristics and Academic Integration). To see a summary of Models A, B, C, and D

that examined covariate effects on the conditional probability of dropping out during

the study period see Appendix C.

Model B: Student Background Characteristics Model, Graduation

With GRAD as the target outcome, a logistic regression model was run using the

student background characteristics listed in Table 20.   All student background variables

were time independent as of the first semester of enrollment. The student background

variables were fit simultaneously using SPSS (version 20.0.0) binary logistic regression

procedure. Parameter coding of student background variables are also shown in table

20, along with the corresponding referent categories.

Table 22. Graduation Model Summary: Parameter Estimates, Standard Errors, Significance, and Odds Ratios

Target: Graduation Covariates	Model A Time Only				Model B Student Background (SB) Characteristics				Model C Academic Integration (AI)				Model D Time, SB & AI			
	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds
D1	-51.203	3.325×10^9		.000	-49.750	3.272×10^9		.000	-50.601	3.041×10^9		.000	-49.622	2.969×10^9		.000
D2	-51.203	3.58×10^9		.000	-49.761	3.577×10^9		.000	-52.788	3.217×10^9		.000	-51.922	3.146×10^9		.000
D3	-51.203	7.053×10^9		.000	-49.819	6.947×10^9		.000	-52.824	6.683×10^9		.000	-51.914	6.575×10^9		.000
D4	-51.203	4.157×10^9		.000	-49.785	4.088×10^9		.000	-53.029	3.851×10^9		.000	-52.114	3.779×10^9		.000
D5	-5.142	.449	***	.006	-3.752	.697	***	.023	-7.967	.671	***	.000	-7.156	.917	***	.001
D6	-3.792	.413	***	.023	-2.434	.673	***	.088	-6.954	.699	***	.001	-6.095	.966	***	.002
D7	-5.186	.501	***	.006	-3.819	.730	***	.022	-7.961	.742	***	.000	-7.118	.983	***	.001
D8	-2.972	.181	***	.051	-1.597	.565	**	.203	-6.001	.457	***	.002	-5.109	.783	***	.006
D9	-3.406	.384	***	.033	-2.045	.656	***	.129	-5.928	.586	***	.003	-5.061	.863	***	.006
D10	-3.470	.254	***	.031	-2.075	.594	***	.126	-6.426	.521	***	.002	-5.449	.817	***	.004
D11	-2.273	.157	***	.103	-.846	.559		.429	-4.786	.411	***	.008	-3.751	.751	***	.023
D12	-2.944	.363	***	.053	-1.515	.650	*	.220	-5.376	.560	***	.005	-4.335	.852	***	.013
D13	-2.839	.219	***	.059	-1.382	.576	*	.251	-5.251	.439	***	.005	-4.145	.762	***	.016
D14	-2.445	.197	***	.087	-1.003	.567		.367	-4.829	.426	***	.008	-3.771	.756	***	.023
D15	-2.773	.390	***	.063	-1.318	.663	***	.268	-5.051	.561	***	.006	-3.952	.853	***	.019
D16	-3.162	.283	***	.042	-1.712	.602	***	.180	-5.033	.446	***	.007	-3.904	.768	***	.020
D17	-3.045	.274	***	.048	-1.604	.601	***	.201	-4.894	.436	***	.007	-3.865	.771	***	.021
D18	-3.664	.585	***	.026	-2.288	.794	***	.101	-5.619	.690	***	.004	-4.476	.936	***	.011
D19	-2.853	.343	***	.058	-1.363	.647	***	.256	-4.964	.499	***	.007	-3.822	.825	***	.022
D20	-1.974	.276	***	.139	-.471	.618		.624	-4.482	.479	***	.011	-3.298	.805	***	.037

Target: Graduation	Model A Time Only				Model B Student Background (SB) Characteristics				Model C Academic Integration (AI)				Model D Time, SB & AI			
Covariates	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds
Hispanic																
Am Indian					-1.117	1.039		.327					-.381	1.071		.684
Black					-.221	.168		.802					-.198	.218		.820
Male					-.643	.177	***	.526					-.640	.222	**	.527
Income, Q1							*									
Income, Q2					-.627	.224	**	.534					-.654	.273	*	.520
Income, Q3					-.746	.625		.474					-1.753	.828	*	.173
Income, Q4					-.747	1.088		.474					-1.208	1.229		.299
Age 25 and under					.445	.182	*	1.561					.405	.236		1.499
Native Language Eng					.132	.194		1.141					-.079	.243		.924
Employed																
Unemployed					-.206	.153		.814					-.145	.197		.865
Unknown					-.151	.408		.860					-.226	.536		.798
Marital Status, Single					.016	.376		1.016					.003	.421		1.003
Parental Status, No Children					.593	.476		1.810					.889	.550		2.432
Not a Single Parent					-.605	.497		.546					-.569	.583		.566
Reading, College Level																
Reading, Below College					.198	.204		1.219					-.007	.305		.993
Reading, Not Tested					.045	.284		1.046					.013	.358		1.013
English, College Level							**									
English, Below College					-.677	.217	**	.508					-.432	.341		.649
English, Not Tested					-.613	.209	**	.542					-.378	.285		.685
Math, College Level							*									
Math, Below College					-.680	.260	**	.507					-.626	.343		.535
Math, Not Tested					-.770	.349	*	.463					-.454	.439		.635
All Areas, Not Below					-.071	.285		.931					.252	.381		1.287
High School Diploma					.023	.186		1.023					-.013	.237		.987

Target: Graduation	Model A Time Only				Model B Student Background (SB) Characteristics				Model C Academic Integration (AI)				Model D Time, SB & AI			
Covariates	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds
Full-time Enrollment									.475	.184	**	1.608	.462	.192	*	1.587
Enrolled in Remedial Reading									.622	.495		1.862	.537	.520		1.712
Enrolled in Remedial English									-.697	.586		.498	-.643	.620		.526
Enrolled in Remedial Math									-1.024	.466	*	.359	-1.087	.482	*	.337
Enrolled in Any Remedial Course									.416	.454		1.515	.397	.481		1.488
Remedial Reading Course, A-C									-.253	.486		.776	-.261	.499		.770
Remedial English Course, A-C									.334	.575		1.397	.408	.593		1.503
Remedial Math Course, A-C									-.064	.336		.938	-.093	.342		.911
College Level English, A-C									.520	.212	**	1.682	.458	.221	*	1.580
College Level Math Course, A-C									.653	.184	***	1.922	.674	.190	***	1.963
Cr Hrs Attempted/Cr Hours Earned									-1.253	.584	*	.286	-1.299	.589	*	.273
Milestone: 20 Credit Hours Earned									2.651	.539	***	14.170	2.732	.549	***	15.358
Received an Advanced or Basic Certificate									2.270	.263	***	9.676	2.309	.275	***	10.064
Term GPA									.262	.105	**	1.299	.289	.106	**	1.335
Withdrew from a Course During Term									-1.271	.364	***	.281	-1.287	.371	***	.276
Failed a Course During the Term									-2.693	.613	***	.068	-2.698	.625	***	.067
Academic Hold on Account									-.690	1.090		.501	-.708	1.077		.493
Transferred to a 4 Yr Institution									2.891	.196	***	18.011	2.921	.200	***	18.564
Took an Online Course During Term									.574	.169	***	1.775	.559	.174	***	1.749
-2 Log Likelihood	1822.941				1763.91				1146.236				1110.898			

A Hosmer and Lemeshow goodness of fit test was computed to determine how well the model fit the sample data. The Hosmer and Lemeshow test classifies the sample into groups, then calculated a test statistic, $\hat{C}$, using the Pearson chi-square from the tables observed and the estimated expected frequency (Guo, 2010). The null hypothesis states that the observed and predicted values are equal, so a p value greater than a 0.05 indicates a good fit. For the student background characteristics, the fit was acceptable, $\hat{C}$ (8, N = 10,052) = 3.761, p = .878.

The omnibus test of model coefficients, provides a test for the null hypothesis that the model beta coefficients were equal to 0. For the Student Background model, the block chi-square and the model chi-square were equal, indicating that there was a significant effect for the combined predictors on the outcome of graduation, X^2 (21, N = 10,052) = 11746.649, p < .001.

Individual parameter estimates for covariates in the student background model reveals that the following variables were significant: *gender, low-income quartiles, age, academic preparation in English and math, and not having a placement test in math.* External commitments such as working, being married, having children, and being a single parent did not have a significant impact on the likelihood of graduation.

The odds ratio in Model B indicated that in any given period, a male low-income, URM student is half as likely (.526) as female low-income, URM students to graduate. Students in the second quartile were half as likely (.534) to graduate as students in the

lowest quartile. Students over the age of 25 were one and a half times (1.561) more likely to graduate than students under the age of 25.

Students that scored below college level on English placement tests were half as likely (.508) to graduate as students scoring at college level. Students that did not take an English placement test were also half as likely to graduate, indicating that they most likely would have been underprepared in that area. Students that scored below college level in math were also half as likely (.507) to graduate than students scoring at college level in math. Students that did not take a math placement test were a half as likely (.463) as students that tested at college level.

<div align="center">Model C: Academic Integration Model, Graduation</div>

With GRAD as the target outcome, a logistic regression model was run using the academic integration variables listed in Table 21. The academic integration variables were time dependent by term. Parameter coding for the variables can also be found in Table 21, along with the referent categories.

To determine how well the model fit the data after adding the academic integration variables, a Hosmer Lemeshow goodness of fit test was calculated. For the complete model, the fit is acceptable, $\hat{C}$ (8, N = 10,052) = 1.839, p = .986. The omnibus test of model coefficients checks to see in the null hypothesis that all beta coefficients are equal to 0. The block chi-square and the model chi-square were not equal, but similar. There was a significant effect for the inclusion of academic integration on the outcome of graduation, X^2 (35, N = 10,052) = 467.542, p < .001. There was significant

improvement by adding the additional variables to the model, X^2 (14, N = 10,052) =
412.494, p < .001.

Individual parameter estimates for covariates in the academic integration model
reveals that the following variables were significant: *full-time enrollment, enrollment in
a remedial math course, successful completion of college level English, math, achieving
the milestone of 20 credit hours, receiving an advanced or basic certificate, transferring
to a four-year institution, and taking online courses. Academic performance variables
appeared to have a significant impact as GPA, credit hours attempted to those earned,
withdrawing from a course, and failing a course all were statistically significant.*
Enrollment in remedial courses and successful completion of remedial courses did not
appear to have an impact on the likelihood of graduation.

Students enrolled full-time were more than one and a half times (1.608) as likely
to graduate. Of all the remediation variables, only enrollment in remedial math was
significant. Students enrolled in remedial math were much less likely (.359) to graduate.
Successful completion of remedial math did not appear to have an impact on the
likelihood of graduation.

However successful completion of college level courses was significant and had a
positive impact on the hazard of graduation. Successful completion of college level
English increased the likelihood of graduating by more than one and a half times
(1.682). Successful completion of college level math had an even bigger impact;
students were twice as likely (1.922) to graduate compared to those that did not.

Certain milestones had a significant impact on the likelihood of graduation. Students that successfully completed 20 credit hours were 14 times (14.17) as likely to graduate. Students that received an advanced or basic certificate were almost 10 times (9.676) as likely to graduate. The relationship between these two variables makes sense as increased credit hours are needed to earn a certificate.

Also significant was a student's transfer activity. If a student transferred to a four-year institution, they were 18 times (18.011) as likely to graduate.

Online courses were significant. If a student took an online course, they were almost twice as likely (1.775) as those that did not. This could be due to the flexibility offered through this type of coursework and the ability to manage external commitments easier.

Credit hours attempted to credit hours earned was significant, but the direction was counterintuitive. When the covariates are continuous, the odds ratios are expressed as a percentage change in the risk of graduation (Singer & Willett, 2003). The conversion is 100 (.286-1) = -71.44% where .286 is the odds ratio. For every unit increase in the ratio of credit hours attempted to earned, there is a 71.44% decrease in the hazard for graduation. Term GPA was also significant. For every unit increase, there is a 29.90% increase in the hazard for graduation.

All academic risk factors were significant. Students that failed a course during the term were .068 times as likely to graduate; or had approximately 14.7% the odds (1/.068) as students that did not fail a course. Rates for withdrawing from a course

were also significant in decreasing the likelihood (.281) of degree completion. Students

that withdrew had approximately 3.6% the odds of graduating.

Model D: Complete Model, Student Background, Academic integration

The complete model was fit simultaneously using the SPSS binary logistic

regression procedure. Individual parameter estimates for covariates in the student

background model reveals that the following variables are significant: *gender, lower*

income quartiles, enrollment status: employed, X^2 (1, N = 10,052) = 5.774, p = .16,

taking a *remedial math course*, X^2 (1, N = 10,052) = 5.097, p = .024, *successfully*

completing a college level English course, X^2 (1, N =10,052) = 4.285, p = .038, *successfully*

completing a college level math course, X^2 (1, N =10,052) = 12.546, p < .001, a higher

ratio of *credit hour attempted to credit hours earned,* X^2 (1, N =10,052) = 4.868, p = .027,

reaching the milestone of earning *20 credit hours* , X^2 (1, N =10,052) = 24.8753, p < .001,

receiving an advanced or basic certificate, , X^2 (1, N =10,052) = 24.8753, p < .001, *Grade*

Point Average , X^2 (1, N =10,052) = 7.425, p = .006*, withdrawing from courses* during the

term, X^2 (1, N =10,052) = 12.040, p = .001, *receiving one or more F grades* in a term, X^2

(1, N =10,052) = 18.631, p < .001, *taking online* courses, , X^2 (1, N =10,052) = 10.274, p =

.001, and *transferring to a four year institution*, X^2 (1, N =10,052) = 213,253, p < .001.

Odds ratios are also displayed in Table 23.

When examining low-income, URM students, background characteristics,

external commitments, and academic preparation did not play a significant role. Only

gender and income were found to be significant. Gender appears to have a significant

impact on the probability of graduating. Males were half as likely to graduate (.527) compared to females. Students in the lower income quartiles were much less likely (.521 and .173) to graduate.

Academic integration played a key role in determining the probability of graduating. In terms of enrollment intensity, students who enrolled full-time were 1.587 times more likely to graduate than students enrolled part-time.

Remedial coursework had a significant impact on graduation. Students who enrolled in remedial math were .337 times less likely to graduate.   However, successful completion of college level coursework had a significant impact on the probability of graduating. Students who successfully completed a college level English course were 1.580 times as likely to graduate. Students who completed a college level math course were 1.963 as likely to graduate.

Academic performance had a significant impact on graduation. Of greatest significance was the impact on failing a course. Failing a course greatly reduced a student's probability of graduating. They were .007 less likely to graduate. Withdrawing from a course also greatly reduced the likelihood of graduating by .276. Higher term GPA increased the probability of graduating. The interpretation of odds ratios when covariates are continuous is best expressed as a percentage change in the risk of graduation. For every unit increase in GPA, there is a 29.9%, increase in the hazard for graduation.

Certain milestones also played a significant role in the likelihood of graduation. Students who reached the threshold of 20 credit hours were 15.388 times more likely to graduate than those that did not. Also significant was receiving an advanced or basic certificate along the way. Students who earned a certificate were 10.064 times are likely to graduates.

Certain types of courses also increased a student's likelihood of graduating. Students who took an online course increased the likelihood of graduating by 1.749. This may be attributed to the significant amount of external commitments, both family and work, and the flexibility that online courses afford to students.

Certain pathways were also found to have a significant impact on graduating. Students who transferred were 18.564 times as likely to graduate.

Comparison of Models A, B, C, and D

In order the measure how well each of the models predict graduation, the -2 Log Likelihood was presented in the last row of Table 22. In Model A, when only time is included, the -2Log Likelihood was 1822.941. After adding in the student background characteristics in Model B, it decreased to 1763.91, indicating that the addition of the student background characteristics improves the model. When just academic integration variables are examined in Model C (without student background), the -2 Log Likelihood was 1146.236, indicating that the inclusion of the academic integration variables greatly increases the fit of the model. The best model is the complete model,

Model D, which includes both student background characteristics and academic

integration variables with a -2 Log Likelihood of 1110.898.

To see fitted hazards for select predictor variables with time effects, see

Appendix D.

Summary

This chapter presented an overview of the descriptive statistics and EHA of the

study. The purpose of this study was to examine the timing of academic factors that

contribute to degree completion and attrition of underrepresented minority and low-

income community college students. A life table was constructed to determine when

students were most likely to graduate and drop out. Students had the highest

probability of graduating in year six, followed by year five. Students had the highest

probability of dropping out in year six, followed by year five.

EHA was used to examine what factors have the greatest impact on graduation

and drop out of low-income, URM students. Variables that were found to increase

chances of graduation included full-time enrollment, successfully completing college

level English and math courses, reaching the milestone of 20 credit hours, receiving an

advanced or basic certificate, maintaining a high ratio of courses attempted to earned,

having a higher GPA, taking online courses, and transferring to a four year institution.

Factors that reduced the likelihood of graduation were being male, lower income

quartiles, failing or withdrawing from courses, and taking remedial math. Chapter 5 will

discuss the results, study limitations, implications, and conclusions.

CHAPTER FIVE

DISCUSSION

Summary of the Study

The purpose of this study was to examine the timing of academic factors that contribute to degree completion and attrition of low-income, underrepresented minority community college students. The conceptual framework for the study used Astin's Input-Environment-Outcome (I-E-O) model, with adjustments and additions of components from Bean and Metzner's (1985) Model of Nontraditional Undergraduate Student Attrition, Weidman's (1989) Model of Undergraduate Socialization, Braxton and Hirschy, and McClendon's (2004) Model of Student Departure at Commuter Colleges proposed for nontraditional student populations, and Perna's (2006) Model of Access and College Choice.

Many characteristics were included in the inputs component: pre-college characteristics that included demographics variables (race/ethnicity, sex, income, native language, age), external commitments at the point of entry (employments, marital status, children, single parent status), and academic preparation in reading, English, and math. In the environment component, many academic integration characteristics were included (enrollment intensity, remedial courses, credit hour milestones, earning a certificate, academic performance, and risk factors). In the output component, two main outcomes were examined: graduation and dropout.

The specific research questions were:

1. When are low-income, URM degree seeking first-time community college students most likely to drop out or graduate with an associate's degree or bachelor's degree? How does this compare to other students?

2. To what extent do academic integration factors affect timing to drop out and graduation for low-income, URM community college students?

Using data provided by an urban community college system, over 3,000 first-time community college students were tracked over a period of 20 semesters to determine when students were more likely to graduate and when they were more likely to drop out. Low-income, URM students comprised about 50% of the population after inclusion and exclusion criteria were applied. Descriptive statistics were run for the low-income, URM student group, as well as all others to serve as a comparison. Low-income URM students were found to be statistically different on most student background characteristics and on academic integration variables. Using EHA, it was examined when both student groups were more likely to graduate and when they were more likely to withdraw. Regressions were run on the predictor covariates to determine what academic integration variables have an impact on the outcomes of students.

Timing to Graduation and Drop out; Comparison

Results from this study indicated that the majority of students did not graduate. After seven years, only 15% of the low-income, URM students graduated with an associate or bachelor's degree, 78% dropped out, and 7% were still enrolled. When

compared to all other students, the graduation rate of low-income, URM students was lower (15% compared to 20% for all other students), the dropout rate was slightly higher (78% compared to 76%), but a higher percentage of this population was still enrolled after seven years (7% compared to 4%).

After constructing a life table for low-income, URM students, it was shown that only 0.7% of the low-income, URM students had graduated at the end of two years, 7.9% graduated within 4 years, and 14.9% graduated after 7 years or 20 semesters. This is well below the national average graduation rate of 30% for community colleges. Of the students that graduated, the majority did so in the fourth year (69 students total), semester 11 (45 students). Conversely, the smallest number of graduates on an annual basis was from year 2; only 11 students. After year 2, the least amount of students to graduate in a semester was 18 (3 students), in year 6.

In terms of dropping out, 1,544 (80.9%) of low-income, URM students dropped out after 7 years or 20 semesters. The majority of students who drop out did so in the second semester of year one (155 students), and in term 17, the second semester in year six (113 students). As can be seen in the table, there is a fairly steady number of drop outs over the 20 semester period. Additionally, 11% of the population had not dropped out at the end of the study period.

How do results from this study compare to national graduation rates? Using a similar method that accounted for censoring (Kaplan-Meier), ACT found that the seven year associate degree completion rate for two year institutions was 26%; the six year

completion rate was 24% (Radunzel & Noble, 2012). The associate and bachelor's

degree completion rate for students that began at two year institutions was 37%, much

higher than the overall rate for students in this study. Radunzel and Noble (2012) also

found that the six year associate degree completion rates for two-year institution

students were lower for URM students: White and Asian students were 41% and 34%

respectively, Hispanic and Black students were 29% and 21%. Associate and bachelor's

degree completion rates for students who began at a two-year institution varied by SES.

The degree completion rate for higher income students was 44%, but only 29% for

lower income students.

The IPEDS 150% graduation rate for public community colleges was 20% (Aud, et

al., 2012), similar to the overall rate for the total population included in the study.

IPEDS graduation rates for the great lakes states in the Midwest for the 2004 cohort

varied greatly: Indiana – 8.7%, Ohio – 13.3%, Michigan – 14.9%, Illinois – 19.4%,

Minnesota – 26.3%, and Wisconsin – 31.3% (Chronicle of Higher Education, 2013).

Academic Integration Factors; Impact on Graduation

In order to answer the second research question, to what extent do academic

integration factors affect timing to drop out and graduation for low-income, URM

community college students, an event history analysis was conducted on a population of

first-time, degree seeking community college students over a seven year period.

Various models with different covariates were explored to determine which best

characterized the probability that a student would graduate or drop out. Distributions

of the different groups who experienced the targeted event and those who did not were examined.

Using discrete-time logistic regression, the model that best estimated the probability of graduation or drop out was one that included the time variables, student background characteristics, and academic integration variables (the complete model). In the complete model, the following variables were significant: gender, low-income quartiles (less than $12,000 and between $12,000 to $20,999), enrollment status, taking a remedial math course, successfully completing a college level English course, successfully completing a college level math course, higher ratio of credit hour attempted to credit hours earned, reaching the milestone of earning 20 credit hours, receiving an advanced or basic certificate, Grade Point Average, withdrawing from courses during the term, receiving one or more F grades in a term, taking online courses, and transferring to a four year institution.

Astin's I-E-O model highlighted the interdependence of input, environment, and outputs. Results of this study highlighted the important of academic integration variables which were emphasized in Bean and Metzner's (1985) model and Braxton et al.'s (2004) model. Academic integration variables found to have an impact include course taking behavior patterns by semester such as developmental coursework, credit hours attempted and earned, course completion ratio, enrollment status, baccalaureate/transfer courses attempted and earned, GPA, number of withdrawals,

number of D's and F's, and academic holds placed on the student due to poor

performance.

In the proposed Integrated Model, the inputs and environment variables take

place within the framework of individual, family, school, and social/economic contexts;

taken from Perna's (2006) model. The student's individual background characteristics

and college preparation influence their educational and career goals and choices (layer

1). This also takes place within the context of a student's family background and

influences (layer 2), school environment and institutional characteristics (layer 3), and

the social, economic, and policy context (layer 4). All of these layers work together to

influence the educational outcomes of the students. However, external characteristics

such as family responsibilities, work, and children did not have as strong as an impact on

graduation as many of the models adapted for community college students would

suggest.

Comparison of Results with Previous Research

Gender

In this study, low-income, URM females were much more likely to graduate with

a higher likelihood of graduating earlier. Males were half as likely to graduate (.527)

compared to females. Both males and females were more likely to graduate in term 17,

both females also were more likely to graduate in terms 11 and 14. Other EHA studies

have also found gender to have a significant role in degree completion. Similar to other

studies, sex and race together also impact graduation. Close to 17% of low-income

black females graduated during the study period compared to 9% of low-income black

males. Hispanic females also had higher graduation rates compared to Hispanic males:

21% and 11% respectively.

<div align="center">External Commitments</div>

In this study, low-income, URM students that worked full-time or part-time had

higher graduation rates (16% and 18% respectively) than students that were not

employed. Unemployed students had the lowest rates of graduation (12%). However,

unlike other research students, external commitments of work and family were not

found to have a significant impact on contributing to the likelihood of graduation.

Students with employment commitments may have adopted better time management

skills in order to balance both work, school, and sometimes family responsibilities. This

also could be an interaction with age since older students tended to work and also had

higher graduation rates.

Parental status was not found to have a significant impact on graduation of low-

income, URM students. However, graduation rates increased as the number of children

increased. Students with four or more children had a graduation rate of 17% compared

to students without children at 14%. This may be due to financial pressure to provide.

Additionally, if a student makes a significant time and financial commitment to

schooling, they may have added incentive to complete. Findings from this study

contradict other studies that found children to have a negative impact on graduation.

Taniguchi and Kaufman (2005) found that the presence of young children (infants,

toddlers, preschoolers) significantly suppressed college degree attainment for both men

and women. In their study, one additional toddler or infant reduces the chances of

degree completion by 50% for both men and women. Similar to Taniguchi and Kaufman

(2005), single parenthood was not found to have a significant impact on graduation,

though again, graduation rates were slightly higher.

Full-Time Enrollment

Consistent with other studies, this study found that full-time enrollment had a

significant impact on the likelihood of degree completion and timing. Students that

enrolled full-time were one and a half times more likely to graduate overall. Students

that enrolled full-time were also more likely to graduate earlier in terms 8, 11, and 14,

as well as term 19. Students that were mostly enrolled part-time were not likely to

graduate until terms 17 and 19. Other research studies, such as Taniguchi and Kaufman

(2005) found that students enrolled part-time had the greatest impact on reduced

likelihood of graduation. Students who completed their bachelor's degree were half as

likely to have enrolled part-time compared to those students who did not complete.

Reasons for reduced likelihood of graduation may include often interrupted enrollment

patterns and limited access to financial aid. It may also be the result of reduced social

integration with classmates and faculty.

Remediation

Remedial coursework had a significant impact on graduation. Students who

enrolled in remedial math were .337 times less likely to graduate. Underprepared

students that took remedial math also took longer to graduate if they did eventually

complete their degree. Underprepared students that did not take remedial math had a

higher likelihood of graduating overall, but also had a higher likelihood of graduating in

earlier terms such as 8, 11, and 14, as well as in term 17 and 19.

Since the majority of students in the study were below college level in reading,

English, and math, it is important to understand the role of remediation in relation to

graduation. Many students needing remediation did not successfully complete their

coursework which deterred their ability to enroll in college level courses and complete

their degree. Though there is a clear need for remediation, there is an ongoing debate

about its' effectiveness. Does the successful completion of remedial coursework result

in better educational outcomes? Results from this study indicate that it does not help.

Whether a student successfully completed their remedial coursework in reading,

English, or math did not have a significant impact on graduation. Just enrolling in a

remedial math course appeared to reduce a student's likelihood of graduating.

Results from this study support earlier research conducted by Wirt, Choy,

Ronney, Provasnik, Sen, & Tobin (2004), Wang (2009), Adelman (2006), and Calcagno

(2007) in that remediation was found to be a barrier or had no impact on degree

completion. Sixty-nine percent of students who did not take remedial coursework

earned a degree or certificate compared to 30% of students with remedial coursework.

Remedial reading was the most significant barrier to degree completion. It accounted

for more total remedial coursework and with lower rates of degree attainment than any

other remedial course-taking pattern (Wirt, et al., 2004). Postsecondary students who took remedial reading were half as likely as students who did not take any remedial course work to earn a degree or certificate. Using the NELS:88 dataset, Wang (2009) found that remediation in reading did not have an effect on bachelor's degree completion among community college transfers, but he found that math remediation had a negative impact on bachelor's degree attainment.

Adelman (2006) also found that remediation did not make a difference in degree completion rates, though he did find that taking remedial courses in the first year had a positive impact. Although Calcagno (2007) found a positive causal relationship on remediation and the likelihood of re-enrolling the following fall, he found that there is no statistically significant difference between similar students assigned to remediation (just below the state cut-off score) and those just above the cut-off score (college level). There was no difference in terms of passing the first level college course or completing an associate degree. Bahr (2012b) also found that the majority of students enrolled in remedial coursework in math, writing, and reading within California's community college system did not attain college-level competency in those subject areas.

College Level Coursework

Although successful completion of remedial coursework did not increase the likelihood of graduation, successful completion of college level coursework did have a significant impact on the probability of graduating. Students who successfully completed a college level English course were 1.580 times as likely to graduate.

Students who successfully completed a college level math course were 1.963 as likely to graduate and the difference was significant. Additionally, students that were able to successfully complete a college level math course in years four and five greatly increased their likelihood of graduation. This support Adelman's (2006) research where students who completed college-level writing, math, and English composition in the first two years had higher graduation rates that those who did not complete the college level coursework.

<div align="center">Grade Point Average</div>

Similar to other studies that found grade performance to be an important predictor for persistence, earning a higher GPA increased the likelihood of completion by almost 30% per unit. GPA above 2.5 was found to substantially increase the likelihood of college completion all throughout the study period, but of greatest impact in terms 8, 11, 14, 17, and 19. Students that earned a GPA below 2.5 in the first two years had significantly lower graduation rates. Demonstrating good academic performance early one helps decrease time-to-degree and increases success.

Academic performance in the first year has been shown to be an important predictor of degree attainment. Adelman (2006) also found that if a student's first-year GPA falls into the top two quintiles, the probability of earning a degree increases by nearly 22%. Nora and Cabrera (1996) found that students' GPA at the end of the first year was three times more important for Black and Hispanic students' persistence than for White students.

Milestones

Certain milestones also played a significant role in the likelihood of graduation.

Students who reached the threshold of 20 credit hours were 15.388 times more likely to

graduate than those that did not. If a student was able to reach the threshold of 20

credit hours in the first two years, they were significantly more likely to not only

graduate, but to do so earlier in years four and five.

The findings of this study support previous research on credit momentum.   The

more credit hours a student accumulates in the first two years, the more likely they are

to graduate. Students who earned a bachelor's degree completed 25 more credits by

the end of the second year than those who did not earn a bachelor's degree (Adelman,

2006). However, this appears to be related to attendance patterns. Students earning

less credit hours in the first two years also were more likely to attend college part-time,

stop out, and earn less than 20 hours in the first year.

Certain courses also serve as gateway courses to degree completion. Adelman

(2006) examined the course categories of students enrolled in their first two years of

college (at both community colleges and four-year institutions). Students who went on

to complete their bachelor's degree completed college-level writing, math, and English

composition in the first two years at a higher rate than students who did not complete

their bachelor's degree.

Course Performance

Academic performance had a significant impact on graduation. Failing a course greatly reduced a student's probability of graduating. They were .007 less likely to graduate. Students that withdrew from a course greatly reduced the likelihood of graduating by .276.   Other studies have shown the importance of course performance.

Study Implications

There is a growing recognition that other countries are surpassing the United States in the percentage of adults that have completed postsecondary education. It is also well documented that the economic returns of increased educational attainment are increasing. This is also at a time when the American economy needs more highly educated workers to provide innovation and leadership in an increasingly more competitive global economy. It is imperative that the US focus attention on boosting college completion, particularly for growing, disadvantaged populations. Despite evidence that these populations greatly benefit from completing a college degree, they are still less likely to enroll in postsecondary education, and even less likely to graduate. Improving the equality of postsecondary education opportunities is critical for promoting economic mobility and increasing educational attainment rates in the United States.

This study focused on low-income, URM students at an urban community college district. Most studies focus on a deficit approach that describes the limitations with the group. This study sought to examine covariates on this population in order to best

understand what factors increase the likelihood of graduation and how interventions can be designed to support educational success.

Need to Clarify Goals of Federal Policy and Research

A report of the Pew Charitable Trusts recommends that we clarify the goals of federal policy and research in postsecondary education. In 1999, Kane argued that one of the challenges with U.S. policy on postsecondary education is that the goals are not clear and it should be to increase college enrollments of low-income students (Kane, 1999). Expanding on that goal, Haskins, Holzer, and Lerman (2009) recommend that the Secretary of Education promote not just enrollment, but college completion rates among low-income students and make it the official goal of U.S. education policy. College completion rates would need to be reported on an annual basis by income to track progress on achieving the goal.

Need to Expand Federal Reporting of Outcomes

Currently, federal accountability measures require reporting of graduation rates at 150% of the length of the expected program length via IPEDS. Though community colleges are still referred to as a two-year institution, the reality is that the vast majority of students – even those enrolled full-time – do not graduate in two or even three years. Less than 1% of the low-income URM population graduated in two years and only 3.5% graduated in three years.

Additionally, because of work and family responsibilities, the majority of them are not enrolled full-time. The majority of low-income, URM students are not being

accounted for in IPEDS reporting because it still assumes a traditional baccalaureate institution and population where students attend full-time at the same place for a specific period of time. The US Department of Education needs to expand their tracking to account for part-time students that move across the higher education system and take longer than the expected 150% time frame. Otherwise, they are slipping through the cracks and their outcomes are not being captured.

<div align="center">Need for Extended Support Beyond the First Year</div>

Unlike other research studies that focus their retention strategies on the first semester or first year experience, this study suggests that low-income, URM community colleges students are actually persisting for a considerable amount of time beyond the first year and are at the greatest risk of dropping out in later years. They are at highest risk of dropping out in years four, five, and even six years. This is true of all other students in the community college district utilized for this study as well. However, non-URM low-income students are graduating and transferring in year 6 at a greater rate, whereas low-income URM students are persisting for six years, then leaving without a degree.

While academic support systems are important in the beginning of a student's career, it is important to have not only sustained support throughout the course of their enrollment, but more targeted interventions in years five and six. It is important to understand the challenges these students face and the persistence they demonstrate when they finally graduate.

Improve Pipeline with Feeder Schools in K-12

As open door institutions, all students are welcome regardless of their level of academic preparation. In this study, 95% of the low-income, URM students were below college-level in math; 74% were below college-level in English; 57% scored below college-level in Reading. Coming underprepared for college level work contributes to the already complex set of challenges in achieving their goals of completing a college degree. Colleges and universities need to work more closely on aligning the K-12 curriculum to better prepare students for college-level work. Students that successfully complete a college-level English or math course had a much higher likelihood of graduating and could earn their degrees quicker.

Improve Outcomes for Students Taking Remedial Coursework

Though students are underprepared in English and math, enrollment in remedial courses did not increase the likelihood of college degree attainment. Even successful completion of remedial math and English courses did not increase degree completion in this study. Nationally, similar results can be found. Results from Complete College America indicate that a significant number of students fail to enter a college program of study because they fail to enroll in the next remedial or gateway course (Charles A Dana Center, et al, 2012). Only 25% of the community college students who took a remedial course graduated within eight years (Bailey, 2009). If students' deficiencies in English and math are to be addressed in the college setting, it is important for success to follow.

Some community colleges have experienced increased success rates by improving the curriculum and creating refresher and fast-track course options. Lee College increased the percentage of students earning grades A through C (from 40% to 60%) by making improvements to the curriculum and in the delivery of their developmental education courses (Achieving the Dream, 2011a). They developed eight week fast-track courses and increased contact hours and class time. They also assigned a counselor to work closely with students in the classroom. Roxbury Community College redesigned their developmental math curriculum, added a lab component, and collapsed the sequence. This resulted in an increase of students progressing to college-level math by the third semester from 11% to 25% (Achieving the Dream, 2011a). Montgomery County Community College redesigned their developmental math curriculum resulting in increased success rates from 40% to 60% (Achieving the Dream, 2011a).

Encourage Milestone Achievements

Earning an advanced certificate or even a basic certificate greatly increased a student's chances of graduating with an associate degree or a bachelor's degree. After being enrolled in a program for so long, it may be encouraging to receive some type of credential and can, in fact, motivate them to complete their degree. Additionally, students who were able to earn 20 credit hours were more likely to graduate. Community colleges should encourage the completion of certificates along the way. Colleges can also integrate a multi-step approach to earning an associate's degree

where incremental specialization certificates are automatically earned as part of the curriculum.

Increase the Rate of Transfer to Baccalaureate Institutions

Students that transferred to a four-year institution had a higher likelihood of graduation. Community colleges need to continue to build strong relationships with four-year institutions. It is critical for community colleges to have comprehensive transfer agreements with numerous four-year institutions. Better curriculum alignment and articulation agreements guarantee a more seamless transition for students. Many low-income, URM students have persisted for several years before transfer to a four-year institution and they cannot afford to lose time and momentum repeating coursework that did not transfer. Many states have comprehensive statewide articulation initiatives to facilitate the transfer of community college students to four-year institutions.

Some community colleges have tried to increase the assistance given to students seeking a bachelor's degree. City Colleges of Chicago hired transfer directors at each of their colleges to assist students interested in transferring to four-year institutions (City Colleges of Chicago, 2013). They have introduced an initiative that includes matching graduation plans with transfer goals and validating education plans created in caseload advising for maximum transferability.

Increase Advising Services

Successful advising increases students' chances of success. Bahr (2008a)

demonstrated the positive effects of academic advising in his research of community

college students in California, particularly for students with the lowest levels of

academic preparation. In all conditions and for nearly all racial and ethnic groups,

advising appeared to be beneficial to students' level of degree attainment.

Academic advising is critical for community college students as they often need

additional assistance in navigating the higher education landscape. It is also challenging

given the variety of students and needs. First generation college students often receive

limited information from their families about the college process, immigrants can be

unfamiliar with the education and employment options here, and undecided students

may be uncertain of their career and educational goals (Bailey & Morest, 2006).

However; with decreasing budgets, academic advisors caseloads are increasing

and counseling sessions are decreasing. The ratios at most community colleges exceed

1,000 students per counselor (Fain, 2012). The San Diego Community College District

has a caseload of 1,700 students per counselor; Pasadena City College's caseload is

1,647 students per counselor (Fain, 2012). To meet demand, many sessions can only

last five minutes with sessions more than ten minutes long impossible. Many students

seeking academic advising are being turned away. San Diego Miramar College often has

wait times of over two hours, and must still turn students away three hours before

closing. Pasadena City College turned away 2,500 students who sought counseling over

a recent six month period (Fain, 2012).   Additionally, more than half of community

colleges limit the number of counseling sessions a student may have in a given term

(Edwards, 2011).

Advisors at community colleges not only have a very high caseloads, but also

perform a wide variety of other types of advising services. Advisors are often called

upon to serve not only as academic counselors, but career counselors, personal

counselors, even financial counselors. A recent study by the American College

Counseling Association's Community Colleges Task Force found that most advisors are

not only responsible for academic advising, but also mental health counseling, career

counseling, admissions advising, disabilities services, teaching, and tutoring (Edwards,

2011). Community colleges are seeing a rise in the number of students with severe

psychological problems, but many must refer these students off campus as they lack the

funding to employ additional staff to meet demand (Grasgreen, 2012).

In order to increase academic advising services, some community colleges have

been able to increase the number of advisors. The City Colleges of Chicago have a goal

of cutting the caseload in half to about 450 students per advisor (City Colleges of

Chicago, 2013).   They also have introduced an initiative called "intrusive advising"

where students are not expected to seek advising support on their own, but are

required to meet with the advisors and develop their own educational plans. They also

have introduced a transfer transcript evaluation process and caseload advising to help

increase the number of student meetings with advisors.

With funding cutbacks, some community colleges are trying to utilize advances in online educational technology to assist in meeting advising needs. Some colleges are using online advising tools to supplement in-person counseling services and decrease caseloads. Many of these tools are free and offer interactive communication and information needed to help inform students. Lane Community College in Oregon has utilized an online advising system with 92% of participants indicating that they were satisfied with their experience and 77% saying that they were very engaged in the process (Alvarez, Hampton, and Meenaghan, 2013). Tennessee Technical Centers have increased graduation rates to 75% through the use of mandatory online orientation and restriction of course choices (Ratliff, J. & Tutty, J., 2012). Students have narrow course enrollment options as the focus is on enrollment in the program with content, objectives, and required courses fully defined.

Other colleges utilize peer mentoring services from more advanced community college students that can assist in providing guidance. Phi Theta Kappa, the international honor society at community colleges, initiated a student-led project to increase completion. Students can work with peer mentors who have been successful in their studies and can help keep them on track to complete their degree and transfer to a four-year institution.

<div align="center">Provide Centralized Services</div>

Many community colleges are starting to provide one-stop services to provide students with the full array of counseling services needed. Because of the financial

challenges low-income students face, it may be beneficial for community colleges to provide centralized services that include other support areas such as financial counseling. Many students have to navigate the complexities of state and federal aid while working. They may also have to balance school with family responsibilities. Students who need to support themselves while attending college may need precise career goals with a clear coursework plan.

<div align="center">Provide More Flexible Course Options</div>

Although previous research has demonstrated mixed reviews of online learning, results of this study indicated that students were more likely to graduate if they took online courses. It suggests the importance of additional flexibility in course delivery options. However, ensuring high quality online teaching and learning is essential to preserving the democratizing aspects of community colleges (Cox, 2006).

<div align="center">Expand the Use of Early Alert Systems for Timely Intervention</div>

This study demonstrated that poor academic performance can increase likelihood of attrition. Lower GPA decreases the likelihood of degree completion. Students who failed a course were less likely to graduate. Research indicates that early intervention can change outcomes. If students are performing poorly in class or have excessive absences, an intervention needs to occur soon. Early intervention strategies to identify at-risk students are critical to ensuring that they succeed in achieving their goals.   Many community colleges utilize an early warning system to alert students,

faculty and advisors that the student is at risk of poor academic performance. Institutions can develop a coordinated response to the address students in need.

If it appears to that the student is overwhelmed and the course outcome cannot be salvaged, students should be encouraged to withdraw from that course instead of failing to attend class and ultimately accepting a failing grade as this practice greatly reduces degree completion. A larger percentage of low-income students repeatedly fail courses due to absence early on in the semester. They can be counseled on taking an appropriate course load before the semester starts and should communicate with faculty early in the semester.

Student Centered Model of Integrated Institutional Improvement

This study demonstrated the achievement gaps of students who traditionally have faced the most significant barriers to success. They graduated at a lower rate compared to other students. A larger percentage of low-income, underrepresented minority students were underprepared for college-level work in reading, English, and math, did not successfully complete remedial coursework, and were more likely to fail and withdraw from courses. In order to increase higher rates of success for all students, community colleges must have a student-centered vision and a culture of evidence to support it.

Achieving the Dream, a national nonprofit group dedicated to improving the success of low-income, minority community college students, developed a model for closing the gap and accelerating student success. Nearly 200 colleges participate in the

Achieve the Dream initiative. Their model includes five principles of institutional

improvement to increase student success through a student centered model. The five

principles are 1) having a committed leadership, 2) using evidence to improve programs

and services, 3) increasing broad engagement, 4) increasing systemic institutional

improvement, and 5) achieving equity for all students.

Several colleges have implemented student centered programs targeted to

specific groups of students. Capital Community College established a Black and Latino

Male Resource Center to provide mentoring, academic support, and counseling services

for male students of color. Participants also are invited to participate in summer bridge

programs with accelerated remedial courses, intrusive advising, and mentoring. Since

its inception, fall-to-fall retention rates increased for this population from 25% to 50%

(Achieving the Dream, 2011b). Tacoma Community College created a summer academy

bridge program for African American males to increase engagement by using a culturally

relevant curriculum and partnering with the basketball team for mentoring and role

modeling. Success rates in all English and math courses have increased for participants

and the performance gap among African American males and White students is

decreasing (Achieving the Dream, 2011b).

Study Limitations

It is important to consider the limitations of this study. It was delimited to

community college students enrolled in an urban community college district. Although

the community college district may be representative of other urban community

colleges across the country, there is a threat of external validity as results may not be generalized to other populations and institutions.

The study focused on a specific type of student enrolled at the community college starting at a particular point in time. The study cohort consisted of first-time, associate degree seeking community college students that began in the fall of 2000. Additionally, associate degree seeking students comprise only a small portion of the total community college population. Community colleges have diverse mission areas and many community college students are enrolled in occupational degree or certificate programs, workforce development programs, adult basic education and English language programs, remedial courses, and community/continuing education courses. The focus of this research study was on students enrolled in associate degree programs, where much of the attention in the community college accountability debate resides.

Since timing was an important component to this research study, it was necessary to control for different types of student mobility patterns common among community college students. Efforts were made to exclude students who began at a four year institution and then transferred to a community college. Additionally, efforts were made to exclude students enrolled at a four year institution taking supplemental courses at a community college, and high school students enrolled in dual degree programs. As a result, this study may only be applicable to those students who begin at community colleges.

The study period was also delimited to seven years. The decision was made to extend the time period to seven years instead of using the IPEDS approach of 150% since many of the community college students pursued their degrees part-time, and many students take multiple remedial courses to bring them up to college level work. The time period of six or seven years was utilized in other research studies examining community college student outcomes. Some outcomes will be missed for students that took longer than seven years to complete a degree.

As noted in the literature review, there are numerous variables that can be studied in college persistence research. The variables used in this study were limited to variables that were available from the institution or the National Student Clearinghouse (NSC) provided by the institution. By studying only a portion of the variables, there is a threat to internal validity as conclusions about the factors that have an impact on the degree attainment and attrition were limited to what was available.

A statistical issue to consider in longitudinal analysis is that variables can include both time independent and time dependent covariates. Time independent covariates do not change over the study time period. An example can be someone's race/ethnicity and sex. Time dependent covariates can change over the study time period. For example, semester GPA or enrollment intensity (full-time or part-time) may change during the time intervals. However, in this study, all student background characteristics, such as demographics, academic preparation, and external commitments, were coded as time independent. The value collected at the first semester was held constant. In

most instances, this made sense as the study participant's sex, race/ethnicity, age at entry, native language, and placement test scores presumably did not change over the course of the 20 semesters studied. However, other student background characteristics such as household income, employment status, marital status, and number of children may, in fact, change over the time period of study. Due to data limitations and institutional practice of demographic data not being regularly updated in subsequent semesters, these variables were used as time independent covariates though they may actually have changed over time.

In this study, it was assumed that the community colleges maintained accurate records. In some cases though, it was known that demographic data were not updated or that there were data entry or respondent errors. For example, at the time of entry for the cohort of study, some demographic data from registration forms were hand entered and contained data entry errors. Some examples include entered the current date instead of a birth date. Efforts were made to exclude known data entry or respondent errors. Missing data were excluded when appropriate. However, additional data errors unknown to the researcher were possible and need to be considered as another potential study limitation. Also, the data used from the National Student Clearinghouse represented a majority (93%) of higher education institutions in the United States, but not 100%. As a result, some students may have transferred and graduated from other institutions that did not participate in the NSC, resulting in an undercount of transfers and graduates.

Another limitation to the study was the inability to incorporate financial aid factors into the overall model. As noted in the literature review, several studies indicate the importance of financial aid to college persistence using EHA (Chen, 2007; Chen & DesJardins, 2010; DesJardina, Ahlburg, & McCall, 1999; Gross 2008). There is evidence to support the idea that more financial aid leads to increased degree completion. Since this study focused on low-income students, the amount, duration, and kind of financial assistance could influence a student's decision to persist or drop out. Paulsen and St. John (2002) found that financial need was associated with lower levels of persistence among low-income students. It would be important to try to understand the relationship between different financial aid types and other factors found to impact persistence. Since financial aid could not be incorporated into this study, it is difficult to gauge the impact of financial aid and the interplay with academic and social integration factors.

Another limitation to consider is the EHA methodology itself. Many times, the hazard rate is higher at the end because the numerator continues to decrease as the survivors entering the next time period decreases. For example, when looking at the number of drop outs per year, the highest overall percentage of students that dropped out were in year one when 268 students out of 1,566 students in the cohort (17.1%), though the years with the highest hazard of drop out occur in years five and six when the total number of students dropping out is 138 and 233 respectively.   Some view the

higher hazard rate as more of an artifact of the process, so it is important to keep the overall percentages in perspective when interpreting results.

Future Research

This study examined community college students enrolled in an urban community college district in the Midwest. Although the community college district may be representative of other large urban community colleges across the country, future research could utilize national datasets to see if it is applicable to the wider population. Results of this study could be used to identify factors associated with degree completion for other college populations and types of institutions.

One area that warrants additional investigation is the complex enrollment patterns of these students. Some students began their enrollment at the community college, stopped out for a semester or even for several years, transferred to another two-year institution, came back to the community college district of study, then concurrently enrolled in a four-year institution before ultimately graduating with either an associate's degree, a bachelor's degree, or both. An interesting question is whether different pathways lead to more successful outcomes for certain groups of students, or if an attempt to reduce the number of transitions would be beneficial for completion and reduced time-to-degree.

Additionally, it might be beneficial to expand the study sample to incorporate students who began at a four year institution and then transferred to a community college. Twenty to thirty percent of students enrolled at four-year institutions transfer

to a community college (Lichtenberger, 2011; Moltz, 2009; Sima, Inman, & Stein, 2003). It would be interesting to conduct research on this population specifically since they do comprise a large portion of community college students. Many times, they also have additional financial burden as they are still responsible for student loans at the four year institutions that they transferred from and have additional financial burden. It is critical to examine their enrollment pathways and to examine strategies for increasing their success.

Beyond external commitments, this study did not fully examine social integration factors that could impact college persistence. Tinto's model of Student Integration has served as the framework for numerous studies over the past several decades. For Astin's I-E-O model, engagement could be viewed as an environmental and outcome factor where engagement is mediated by student choice. It would be interesting to examine how institutional conditions can affect the environment by encouraging student involvement with the institution, then assessing the impact on degree completion. Future research could examine how social integration factors and engagement levels impact degree completion among low-income, URM community college students.

The study period was also delimited to seven years. The time period of six or seven years is often used in the literature to track degree outcomes for community college students. However, given the complex mobility patterns of the students, their level of preparation, and additional family and work responsibilities, some students will

take longer than seven years to complete their degree. Seven percent of low-income,

URM students were still enrolled at the end of the study period. Four percent of the

rest of the population were also still enrolled. Future studies could extend the study

period to ten years to get a more comprehensive perspective on time-to-degree. It also

may allow for a median lifetime to be calculated.

Another area for future research is the area of financial aid. Originally, financial

factors were going to be included in the overall conceptual model, but due to data

availability and accuracy in the study sample, they were omitted from the analysis.

Since the focus on the study was on low-income students, this could be an important

consideration. As noted, several studies have noted the positive impact of financial aid

on degree completion, particularly for low-income students. It would be beneficial to

examine the impact of the timing of financial aid on degree completion for this

population. It would be important to consider not only whether financial aid promotes

degree completion, but when those effects occur and how they vary over time.

In the future, it could be useful to focus on the impact of sex and ethnicity.

When examining the seven year outcomes of all students by ethnicity, degree

completion rates were similar for all ethnicities except for Black students: 20.8% for

Whites, 19.3% for Asians, 18.7% for Hispanics, and 14.4% for Blacks.   By sex, completion

rates were higher for females (18.7%) than for males (14.8%). But for Black males,

completion rates were only 10.1% compared to 20.4% for White males, 20.2% for Asian

males, and 15.2% for Hispanic males. Degree completion rates for Black females were

higher than Black males despite being more underprepared in reading, English, and math. Completion rates for higher income Black males were only slightly higher than lower income males: 14.0% below the poverty line and 15.7% for Black males above the poverty line. In order to design the most effective intervention strategies, it would be beneficial to examine what academic integration factors contributed to degree completion among Black males.

It also may be worthwhile to re-examine the treatment of missing data in this dataset. Missing data can create a biased sample if handled in a manner which makes the sample different than the full population from which it was drawn. In this study, students with missing ethnicity or income information (600 students) were excluded from the analysis. Other missing data representing less than 10% of the cases were eliminated via listwise deletion in the analysis. This may bias results if the remaining cases were not representative of the sample. Other methods shown to perform better than ad-hoc methods are maximum likelihood estimation and multiple imputation. Maximum likelihood estimation can preserve relationships in the dataset and specifies a statistical model for each analysis. In multiple imputation, missing data points are predicted using existing data from other variables. Multiple imputation restores the variability in the missing data. Either of these methods offer different solutions to the issue of missing data.

Conclusion

Community colleges are an important entry point for student groups that have faced the most significant barriers to success. Community colleges account for almost half of all undergraduate enrollments in the United States and also enroll a higher proportion of low-income and minority students (American Association of Community Colleges, 2012; Aud, Hussar, Johnson, Kena, & Roth, 2012). The purpose of this study was to examine the timing of academic integration factors that contribute to degree completion of underrepresented minority and low-income community college students. In order to identify the temporal aspect of academic factors associated with degree completion and withdrawal, this study used Event History Analysis (EHA).

EHA was used to characterize the probability that a student would graduate or drop out during the study period and modeled the probability as a function of targeted covariates using discrete-time logistic regression. This study examined associate degree seeking, first time, urban community college students over the course of seven years (20 semesters) and examined their outcomes. Results indicated that students were most likely to graduate in year five and six. Students were also most likely to drop out in years five and six. This is contrary to most studies that indicate that the first year is the most important retention time period. Variables that were found to increase chances of graduation included full-time enrollment, successful completion of college level English and math courses, completion of 20 credit hours, receiving an advanced or basic certificate, maintaining a high ratio of courses attempted to earned, earning a higher

GPA, taking online courses, and transferring to a four year institution. Factors that reduced the likelihood of graduation were being male, having a lower family income quartile, failing or withdrawing from multiple courses, and taking remedial math. Results of this study can be used to promote policies and practices within the community college system that lead to improved degree outcomes for low-income, underrepresented minority students.

APPENDIX A

DESCRIPTION OF ASSOCIATE DEGREE PROGRAMS

Students in the liberal arts/baccalaureate transfer mission area include students enrolled in five different degree programs: the Associate in Arts, Associate in Science, Associate in Engineering Science, and Associate in Fine Arts, and the Associate in Arts in Teaching. All of these programs are intended for students planning to transfer to a four-year college or university to complete their baccalaureate degree.

The Associate in Arts (A.A.) degree includes 62 credit hours with a minimum of 38 credit hours in general education, 16 elective credit hours, and 8 hours of a foreign language. The Associate in Science (A.S.) degree includes 64 credit hours with 39 credit hours in general education, 14 credit hours in mathematics and physical sciences, and 11 elective credit hours. Completion of the A.A. or A.S. degree fulfills the requirements of the state's transferable general education core curriculum and prepares students to transfer with junior standing.

The Associate of Arts in Teaching (A.A.T.) degree offers courses required for transfer to a four-year college or university for students wanting to pursue a major in teaching secondary math or early childhood education. The A.A.T. degree is based on the state's professional teaching standards and includes the general education core curriculum. In addition, students must have a 2.5 grade point average, successfully completed the state test of basic skills, and have started the standards based professional portfolio.

The Associate in Engineering (A.E.S.) degree offers courses required for transfer to a four-year college or university for students majoring in engineering sciences.

The Associate in Fine Arts (A.F.A) degree offers courses required for transfer to a four-year college or university for students majoring in art, art education, music education, or music performance. Completion of the A.E.S. or A.F.A. degree does not fulfill the requirements of the state's requirements of the general education core curriculum.

Students can also enroll in the numerous Associate in Applied Science (A.A.S.) degree programs that are designed primarily for students interested in acquiring technical/occupational skills to enter the job market. Along with advanced and basic certificate offerings, they constitute an important share of the occupational/career programs at community colleges and comprise a growing share of projected jobs in the U.S. job market outlook. A number of A.A.S. degree students do, indeed, transfer and graduate with a bachelor's degree. A number of four-year colleges and universities offer baccalaureate degrees designed for A.A.S. degree graduates. For example, students enrolled in the Architectural Drafting A.A.S. degree program tend to graduate from four-year institutions at a higher rate than other programs. Students in the A.A.S. degree programs have similar associate degree and bachelor's degree completion rates as students in the baccalaureate degree transfer areas. Similarly, they also tend to transfer to four year institutions at similar rates. As a result, they were included in the study sample cohort.

APPENDIX B

SEVEN YEAR OUTCOMES BY STUDENT BACKGROUND CHARACTERISTICS

Outcomes by Sex

Group	Outcome		Male	Female
Low-income URM	Still Enrolled	N	38	70
		%	7.4%	6.6%
	Graduated	N	47	187
		%	9.2%	17.7%
	Dropped	N	426	798
		%	83.4%	75.6%
All Others	Still Enrolled	N	23	43
		%	3.4%	4.9%
	Graduated	N	129	175
		%	19.0%	19.8%
	Dropped	N	526	665
		%	77.6%	75.3%

Outcomes by Ethnicity

Group	Outcome		Asian/ Pacific Islander	American Indian/ Alaskan Native	Black	Hispanic	White
Low-income URM	Still Enrolled	N	-	3	75	30	-
		%	-	21.4%	7.0%	6.3%	-
	Graduated	N	-	1	151	82	-
		%	-	7.1%	14.0%	17.3%	-
	Dropped	N	-	10	851	363	-
		%	-	71.4%	79.0%	76.4%	-
All Others	Still Enrolled	N	9	0	16	16	25
		%	3.4%	0.0%	4.7%	5.2%	3.9%
	Graduated	N	51	1	53	64	135
		%	19.3%	33.3%	15.6%	20.9%	20.8%
	Dropped	N	204	2	270	226	489
		%	77.3%	66.7%	79.6%	73.9%	75.3%

Outcomes by Age

Group	Outcome		Over 25 yrs	Under 25
Low-income URM	Still Enrolled	N	28	80
		%	7.5%	6.7%
	Graduated	N	64	170
		%	17.2%	14.2%
	Dropped	N	281	943
		%	75.3%	79.0%
All Others	Still Enrolled	N	12	54
		%	2.7%	4.8%
	Graduated	N	60	244
		%	13.7%	21.7%
	Dropped	N	365	826
		%	83.5%	73.5%

Outcomes by Number of Children

Group	Outcome		0%	1 to 3 kids	4 or more
Low-income URM	Still Enrolled	N	63	34	11
		%	6%	8%	16%
	Graduated	N	151	71	12
		%	14%	16%	17%
	Dropped	N	840	337	47
		%	79.7%	76%	67%
All Others	Still Enrolled	N	117	46	11
		%	5.0%	7%	13%
	Graduated	N	409	115	14
		%	17.5%	16%	17%
	Dropped	N	1813	545	57
		%	77.5%	77%	70%

Outcomes by Parental Status

Group	Outcome		Not a single parent	Single Parent
Low-income URM	Still Enrolled	N	72	36
		%	6.2%	8.7%
	Graduated	N	163	71
		%	14.1%	17.2%
	Dropped	N	918	306
		%	79.6%	74.1%
All Others	Still Enrolled	N	59	7
		%	4.1%	5.9%
	Graduated	N	283	21
		%	19.6%	17.6%
	Dropped	N	1100	91
		%	76.3%	76.5%

Outcomes by Marital Status

Group	Outcome		single	married
Low-income URM	Still Enrolled	N	98	10
		%	6.9%	6.7%
	Graduated	N	213	21
		%	15.0%	14.1%
	Dropped	N	1106	118
		%	78.1%	79.2%
All Others	Still Enrolled	N	55	11
		%	4.3%	4.0%
	Graduated	N	262	42
		%	20.4%	15.1%
	Dropped	N	966	225
		%	75.3%	80.9%

Outcomes by Employment Status

Group	Outcome		FT	PT	Unemployed	Unknown
Low-income URM	Still Enrolled	N	42	31	33	2
		%	8.3%	7.1%	5.9%	3.4%
	Graduated	N	82	78	67	7
		%	16.1%	17.8%	11.9%	12.1%
	Dropped	N	384	329	462	49
		%	75.6%	75.1%	82.2%	84.5%
All Others	Still Enrolled	N	33	15	18	0
		%	4.7%	3.5%	4.5%	0.0%
	Graduated	N	132	93	75	4
		%	18.9%	21.7%	18.9%	10.8%
	Dropped	N	534	320	304	33
		%	76.4%	74.8%	76.6%	89.2%

Outcomes by Level of Reading Preparation

Group	Outcome		College Level in Reading	Below College Level in Reading
Low-income URM	Still Enrolled	N	38	49
		%	7.6%	7.3%
	Graduated	N	83	97
		%	16.7%	14.5%
	Dropped	N	376	522
		%	75.7%	78.1%
All Others	Still Enrolled	N	20	25
		%	3.4%	6.4%
	Graduated	N	146	65
		%	25.1%	16.6%
	Dropped	N	416	301
		%	71.5%	77.0%

Outcomes by Level of English Preparation

Group	Outcome		College Level in English	Below College Level in English
Low-income URM	Still Enrolled	N	19	55
		%	6.7%	6.8%
	Graduated	N	68	89
		%	23.9%	11.0%
	Dropped	N	197	662
		%	69.4%	82.1%
All Others	Still Enrolled	N	11	24
		%	3.3%	4.9%
	Graduated	N	96	94
		%	28.7%	19.1%
	Dropped	N	228	375
		%	68.1%	76.1%

Outcomes by Level of Math Preparation

Group	Outcome		College Level in Math	Below College Level in Math
Low-income URM	Still Enrolled	N	3	87
		%	4.8%	7.6%
	Graduated	N	21	168
		%	33.9%	14.7%
	Dropped	N	38	889
		%	61.3%	77.7%
All Others	Still Enrolled	N	4	46
		%	2.5%	4.9%
	Graduated	N	50	189
		%	30.7%	20.3%
	Dropped	N	109	695
		%	66.9%	74.7%

Outcomes by Level of Preparation Overall

Group	Outcome		Below College Level All Areas
Low-income URM	Still Enrolled	N	30
		%	6.7%
	Graduated	N	48
		%	10.6%
	Dropped	N	373
		%	82.7%
All Others	Still Enrolled	N	11
		%	5.3%
	Graduated	N	35
		%	16.7%
	Dropped	N	163
		%	78.0%

Outcomes by Degree Type at Entry

Group	Outcome		AA	AAS	AES	AFA	AGS	AS
Low-income URM	Still Enrolled	N	47	12	0		41	8
		%	7.3%	7.2%	0.0%		6.5%	6.6%
	Graduated	N	99	18	1		88	28
		%	15.5%	10.8%	25.0%		13.9%	23.1%
	Dropped	N	494	137	3		505	85
		%	77.2%	82.0%	75.0%		79.7%	70.2%
All Others	Still Enrolled	N	24	4	0	1	34	3
		%	4.9%	2.4%	0.0%	100.0%	4.2%	4.2%
	Graduated	N	89	22	3	0	175	15
		%	18.1%	13.0%	33.3%	0.0%	21.4%	20.8%
	Dropped	N	379	143	6	0	609	54
		%	77.0%	84.6%	66.7%	0.0%	74.4%	75.0%

APPENDIX C

DROP OUT MODEL SUMMARY

Target: Drop Out	Covariates	Model A Time Only				Model B Student Background (SB) Characteristics				Model C Academic Integration (AI)				Model D Time, SB & AI			
		B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds
D1		-2.671	.103	***	.069	-3.308	.311	***	.037	-1.144	.192	***	.319	-1.409	-1.409	***	.365
D2		-2.037	.085	***	.130	-2.660	.306	***	.070	-.949	.150	***	.387	-1.224	-1.224	***	.344
D3		-3.329	.294	***	.036	-3.891	.415	***	.020	-2.434	.316	***	.088	-2.664	-2.664	***	.441
D4		-2.325	.111	***	.098	-2.934	.313	***	.053	-1.232	.164	***	.292	-1.485	-1.485	***	.350
D5		-3.286	.183	***	.037	-3.897	.346	***	.020	-2.181	.216	***	.113	-2.427	-2.427	***	.377
D6		-2.992	.284	***	.050	-3.543	.406	***	.029	-1.864	.308	***	.155	-2.060	-2.060	***	.434
D7		-2.196	.124	***	.111	-2.788	.317	***	.062	-1.028	.171	***	.358	-1.276	-1.276	***	.352
D8		-1.948	.118	***	.143	-2.538	.315	***	.079	-.706	.163	***	.493	-.931	-.931	**	.350
D9		-2.349	.240	**	.095	-2.887	.377	***	.056	-1.331	.267	***	.264	-1.543	-1.543	***	.406
D10		-2.097	.139	***	.123	-2.679	.324	***	.069	-.895	.180	***	.408	-1.125	-1.125	**	.357
D11		-1.895	.135	***	.150	-2.475	.321	***	.084	-.694	.173	***	.500	-.921	-.921	*	.353
D12		-2.004	.244	***	.135	-2.544	.381	***	.079	-.985	.270	***	.373	-1.181	-1.181	**	.413
D13		-1.729	.140	***	.178	-2.304	.321	***	.100	-.602	.178	**	.547	-.807	-.807	*	.353
D14		-1.463	.137	***	.232	-2.015	.319	***	.133	-.235	.175		.790	-.428	-.428		.351
D15		-2.188	.304	***	.112	-2.723	.421	***	.066	-1.278	.328	***	.279	-1.467	-1.467	***	.447
D16		-1.426	.141	***	.240	-1.986	.322	***	.137	-.292	.178		.747	-.499	-.499		.354
D17		-.546	.118	***	.579	-1.082	.313	***	.339	.716	.163	***	2.046	.533	.533		.346
D18		-.067	.183		.935	-.544	.345		.580	1.180	.223	***	3.253	1.027	1.027	**	.381
D19		-.380	.159	*	.684	-.898	.335	*	.408	1.049	.212	***	2.856	.901	.901	*	.375
D20		.767	.194	***	2.154	.278	.355		1.320	2.614	.248	***	13.647	2.445	2.445	***	.401

Target: Drop Out	Model A Time Only				Model B Student Background (SB) Characteristics				Model C Academic Integration (AI)				Model D Time, SB & AI			
Covariates	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds
Hispanic																
Am Indian					-.504	.348		.604					-.742	.386	*	.476
Black					-.065	.082		.937					-.188	.090	*	.829
Male					.191	.071	**	1.210					.051	.075		1.052
Income, Q1																
Income, Q2					-.055	.098		.947					.013	.104		1.013
Income, Q3					-.257	.272		.774					-.230	.287		.794
Income, Q4					-.050	.523		.951					-.065	.570		.937
Age 25 and under					.087	.091		1.091					.181	.100		1.198
Native Language Eng					-.309	.096	***	.734					-.294	.105	**	.745
Employed																
Unemployed					.266	.069	***	1.305					.190	.074	**	1.209
Unknown					.402	.172	*	1.495					.348	.183		1.416
Marital Status, Single					-.063	.189		.939					-.072	.205		.930
Parental Status, No Children					.202	.226		1.224					.086	.242		1.090
Not a Single Parent					.014	.236		1.014					.144	.254		1.155
Reading, College Level																
Reading, Below College					-.187	.115		.830					-.245	.138	*	.783
Reading, Not Tested					-.168	.139		.845					-.387	.151	**	.679
English, College Level																
English, Below College					.148	.109		1.159					.100	.142		1.105
English, Not Tested					.040	.113		1.040					-.197	.129		.821
Math, College Level																
Math, Below College					.463	.183	**	1.589					.610	.203	**	1.840
Math, Not Tested					.713	.211	***	2.039					.725	.226	*	2.065
All Areas, Not Below					.373	.137		1.452					.144	.149		1.155
High School Diploma					-.170	.085	*	.843					-.017	.091		.983

Target: Drop Out	Model A Time Only				Model B Student Background (SB) Characteristics				Model C Academic Integration (AI)				Model D Time, SB & AI			
Covariates	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds	B	S.E.	Sig	Odds
Full-time Enrollment									-.434	.073	***	.648	-.459	.075	***	.632
Enrolled in Remedial Reading									.248	.147		1.281	.285	.156		1.330
Enrolled in Remedial English									.133	.143		1.143	.071	.157		1.074
Enrolled in Remedial Math									-.253	.173		.777	-.377	.177	*	.686
Enrolled in Any Remedial Course									.208	.196		1.231	.097	.203		1.102
Remedial Reading Course, A-C									-.257	.145		.773	-.218	.148		.804
Remedial English Course, A-C									-.238	.131		.788	-.312	.134	*	.732
Remedial Math Course, A-C									-.183	.087		.833	-.129	.089		.879
College Level English, A-C									-.721	.076	***	.486	-.770	.079	***	.463
College Level Math Course, A-C									-.842	.122	***	.431	-.853	.124	***	.426
Cr Hrs Attempted/Cr Hours Earned									-.270	.171		.763	-.289	.173		.749
Milestone: 20 Credit Hours Earned									.234	.125		1.264	.263	.126	*	1.300
Received an Advanced or Basic Certificate									1.383	.220	***	3.988	1.387	.223	***	4.003
Term GPA									-.410	.049	***	.663	-.402	.049	***	.669
Withdrew from a Course During Term									.280	.101	**	1.323	.279	.102	**	1.322
Failed a Course During the Term									.123	.096		1.131	.102	.097		1.107
Academic Hold on Account									.501	.182	**	1.650	.490	.184	*	1.632
Transferred to a 4 Year Institution									-.162	.148		.851	-.158	.150		.853
Took an Online Course During Term									.036	.100		1.037	.036	.102		1.037
-2 Log Likelihood	6749.898				6657.626				5938.874				5867.276			

*** Indicates significance at the .001 level; ** at the .01 level; and at the .05 level

APPENDIX D

FITTED HAZARD FUNCTIONS: TARGET GRADUATION BY SELECT CHARACTERISTICS

Sex*
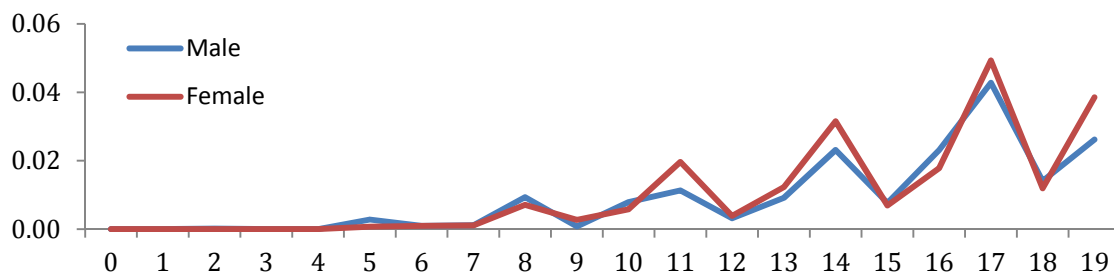
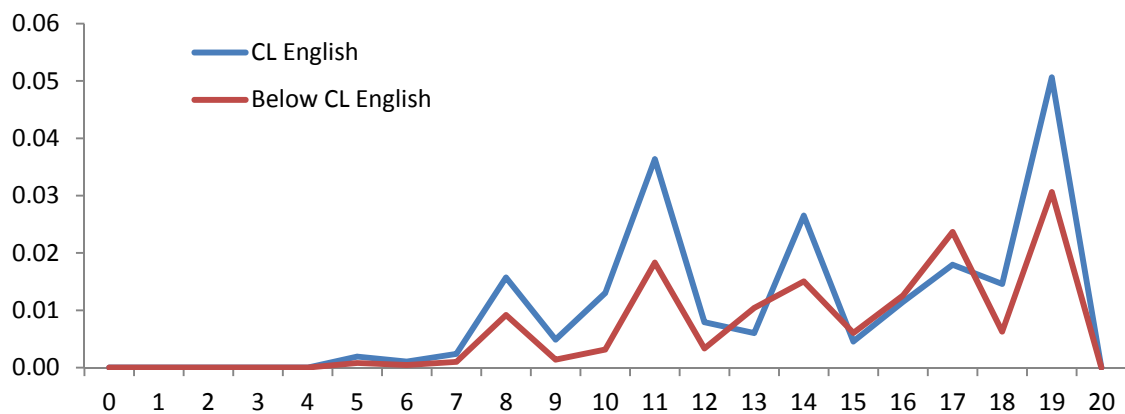Income Quartile*
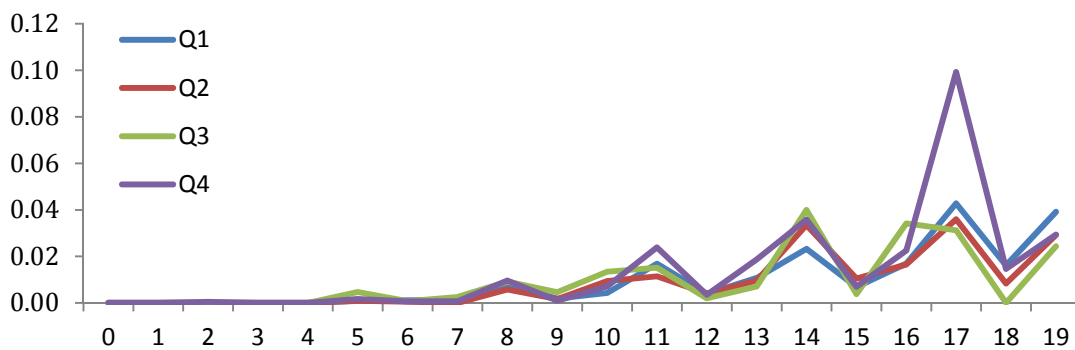
Race/Ethnicity
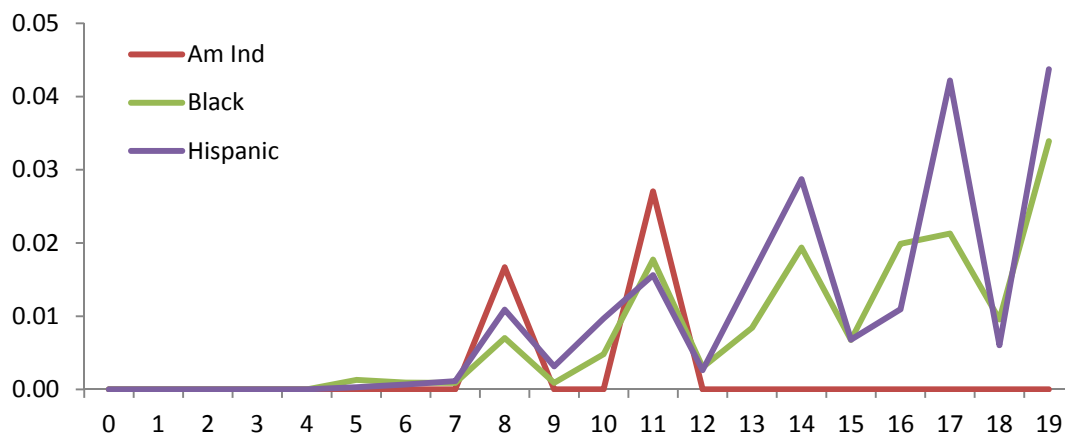
* Statistically significant
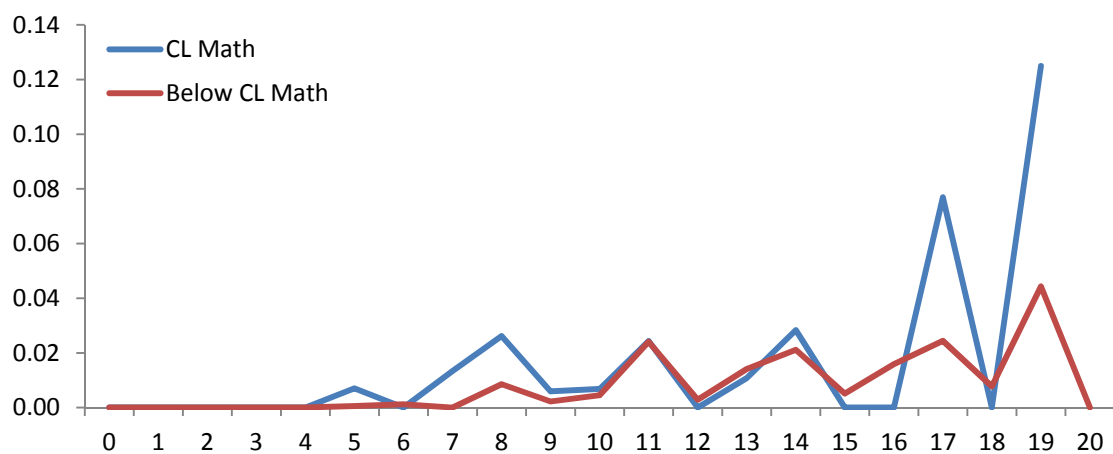
Age Group
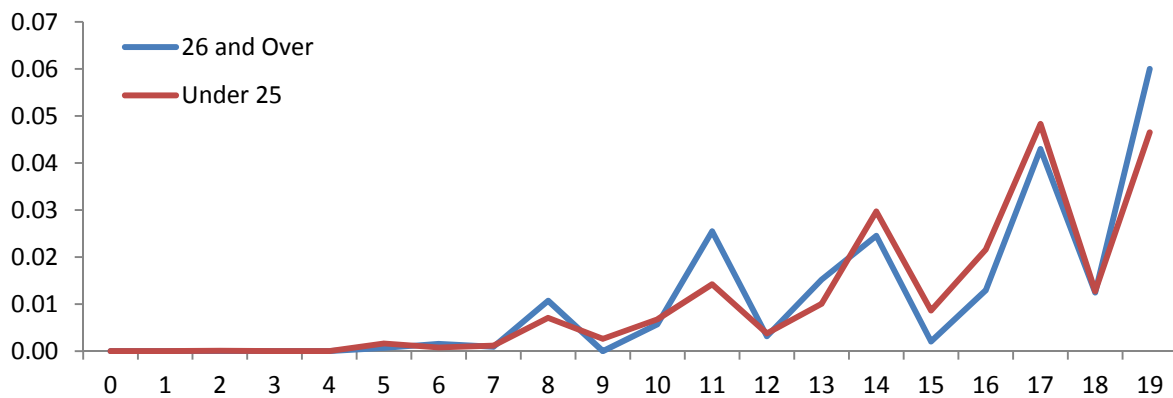
Native Language
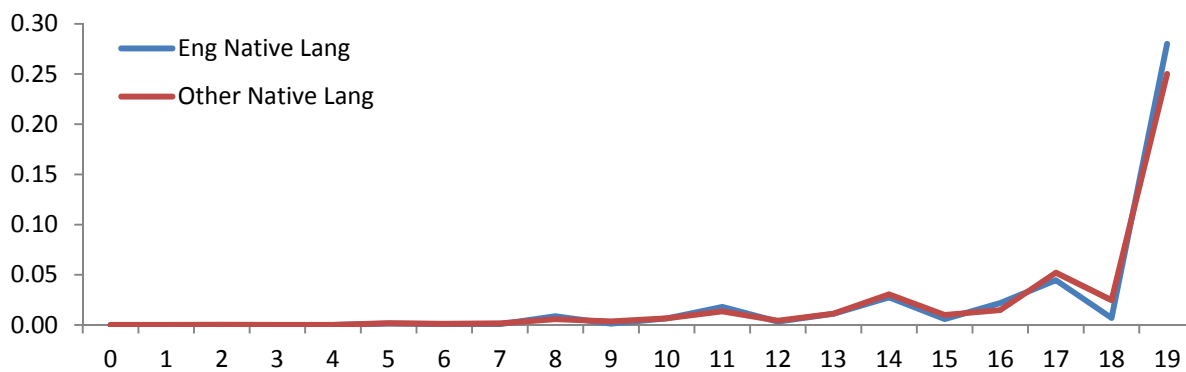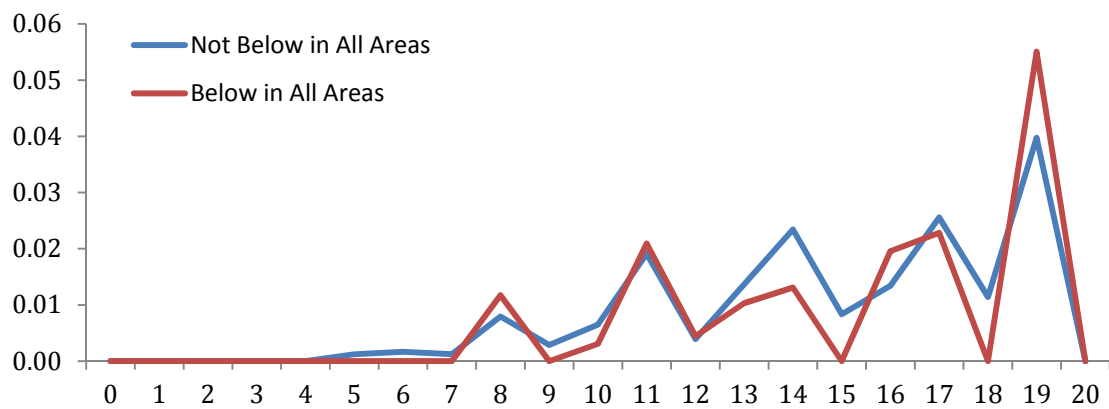

High School or GED
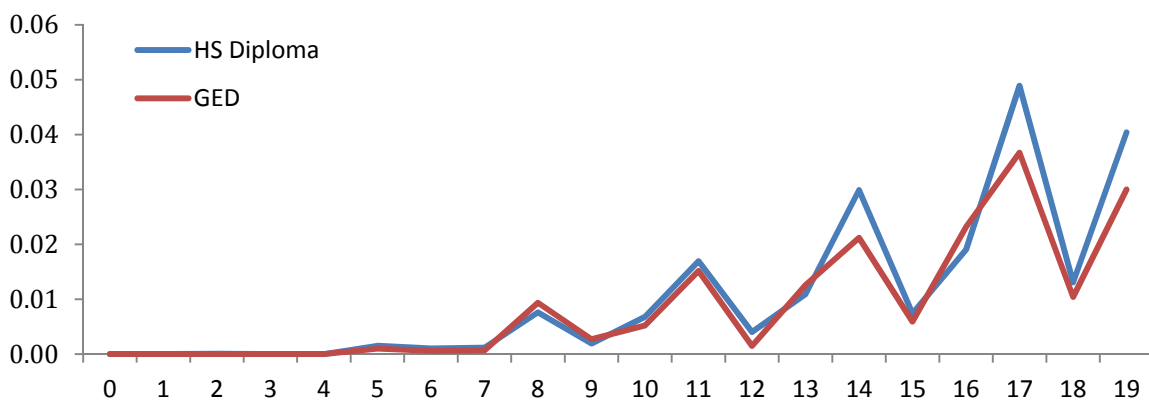
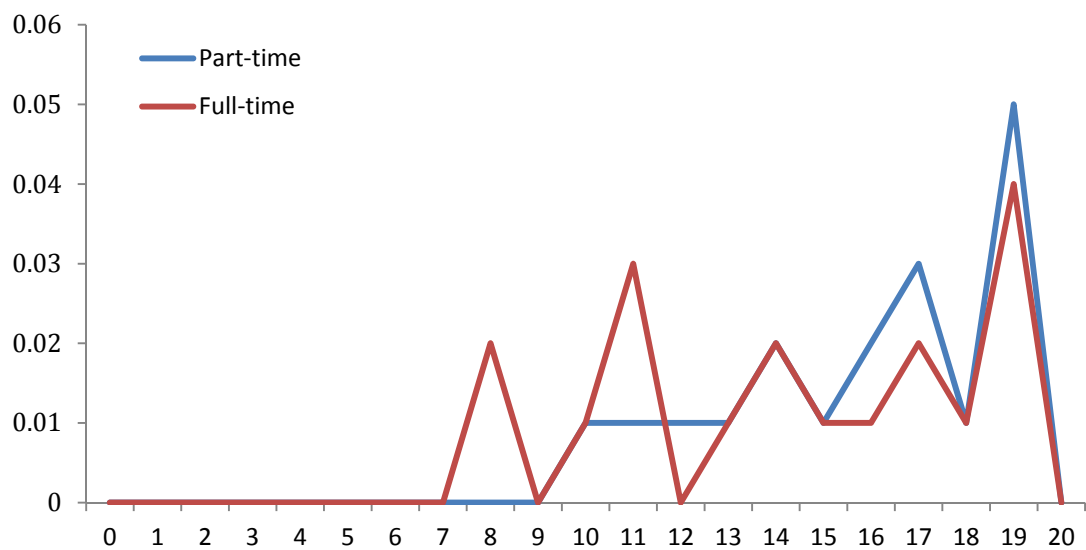Level of Preparation in English

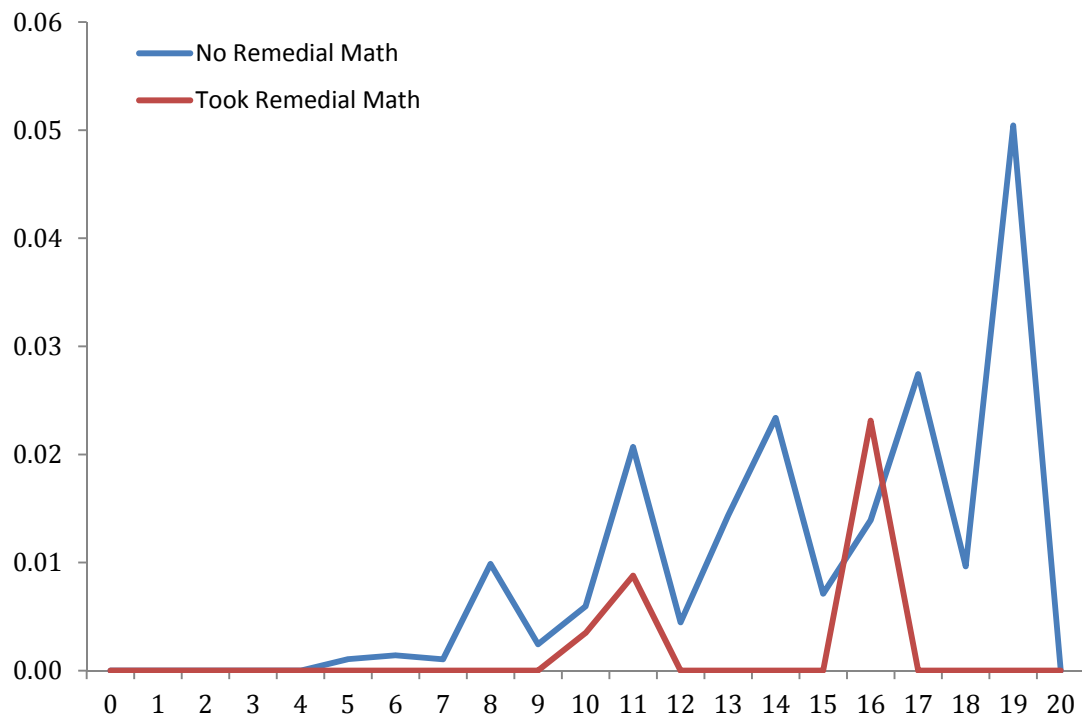Level of Preparation in Math

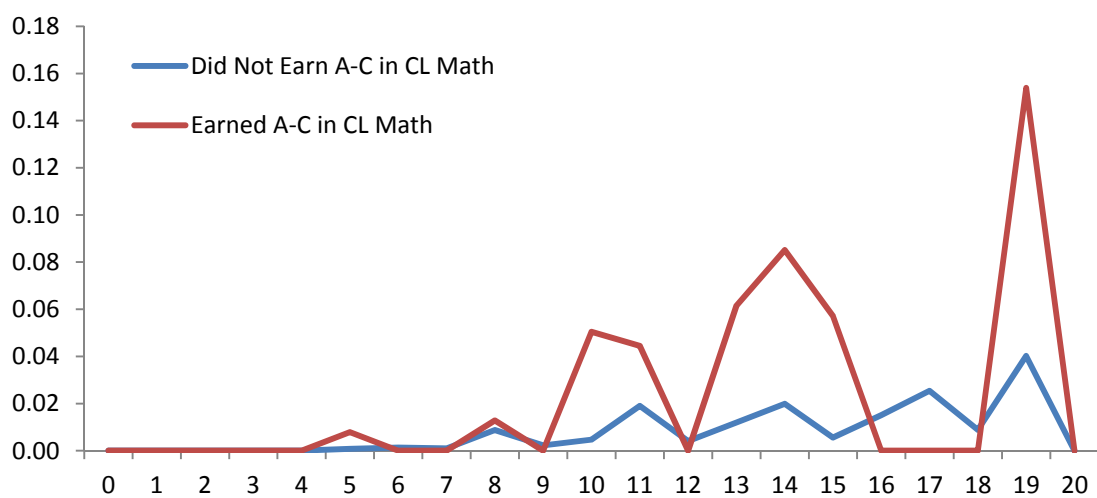Level of Preparation in All Areas
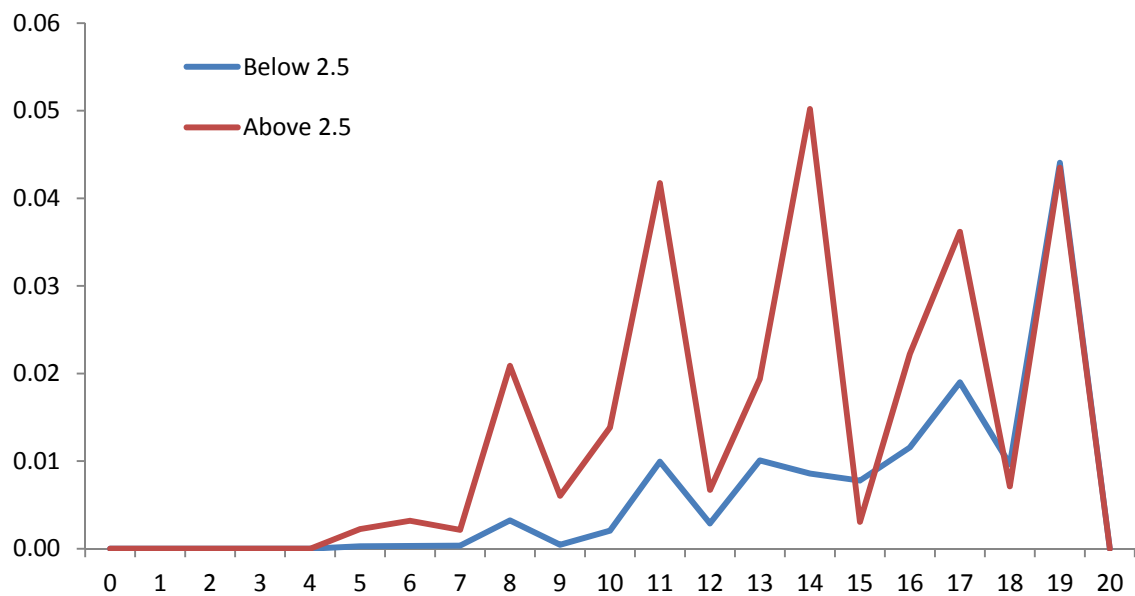

By Enrollment Intensity*

By Remedial Math Enrollment*

*Statistically significant
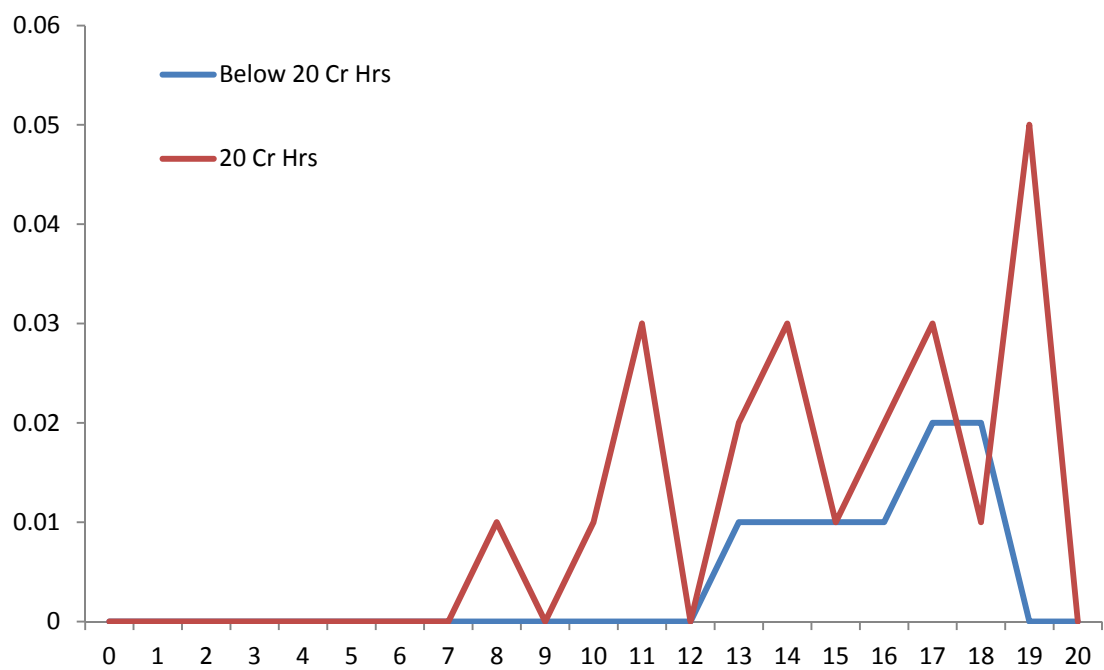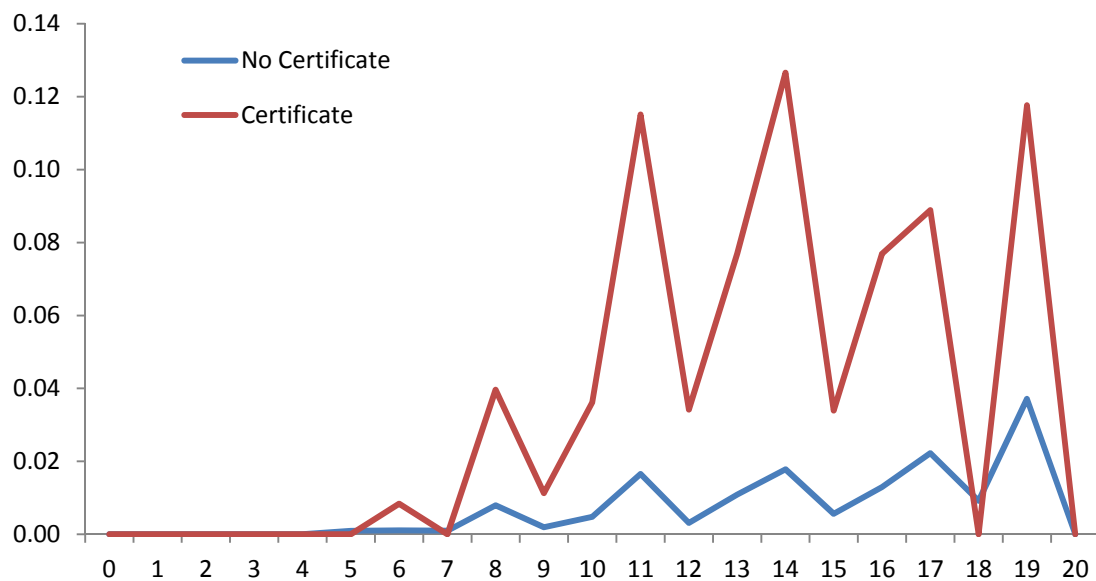
Earned Grades A-C in College Level Math*

GPA Above 2.5*

*Statistically significant

20 Credit Hour Milestones*

Received a Certificate*

*Statistically significant

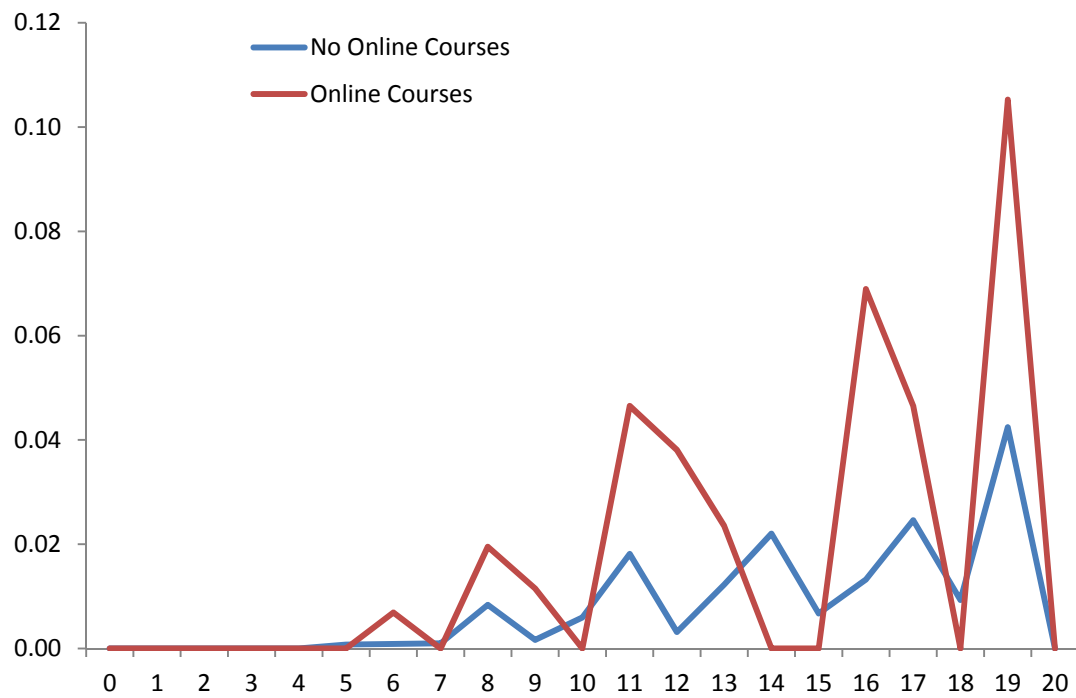Withdrew from a Course during the Term*
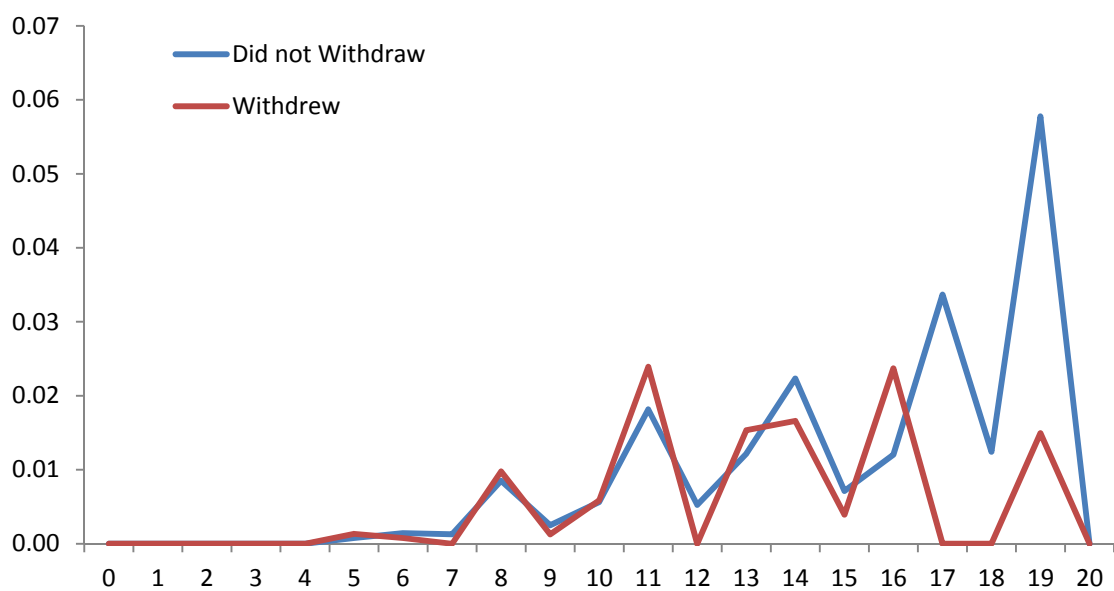
Failed a Course during the Term*
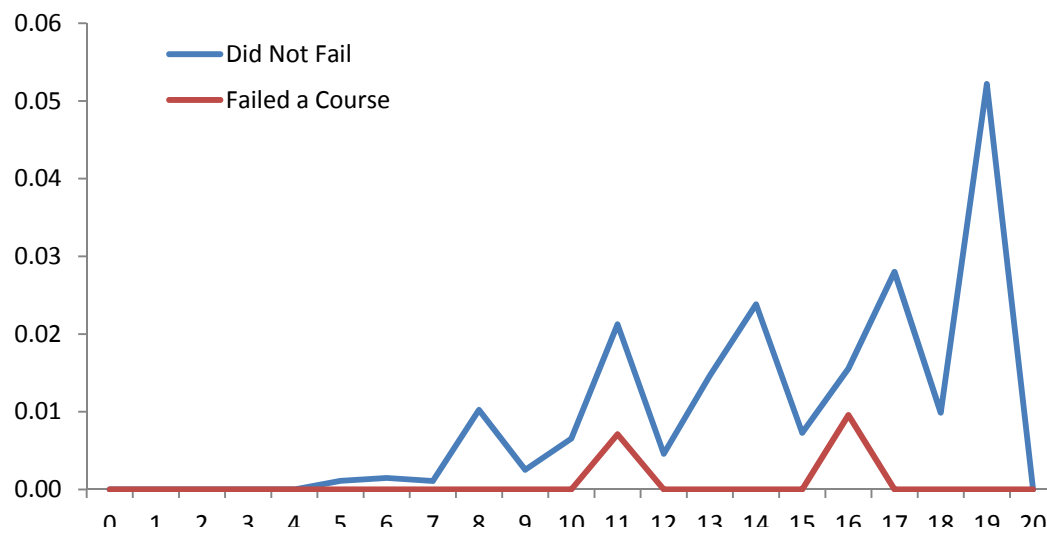
*Statistically significant

Transferred to a Four Year Institution*
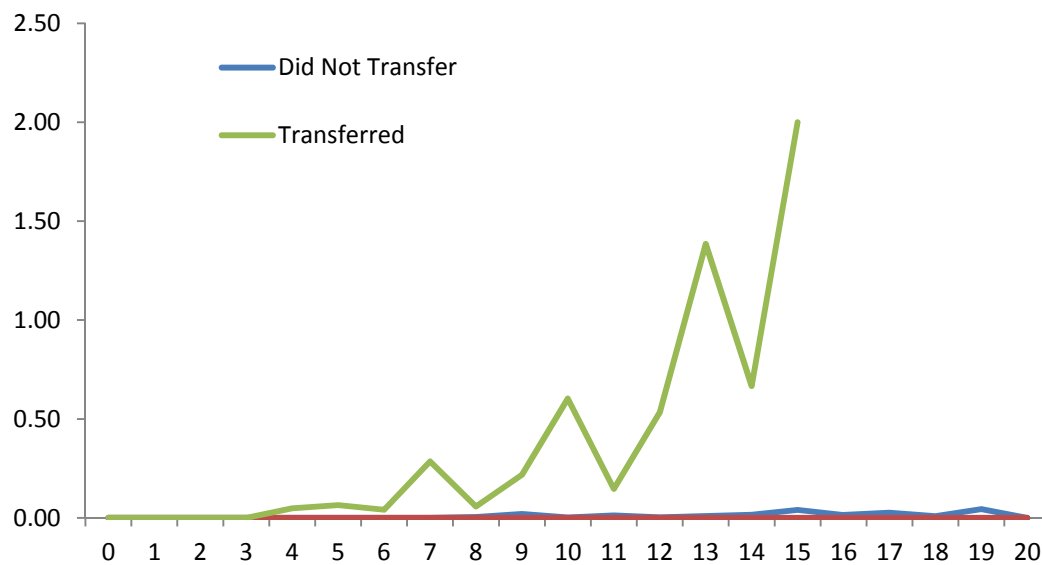
Took an Online Course*

*Statistically significant

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