ACCESS TO THE BACCALAUREATE: A MULTILEVEL MODEL OF BACCALAUREATE COMPLETION FOR ASSOCIATE IN APPLIED SCIENCE TRANSFERS

by

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ABSTRACT

ADAM KRISTOPHER ATWELL. Access to the baccalaureate: A multilevel model of baccalaureate completion for associate in applied science transfers. (Under the direction of DR. MARK D'AMICO)

This study used multilevel modeling to examine the extent to which student, academic, institutional, and community-level characteristics impact the baccalaureate attainment of students who transferred with the Associate in Applied Science (AAS) degree. Given that AAS transfer students were nested within community colleges, ordinary least squares (OLS) regression was insufficient to answer the research questions, and multilevel modeling was needed to account for this clustering effect (Raudenbush & Bryk, 2002). Using the conceptual model for community college student success in occupational programs developed by Hirschy, Bremer, and Castellano (2011), the researcher found that baccalaureate completion was a function of student-level, institutional-level, and community-level variables. Findings suggest that a number of inequities exist among AAS completers along lines of race/ethnicity, age, and socioeconomic status. Further, findings suggest that community college and county-level characteristics impact baccalaureate attainment for AAS completers. Policy implications include the need to create more bilateral articulation agreements between community colleges and public universities, in addition to seamless pathways to the baccalaureate via applied baccalaureate programs and community college baccalaureates.

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DEDICATION

This dissertation is dedicated to my sons, Anderson and Arlo. I love you both beyond words, and I'm so proud to be your dad. You are strong and resilient, and always remember that you can achieve anything through hard work, a kind heart, and a passionate spirit.

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CHAPTER 1: INTRODUCTION

Community colleges enroll 42% of all undergraduates in the United States and have a higher representation of students of color than traditional four-year institutions (Ma & Baum, 2016). The number of baaccalaureate earners served by community colleges is substantial. Forty nine percent of baccalaureate earners in 2015-2016 attended a public community college in the 10 years prior (National Student Clearinghouse Research Center, 2017). Community colleges are a significant access point for students pursuing higher education, yet baccalaureate attainment remains a challenge for many students who begin their education at the nation's community colleges.

Findings from Shapiro et al. (2017) suggested that only 32% of aspiring baccalaureate earners from community colleges transferred to a baccalaureate institution within six years, and less than half of those that transferred completed the baccalaureate within six years (Jenkins & Fink, 2016; Shapiro et al., 2017). Considering the apparent lag in degree attainment and transfer momentum, removing barriers for community college students who intend to transfer is of paramount importance.

The associate degree offered by community colleges across the United States has traditionally been recognized as the credential that provides general education courses throughout students' community college enrollment and ensures junior-level status to four-year institutions upon transfer (AACC, 1998; Cohen, Brawer, & Kisker, 2014; Ignash, 2012; Ryder et al., 2015; Townsend, 2001). It is critical to note that all associate degrees were not created to serve the same function (Bender, 1991; Townsend, 2001). From inception, Associate in Arts and Associate in Science (AA/AS) degrees were

created to serve the primary function of college transfer (i.e., provide the student with a general education prior to pursuing the baccalaureate). Associate degrees in areas of career and technical education (CTE), typically the Associate in Applied Science (AAS), were originally designed as terminal degrees leading directly to work placement by providing students with technical skills relevant to the needs of the labor force (AACC, 1998; Bender, 1991; Chase, 2011; Cohen et al., 2014; Townsend, 2001). While AAS degree programs often require the same amount of credit hours as AA/AS degrees, the core of general education courses in AAS programs that are viable for transfer is much lower than AA/AS programs. Not surprisingly, this leaves room for courses that provide technical and skills-based training needed in the workplace (AACC, 1998; Cohen et al., 2014; Ryder et al., 2015).

Not only do associate degrees differ in purpose and function, but there are considerable differences between students enrolled in AA/AS program and students in AAS programs (Chase, 2011; Ma & Baum, 2016). Students enrolled in AAS programs are more likely to be students of color, to be female, to work full-time, to be married, and to receive financial aid than students enrolled in AA/AS programs (Hirschy, Bremer, & Castellano, 2011). Students enrolled in AAS programs and CTE certificate programs are also slightly more likely to have a disability than traditional transfer-track students. Lastly, AAS students are more likely to identify as "an employee who studies" (p. 298), and whose parent(s) has a high school diploma or less (Hirschy et al., 2011). As discourse in higher education continues to focus on access, equity, and student success outcomes, this unique student population is of particular concern.

Statement of the Problem

Career, technical, occupational, and *vocational* have all been used to describe an area in the community college that prepares students to enter the workforce after receiving training oriented toward a specific occupation (Cohen et al., 2014). Proper terminology for the field has never reached a general consensus, but the National Center for Education Statistics (NCES) uses the term *occupational* in the majority of its publications. In addition, many institutions blend *career* and *technical education* (CTE) to denote programs oriented toward a specific occupation. Any of these terms may be used to denote specific occupational programs of study in community colleges across the nation (Cohen et al., 2014; Hirschy et al., 2011).

Historical Background

Vocational education has been a federal agenda item since the early 1900s during the years of the American Association of Junior Colleges. The Vocational Education Act of 1963 provided the impetus for considerable growth in vocational education funding and program development. After the passage of the Vocational Education Act of 1963, occupational and career programs of study surpassed the growth rate of liberal arts until the 1980s. Subsequent to the passage of the 1963 Act, the federal government was persistent in its mission to fund workforce education, passing the Job Training Partnership Act in 1982, and the Carl D. Perkins Vocational Education Act in 1984, among many others. The federal higher education agenda was clear: Workforce and occupational training have a direct impact on the economy, and it is a force multiplier in which the government should invest (Cohen et al., 2014).

Distinctly Different: AA/AS vs. AAS

The American Association of Community Colleges (AACC) made the degree distinction clear in a 1998 Position Statement on the Associate Degree: (1) AA/AS degrees are designed to transfer, and students should enter a baccalaureate program as a junior; and (2) AAS degrees are terminal and do not ensure junior status at a four-year institution. There is, however, some variation in degree designation across states. For example, in Florida the AS is designated as an applied CTE degree and is not designed for transfer (AACC, 1998; Bender, 1991).

The duality of AA/AS versus AAS pathways makes it easy to assume that students will choose either a CTE field and enter the workforce with the AAS or pursue the AA/AS with the goal of college transfer. Data on this subject, however, show a different, more complicated picture of college transfer as it relates to the associate degree. Before and after the AACC's 1998 Position Statement on the Associate Degree, the likelihood of AAS students' transfer aspirations has remained similar. Despite its terminal designation, students pursuing the AAS are equally as likely as AA/AS students to express intent to transfer to a four-year college or university (Cohen & Brawer, 1996; Cohen & Ignash, 1994; Fredrickson, 1998; Hill, Closson, Dedrick, & Young, 2016; Ignash, 2012; Townsend, 2001). Many AAS students who enroll in nontransferable CTE courses later decide to transfer to a four-year institution. Conversely, AA/AS students will often enroll in college-transfer pathways then terminate their pursuit of the baccalaureate after earning the AA/AS degree (Townsend, 2001). Thus, the behavior of community college students can often be counterintuitive to the assumption that students

will select the traditional pathways of associate degree programs based on their desire to transfer or not.

The Prevalence of CTE

Data from 2011-2012 compiled by the National Center for Education Statistics (2013a) shows the popularity of the AAS and its appeal to students pursuing specific occupations. In 2011-2012, the top five degrees conferred were in applied career and technical education fields (i.e., business management, health professions, law enforcement/homeland security, engineering, and firefighting). In 2017-2018, health professions and business associate degree earners (CTE areas) were two of the three largest conferred associate degree fields in the nation (NCES, 2018). These areas coupled with 11 additional occupational areas comprise a group of nationally recognized career clusters that contain more than 79 pathways to technical training and careers (Association for Career and Technical Education, 2014). National-level data compiled by the National Center for Education Statistics (2013b) showed 67% of all sub-baccalaureate credentials awarded from community colleges were in CTE fields. These data alone make a strong statement for CTE and amplify the call for seamless access to the baccalaureate.

The National Need for CTE and Baccalaureate Attainment

Xu, Jaggers, and Fletcher (2016) examined how the community college route to the baccalaureate affects degree attainment and short-term labor market outcomes using data from Virginia. Findings by Xu et al. (2016) showed that, while students originating at the community college were less likely to earn a baccalaureate than students beginning at four-year institutions, labor-market outcomes for community college students who transferred successfully and earned the baccalaureate were comparable to or better than

those of students starting at a four-year institution. Accounting for the cost of a student's education to the student and taxpayers, Belfield (2013) found that earnings after graduation were higher if the student earned an associate degree prior to transferring to a four-year institution than if the student had transferred without a degree. It is imperative to foster policies and practices aimed at seamless transfer for community college students for not only increased baccalaureate attainment, but also to maintain pace with students who originate at four-year colleges and universities.

The topic of vertical transfer and subsequent baccalaureate attainment is also significant in the conversation on degree outcomes by race and ethnicity. In 2007, only 8% of the work-eligible Hispanic population held a baccalaureate degree, compared to 37% of the White work-eligible population (Myers, 2007). Coulombe and Gil (2016) reported that Hispanic students made up 16 percent of America's labor market in 2016; yet they will "account for one out of every two new workers entering the workforce by 2025" (p. 4). Successful transfer pathways for people of color is key to bridging achievement gaps in baccalaureate attainment. The unique student population of applied fields is comprised of a significant number of people of color and underrepresented populations in higher education (Chase, 2011; Ma & Baum, 2016). As Chase (2011) points out, this means that transfer mechanisms (e.g., bilateral and statewide articulation agreements) will be these students' principal vehicle to the baccalaureate.

Why North Carolina?

Recent data show that AAS completers are transferring to four-year institutions in North Carolina at increasing rates (D'Amico, Chapman, & Robertson, 2020). In North Carolina during the 2014-2015 academic year, 26% of community college students were

African-American compared to 22% in the state's university system (D'Amico & Chapman, 2018). Further, D'Amico and Chapman (2018) identified a considerable achievement gap in baccalaureate attainment and race/ethnicity. North Carolina community college students who transferred to a four-year institution had lower baccalaureate completion rates in eight out of nine race/ethnicity categories. Compared to their AA/AS counterparts, AAS completers in North Carolina are known to experience difficulties in the application of community college credits toward the baccalaureate degree, and have lower baccalaureate attainment rates compared to AA/AS completers (D'Amico et al., 2020). Further, D'Amico et al. (2020) examined the economic distress tiers assigned to counties by the North Carolina Department of Commerce, and demonstrated that higher percentages of vertical transfer students from economically distressed counties transferred with the AAS. Examining the differences in baccalaureate completion among AAS completers and investigating student and institutional variables that influence baccalaureate degree completion is critical to illuminating barriers to, and facilitators of, the baccalaureate attainment of students enrolled in CTE programs across North Carolina's community colleges. Toward this end, a statewide investigation of AAS earners' baccalaureate completion may identify critical gaps in CTE at institutional and system levels.

Purpose

The purpose of this study was to determine what student and academic factors predict the baccalaureate attainment of AAS completers who transfer to four-year institutions. Further, this study aims to determine whether baccalaureate attainment varies between community colleges, and if so, which community college characteristics account

for this variation. Ultimately, the overarching goal of this study is to promote increased access to the baccalaureate for AAS completers who transfer to a four-year institution from the community college.

Conceptual Framework

The guiding framework for this study is based on previous literature, and prompts the inclusion of variables in the following categories: (1) demographics and individual characteristics, (2) institutional context, and (3) community college achievement and experiences. Hirschy, Bremer, and Castellano (2011) developed "the conceptual model for student success in community college occupational programs" (p. 310) which incorporated student-level factors, college-level factors, community-level factors, and student success outcomes (e.g., baccalaureate attainment) to model student success in community college CTE programs. The Hirschy model acknowledges the overlap of multiple constructs that contribute to students' college success, and it was designed with the specific population of CTE students in mind. The present study does not address each variable in the Hirschy model, but the variables proposed in this study align with the major components of the Hirschy model, and offer a multilevel perspective on baccalaureate attainment for AAS transfers that incorporates probative student and community college characteristics. Figure 1 presents the conceptual framework for the current study.

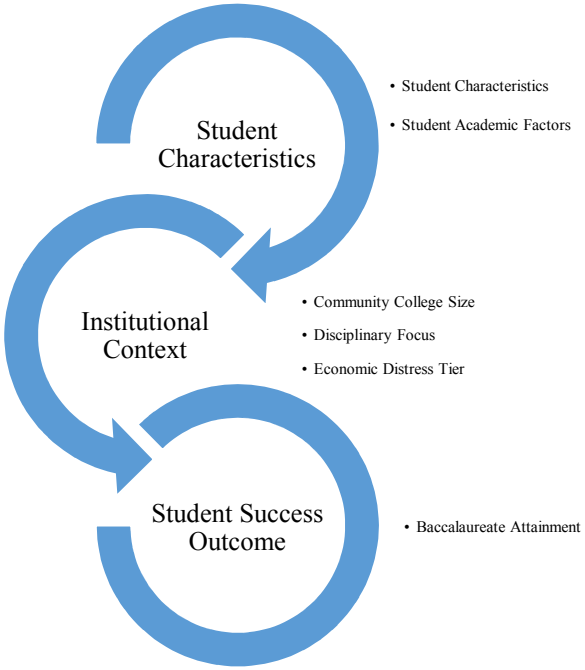

Figure 1. Conceptual framework.

Research Questions

The following research questions will guide this study:

1. What student and academic factors predict the baccalaureate attainment of AAS completers?

2. Does the average likelihood of baccalaureate attainment vary across community colleges? If yes, what characteristics of the community college explain differences in students' likelihood of baccalaureate attainment?

Significance

Removing barriers to the successful vertical transfer and baccalaureate attainment of AAS completers bridges two critical gaps in CTE: (1) The successful vertical transfer and baccalaureate attainment of AAS completers widens access to higher education, particularly for people of color (Chase, 2011; Cohen et al., 2014; Ma & Baum, 2016), and

(2) baccalaureate attainment is a significant workforce driver in the current U.S. economy (Carnevale, Jayasundera, & Gluish, 2016).

Earning a college degree is strongly correlated with employment and earnings. Workers with an associate degree or some college lost 1.8 million jobs during the recent recession, yet gained 3.1 million jobs in the recovery. Workers with a baccalaureate degree recovered 8.4 million jobs post-recession, and these same workers gained 187,000 jobs while the economy was still in recession. Conversely, during this same time period, workers with a high school diploma or less experienced a total loss of 5.6 million jobs (Carnevale et al., 2016). National data show that earning the baccalaureate means more job security. Carnevale, Jayasundera, and Hanson (2012) found that annual income among people with AAS degrees was significantly more than people who have only graduated high school. The American Community Survey (ACS) found that associate-degree holders earn $400,000 more over the course of a lifetime than people with a high school diploma (Ryder et al., 2015). Employment security and earning potential are strong pillars of social mobility that need to be available to all community college populations, but particularly the unique population of AAS completers. There is no doubt that higher education yields benefits in today's economy. Considering the fact that 49% of all baccalaureate earners in 2015-16 had attended a public two-year institution in the previous 10 years (National Student Clearinghouse Research Center, 2017), and 42% of the nation's undergraduate enrollments are community college students (Ma & Baum, 2016), upward access and mobility in higher education is critical.

Another major area of significance relates to methodological inquiry. Few studies in postsecondary CTE have examined both individual and community college-level

factors that influence the academic success of AAS completers (Bahr, 2013). The Hirschy et al. (2011) conceptual model used in this study views student success (i.e., baccalaureate attainment) as a function of the interactions between student characteristics and the college environment (coupled with the local environment), which exist at different levels of a conceptual hierarchy. Hierarchical linear modeling (HLM), or multilevel modeling (MLM), examines variance in the outcome variable when predictor variables exist at multiple levels of a hierarchical structure (e.g., students nested within schools). Prior to the implementation of MLM, ordinary least squares (OLS) regression models would make inferences across multiple levels of hierarchically structured data, but these OLS models did not accurately account for shared variance due to the nested nature of the data (Raudenbush & Bryk, 2002; Woltman, Feldstain, MacKay, & Rocchi, 2012). Failure to account for clustering, or nesting, violates the assumption of independence required for OLS regression models and requires alternative statistical techniques (Raudenbush & Bryk, 2002). Since the outcome variable in this study is dichotomous (baccalaureate attainment or nonattainment), this study employs multilevel logistic regression to conduct the data analyses. The language in the following chapters will reflect this terminology throughout the remainder of the study. In higher education research, few known studies have used MLM to study the vertical trajectory of associate degree completers after graduation (see Dundar, 2011; Eagan & Jaeger, 2009; Umbach, Tuchmayer, Clayton, & Smith, 2018; Wang, 2016). To date, Umbach et al. (2018) have conducted the only known study in North Carolina on associate degree transfer and student success using multilevel modeling. This study intends to build on the findings of Dundar (2011), Eagan and Jaeger (2009), Umbach et al. (2018), and other studies by

examining additional student-level and institutional-level variables that influence the baccalaureate attainment of AAS completers.

Research Design

A nonexperimental, correlational design using archival data was used in this study. Data from the University of North Carolina (UNC) system of students who transferred to one of the 16 UNC system institutions with an AAS earned at one of North Carolina's 58 community colleges were examined. Out-of-state transfers and AAS completers with multiple associate degrees were excluded from the analyses.

The researcher employed multilevel binary logistic regression to examine the extent to which student and community college factors predict the baccalaureate attainment of AAS completers who transferred to a four-year institution. A random effect for community college (i.e., random intercept at the community college) was included to account for the between-group differences on the dependent variable. In addition, random slopes were included for select level-1 predictor variables to examine cross-level interaction effects (i.e., the interaction between lower-level and higher-level variables).

Student-level data were obtained from a University of North Carolina (UNC) System dataset in the custody of the Belk Center for Community College Leadership and Research at North Carolina State University. Community college-level data were obtained and compiled by the researcher from publicly accessible data from the North Carolina Community College System (NCCCS), the Carnegie Classification of Institutes of Higher Education, and the North Carolina Department of Commerce. Baccalaureate attainment is a dichotomous outcome variable and indicates whether the student earned a baccalaureate degree after transferring with the AAS degree.

Definitions

Due to the lack of consensus on definitions within the CTE field itself (Cohen et al., 2014), and the type of data analysis used in this study, it is important to consider several terms individually.

Associate in Arts (AA) and Associate in Science (AS). These degrees are offered by community colleges to students who intend to transfer to a four-year institution, and satisfy the general education core needed to ensure junior status upon transferring (AACC, 1998).

Associate in Applied Science (AAS). This degree is offered by community college as a career and technical education (CTE) degree, and includes relevant coursework to train students for workforce entry upon graduation. This degree was designed as terminal, and is not considered a college transfer degree (AACC, 1998; Chase, 2011; Cohen et al., 2014; Townsend, 2001).

Career, technical, occupational, and *vocational.* These terms, often used interchangeably, denote fields of study that offer students training that prepares the student to enter the workforce upon graduation (Cohen et al., 2014; Hirschy et al., 2011).

Community College. A two-year institution that awards the associate degree as the highest degree of completion. In addition, community colleges award certificates and diplomas, which require fewer credits than the associate degree (Cohen et al., 2014).

Cross-Level Interaction. When a higher-level predictor interacts with a lower-level predictor creating an effect at either level of the data hierarchy (Raudenbush & Bryk, 2002)

CTE. The popular blending of *career and technical education*. These are occupational programs that train students for specific jobs in the workforce (Cohen et al., 2014; Hirschy et al., 2011).

Four-Year Institution. A four-year institution is any public or private institution that awards the baccalaureate degree that is typically considered a college or university. In this study, the four-year institutions are public universities (16) in the UNC System.

Level-1 Variables. In MLM, level-1 variables often refer to the first hierarchical structure in which level-1 predictors are clustered (Raudenbush & Bryk, 2002). In this study, level 1 is the AAS transfer student and level-1 predictors are specific student characteristics and academic factors.

Level-2 Variables. Level-2 variables in this study refer to community college characteristics (i.e., the community college from which the student transferred), and represent the next level in the data structure (Raudenbush & Bryk, 2002).

Moderator(s). In MLM, a moderating variable (moderator) affects the strength of the relationship between the outcome variable and student-level predictors (Raudenbush & Bryk, 2002).

Multilevel. This refers to the hierarchical structure, or nested nature of the data. In this study, students are nested within community colleges to create a two-level data structure (Raudenbush & Bryk, 2002).

Transfer. While students can transfer laterally (e.g., between community colleges), *transfer* in this study refers to *vertical transfer*, which is the transfer of an associate degree earner to a baccalaureate-granting institution (Cohen et al., 2014).

Organization of the Study

The first chapter outlines the framework of the study. A review of the literature on AAS transfer and baccalaureate attainment, emergent themes, and CTE student success is presented in Chapter Two. In Chapter Three, the author outlines the methodology used in this study. Data analysis and findings are presented in Chapter Four. Chapter Five includes a discussion of the findings and recommendations for research, policy, and practice.

Summary

Community colleges are rooted in, and maintain a commitment to, open access to higher education (Cohen et al., 2014). Enrolling nearly half of all undergraduates in the United States (Ma & Baum, 2016), community colleges play an integral role in training a skilled and credentialed workforce (Ryder et al., 2015). While AAS degrees were not originally designed for college transfer (AACC, 1998; Cohen et al., 2014; Townsend, 2001), research has shown that AAS students (i.e., students in CTE programs) are as likely to pursue transfer as their AA/AS counterparts (Cohen et al., 2014; Cohen & Ignash, 1994; Fredrickson, 1998; Hill, 2016; Ignash, 2012; Townsend, 2001). Considering the personal and economic impacts of baccalaureate attainment (Carnevale et al., 2012, 2016; Ryder et al., 2015), it is imperative that students in CTE programs have access to the baccalaureate through seamless transfer. Embedded in the confusion of AAS articulation and transfer are a minoritized population of students experiencing barriers to higher education because of their degree choice (Chase, 2011; Ma & Baum, 2016; Townsend, 2001). A substantial issue of equity arises from the transfer problem surrounding the AAS degree. Applied fields are workforce drivers that have a sustained,

positive impact on the economy, and contain a large number of community college enrollments across the United States (Hirschy et al., 2011; Ryder et al., 2015). As leaders in higher education tackle issues of equity, the completion agenda, and bridging the educational gap, creating clear and solid pathways to the baccalaureate for AAS degree earners is vital.

CHAPTER 2: LITERATURE REVIEW

Baccalaureate attainment is strongly linked to labor market outcomes, and workers with college degrees earn significantly higher wages than workers with a high school diploma (Belfield, 2013; Carnevale et al., 2012; Carnevale et al., 2016; Ryder et al., 2015; Xu et al., 2016). Carnevale et al. (2016) examined labor market outcomes during the most recent recession, and found that workers who had earned the baccalaureate were the only group to *gain* jobs during the recession. Further, studies have shown that labor market outcomes for students who began at the community college and earned an associate degree, then transferred and earned the baccalaureate were equal to or better than those of traditional university students (Belfield, 2013; Xu et al., 2016). The outcome evidence is clear that baccalaureate attainment yields substantial benefits at individual, societal, and economic levels. Since AAS students are equipped with courses anchored heavily on workforce and occupational training, seamless access to the baccalaureate for these students buttresses America's growing work force via higher education credentialing.

In addition to positive impacts on the workforce, creating seamless pathways to the baccalaureate through the nation's community colleges tackles an important issue of equity and access. Associate degrees in CTE areas were the top five credentials awarded in 2012 (National Center for Education Statistics, 2013a). In addition, CTE credentials (e.g., AAS and certificates) comprise two-thirds of all credentials below the baccalaureate (National Center for Education Statistics, 2013b). Despite its popularity, the AAS degree poses many challenges for those pursuing transfer (AACC, 2004; Chase, 2011, Townsend, 2001). Perhaps the most significant challenge is the loss of credits upon

transfer (AACC, 2004; Fink, Jenkins, Kopko, & Ran, 2018; Monaghan & Attewell, 2015). Credit loss, operationalized as the number of credits earned at the community college that do not transfer toward the baccalaureate degree, coupled with the fact that CTE fields are comprised of a significant number of students from minoritized populations (Chase, 2011; Hirschy et al., 2011; Ma & Baum, 2016; Townsend, 2001), presents a significant barrier to the baccalaureate for AAS completers. Thus, a focus on the successful transfer and baccalaureate completion of AAS students and an examination of potential facilitating variables would be useful to community colleges and higher education systems as they pursue ways to increase access to the baccalaureate.

Conceptual Model for CTE Student Success in Community Colleges

The review of literature was informed by the conceptual model for student success in community colleges, developed by Hirschy et al. (2011). Hirschy et al. (2011) incorporated the following constructs to model community college students' success in CTE programs: (1) student-level characteristics, (2) community college-level characteristics, (3) community/environmental characteristics, and (4) outcome measures of student success. Collectively, these constructs lend a multilevel structure for researchers to examine potential predictors that foster student success in CTE programs.

Several studies have employed the Hirschy model to generate research on community college students enrolled in CTE programs. Bremer, Center, Posal, Medhanie, Jang, and Geise (2013) used the model to inform a multistate analysis of outcome trajectories for students enrolled in developmental math and English classes at the community college. Van Noy, Trimble, Jenkins, Barnett, and Wachen (2016) used the model to create a framework to identify "dimensions of structure" (p. 266) of CTE

programs in community colleges as it is expressed in policy and practice. Using predictors from the Educational Longitudinal Study of 2002, Morgan, D'Amico, and Hodge (2015) used the Hirschy model to drive their research on factors that influence community college persistence in career clusters. The literature is rich with numerous studies that have employed this CTE-specific framework to drive research on community college student success outcomes. Hirschy et al.'s (2011) keen focus on community college students enrolled in CTE programs using multiple constructs allows for a "best fit" conceptual model to drive research in this area.

The conceptual model used in this study has guided the organization of Chapter Two to include sections on CTE community college students (AAS students), institutional factors influencing vertical transfer (including urbanicity/geography), and policy solutions aimed at improving the successful vertical transfer of students earning the AAS. The studies cited within these sections create a multilevel picture of vertical transfer from the community college to a baccalaureate-granting college or university.

In the following sections, the author will review the extant literature on student and institutional-level predictors of associate degree transfer, with a particular focus on the transfer of the AAS. In addition, current literature discussing potential solutions and best practices will be reviewed. An organizer of the major themes and subsections of the literature review is presented in Table 1.

Table 1

Overarching Themes and Subsections in the Literature

Theme and Subsections	Sources
AAS Students	
Intent to Transfer and Baccalaureate Aspirations	Berkner, Horn, & Clune, 2000; Cohen & Brawer, 1996; Cohen & Ignash, 1994; Eells, 1943; Findlen, 1997; Fredrickson, 1998; Hill, 2016; Horn & Skomsvold, 2011; Ignash, 2012; Kintzer, 1983; Monroe & Richtig, 2002; Shearon, Brownlee, & Johnson, 1990
The Transfer Problem	D'Amico, 2016; Ehrenburg & Smith, 2004; Fink et al., 2018; Giani, 2019; The Government Accountability Office, 2017; Hezel Associates and Western Interstate Commission for Higher Education; Kopko & Crosta, 2016; Monaghan & Attewell, 2015
CTE Student Population	Chase, 2011; Cohen, Brawer, & Kisker, 2014; D'Amico & Chapman, 2018; Hirschy, Bremer, & Castellano, 2011; Ma & Baum, 2016
Student-Level Predictors of Transfer	Bahr, 2013; Davidson, 2015; Ehrenburg & Smith, 2004; Karandjeff et al., 2011; Kopko & Crosta, 2016; Wang, Chuang, & McCready, 2017; Wolzinger & O'Lawrence, 2018
Institutional Factors Influencing Transfer	
Community College Characteristics	Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008; Dundar, 2011; Eagan & Jaeger, 2009; Umbach et al., 2018; Wassmer, Moore, & Shulock, 2004; Wang, 2016
Policy Solutions	
Articulation Agreements	Bers, 2013; D'Amico, 2016; Ignash, 2012; Ignash & Kotun, 2005; Ignash & Townsend, 2000; NCCCS, 2014
Pathways to the Baccalaureate	
The Applied Baccalaureate	Batts & Pagliari, 2013; Chase, 2011; Floyd, Felsher, Garcia-Falconetti, & Cohen, 2012; Floyd, Skolnik, & Walker, 2005; Ignash, 2012; Kujawa, 2013; Townsend, Bragg, & Ruud, 2009
The Community College Baccalaureate	Brint & Karable, 1989; Floyd & Walker, 2009; Grizzell, 2016; McKinney, Scicchitano, & Johns, 2013; Wesse, 2012

AAS Students

Intent to Transfer and Baccalaureate Aspirations

Research shows that a significant portion of community college students, including students enrolled in CTE programs have intent to transfer to a four-year institution and earn the baccalaureate (Findlen, 1997; Hill, 2016; Horn & Skomsvold, 2011; Ignash, 2012). In 1943, Eells uncovered the existence of students who were enrolled in "terminal" CTE programs who then transferred to a four-year institution. Kintzer (1983) empirically demonstrated the existence of "the vocational transfer" student in areas that were once solely considered terminal fields (p. 1). A study by Findlen (1997) in Wisconsin found that students enrolled in CTE associate degree programs had intent to transfer, and that CTE students outnumbered traditional transfer students in successful transfer. Another study in Michigan showed that 61% of community college students surveyed expressed intent to transfer to a four-year institution (Monroe & Richtig, 2002). For over half a century, research findings have been consistent: Many CTE students intend to, and will transfer, despite the terminal designation of their degree.

Beginning in the 1990s, several studies suggested that AAS students were equally as likely to transfer to four-year institutions as those students enrolled in AA/AS programs (Cohen & Brawer, 1996; Cohen & Ignash, 1994; Fredrickson, 1998). A study in North Carolina found that nearly 50% of community college students expressed intent to transfer, yet less than 20% of these students were enrolled in traditional, transfer-track AA/AS programs (Shearon, Brownlee, & Johnson, 1990). Another study conducted in

North Carolina by Fredrickson (1998) found that three out of seven students who successfully transferred to four-year institutions from community colleges were from CTE programs. Berkner, Horn, and Clune (2000) examined national-level data from the 1995-1996 Beginning Postsecondary Students Longitudinal Study, and found that over 30% of CTE students intended to transfer to a four-year institution to pursue the baccalaureate. More recently, Hill et al. (2016) found that students who were enrolled in non-transfer, applied associate degree programs had intent to transfer to a four-year institution upon graduation from the community college, despite the fact that the degree itself was not designed for transfer. Evidence shows there is a tendency for CTE students to seek access to transfer mechanisms, but significant barriers continue to block seamless access.

The Transfer Problem

Students in AAS programs are, by default, at a disadvantage when attempting to transfer credits to four-year institutions. Community college students who earned AA or AS degrees are 20% more likely to earn a baccalaureate than students with no degree. Community college students who earned the AAS degree are 15% more likely to earn a baccalaureate than students with no degree (Ehrenburg & Smith, 2004). While AAS attainment showed significant returns, the data show that AAS students are still less likely to earn the baccalaureate compared to those earning the AA/AS (Ehrenburg & Smith, 2004). To the same point, Kopko and Crosta (2016) found that students who earned the AA/AS prior to transfer were more likely to earn the baccalaureate than students who had not earned these traditional, transfer-oriented degrees. Giani (2019) found that North Carolina community college students who earned a certificate or AAS

degree lost an average of 13 credits when compared to an average loss of six credits for AA/AS students. This means that, on average, students enrolled in CTE programs in North Carolina experience more than double the credit loss of student enrolled in AA/AS tracks (Giani, 2019).

Coupled with the loss of credits is the fact that community colleges and universities typically do not share the same course numbering system and general education core (D'Amico, 2016). Hezel Associates and Western Interstate Commission for Higher Education (WICHE) (2010) found that commonalities between the course numbering system and the general education core were major factors influencing successful transfer of community college students. In other words, a lack of these commonalities may indicate barriers to vertical transfer. D'Amico (2016) highlighted the transfer problem when using the criteria mentioned above:

> While these are relevant to the college parallel Associate of Arts and Associate of Science degrees, the strong technical component of the A.A.S. degree will likely not work in this systematic way. For example, career-focused courses at the first- and second-year levels at the community colleges would, in most cases, not have equivalent courses at universities. (p. 43)

Nationally, community college students, on average, lose 13 credit hours when transferring from a community college to a four-year institution (The Government Accountability Office, 2017). Previous research has made clear that the transfer of credits from community colleges to four-year institutions is a critical variable affecting academic success and completion.

A disaggregated perspective on credit loss is key to understanding the variation of successful credit articulation. Controlling for GPA and total number of credits, Monaghan and Attewell (2015) found that 42% of students who transfer are not able to transfer all credits earned at the community college. Further, Monaghan and Attewell (2015) found that students were more than two times more likely to receive a baccalaureate degree if they were able to use most, if not all, of the credits earned at a community college. In the same study, only 58% of community college transfer students were able to use more than 90% of their community college credits at the four-year institution. Twenty-eight percent of these transfer students were not able to use between 10% and 89% of curriculum credits earned at a community college. Lastly, and arguably the most salient finding, 14% of transfer students had to basically begin as newly admitted freshmen, with nearly a total loss of credits earned at the community college. In other words, one out of seven transfer students lost nearly all credits earned at the community college.

CTE Student Population

Extant research demonstrates that students of color are more likely than White students to enroll in community college (Cohen et al., 2014). In North Carolina during the 2014-2015 academic year, more than one quarter (26%) of community college students were African-American compared to 22% in the state's university system (D'Amico & Chapman, 2018). In the same way, community college CTE programs enroll higher percentages of students of color than transfer-track programs (Hirschy et al., 2011). The student population of CTE programs across the nation's community colleges is comprised of a significant number of people of color and underrepresented populations

in higher education, including higher percentages of women, students with disabilities, students on financial aid, and full-time workers (Chase, 2011; Hirschy et al., 2011; Ma & Baum, 2016). Without access to transfer pathways, these students are in many ways barred from vertical transfer mobility (Chase, 2011). CTE students are more likely than AA/AS students to be African American, female, older than 24, married, and first-generation college students. The inequities of AAS transfer become more pronounced as sociodemographic factors are examined.

Student-Level Predictors of Transfer

To address the hierarchical nature of this study, it is important to consider student-level and institutional-level characteristics that may influence vertical transfer. As Bahr (2013) pointed out, there is considerable lack of research addressing both levels simultaneously. Davidson (2015) studied community college students in Kentucky, and found that "leading indicators" (p. 1007) that predicted transfer included earning 30 credit hours by the end of the first academic year, completing a summer course, completing a college-level Math course, completing college-level English, and successfully passing all first semester courses. In the same study, Davidson (2015) found that low-income and underprepared students were statistically significantly less likely to earn an associate degree or transfer to a four-year institution. Male students were 33% more likely to complete as associate degree and transfer than female students (Davidson, 2015).

Several studies have indicated that earning an associate degree prior to transferring has positive effects on baccalaureate attainment (Ehrenburg & Smith, 2004; Kopko & Crosta, 2016). Yet, one study by Wang, Chuang, and McCready (2017) found

no statistically significant differences in transfer between students who had transferred with an associate degree and those without an associate degree.

Some research on transfer has identified significant barriers to successful transfer as a function of race/ethnicity. In a recent study, Wolzinger and O'Lawrence (2018) examined the probability of transfer readiness by race and ethnicity, and found that students who are older, students in foster care, students who identify as nonbinary gender, Black, Filipino, Pacific Islander, or other ethnicity were less likely to be academically prepared for vertical transfer.

In some cases, across the nation's community colleges, more than half of a CTE program's enrollments are people of color (Chase, 2011; Ma & Baum, 2016). Karandjeff et al. (2011) conducted the CTE Transfer Research Project to improve transfer pathways for CTE students in California. There was considerable variation in transfer across racial and ethnic groups. The researchers concluded that while Asian students made up nearly 13% of students who completed at least 12 credits of transferable courses in a CTE field, they represented nearly 22% of all transfers from applied fields. Conversely, Hispanic students accounted for nearly 30% of CTE majors, yet they comprised 21% of all transfers in applied fields (Karandjeff et al., 2011). Lastly, a study in Iowa examined the persistence of students with applied associate degree to graduation, culminating in the baccalaureate, and developed a profile of students who successfully transferred (Thomas et al., 2012). Results of this study showed that the "typical" successful CTE transfer was male, White, and a U.S. citizen. The literature has emphasized the robust impact of race/ethnicity on successful AAS transfer and uncovered inequities that need to be addressed.

The research literature on AAS students informed this study in several meaningful ways. By focusing on AAS student characteristics, this study aligns with the first construct in the Hirschy conceptual model, and satisfies the level-1 requirement for student-level data in the multilevel logistic regression model. Further, the literature is clear that student-level predictors are critical in the investigation of successful vertical transfer and in the identification of inequities across transfer students.

Institutional Factors Influencing Transfer

Community College Characteristics

The majority of studies on AAS transfer center on student-level characteristics that predict successful transfer. Studies that incorporate institutional-level factors (i.e., community college characteristics) to assess associate degree transfer are very limited (Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008; Dundar, 2011; Eagan & Jaeger, 2009; Umbach et al., 2018; Wassmer, Moore, & Shulock, 2004; Wang, 2016).

One should use caution when examining the following findings at the risk of inviting deficit thinking. Wassmer et al. (2004) found that community colleges that enrolled higher percentages of Black or Hispanic students had statistically significantly lower transfer rates. Further, the community colleges with high transfer rates had younger students and a "greater focus on academic programs" (p. 65). This indicated that older, nontraditional students were significantly less likely to transfer (Wassmer et al., 2004). Wassmer et al. (2004) used aggregate measures as proxies for institutional-level variables that may influence transfer and found that the percentage of students under 25 years old had a positive impact on transfer, while the percentage of Black, Hispanic, and female

students had a negative impact on transfer. It is important to note that Wassmer et al. (2004) used three models with different time-to-degree measures.

Calcagno et al. (2008) examined institutional factors that influenced the probability of (1) degree/certificate attainment and (2) transfer, and found that successful transfer is a function of institutional size, the percentage of adjunct faculty, and the percentage of students of color enrolled at the community college. Dundar (2011), however, did not find that the percentage of students of color enrolled at the community college influenced the odds of successful transfer. The different findings could be explained by the fact that these studies took place in different states and were not national-level analyses.

In a multilevel study of associate degree transfer, Eagan and Jaeger (2009) found that the percentage of students in each institution enrolled in CTE programs was not statistically significantly related to transfer; although the same study showed that enrollment in a CTE program was negatively associated with successful transfer at the student level.

Dundar (2011) used a multilevel model to explore institutional-level and student-level predictors of transfer and found that successful transfer was indeed a function of both student and institutional characteristics. At the institutional level, the researcher examined the following: (1) locale of community colleges; (2) average percentage of minority students; (3) mean GPA at the community college; (d) mean income level at the community college (i.e., students' mean income); and (d) percentage of students on financial aid. Dundar (2011) found that an institution's geographic locale (rural, suburban, urban) and the institution's mean GPA were the only statistically significant

variables that impacted the odds of transfer. Students at rural institutions were less likely to transfer compared to students in urban areas. Lastly, there was a positive association between mean GPA and the likelihood of transfer.

Institutional-level variables can significantly affect the odds of transfer, as demonstrated by prior research (Dundar, 2011; Eagan & Jaeger, 2009; Wassmer et al., 2004). This study's inclusion of community college and environmental predictors, specifically community college size, disciplinary focus, and level of economic distress, maintains alignment with the Hirschy model by addressing the major constructs of college and community environments. In addition, the inclusion of community college and environmental predictors meets the requisite components for a multilevel model by creating a nested, hierarchical data structure (level-2). D'Amico et al. (2020) pioneered the use of economic distress tiers and community college service areas to examine AAS transfers in North Carolina. The present study's inclusion of economic distress tiers and community college disciplinary foci address gaps in the research literature because this study marks the first time these variables have been included in a statewide, multilevel model of AAS completers' baccalaureate attainment in North Carolina. It is important that future research considers a host of institutional-level factors coupled with student-level characteristics to arrive at a more accurate picture of associate degree transfer, particularly for students enrolled in CTE programs.

Policy Solutions

Articulation Agreements

Another pathway to the baccalaureate is the articulation agreement. Articulation agreements mainly exist in two major forms: Statewide articulation agreements and

bilateral articulation agreements. Statewide articulation agreements typically involve a comprehensive articulation of common courses from the associate degree to a baccalaureate institution for all public two-year and four-year institutions in a given state. The latter agreements, typically called 2 + 2 based on their function, are individual college-to-college agreements between a two-year program of study and a four-year program of study (Bers, 2013).

As expected, most state-level articulation agreements anchor on the AA/AS as the transfer credential, as opposed to the AAS. For example, the Comprehensive Articulation Agreement (CAA) between the North Carolina Community College System (NCCCS) and the UNC System makes the distinction clear:

> To be eligible for the transfer of credits under the CAA, the student must graduate from the community college with an Associate in Arts (AA) or Associate in Science (AS) degree and have an overall Grade Point Average (GPA) of at least 2.0 on a 4.0 scale and a grade of "C" or better in all CAA courses. Students who do not complete the degree are eligible to transfer credits on a course-by course basis. (NCCCS, 2014, p. 6)

Several studies have examined the national state of articulation agreements for the AAS (Chase, 2011; Ignash, 2012; Ignash & Townsend, 2000; Ignash & Kotun, 2005), and D'Amico (2016) provided a comprehensive review of the literature in this area in a handbook chapter focusing on student success and community college workforce development.

In a survey conducted by Ignash and Townsend (2000), 79% of leaders of state bodies of higher education reported that their states had articulation agreements in place.

The caveat, however, is that most of these articulation agreements hinged on the AA/AS degrees as seamless transfer pathways to the baccalaureate; AAS articulation agreements were not prevalent. Acknowledging the lack of statewide AAS articulation agreements, Ignash and Kotun (2005) investigated articulation agreements among community college programs in CTE. The researchers found that while 90% of state leaders of higher education emphasized the necessity of articulation agreements for transfer from CTE programs, only 58% of respondents reported uniform, statewide articulation agreements for associate degrees in CTE. Further, this research showed that states having statewide articulation agreements for the AAS only had an agreement for one particular program.

In a study across four states, Chase (2011) found that AAS programs allowed a maximum of 30 credit hours from general education courses to transfer to a four-year institution, but credits from CTE courses were nontransferable. To address the issues of articulation surrounding the AAS, Ignash (2012) identified multiple routes to the baccalaureate for AAS students. One approach emphasizes seamless transfer from any CTE program to an applied baccalaureate, while another approach focuses on career-specific pathways from the AAS to a bachelor in applied science (BAS) where both degrees are earned in the same major. The third pathway described by Ignash (2012) allows CTE associate degree earners to apply their AAS credits to the traditional baccalaureate only after requisite courses in general education were satisfied at the receiving institution. In the absence of a statewide articulation agreement for the AAS, bilateral articulation agreements have become a population transfer pathway for these CTE students seeking transfer. These are agreements that exist between two institutions that allow an associate degree from the community college to be applied toward the

baccalaureate at the senior institution (Bers, 2013; Ignash, 2012). While bilateral agreements are useful and effective pathways to the baccalaureate, they are not without shortcomings. Since bilateral agreements exist between two institutions or programs and lack comprehensiveness, a student obtaining the AAS at a community college may be significantly limited to choices of senior institutions. There is still a substantial need for research in this area to widen access to the baccalaureate for CTE students. Toward this end, attention has been turned toward the implementation of applied baccalaureate degrees and the community college baccalaureate.

Pathways to the Baccalaureate

The Applied Baccalaureate. A nontraditional associate degree like the AAS may require nontraditional pathways to the baccalaureate, given the current articulation and transfer problem surrounding CTE associate degrees. One way the AAS articulation problem has been addressed is through the application of hours for technical courses (i.e., the majority of core hours in AAS programs) at the associate degree level toward major hours at the baccalaureate level. Since states have experienced problems with the articulation of AAS courses toward traditional baccalaureate degrees, applied baccalaureates have taken the spotlight (Batts & Pagliari, 2013; Floyd, Felsher, Garcia-Falconetti, & Cohen, 2012; Floyd, Skolnik, & Walker, 2005; Ignash, 2012; Kujawa, 2013; Townsend, Bragg, & Ruud, 2009). Bachelor of Applied Science (BAS) degrees are being offered in many states to widen the transfer pathway for students who obtain the AAS degree (Chase, 2011; Kujawa, 2013; Townsend et al., 2009). Townsend et al. (2009) highlighted the existence of BAS degrees in two sectors: traditional four-year colleges and universities and community colleges. Further, Townsend et al. (2009) found

that the majority of BAS degrees are awarded from traditional four-year institutions, yet a significant number of community colleges were now offering BAS degrees for direct transfer and articulation of AAS courses.

Kujawa (2013) studied the AAS to BAS pathway and the "heating up" (p. 357) of AAS students' educational aspirations toward a baccalaureate, and found that that a BAS pathway was beneficial for AAS students who changed their educational course to include this pursuit. Since students enrolled in applied/technical associate degree programs are just as likely to pursue a baccalaureate as AA/AS students in traditional transfer pathways (Cohen & Brawer, 1996; Cohen & Ignash, 1994; Fredrickson, 1998), a pathway toward an applied baccalaureate addresses the curriculum articulation problem associated with applied associate degrees and provides greater access to baccalaureate degrees for community college students enrolled in career and technical education programs. In all, differences between AA/AS and AAS pathways point to the need to improve transfer functions and baccalaureate attainment among CTE degree seekers as a whole, but especially for those students who are members of underrepresented and minoritized populations in higher education.

The Community College Baccalaureate. Community colleges are institutions of continual evolution. The first Junior College, established in 1901 as Joliet Junior College, harnessed the mission of a transfer institution in which students received their first two years of undergraduate study before moving on to a four-year college or university. Rebranded as 'community colleges' after the passage of the Higher Education Act in the 1960s, the mission became somewhat bifurcated with a focus on transfer and occupational training/workforce development (Brint & Karable, 1989).

An additional change in the mission of community colleges is currently underway, with the creation of the community college baccalaureate (CCB). The CCB is defined by Floyd and Walker (2009) as:

> A degree granted by post-secondary institutions approved for associate degree awards with the addition of limited baccalaureate degree approval in specialized fields. In most, but not all cases, the CCB degree includes the same general education requirements of certain university-granted baccalaureates. (p. 115)

The caveat, in limited instances, is that some CCBs anchor heavily on occupational training and CTE courses that may preclude students' preparation for a graduate-level program. Still, students enrolled in CTE programs are granted access to a baccalaureate degree awarded by the community college (Floyd & Walker, 2009; McKinney, Scicchitano, & Johns, 2013).

A survey of community colleges that offered at least one CCB showed that the primary reason for the CCB offering was an increase in baccalaureate access for place-bound students living and working in their communities (McKinney et al., 2013). Since most of our nation's learners are situated in closer proximity to community colleges than four-year institutions due to work/family constraints, the CCB offers one viable avenue of access for community college students, particularly those enrolled in CTE programs (Floyd & Walker, 2009; McKinney et al., 2013).

Echoing prior research that earning an associate degree was positively associated with baccalaureate access and attainment (see, e.g., Ehrenburg & Smith, 2004; Kopko & Crosta, 2016), Wesse (2012) found a positive association between the number of CCBs offered and the number of associate degrees awarded, which means that offering a CCB

did not detract from associate degree completion and widened access to the baccalaureate for a significant number of students. While there is a risk of infringing upon the mission of four-year institutions by offering the CCB (Grizzell, 2016), the fact remains that CCBs are a policy solution worth considering if equitable access to the baccalaureate is a primary concern in 21st century higher education.

The literature on policy solutions is a critical piece in addressing the inequities of AAS transfer, and it informs both community colleges and four-year institutions on ways to tackle them. The inclusion of proposed policy solutions is a necessary discussion, and it provides a navigational beacon in the area of AAS to guide future research toward solving problems in practice.

Summary

This review of literature examined AAS student characteristics and baccalaureate aspirations, problems surrounding the transfer of AAS degrees, community college factors, and policy solutions as each relates to the successful vertical transfer of the AAS. AAS students intend to, and do, transfer to four-year institutions with aspirations of earning the baccalaureate (Berkner, Horn, & Clune, 2000; Cohen & Brawer, 1996; Cohen & Ignash, 1994; Eells, 1943; Findlen, 1997; Fredrickson, 1998; Hill et al., 2016; Horn & Skomsvold, 2011; Ignash, 2012; Kintzer, 1983; Monroe & Richtig, 2002; Shearon, Brownlee, & Johnson, 1990). Yet, AAS students encounter substantial barriers to successful transfer, from credit loss to lack of general education courses, to problems with degree articulation and transfer alignment (D'Amico, 2016; Ehrenburg & Smith, 2004; Fink et al., 2018; Giani, 2019; The Government Accountability Office, 2017; Hezel

Associates and Western Interstate Commission for Higher Education; Kopko & Crosta, 2016; Monaghan and Attewell, 2015).

This study addresses gaps in previous and current literature in several meaningful ways. First, this study presents a "deep dive" into AAS completers' baccalaureate attainment using statewide transfer data over the course of 13 years. As Bahr (2013) pointed out, most studies that focus on AAS students center on student-level characteristics, ignoring the nesting effects of students within community colleges. This study addresses these gaps by including community college-level and county-level (i.e., economic distress tiers) variables in a multilevel model. Lastly, the present study incorporates community college disciplinary foci and the college service areas' level of economic distress—both of which have never been used in an inferential model of AAS baccalaureate attainment in North Carolina to date.

To further highlight the inequities surrounding AAS transfer, the CTE student population is distinctly different from the population of traditional, transfer-track community college students. CTE students are more likely to be older, students of color, women, on financial aid, first-generation college students, and hold full-time jobs (Chase, 2011; Cohen, Brawer, & Kisker, 2014; D'Amico & Chapman, 2018; Hirschy, Bremer, & Castellano, 2011; Ma & Baum, 2016). Several studies have found successful vertical transfer to be a function of community college student characteristics (Bahr, 2013; Davidson, 2015; Ehrenburg & Smith, 2004; Karandjeff et al., 2011; Kopko & Crosta, 2016; Wang, Chuang, & McCready, 2017; Wolzinger & O'Lawrence, 2018). Thus, further exploration of statistically significant correlates of successful vertical transfer is warranted.

In addition to successful vertical transfer being a function of student-level characteristics, the literature also highlights the role of community college characteristics in successful vertical transfer, emphasizing the percentage of minority students, institutional size, mean GPA, and urbanicity (Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008; Dundar, 2011; Eagan & Jaeger, 2009; Umbach et al., 2018; Wassmer, Moore, & Shulock, 2004; Wang, 2016).

Lastly, policy solutions are a critical component in addressing the transfer gaps for AAS degree holders. Articulation agreements stress the importance of creating seamless pathways from CTE associate degree programs to the baccalaureate (Bers, 2013; D'Amico, 2016; Ignash, 2012; Ignash & Kotun, 2005; Ignash & Townsend, 2000; NCCCS, 2014). Intimately tied to articulation agreements are discussions surrounding the applied baccalaureate (Batts & Pagliari, 2013; Chase, 2011; Floyd, Felsher, Garcia-Falconetti, & Cohen, 2012; Floyd, Skolnik, & Walker, 2005; Ignash, 2012; Kujawa, 2013; Townsend, Bragg, & Ruud, 2009), and more recently the community college baccalaureate (Brint & Karable, 1989; Floyd & Walker, 2009; Grizzell, 2016; McKinney, Scicchitano, & Johns, 2013; Wesse, 2012).

With increasing focus on student success outcomes in community colleges across the nation, it is imperative that research takes a holistic approach to the problem of AAS transfer-to-baccalaureate completion. By capturing correlates to AAS transfer students' baccalaureate attainment at the student-level, the community-college level, and environmental-levels, researchers can inform actionable responses to staggering inequities, and ultimately widen access to the baccalaureate for all who wish to pursue it.

CHAPTER 3: METHODOLOGY

This study examined the influence of student, academic, and community college factors on the baccalaureate completion of students who transferred to four-year institutions in North Carolina with the AAS over multiple academic years. Building upon research by D'Amico et al. (2020) that suggests AAS completers in North Carolina have lower baccalaureate attainment rates and represent higher percentages of transfer students from economically distressed counties, it was the intent of this study to examine specific predictors of baccalaureate completion for this unique student population. The following sections describe the research questions, sample, setting, data collection procedures, research design, data analyses, and measures.

Research Questions

This study used multilevel logistic regression to examine student, academic, and community college factors that are associated with the baccalaureate completion of students who transferred to four-year institutions with the AAS. A three-step turnkey approach in building multilevel logistic regression models was used (Sommet & Morselli, 2017). The first research question will be addressed using multilevel logistic regression to examine the extent to which student and academic factors predict the baccalaureate completion of AAS transfers to four-year institutions. The second research question will be addressed using multilevel logistic regression to determine the extent to which the likelihood of baccalaureate attainment varies between community colleges, and what community college characteristics explain differences in the likelihood of baccalaureate attainment. The following research questions and null hypothesis will be examined:

1. What student and academic factors predict the baccalaureate attainment of AAS completers?

2. Does the average likelihood of baccalaureate attainment vary between community colleges? If yes, what characteristics of the community college explain differences in students' likelihood of baccalaureate attainment?

Table 2 provides a summary of the research questions and analytic methods to be used for each question.

Table 2

Summary of Research Questions and Analytic Methods

Research Question	Predictor(s)	Outcome	Analyses
Question 1: What student and academic factors predict the baccalaureate attainment of AAS completers?	Race Sex Age Attempted university hours Applied Transfer Hours Upon Entry Total Transfer Hours Cumulative GPA Pell Recipient	Earned Baccalaureate	Multilevel Logistic Regression Summary Measures
Question 2: Does the average likelihood of baccalaureate attainment vary between community colleges? If yes, what characteristics of the community college explain differences in students' likelihood of baccalaureate attainment?	Institutional Size Disciplinary Focus Economic Distress Tier	Earned Baccalaureate	Multilevel Logistic Regression Summary Measures

Sample and Setting

The researcher examined transfer data of 11,770 students who entered universities within the UNC System with a single AAS degree. Student-level data were obtained from a UNC System transfer student dataset made available to the researcher through the Belk Center for Community College Leadership and Research at North Carolina State University. Institutional-level data are public and were obtained from the North Carolina Community College System (NCCCS), the NC Department of Commerce, and the

Carnegie Classification of Institutes of Higher Education. The sample size at level-2 (community colleges) is 58.

Data Collection Procedures

Student-level data were obtained from the UNC System transfer student dataset. Only students who earned one AAS degree were included in the analyses. Students who completed multiple AAS degrees and other credentials were omitted. Students who received associate degrees in 2016 and 2017 were omitted. *Baccalaureate Completion* is a binary outcome variable and indicates whether the student graduated from one of the 16 universities in the UNC System (yes or no). *Race* is a dummy variable and includes nine race/ethnic categories: Non-Resident Alien; race and ethnicity unknown; Hispanic; American Indian or Alaskan Native; Asian; Black; Native Hawaiian or Pacific Islander; White; and two or more races. Black, White, Hispanic, and Other Race are the races used in the model. *Other Race* was created by collapsing all identifiers other than White, Black, and Hispanic into a single category. *Sex* is male or female, and *Age* is approximate age during a specific academic year, calculated by subtracting year of birth from academic year. *Applied Transfer Hours* indicates transfer hours applied to the baccalaureate degree upon entry at the university. *Cumulative transfer hours* represent the total number of college-transfer hours transferred from the community college and applied to the baccalaureate degree program (this variable is only different from applied transfer hours if the student changed majors at the university). *Cumulative GPA* indicates the cumulative grade point average at the university during a specific term, ranging from 0.00- 4.00. *Cumulative attempted hours* are the total number of hours the student

attempted at the university. *Pell Recipient* is binary, and indicates whether a student was awarded a Pell Grant (to be used as a proxy for socioeconomic status).

The Carnegie Classification of Institutes of Higher Education was used to determine *Community College Size* and *Disciplinary Focus*. Economic distress tiers in which community colleges are located (by county) were obtained from the NC Department of Commerce and manually compiled by Dr. Mark M. D'Amico at the University of North Carolina at Charlotte. While the North Carolina Department of Commerce uses three distress tiers for county designations, several community colleges in this study serve more than one county, which resulted in several community colleges with differing distress tiers. In these cases, the researcher included all community colleges serving Tier 1 counties in Tier 1 (highest level of economic distress); and Tier 2/3 designation (i.e., community colleges serving counties in Tiers 2 and 3) in Tier 2. Tier 3 was used as the reference category and includes community colleges that only serve counties in Tier 3. Student and college-level predictor variables were selected based on the literature and the available data (see Table 3).

Table 3

Names, Descriptions, and Analyses of Variables

Variable name	Variable description	Multilevel Logistic Regression	Summary Measures
Student-Level Variables			
Female	Female = 1, Male = 0	X	X
Race/Hispanic	Dummy coded	X	X
Race/Black	Dummy coded	X	X
Race/White	Reference group		X
Race/Other	Dummy coded	X	X
Age	Continuous	X	X
Applied Transfer Hours	Continuous	X	X
Cumulative Transfer Hours	Continuous	X	X
Cumulative GPA	Continuous	X	X
Pell Recipient	Dichotomous	X	X
Earned Baccalaureate	Dichotomous (Outcome Variable)	X	X
Community College Variables			
Institutional Size	Very small/small = 1*; Medium = 2; Large/very large = 3	X	X

Disciplinary Focus	High Transfer=1*; High Career and Technical=2; Mixed=3	X	X
Economic Distress Tier	Most Distress = 1; 2 = Mid-Tier; Least Distress = 3*; Mixed 1/2 = 4; Mixed 2/3 = 5; Mixed 1/3 = 6; Mixed 1/2/3 = 7	X	X

*indicates reference group for level-2 categorical predictors after dummy coding.

Protection of Human Subjects

The study was submitted for IRB approval and was not deemed human subjects research. Students are deidentified and have a unique identifier, and institutions will be designated by their respective FICE code. Identifiers are not a social security number or student ID number issued by the institution.

Research Design

A nonexperimental, correlational design using archival data was used in this study. Transfer data from the University of North Carolina (UNC) system from students who transferred with an AAS to one of the 16 UNC system institutions were examined. Only those students who earned the AAS from one of North Carolina's 58 community colleges were included in the analyses. Out-of-state transfers, multiple AAS earners, certificate and diploma earners, and non-AAS degree earners were excluded.

Data Analysis

The analytical approach for the research questions was a two-level logistic regression model with a binary outcome (Raudenbush & Bryk, 2002). For this approach, all inferences were made at the student and community college levels. Using the binary outcome of baccalaureate attainment as a measure of student success, this study incorporated variables that fall within the major constructs of the Hirschy framework to create a multilevel logistic regression model that examined predictors of baccalaureate completion. Student-level characteristics are examined at level-1; community college

characteristics are examined at level-2 (size and disciplinary focus); and community-level characteristics (economic distress tiers) are examined at level-2. The following subsections describe the unconditional model, the conditional models and levels one and two, and the full, multilevel logistic regression model with all predictors. The researcher used a three-step turnkey procedure for constructing multilevel logistic regression models for the following analyses (Sommet & Morselli, 2017). After reviewing the effects of a random-intercept model, the researcher allowed select slopes to randomly vary across community colleges to examine cross-level interactions.

Unconditional Model

The unconditional, or null model, was tested to examine variation among community colleges on AAS completers' baccalaureate attainment with students *i* from community college *j*, and can be expressed as: $\eta_{ij} = \log(\pi_{ij} /(1 - \pi_{ij})) = \beta_{0j}$. A random effect for community college (i.e., random intercept at the community college) was included to account for the between-group differences on the outcome variable. Variation in random intercepts between groups can be expressed as: $\beta_{0j} = \gamma_{00} + u_{0j}$ at level two, where: β_{0j} is the intercept for the *j*th college; $\log(\pi_{ij} /(1 - \pi_{ij}))$ is the logit function that links the expected value of the outcome variable to the predicted values for variate η_{ij}; γ_{00} represents the average log-odds of baccalaureate attainment of AAS transfers across North Carolina community colleges; u_{0j} is the random effect at level 2 (Raudenbush & Bryk, 2002).

The unconditional model is used as a baseline model to determine if sufficient unexplained variance exists at level 2. In contrast to standard hierarchical linear models with continuous outcome variables, calculating the intraclass correlation coefficient is

typically not useful with binary outcomes via nonlinear link functions because there is heteroscedasticity in the level-1 variance; the variance for the residual is not constant (Raudenbush & Bryk, 2002). Engberg and Wolniak (2010) argue that statistical significance of the estimate of variation between level-2 clusters provides justification to employ a multilevel model.

Conditional Model: Level 1

In the random intercepts model, level-1 parameters were not allowed to vary across the 58 community colleges. The conditional model includes predictor variables added in levels one and two. Analyzing the effect of student-level predictors on baccalaureate attainment can be expressed as: $\eta_{ij} = \beta_{0j} + \beta_{1j} X_{ij}$, where $\beta_{1j} X_{ij}$ represents the unstandardized, within-group predictors at level 1. After entering predictors into the level-1 model, the model can be defined as:

$$\eta_{ij} = \beta_{0j} + \beta_{1j}(\text{Female}) + \beta_{2j}(\text{Hispanic}) + \beta_{3j}(\text{Black}) + \beta_{4j}(\text{Other Race}) + \beta_{5j}(\text{Age}) + \beta_{6j}(\text{Applied Transfer Hours}) + \beta_{7j}(\text{Attempted University Hours}) + \beta_{8j}(\text{Cumulative Transfer Hours}) + \beta_{9j}(\text{Cumulative GPA}) + \beta_{10j}(\text{Pell})$$

Conditional Model: Level 2

Like the level-1 parameters, level-2 parameters were constrained as fixed in the random intercepts model. The level-2 model can be expressed as $\beta_{0j} = \gamma_{00} + \gamma_{01} W_{0j} + u_{0j}$, where $\gamma_{01} W_j$ represents community college-level moderating variable(s). The level-2 equation with predictors added can be expressed as:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Tier 1}) + \gamma_{02}(\text{Tier 2}) + \gamma_{03}(\text{High CTE}) + \gamma_{04}(\text{Mixed CTE/Transfer}) + \gamma_{05}(\text{Medium}) + \gamma_{06}(\text{Large}) + u_{0j}$$

Full, Conditional Model

The full, conditional model with student-level explanatory variables and institutional-level moderators added to the equation will be:

$$\eta_{ij}\ \gamma_{00} + \gamma_{01}\,(\text{Tier 1}) + \gamma_{02}\,(\text{Tier 2}) + \gamma_{03}\,(\text{High CTE}) + \gamma_{04}\,(\text{Mixed CTE/Transfer}) + \gamma_{05}\,(\text{Medium}) + \gamma_{06}\,(\text{Large}) + \beta_{0j} + \beta_{1j}\,(\text{Female}) + \beta_{2j}\,(\text{Hispanic}) + \beta_{3j}\,(\text{Black}) + \beta_{4j}\,(\text{Other Race}) + \beta_{5j}\,(\text{Age}) + \beta_{6j}\,(\text{Applied Transfer Hours}) + \beta_{7j}\,(\text{Attempted University Hours}) + \beta_{8j}\,(\text{Cumulative Transfer Hours}) + \beta_{9j}\,(\text{Cumulative GPA}) + \beta_{10j}\,(\text{Pell}) + u_{0j}$$

Analyses that examined student-level inferences were conducted using this two-level logistic regression model, with students nested within community colleges. Some institutional-level factors were expected to explain differences in the likelihood of baccalaureate attainment. A second multilevel logistic regression model with random slopes was used to examine cross-level interactions. Effects from the random slopes model are discussed in Chapter Four. This study used an alpha level between .01 to .05, which is the range of probability cutoffs that are associated with Benjamini-Hochberg adjustments.

Missing Data

Four predictor variables at level-1 contained missing data in this sample. Cumulative transfer hours contained four missing values; Cumulative GPA had 627 missing values; Age had four missing values; and Transfer Hours contained 87 missing values. These missing values combined represent 5% of the overall sample. When missing data comprise between 5-10% of the overall sample, Tabachnick and Fidell (2012) encourage the listwise deletion method to eliminate cases with missing data.

Accordingly, the researcher used listwise deletion to handle these missing values at level-1. There were no missing data in level-2.

Assumptions

The first assumption examined for multilevel modeling was sample size. Maas and Hox (2005) proposed (based on simulations) that at least 50 level-2 clusters are needed to obtain accurate standard error estimates. Since this study incorporated 58 community colleges, there was an adequate sample size at level 2 for the analysis (Maas & Hox, 2005). Logistic regression does not require the same assumptions as linear regression; a linear relationship between the outcome and predictor variable is not required, and residuals need not be normally distributed (Stolzfus, 2011). Since this study employed multilevel logistic regression, the independence assumption was not required (Raudenbush & Bryk, 2002). Multicollinearity was tested by examining the variance inflation factors (VIF) of all predictor variables in levels one and two. There was no evidence of multicollinearity, with all VIF values < 3. The outcome variable in this study (earned baccalaureate) was dichotomous, and met the structural requirements for a binary logistic regression (Stolzfus, 2011). Mahalanobis distance was calculated to identify multivariate outliers. There were 133 multivariate outliers (approximately 1% of the total sample). The researcher made the decision to leave these outliers in the sample. The intraclass correlation coefficient was .02, indicating that 2% of the variance is attributed to the community college of origin. While this is a very small effect, Bleise (1998) simulated the effect of an ICC of .01 and found there were significantly strong group-level relationships that remained undetected in lower levels of the data.

Summary

In this correlational study using archival data, the dichotomous outcome variable was baccalaureate attainment for students who transferred to a four-year institution with the AAS degree. This study examined the extent to which student-level characteristics predicted the baccalaureate completion of AAS transfer students. This study also examined what institutional-level factors moderated the relationship between student-level predictors and the baccalaureate completion of AAS transfer students. Due to the multilevel structure of the data, a multilevel logistic regression analysis was needed to ensure the independence of errors assumption was not violated (Raudenbush & Bryk, 2002).

This study employed the conceptual model developed by Hirschy et al. (2011) on community college student success in occupational programs which drives the inclusion of predictors at the student level and the institutional/environmental level. The student success outcome construct in the Hirschy model was designated baccalaureate completion in this study. The variables included in this multilevel study were informed by the research literature on associate degree transfer, particularly the few studies that have used multilevel models to study associate degree transfer (e.g., Calcagno, Bailey, Jenkins, Kienzl, & Leinbach, 2008; Dundar et al., 2011; Eagan & Jaeger, 2009; Umbach et al., 2018; Wassmer, Moore, & Shulock, 2004; Wang, 2016).

Analyses conducted in this study employed a multilevel logistic regression containing the following models: (1) A null, unconditional model, (2) a level-1 random intercepts model, (3) a level-2 random intercepts model, (4) a full, conditional random intercepts model, and (5) a full, conditional multilevel model with random slopes.

Assumptions were checked pursuant to the requisite statistical assumptions of a multilevel logistic regression model with a binary outcome (Raudenbush & Bryk, 2002).

Driven by a conceptual model for CTE student success in community college and literature on baccalaureate aspirations and successful vertical transfer, it is the intent of this study to illuminate student-level predictors and institutional/environmental-level moderators of the baccalaureate attainment of AAS transfer students. In addition, this study aims to provide descriptive measures of differences of baccalaureate attainment for AAS transfer students. Ultimately, the research questions and methodology used in this study seek to produce practical and actionable findings that lead to an increased number of pathways for AAS transfer students to earn the baccalaureate.

CHAPTER 4: RESULTS

This study examined student-level and institutional-level variables that impacted baccalaureate attainment of AAS completers who transferred to a four-year university after earning their credential at one of North Carolina's 58 community colleges. Variables included in the model were aligned with the conceptual framework developed by Hirschy et al. (2011) and prior research on community college transfer students. First, descriptive analyses of the sample population are presented, followed by the results of the multilevel logistic regression models. A three-step turnkey procedure was used to construct random intercepts models (Sommet & Morselli, 2017). Then, an additional model was constructed that included random slopes on select predictor variables. Table 4 contains the descriptive statistics of AAS transfer students.

Table 4

Descriptive Statistics of Student-Level Variables

Variable	*N*	*M*	*SD*
Outcome variable			
Baccalaureate completion	11770	.62	0.485
Student-level variables			
Female	7808	.66	0.473
White	7673	.65	0.476
Hispanic	406	.034	0.183
Black	2472	.21	0.407
Race/Other*	1219	.11	.307
Age	11770	34	8.86
Transfer hours applied to degree at entry	11770	60.12	27.91
Cumulative transfer hours	11770	73.37	37.37
Credit loss	11770	13.34	28.5
Cumulative attempted university hours	11770	48.81	29.6
Cumulative GPA	11770	3.31	.885
Pell	5896	0.50	.50

No Pell	5874	0.50	0.50	

*Non-Resident Alien, Asian, American Indian/Alaskan Native, Race unknown, Native Hawaiian/Pacific Islander, Two or more races; means for categorical data are the proportion of participants in the group.

Descriptive Findings

Table 5 reports the descriptive results of select explanatory variables on the outcome of baccalaureate completion at level-1 (student level).

Table 5

Overview of Baccalaureate Completion by Select Variables at Level-1(N = 11,770)

Variable	% Graduated	Total Transfer Hours	Applied Transfer Hours	Cumulative GPA	% Pell
Pell recipient	61	67	57	3.2	100
Non-Pell recipient	63	80	63	3.4	0
Female	62	76	61	3.4	51
Male	62	68	58	3.2	48
Hispanic	55	72	59	3.3	57
Black	55	67	56	3.0	73
White	65	76	62	3.4	41
Other Race*	62	71	59	3.3	59
24 and younger	64	63	53	3.0	37
25 and older	62	75	61	3.4	52

*Non-Resident Alien, Asian, American Indian/Alaskan Native, Race unknown, Native Hawaiian/Pacific Islander, Two or more races

Sex, race and ethnicity.

The sample population included 11,770 students who earned the AAS and transferred to a university between 2002 and 2015. The majority of AAS transfer students were White (65%). Black students comprised 21% of the sample population, and Hispanic students comprised only 3.4%. Examining AAS degrees earned by the sample population between 2002 and 2015, 62% of AAS completers earned the baccalaureate after transferring. Of the Black students who transferred with the AAS, 55% completed

the baccalaureate, compared to 65% of white students who transferred with the AAS. Around 55% of Hispanic students in the sample completed the baccalaureate. There is a clear difference in the rate of baccalaureate completion according to race and ethnicity by examining descriptive measures alone.

Women comprised the majority of the sample at 66%. Women were slightly more likely than men to complete the baccalaureate; 62.2% of women in the sample graduated compared to 61.7% of males. Black men and Black women graduated at a rate of 55%. White women graduated at a rate of 65%, while White men graduated at a rate of 64%. Hispanic women were significantly more likely to graduate than Hispanic men with a graduation rate of 57% compared to males at 50%. Descriptively, sex only seems to significantly impact graduation in the Hispanic race/ethnicity category.

Age.

The average age of the sample population was 34, and only 12.6% of the sample were 24 or younger. AAS completers age 25 and older comprised 87.4% of the overall sample. This aligns with findings from Hirschy et al. (2011) that students in career and technical education programs tend to be older than traditional college transfer students.

Baccalaureate completion between traditional-age college students (24 and younger) was 64% compared to students 25 and older at 62%. When applied transfer hours (to the baccalaureate) were examined by age, students who were 24 or younger transferred an average of 53 credits to the baccalaureate degree upon entry, while students who were 25 and older transferred an average of 61 credits applied to the baccalaureate.

Pell as a proxy for SES.

Half of the sample received Pell grants. Compared to 41% of white students who were receiving Pell aid, 57% of Hispanic students and 73% of Black students were receiving Pell. Categorized as other race, 59% of students who were two or more races, non-resident alien status, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, Asian, or unknown race received Pell. As a proxy for socioeconomic status, these summary measures demonstrate that people of color transferring with the AAS are not only less likely to earn the baccalaureate than White students, but they are more likely to experience financial need, as well.

There are differences in transfer credit hours applied to the baccalaureate degree program by Pell recipients. On average, students who were not receiving Pell aid transferred 63 credit from the community college to their baccalaureate degree program upon admission to the university, compared to an average of 57 credits from students who were receiving Pell. These descriptive data suggest that AAS transfer students who were not Pell recipients were able to apply six additional credit hours to the baccalaureate degree compared to Pell recipients.

Credit hours.

On average, 60 hours of community college credits were applied to students' baccalaureate degree programs upon transfer. In the present study, only 52% of AAS completers were able to apply 60 or more credit hours from the community college toward a baccalaureate degree. Around one quarter of the sample (25.6%) were able to

apply 45 credit hours or fewer to the baccalaureate, and 10% of the sample were able to apply fewer than 30 credits hours toward the baccalaureate.

Differences in the application of transfer hours to the baccalaureate degree becomes more pronounced when the data are disaggregated by race and ethnicity. While White students were able to apply an average of 62 credits to their baccalaureate degree program upon entry, Black students were only able to apply an average of 56 credits. On average, Hispanic students were able to apply 59 credits toward their degree program, and students in the collapsed Other Race category were able to apply 59 credits. These data show that people of color lose a larger number of credits applied to the baccalaureate upon admission compared to White students.

On average, AAS completers attempted 49 hours at the destination university. While attempted hours at the university may be unrelated to community college characteristics, it could serve as an indicator of persistence for AAS students who transfer to a four-year institution.

GPA.

The average cumulative GPA from the total sample population was 3.29. Disaggregated by race, the average GPA for Black AAS completers was 3.0, and Hispanic students and Other Race category had an average cumulative GPA of 3.3. White students had an average cumulative GPA of 3.4.

Community college variables.

Next, community college variables are discussed as they relate to the outcome of baccalaureate completion and the explanatory variables at level-1. Table 6 presents student enrollment by community college characteristics.

Table 6

Enrollment by Community-College Level Variables

Variable	*N*	CC Frequency	% Students
Size	58		
Very small	85	3	.7
Small	5007	37	43.3
Medium	3772	13	32
Large	1735	3	14.7
Very large	1171	2	9.9
Disciplinary Focus	58		
High transfer	3546	12	30.1
High CTE	757	7	6.4
Mixed CTE/transfer	8029	39	63.4
Service Area Tier	58		
Tier 1	3441	20	29.2
Tier 1/2	787	7	6.7
Tier 1/2/3	108	1	.9
Tier 1/3	186	2	1.6
Tier 2	3397	13	28.9
Tier 2/3	1649	7	14
Tier 3	2202	8	18.7

Community colleges.

There are at least 12 students transferring from each of the 58 community colleges, which allows the use of a multilevel model for inferential analyses. The range of AAS completers transferring from the 58 community colleges is 12 to 813 transfers per college.

Twenty community colleges in the sample (29%) have service areas that are designated by the North Carolina Department of Commerce as Tier 1, meaning these areas have the highest levels of economic distress in the state. Thirty community colleges in the sample serve at least one county designated Tier 1. The majority of community colleges are designated as small (64%), and the second largest size category is medium (22%). In terms of community college disciplinary focus, the majority of colleges in the sample were mixed CTE/transfer (67%). The second largest disciplinary focus was high transfer (21%), and the smallest category was high CTE (12%). As the largest category of disciplinary focus indicates, North Carolina's community colleges place a strong emphasis on career and technical education.

The overall population sample contained 29% (3,441) of AAS completers who transferred from community colleges in service areas designated Tier 1. The majority of the community colleges in Tier 1 were small and were designated *mixed CTE/transfer* in disciplinary focus.

Community college characteristics by outcome and predictor variables.

Table 7 presents the summary measures for level-2 community college characteristics by the outcome variable and other student/academic characteristics.

Table 7

Community College Characteristics by Outcome and Predictor Variables (N = 58)

Variable	% Graduated	Average Total Transfer Hours	Average Applied Transfer Hours	% Pell	% Minoritized Students*
Distress tier					
Tier 1	61	75	62	56	46
Tier 1/2	59	74	61	52	24
Tier 1/2/3	69	79	65	47	37
Tier 1/3	58	72	58	48	17
Tier 2	63	70	57	49	31
Tier 2/3	64	76	60	46	22
Tier 3	62	74	61	44	37

Disc. focus					
High transfer	63	75	62	50	37
High CTE	57	69	59	67	54
Mixed CTE/transfer	62	73	59	49	30
Size					
Very Small	62	75	64	56	46
Small	62	74	61	52	33
Medium	63	74	60	47	29
Large	61	70	59	57	48
Very Large	63	73	61	42	42

*non-White race/ethnicity categories

Baccalaureate completion.

Baccalaureate completion for Tier 1 transfers was 61% compared to 63% and 62% in Tiers 2 and 3, respectively. Not surprisingly, the highest percentage of baccalaureate completion by disciplinary focus was *high transfer* (63%), compared to *high CTE* at 57% and *Mixed CTE/transfer* at 62%. Summary measures indicate that students transferring from *high CTE* community colleges have an average graduation rate that is six percentage points lower than students from *high transfer* community colleges. Students graduating from large community colleges had a slightly lower graduation rate than students transferring from very large, medium, and small community colleges.

Minority student enrollment.

AAS completers transferring from Tier 1 areas are comprised of a higher percentage of people of color at 46%, compared to 31% at Tier 2 and 37% at Tier 3. Community colleges designated *high CTE* had an average minority student enrollment of 54%, compared to 37% at *high transfer* institutions and 30% at *mixed CTE/transfer* institutions. Large community colleges had the highest average percentage of minority student enrollments (48%) compared to other sizes. Medium-size community colleges had the lowest average percentage of minority enrollments (29%).

Applied Credit Hours.

Applied credit hours are operationalized as the number of credit hours from the community college that were applied to a student's baccalaureate degree program upon entry. Community college serving multiple counties designated in Tiers 1/2/3 had the highest number of applied credits toward the baccalaureate degree upon entry at 65, compared to Tier 2 at 57 credit hours and Tier 1 at 62 credit hours. In terms of disciplinary focus, students transferring from *high CTE* institutions and *mixed CTE/transfer* institutions were able to apply an average of 59 credits to the baccalaureate, compared to students from *high transfer* institutions who were able to apply an average of 62 credits to the baccalaureate upon entry. Community colleges that were designated very small in size had the highest average applied credit hours at 64, compared to the lowest average of applied credit hours from students transferring from large community colleges at 59.

Pell recipients.

A higher percentage of students transferring from Tier 1 service areas received Pell (56%) than the overall sample (50%). Further, Tier 1 community colleges had significantly higher percentages of Pell recipients (56%) than Tier 2 (50%) and Tier 3 (46%) colleges. The percentage of Pell recipients becomes much more pronounced when community colleges were examined by disciplinary focus. An average of 67% of *high CTE* community college AAS completers received Pell, compared to 50% at *high transfer* institutions and 49% at *mixedCTE/transfer* institutions. Large community colleges and small community colleges had the highest average percentage of Pell recipients at 57% and 56%, respectively.

Findings from Multilevel Models

Unconditional model.

The unconditional model was used as a baseline model to determine if there was sufficient variation in proportions of students across community colleges in terms of baccalaureate completion. In other words, the unconditional model presents the variation in the probability of baccalaureate completion across 58 community colleges. In this model, no predictors were entered into the model at levels one or two. The fixed intercept for the unconditional model was .489 (i.e., overall log-odds of earning a baccalaureate) and the odds ratio was 1.631, indicating that AAS completers had a 62% chance of baccalaureate completion. This indicated that AAS transfer students in the sample have 1.6 times greater odds of earning the baccalaureate than not earning the baccalaureate. The random intercept variance (.019, CI .008- .045) was statistically significant ($p < .05$), indicating there was significant variation between community colleges of the proportion of students who completed the baccalaureate. Engberg & Wolniak (2010) suggest examining whether an estimate between level-2 clusters is significant to justify the use of a multilevel model. In this study, there was statistically significant variation in the log-odds of baccalaureate completion, and therefore the use of a multilevel model can be justified.

Level-1 random intercepts model.

Next, a second model was constructed to include student-level predictors to examine their association with baccalaureate attainment. Level-1 parameters remained fixed across all 58 community colleges. Fixed effects are discussed first, then random

effects are discussed. Table 8 reports the regression coefficients, standard errors, *t* values, and odds ratios for level-1 predictors.

Table 8

Parameter Estimates, Standard Errors, t-values, and Odds Ratios for Level-1

Variable	Coefficient	*S. E.*	*t* -value	OR	Sig.
γ_{00}	-9.129	.2878	-31.715		<.001
Female	.341	.0406	8.480	1.407	<.001
GPA	1.457	.0664	21.895	4.291	<.001
Cum transfer hrs	.037	.0018	20.102	1.038	<.001
Applied hours	-.011	.0016	-6.842	.989	<.001
Attempted university hrs	.079	.0022	35.991	1.082	<.001
Pell	-.314	.0612	-5.127	.731	<.001
Age	-.034	.0034	-10.517	.960	<.001
Black	-.054	.0694	-.778	.947	.437
Hispanic	-.594	.2045	-2.903	.552	.004
Other Race	.005	.1137	.040	1.005	.968

The coefficient γ_{00}, which can be interpreted as the intercept and grand mean of the expected log-odds of baccalaureate attainment, is -9.129 (t = -31.715, p < .001). First, variables that had a significant, positive relationship to baccalaureate attainment will be discussed. Then, variables that had a significant negative relationship to baccalaureate attainment will be discussed; and finally, variables that had no statistically significant impact on baccalaureate attainment will be discussed.

There were several statistically significant findings from student-level variables that positively impacted the baccalaureate attainment of AAS transfer students. The main effect of cumulative GPA significantly and positively impacted baccalaureate completion among AAS transfers (t = 21.895, p < .001). For every one unit increase in cumulative GPA, AAS transfer students were 4.2 times more likely to earn the baccalaureate after controlling for all other variables in the model. Cumulative transfer hours had a small, yet positive and significant effect on baccalaureate attainment (t = 20.102, p < .001); for every one unit increase in hours transferred from the community college, the student was

1.03 times (51%) more likely to earn the baccalaureate. Attempted hours at the university were positively and significantly associated with baccalaureate attainment (t = 35.991, p < .001); While the effect was small, every one unit increase in hours attempted that the university was associated with a 52% increase in the chances of baccalaureate attainment. Lastly, women (t = 8.409, p < .001) were 1.4 times (58%) more likely than men to earn the baccalaureate.

Several student-level variables had a negative and statistically significant relationship with baccalaureate completion. The amount of transfer hours applied to the baccalaureate upon admission was negatively associated with baccalaureate attainment, but the effect size is very small (t = -6.842, p < .001). Age is a continuous value and was centered on the grand mean. A very small effect size, the main effect on students' age (t = -10.517, p < .001) was negative and statistically significant, indicating that as a student's age increased, the student was 51% less likely to earn the baccalaureate. The main effects of students' ethnicity being Hispanic, (t = -2.903, p < .01), demonstrate that this student characteristic was negatively and significantly associated with baccalaureate completion. It should be noted that Hispanic students comprised around 4% of the total sample. Results from the level-1 model suggest that Hispanic students were 1.8 times (64%) less likely than White students to complete a baccalaureate. Lastly, Pell recipients had a significant negative relationship to baccalaureate attainment (t = -5.127, p < .001); AAS completers who received Pell were 57% less likely to earn the baccalaureate than AAS completers who did not receive Pell.

The random effects in the student-level model showed that significant variation across community colleges remained after controlling for several student and academic

characteristics. The variance was statistically significant (variance component = .100, p =.001). This suggests there is variance in the outcome of baccalaureate completion that remains unexplained. There may be institutional-level variables that could be added to the model that might explain this random variation, and justifies the use of multilevel modeling due to clustering in the data.

Level-2 random intercepts model.

Noted in the previous models' estimations above, the likelihood of baccalaureate completion varied to a statistically significant degree across 58 community colleges. The unconditional and conditional level-1 model demonstrated that the likelihood of baccalaureate completion varied to a statistically significant degree across 58 community colleges. This prompted the researcher to examine several institutional-level variables that could account for variation in baccalaureate attainment: Community college disciplinary focus, size, and economic distress tier. Thus, institutional-level variables were added to the second level of the model. Level-2 parameters were fixed across all community colleges in this model. Table 9 presents the coefficients, standard errors, *t*-values, and odds ratios of the level-2 model with fixed effects.

Table 9

Parameter Estimates, Standard Errors, t-values, and Odds Ratios for Level-2 Fixed Effects

Variable	Coefficient	*S. E.*	*t*-value	OR	Sig.
Includes Tier 1	-.239	.1485	-1.611	.934	.107
Includes Tier 2	-.068	.1471	-.464	.934	.643
High CTE	-.288	.1427	-2.021	.749	.043
Mixed CTE/Transfer	.033	.1306	.250	1.033	.803
Large	-.299	.1934	-1.544	.742	.123
Medium	-.119	.1024	-1.160	.888	.246

Estimates from the two-level conditional model with fixed effects at levels one and two suggest that, among the community college variables included in the model, students transferring from community colleges that were identified as *high CTE* as a disciplinary focus by the Carnegie Institutes of Higher Education classification were significantly and negatively associated with baccalaureate completion. AAS completers who transferred from institutions designated *high CTE* were 57% less likely to earn the baccalaureate than AAS completers who transferred from institutions designated *high transfer*. This is a relatively small sample size considering that only seven of North Carolina's community colleges are designated *high CTE*. Community colleges designated *mixed CTE/transfer* were positively associated with baccalaureate attainment, but the relationship was not statistically significant. Students transferring from community colleges that served at least one Tier 1 county were negatively associated with baccalaureate completion, but the association was not statistically significant. Students transferring from community colleges that served at least one Tier 2 county were also negatively associated with baccalaureate completion, but the results were not statistically significant.

Community college size was not associated with baccalaureate attainment to a statistically significant degree. Large community colleges had a negative association with baccalaureate attainment, but the relationship was not statistically significant. Medium community colleges also had a negative association with baccalaureate attainment, but the relationship was not statistically significant.

Random slope model.

Next, the researcher allowed the slopes of the predictor variables at level-1 to vary across all 58 community colleges to test for cross-level interactions. The only level-1 predictor that showed significant variance across community colleges was cumulative GPA (variance estimate = 1.604, $p < .001$). A cross-level interaction was detected between GPA and the level-2 variable of Tier 2 Service Areas (i.e., community colleges that serve at least one county in Tier 2). The moderating effect of community colleges serving at least one tier 2 county ($t = -3.123$, $p < .01$) on the relationship between university GPA and baccalaureate completion was captured by this cross-level interaction. This interaction suggest that Tier 2 Service Areas had a smaller GPA slope than the Tier 3 Service Areas.

An additional, salient cross-level interaction was found between cumulative transfer hours and community colleges that serve at least one Tier 1 county (most economically distressed). When cumulative transfer hours were allowed to vary randomly across community colleges, the odds of earning a baccalaureate after transferring from a community college serving counties in Tier 1 became negative and statistically significant ($t = -2.041$, $p < .05$). Community colleges that serve at least one Tier 1 county moderate the effect of cumulative transfer hours on baccalaureate attainment across the state's 58 community colleges. Unlike GPA, cumulative transfer hours did not have a statistically significant variance estimate, but the effect on baccalaureate completion regarding Tier 1 community colleges was statistically significant.

Summary and Conclusions

This chapter reported key findings from the descriptive analyses and multilevel logistic regression analyses of 11,770 AAS transfer students who transferred to universities within the UNC system from 58 community colleges across North Carolina. Descriptive findings indicated that 62% of the sample earned the baccalaureate after transferring with the AAS. A significantly higher percentage of White students who transferred with the AAS completed the baccalaureate compared to Black and Hispanic students.

Credit loss was a significant theme in the descriptive findings. An average of 60 credit hours were applied to the baccalaureate across the sample of AAS completers. Only slightly over half (52%) of the sample population were able to apply 60 or more credit hours toward the baccalaureate, and 10% of the sample were able to apply 30 or fewer credit hours toward the baccalaureate. White students were able to apply an average of 62 credits to the baccalaureate upon admission to the university, but Black and Hispanic students were only able to apply an average of 56 and 59 credits, respectively. This finding suggested that students of color experienced greater credit loss upon admission compared to White students.

The descriptive findings surrounding Pell, used as a proxy for SES, were also probative. Not only did people of color represent a lower percentage of baccalaureate completers, but they are substantially more likely to experience financial need. There were significant differences in Pell recipients by race, with 41% of white students receiving Pell compared to 58% of Hispanic students and 73% of Black students. In addition, Pell recipients were able to apply fewer transfer credits (57 credits) to the

baccalaureate on average compared to non-Pell recipients (63 credits). In other words, on average, Pell recipients lost six credits more than non-Pell recipients when applying transfer credits to a baccalaureate degree program upon university admission.

Descriptive findings were also significant when examining community college variables in the study. Examining community colleges that only serve counties in Tier 1, the highest level of economic distress, the findings suggest that (1) students transferring from community colleges that exclusively serve Tier 1 counties are more likely to be people of color, and (2) a higher percentage of students transferring from Tier 1 service areas receive Pell and experience financial need.

Descriptive results pertaining to a community college's disciplinary focus were also probative in the discussion on equity of access to the baccalaureate for AAS transfer students. A higher percentage of students transferring from community colleges designated *high CTE* were (1) receiving Pell; (2) were able to apply fewer transfer credits to the baccalaureate degree program; and (3) were an ethnic/racial minority.

Results from the multilevel logistic regression models suggest that baccalaureate completion is a function of student demographics, student academic factors, and community college characteristics. The variance component in the student-level model was statistically significant, indicating there may be additional factors that impact baccalaureate completion. By adding institutional-level variables to create a two-level random intercept model, the variance component reduced from .100 to .020, but was still statistically significant ($p < .05$); once the researcher allowed select level-1 predictors to randomly vary across community colleges, the variance component became nonsignificant. A community college's disciplinary focus of *high CTE* was significantly

and negatively associated with the odds of baccalaureate completion (i.e., students transferring from high CTE community colleges were associated with lower odds of baccalaureate completion compared to students transferring from *high transfer* community colleges). Community college service area tier designation and community college size were not related to baccalaureate completion for AAS transfer students to a statistically significant degree in the random intercept model.

AAS transfer students who are Hispanic were slightly less likely to earn the baccalaureate compared to White students. In addition, Pell recipients were slightly less likely to earn the baccalaureate compared to non-Pell recipients. This finding was particularly salient, indicating that students of lower SES faced substantial barriers in the pursuit of a baccalaureate. As the findings from Hirschy et al. (2011) suggest, students in CTE programs (i.e., AAS programs) tend to be older than traditional college students. The variable of age was negatively and significantly associated with the outcome variable, indicating that as a student's age increased the likelihood of baccalaureate completion decreased. Women had significantly greater odds of baccalaureate completion than men. Black students were negatively associated with the odds of baccalaureate completion, but the relationship was not statistically significant. A noteworthy and somewhat counterintuitive finding from the multilevel models concerns the number of credit hours applied to the baccalaureate degree from the community college. The amount of credit hours applied to the baccalaureate upon transferring had a negative and significant impact on the odds of baccalaureate completion.

Several student academic factors were positively and significantly associated with the odds of baccalaureate completion. Cumulative GPA was significantly and positively

associated with baccalaureate completion. The number of hours attempted at the university after transferring with the AAS was also significantly and positively associated with the odds of baccalaureate completion. Cumulative transfer hours (i.e., the total number of hours transferred to the university from the community college) was significantly and positively associated with baccalaureate completion.

Allowing select level-1 predictors to randomly vary (i.e., random slopes) added another layer to the findings. A cross-level interaction was detected between cumulative GPA and community colleges that served Tier 2 counties (i.e., Tier 2 and Tier 2/3), and indicated that a Tier 2 designation moderated the relationship between GPA and baccalaureate attainment to a statistically significant degree across community colleges.

A second cross-level interaction was identified when cumulative transfer hours were allowed to randomly vary across community colleges. When cumulative transfer hours were unconstrained in the model, community colleges serving at least one Tier 1 county (i.e., the most economically distressed) moderated the relationship between cumulative transfer hours and baccalaureate attainment.

CHAPTER 5: CONLUSION AND IMPLICATIONS

As major access points to higher education in the United States, community colleges are well positioned to serve as a "launching pad" for students pursuing education beyond the associate degree (National Student Clearinghouse Research Center, 2017). Eighty percent of community college students intend to earn a baccalaureate (Horn & Skomsvold, 2011), but data show that only 32% transferred to a four-year college or university within six years (Shapiro et al., 2017). Of the students who transferred to a four-year college or university, only 42% earned the baccalaureate within six years of starting their educational journey at a local community college (Jenkins & Fink, 2016; Shapiro et al., 2017).

Data show that community college transfer students are slow to earn the baccalaureate (Jenkins & Fink, 2016; Shapiro et al., 2017). These data include college-transfer degree students (i.e., AA and AS students) in addition to students transferring with other associate degrees. Since the AAS was designated as a terminal associate degree (AACC, 1998), it is easy to assume that students in AAS (i.e., career and technical education) programs will complete the degree and enter the workforce. Yet, a number of studies have shown that many AAS students decide to pursue a baccalaureate degree after graduating from the community college (Cohen & Brawer, 1996; Cohen & Ignash, 1994; Fredrickson, 1998; Hill, 2016; Ignash, 2012; Townsend, 2001).

While much attention has been given to community college transfer as a whole, little attention has been given to the transfer and baccalaureate attainment of AAS students in CTE program areas. Students in AAS programs are less likely to earn the baccalaureate than students in AA/AS programs (Ehrenburg & Smith, 2004), despite the

fact that they are equally as likely to intend to transfer (Cohen & Ignash, 1994; Fredrickson, 1998; Hill, 2016; Shearon et al., 1990). Not surprisingly, since the designation of the AAS was considered *terminal*, the majority of state-level articulation agreements hinge on AA/AS degrees as the optimal college-transfer credential (Ignash & Townsend, 2000). In other words, AAS degrees are, for the most part, not considered college-transfer degrees.

Ignash and Kotun (2005) found that some states have uniform, statewide articulation agreements for AAS degrees. In states that did have uniform, statewide articulation agreements for the AAS, the agreement only included a particular CTE program and did not apply to all AAS programs. Such is the case with North Carolina. North Carolina includes some AAS programs in select statewide articulation agreements (not the CAA) between the community college system and the state university system, but these are not applicable to all AAS programs (NCCCS, 2014). Thus, the majority of AAS programs across North Carolina are forced to rely on bilateral articulation agreements between the community college and a specific four-year institution as a mechanism for vertical transfer for AAS students.

At the close of 2019, the *Strengthening Community Colleges Initiative* was passed by the U.S. Senate Appropriations Committee, further solidifying the federal government's agenda aimed at aligning community college programs with local labor markets (Senate Appropriations Committee, 2019). This recent initiative, coupled with the most recent reauthorization of the Carl D. Perkins Career and Technical Education Act (ACTE, 2018) and the College Affordability Act of 2019 (House Committee on Education and Labor, 2019), both of which focus on completion and program alignment

with labor markets, demonstrates that career and technical education and a credentialed workforce is a top priority in the federal higher education agenda.

Recently, D'Amico et al. (2020) demonstrated that AAS transfer students represent a higher percentage of vertical transfers from economically distressed areas, yet they represent a lower percentage of baccalaureate completers in North Carolina compared to AA/AS completers. With groundbreaking work on AAS underway (see D'Amico et al., 2020), the time is ripe to study this unique population of students who fuel North Carolina's workforce and economy.

North Carolina has recently announced an ambitious goal, known as House Bill 664, as a collective vision among the state's leaders in government, education, and workforce sectors: By 2030, two million North Carolinians between the ages of 25 and 44 will have a high-quality education credential or college degree (*myFutureNC*, 2020). If the growth of the state's high-quality education credentials and postsecondary degrees continues at its current rate, there will be a 400,000 credential/degree deficit by 2030 where the growth of the labor market outpaces educational attainment. In addition to government and business sectors, the State Board of Community Colleges and the UNC Board of Governors have both committed to this attainment goal (*myFutureNC*, 2020). In light of this goal, equitable access to the baccalaureate and the educational mobility of the state's AAS completers are more important now than ever.

While a number of studies have focused on the baccalaureate attainment and academic success of community college transfer students (D'Amico & Chapman, 2018; Ehrenburg & Smith, 2004; Fink et al., 2018; Kopko & Crosta, 2016; Umbach et al., 2018; Wang et al., 2017), no currently known studies in North Carolina have taken a "deep

dive" into the baccalaureate attainment of AAS completers. Further, most studies on AAS transfer student success focus on student characteristics alone; most studies do not incorporate institutional-level characteristics (Bahr, 2013; Calcagno et al., 2008; Dundar et al., 2011; Eagan & Jaeger, 2009; Umbach et al., 2018; Wassmer et al., 2004; Wang, 2016).

To address this gap in the research literature, the present study proposed two significant questions that examined student, academic, and institutional characteristics that influenced the baccalaureate attainment of AAS completers who transferred to four-year institutions. The results presented in Chapter Four demonstrate that baccalaureate attainment varies significantly by certain student, academic, and community college characteristics. Chapter Five presents the findings within the context of the conceptual model from Hirschy et al. (2011) and the review of extant literature, and addresses policy and research implications relevant to the findings.

Overview of the Present Study

The present study provided an opportunity to understand the likelihood of baccalaureate attainment among AAS completers through the unique lens of a multilevel model that incorporated both student/academic factors and community college/community-level factors. Chapter One introduced "the conceptual model for student success in community college occupational programs" (p. 310) developed by Hirschy et al. (2011), and the researcher suggested, in alignment with the Hirschy et al. (2011) model, that the baccalaureate attainment of AAS completers (i.e., students in community college occupational programs) was a function of student, academic, community college, and community-level characteristics.

Multilevel logistic regression analyses demonstrated that baccalaureate attainment of AAS completers was, in fact, a function of student, academic, community college, and community characteristics. The relationship between community college/community context and the baccalaureate attainment of AAS completers was particularly notable. Results from multilevel logistic regression analyses suggest that (1) AAS completers transferring from community colleges designated *high CTE* are slightly less likely to earn the baccalaureate compared to students transfer from *high transfer* community colleges; (2) Students transferring from community colleges that served at least one Tier 2 (mid-tier of economic distress) county were significantly less likely to earn the baccalaureate than students from Tier 3 (least economically distressed) service areas; and (3) Students transferring from community colleges that served at least one Tier 1 (most economically distressed) county were significantly less likely to earn the baccalaureate than students from Tier 3 service areas. These findings are consistent with the propositions from Hirschy et al. (2011) that, while student success in occupational programs is certainly dependent upon student-level factors, college environment and community contexts also play a substantial role in the academic success of these students.

Discussion of Descriptive Findings

There were several meaningful findings from descriptive analyses of the data in the present study. More specifically, substantial inequities were uncovered by looking at summary measures alone. Compared to 65% of White students in the sample who completed the baccalaureate, 55% of Black and Hispanic students completed the baccalaureate. There is a clear achievement gap in baccalaureate attainment when looking at race and ethnicity alone, and this finding aligns with those of D'Amico and Chapman

(2018) on North Carolina transfer students' baccalaureate attainment by race/ethnicity. Further, nearly three quarters (73%) of Black students in the sample received Pell, compared to 59% of Other Race/Ethnicity categories, 57% of Hispanic students and 41% of White students. Pell was used as a proxy for socioeconomic status, and these descriptive results suggest that AAS students of color are not only more likely to be economically disadvantaged than White students, but fewer AAS students of color complete the baccalaureate compared to White students, as well. Returning to findings from Hirschy et al. (2011), occupational programs (i.e., AAS programs) tend to enroll higher percentages of students of color than college-transfer programs (i.e., AA/AS), and include higher percentages of students on financial aid. Coupled with the findings from the present study, the evidence suggests that inequities exist not only across degree types (AA/AS vs. AAS), but within the AAS degree itself. An equitable path to the baccalaureate is certainly necessary to address these inequities among AAS completers.

The present study echoed previous findings on credit loss and transfer students, which widens the gap between AAS and AA/AS completers' success. The present study builds on the findings of Monaghan and Attewell (2015) who discovered that 42% of community college transfer students lose credits upon transferring to a four-year university, and only 58% of community college transfer students are able to use more than 90% of their credits at the four-year transfer destination. By definition, the AA and AS degrees offered by community colleges within the North Carolina Community College system must contain a minimum of 60 credit hours (NCCCS, 2018). Findings from the present study indicate that only 52% of AAS transfer students were able to apply 60 or more credit hours toward the baccalaureate degree, and around 26% were

able to apply 45 or fewer credit hours. Lastly, 10% of the sample were able to apply fewer than 30 credit toward the baccalaureate.

Yet, again, as findings from the present study were disaggregated by race and ethnicity, further inequities became apparent. White students were able to apply an average of 62 credit to their baccalaureate degree program upon admission to the university, but Black students were only able to apply an average of 56 credits, even though both groups had earned the AAS. Hispanic students and students in the Other Race category were able to apply 59 credits toward the baccalaureate, indicating that, on average they were able to apply three fewer credits to the baccalaureate than White students upon admission. Assuming a typical community college course is three credit hours, these findings suggest that, on average, Black students in AAS programs lose two full courses applied to the baccalaureate degree compared to White students. Yet, the salience of this finding is not complete without coupling it with the descriptive finding on credit loss regarding Pell recipients. On average, students receiving Pell (i.e., 73% of Black AAS completers and 57% of Hispanic AAS completers) were able to transfer 57 credits to their intended baccalaureate degree program compared to White students (41% on Pell) who were able to transfer 63 credits to their baccalaureate degree program. Regardless of race, students who are on financial aid experience greater credit loss than students who are not on financial aid. AAS students of color who are already economically disadvantaged and on financial aid are further marginalized through the loss of credits upon transferring to a four-year institution. One finding is resoundingly clear by examining summary measures from the present study: The inequities surrounding baccalaureate completion for AAS students is heavily layered, and become

more pronounced along lines of race and ethnicity. It is imperative that equitable pathways to the baccalaureate are established for AAS completers to address disparities in credit articulation. One pathway to the baccalaureate is the articulation agreement. In the absence of a statewide uniform articulation agreement for all AAS programs, community colleges need to strongly focus on the implementation of bilateral, 2 + 2 agreements between the community college and top transfer destinations (Bers, 2013).

While substantial inequities were revealed when examining AAS students by race and ethnicity, another layer of inequity focuses on students 25 or older. First, a substantially large percentage of AAS students in the sample were older than traditional-age college students. The average age of the sample was 34, and AAS completers who were 25 and older comprised 87.4% of the sample population. This finding is congruent with data from Hirschy et al. (2011) that AAS students are usually older than traditional transfer-track students. In addition, Hirschy et al. (2011) found that these students are not only older than their AA/AS counterparts, but they are more likely to work full-time, receive financial aid, and have dependents in their households. Descriptive findings from the present study further inform the literature on AAS students by examining baccalaureate completion by age groups. Findings from the present study showed that a higher percentage of students who were 24 and younger completed the baccalaureate compared to students who were 25 and older, despite the fact that almost 90% of the sample was comprised of older students. Considering the Hirschy et al. (2011) finding that these students are likely to work full-time, receive financial aid, and have dependents in their households, the success of nontraditional age AAS completers is necessary to meet the state's goal of a highly-credentialed workforce by 2030 (*myFutureNC*, 2020).

Following the discussion of student and academic characteristics is the discussion on how institutional and community characteristics influence baccalaureate attainment. Congruent with the model proposed by Hirschy et al. (2011), descriptive findings from the present study show differences in baccalaureate completion as a function of community-level contexts. In the present study, community context was operationalized by economic distress tiers assigned to the state's 100 counties by the North Carolina Department of Commerce. A greater percentage of students transferring from community colleges in Tier 2 (63%) and Tier 3 (62%) earned the baccalaureate compared to Tier 1 (61%). While these differences are small and arguably negligible, the nuance comes when we look at the composition of AAS transfers from select service areas by race and ethnicity. Community colleges in strictly Tier 1 service areas were comprised of a substantially higher percentage of students of color than colleges in Tier 3, at 46% and 37% respectively. Further, AAS students transferring from Tier 1 service areas comprised 29% of the sample population. This means that AAS completers who resided in the most economically distressed counties in the state represented a lower percentage of baccalaureate completers compared to students from counties with less economic distress.

The present study's findings suggest that a higher percentage of AAS completers transferring from Tier 1 service areas were on financial aid (56%) than Tier 2 (50%) and Tier 3 (46%) service areas. In several studies on the vertical transfer of community college students, evidence showed that the likelihood of vertical transfer was negatively associated with the percentage of minority students enrolled at the community college (Calcagno et al., 2008; Wassmer et al., 2004). While the present study did not include the

percentage of minority students in each community college as a predictor at level-2, descriptive results examining economic distress tiers suggest that (1) the majority of service areas including at least one Tier 1 county had a lower percentage of baccalaureate completers; and (2) the most economically distressed service areas were comprised of higher percentages of AAS students of color and higher percentages of AAS students who received financial aid. These findings are particularly relevant to the conversation on how social structure and economic distress influence AAS student mobility and educational attainment.

The conceptual model for community college student success in occupational programs, developed by Hirschy et al. (2011), holds that, in addition to student characteristics and the community environment, community college-level contexts play a substantial role in academic achievement. Descriptive results from the present study showed that community colleges with a disciplinary focus of *high CTE* had lower percentages of baccalaureate completers than institutions with a *high transfer* and a *mixed CTE/transfer* disciplinary focus. Further, four out of the seven community colleges in the state designated *high CTE* serve at least one county in Tier 1 of the economic distress tiers. Descriptive results from the present study showed that community colleges designated *high CTE* had significantly higher percentages of Pell recipients and minority student enrollments than *high transfer* and *mixed CTE/transfer* colleges. The findings suggest that students transferring from community colleges that have extensive focus on occupational training are substantially more economically and socially disadvantaged than students transferring from community colleges with other disciplinary foci. It stands to reason that, in order to fill the skills gap by developing a well-credentialed workforce

in the state, students from *high CTE* community colleges that focus on occupational training are given equal access to baccalaureate attainment and upward educational mobility.

The size of a community college was also examined in the context of student success and baccalaureate attainment. Descriptive results from the present study suggest that large community colleges have the lowest percentage of baccalaureate completers, but have the highest percentage of Pell recipients and minority AAS student enrollments. Nearly 15% of the sample population transferred from large community colleges in the state.

In the present study, descriptive findings alone provide substantial evidence that AAS students face a number of barriers and inequities en route to the baccalaureate after transferring to a university. Facing socioeconomic disadvantages and attainment gaps across age and race/ethnicity, AAS transfer students are not given equal footing upon admission to the university. These inequities in conjunction with having to navigate a new, often intimidating, educational environment make the road to the baccalaureate an uncertain and arduous journey for AAS completers. These findings support the case for more equitable pathways to the baccalaureate for these students.

Discussion of Findings from Multilevel Models

The present study modeled baccalaureate attainment for AAS transfer students as a function of student, community college, and community-level characteristics. The findings are reported as they relate to each research question in the study are reported below.

Random intercepts models.

The present study used a three-step turnkey procedure for the construction of random intercept models that examined student, community college, and community-level variables that were associated with the baccalaureate attainment of AAS completers. The variance component in the unconditional model was statistically significant, indicating that not only did AAS students vary in their likelihood of baccalaureate completion, but baccalaureate completion varied significantly across community colleges of origin, as well. The dispersion of community colleges' mean baccalaureate attainment was significantly different from zero, which suggests that community colleges had a statistically significant effect on the baccalaureate attainment of AAS students who transferred from these institutions.

Research question 1. The first research question addressed in this study was: "What student and academic factors predict the baccalaureate attainment of AAS completers?" Results presented in Chapter Four suggest that several student and academic factors have a significant impact on the baccalaureate attainment of AAS completers. A student's cumulative GPA at the university, cumulative transfer hours, being female, and attempted hours at the university had a statistically significant and positive effect on baccalaureate attainment.

The finding that cumulative GPA at the university is positively associated with baccalaureate completion is consistent with the research literature on community college student transfer and success (see, e.g., Dundar, 2011). As a measure of academic preparedness, it stands to reason that as a student's GPA increases, the likelihood of baccalaureate completion also increases. Toward this end, and in an effort to articulate

transfer credits, several institutions in North Carolina have eliminated D grades in an effort to create more seamless transfer pathways for students (Smith, 2018) since the grade of D will not transfer to a four-year institution in the state (North Carolina Community College System, 2014). Making students earn a grade of C or higher to pass a transfer course not only increases a student's GPA at the community college, but widens access for transfer students and reduces the chances of credit loss upon vertical transfer.

Similar to the positive effects of GPA on baccalaureate attainment, cumulative transfer hours also had a statistically significant, positive effect on baccalaureate attainment. The more college-transfer hours that were accumulated by the community college student and transferred to the university, the more likely the student was to complete the baccalaureate. Like GPA, cumulative transfer hours can also be used as a measure of academic preparedness. Findings from Monaghan and Attewell (2015) and Giani (2019) suggest that community college students lose a significant number of credits upon transferring to a four-year institution. The present study's findings suggest that the more hours a student is able to transfer, the more likely the student will earn the baccalaureate. This is particularly important for AAS completers since, according to Giani (2019), they lose more than double the credits of AA/AS completers upon transfer. A potentially confounding variable here is change of major. Some credits may not be immediately applied to a student's baccalaureate degree program upon entry, but then the student changes majors and certain credits that were not originally applied to the baccalaureate program become academically applicable. This study controlled for this by

including both applied transfer hours upon admission and cumulative transfer hours in the inferential models.

This study's findings suggest that women were more likely than men to attain the baccalaureate. This is somewhat contradictory to the findings of Davidson (2015), Dundar et al. (2011), and Thomas et al. (2012) who found that men were more likely than women to complete the associate degree and transfer to a four-year institution. Yet, the present study's findings are consistent with educational attainment data from the National Center for Education Statistics (2019) that showed between 2000 and 2018 the educational attainment rates were higher for women than men, and the gender achievement gap widened by six percentage points during this time. Findings from Wang (2009) in a study of baccalaureate attainment among community college transfer students also suggested that women were more likely than men to earn the baccalaureate after transferring.

The final student-level variable that had a positive and significant relationship to baccalaureate completion was attempted hours at the university. That is, the more hours a student attempted at the university, the more likely the student was to complete the baccalaureate. While attempted hours at the university may not be directly related to community college characteristics, it is still relevant as a measure of student persistence. For each one credit hour increase in a student's attempted hours at the university, the student was slightly more likely to earn the baccalaureate. That is, the more an AAS transfer student persists through the baccalaureate degree program, the more likely the student will complete the degree.

Several student-level variables were negatively and statistically significantly related to baccalaureate attainment in the sample. An interesting, yet counterintuitive finding from the random intercepts model was the negative association between transfer hours applied to the baccalaureate upon transfer and the likelihood of baccalaureate completion. As the amount of transfer hours applied to the baccalaureate upon entry increased, the likelihood of baccalaureate attainment decreased. The reason for this relationship remains unknown, and may require additional research to uncover the causal mechanisms behind this effect.

An AAS completer's age was negatively and statistically significantly related to baccalaureate completion in the present study. As a student's age increased by one year, the chances of baccalaureate completion slightly deacreased (51%). While this is a relatively small effect, this finding is relevant to the finding of Woltzinger and O'Lawrence (2018) that older students are less likely to persist in transfer readiness, and that of Wassmer et al. (2004) that older students had significantly lower transfer rates from community colleges. This finding is particularly meaningful when considering the population of AAS students as a whole, and the sample population in the present study. Students who are 25 and older make up more than 87% of the sample in the present study. Further, students in AAS programs are older, work full-time, have dependents in their households, and receive financial aid. This finding suggest that older students are potentially at-risk in terms of baccalaureate completion and post-transfer success.

Students receiving Pell aid were negatively and significantly associated with baccalaureate completion among AAS completers in the sample. AAS completers who received Pell were slightly less likely to earn the baccalaureate than AAS completers who

did not receive Pell aid. As a proxy of low-income, this is consistent with the research literature that low-income students are less likely to move vertically in higher education attainment goals. In a recent analysis of IPEDS Pell data, Whistle and Hiler (2018) argued that many institutions of higher education (IHE) across the United States do not adequately serve Pell students, and there is a considerable gap between how Pell and non-Pell students are served. The findings from Whistler and Hiler (2018) indicated that 80% of the nation's IHEs graduate Pell students at significantly lower rates than non-Pell recipients, and the present study's findings echo this trend. Not only are students in occupational programs more likely to be on Pell than their college-transfer track counterparts (Hirschy et al., 2011), but the present study's findings suggest that receiving Pell is a negative indicator of baccalaureate completion among AAS completers.

Hispanic students were negatively and significantly associated with baccalaureate completion among AAS completers in the sample. Hispanic AAS completers were slightly less likely than White students to earn the baccalaureate. This finding is consistent with the findings of Wassmer et al. (2004) and Wolzinger and O'Lawrence (2018) that transfer readiness and transfer rates were significantly lower for Hispanic students. Coulombe and Gil (2016) reported that Hispanics made up 16 percent of America's labor market in 2016; yet they will "account for one out of every two new workers entering the workforce by 2025" (p. 4). Further, in 2020, 67% of jobs in North Carolina will require a postsecondary credential (*myFutureNC*, 2020). Educational attainment is directly related to the earning potential of Hispanic workers (Coulombe & Gil, 2016). The present study's findings are resoundingly clear: Hispanic AAS students, while comprising nearly 20% of the nation's eligible workforce do not have equitable

access to the baccalaureate. It is extremely important to avoid the deficit mindset in this case, and increase efforts geared toward the success of students of color enrolled in CTE programs at the community college.

Research Question 2. The second research question addressed in this study was: "Does the average likelihood of baccalaureate attainment vary between community colleges? If yes, what characteristics of the community college explain differences in students' likelihood of baccalaureate attainment?" Findings from the multilevel logistic regression models demonstrate significant variation in AAS completers' baccalaureate attainment across North Carolina's 58 community colleges. A significant variance component after the level-1 analyses indicated the potential of institutional-level variables to account for the significant variance. At level-2, institutional size, disciplinary focus, and distress tier service area were examined.

Findings discussed in Chapter Four suggest that a community college's designation by the Carnegie Classifications for Institutes of Higher Education as *high CTE* was negatively and statistically significantly associated with baccalaureate attainment. There are seven community colleges designated *high CTE* in North Carolina, and 6.4% of the sample (757 students) population transferred from these institutions. Eagan and Jaeger (2009) found, at least at the student level, enrollment in a CTE program was negatively associated with vertical transfer, although the percentage of CTE enrollments at the institutional level were not associated with the likelihood of transfer. Findings from multilevel logistic regression models in the present study suggest that students transferring from *high CTE* community colleges slightly (57%) less likely to earn the baccalaureate than students who transferred from community colleges that were

designated *high transfer*. Descriptive analyses of the data suggest possible factors contributing to this negative relationship. Although no causal inference can be made, it is significant to note the following: (1) *High CTE* community colleges have the lowest average graduate rate (57%) compared to *high transfer* (63%) and *mixed CTE/transfer* community colleges; (2) The percentage of AAS completers from *high CTE* community colleges receiving Pell aid was 17 percentage points higher than *high transfer* community colleges; and (3) More than half (54%) of AAS completers in the sample who transferred from *high CTE* were people of color, compared to 37% of transfers from *high transfer* institutions and 30% from *mixed CTE/transfer* institutions. Findings from the present study suggest that students transferring from *high CTE* community colleges are at substantial risk of not completing the baccalaureate after earning the AAS. These findings align with Calcagno et al. (2008) and Wassmer et al. (2004) who found that a student's likelihood to transfer was significantly impacted by the percentage of students of color enrolled at the community college. Findings from the present study suggest that students of color face significant barriers en route to the baccalaureate, and transfer pathways are inequitable, particularly for students of color.

Two negative, statistically significant relationships were identified through the implementation of a random slopes model that examined cross-level interactions. Results from the random slopes model suggest that when the model accounted for the random variation of cumulative GPA across the sample population, community colleges serving at least one Tier 2 county moderated the relationship between GPA and baccalaureate attainment to a statistically significant degree. Tier 2 counties are considered the second most economically distressed counties in the state. In the same vein, when cumulative

transfer hours were allowed to vary randomly across community colleges, students who transferred from community colleges that served at least one Tier 1 county were slightly less likely to earn the baccalaureate than students who transferred from colleges serving Tier 3 counties. Thus, a Tier 1 designation moderated the relationship between cumulative transfer hours and baccalaureate attainment to a statistically significant degree. A county's level of economic distress is significantly associated with the baccalaureate attainment of students in CTE fields. Clear and equitable routes to the baccalaureate are particularly necessary in these high-risk areas. At the outset of the second decade of the 21st century, the time is ripe for seamless and equitable pathways to the baccalaureate for AAS completers who will most certainly impact the statewide goal of 2 million North Carolinians with high-quality educational credentials (*myFutureNC*, 2020).

Limitations of the Study

This study has several limitations. Secondary data were used, and therefore the analyses were limited by the variables and definitions included in the dataset. For example, the community college major of the student was unknown. North Carolina has uniform, statewide articulation agreements for several AAS programs (e.g., nursing, early childhood education, engineering technology). Although the major at the university was known, the researcher could not assume that the student's major at the university was the same at the community college. Further, the researcher excluded certain variables that may have affected baccalaureate attainment. For example, the researcher excluded U.S. citizenship, a rural county indicator, developmental education credits, university major, and high school variables available in the dataset.

Second, the researcher aggregated longitudinal data for the analyses. The dataset included panel data from community college transfer students who were measured at multiple points in time. A growth model was not employed in this study to account for the factor of time and student trajectories. Thus, variations in student and academic variables over time were not accounted for. In addition, North Carolina's Comprehensive Articulation Agreement between the state's community colleges and university system was originally published in 1996, but has undergone numerous revisions in 20 years (NCCCS, 2014). These changes were not accounted for in the present study. Several AAS programs have been added to the articulation agreement over time, and this would have likely influenced students in the sample population of the present study.

Third, Pell was used as a proxy for socioeconomic status. While this is common in higher education research, the measure that combines the income, education, and occupation of each student was not known. Inferences about SES were made from the Pell proxy variable alone.

Fourth, while the researcher did account for transfer hours applied to the baccalaureate upon entry and cumulative transfer hours applied to the baccalaureate (these were only different if the student changed majors), the change of majors across the population sample was not examined in this study. In other words, the change of major as a barrier or facilitator of baccalaureate attainment was not addressed in the present study.

Fifth, two community college-level variables were collapsed into fewer categories for the analyses. Community colleges had five size categories specified by the Carnegie Classification of Institutes of Higher Education. Very small was combined with small, and very large was combined with large for the inferential analyses. Similarly,

community colleges that served multiple counties in different economic distress tiers were collapsed into a single distress tier for the inferential analyses. For example, community colleges that served at least one Tier 1 county were treated as Tier 1, and community colleges that served two counties, one in Tier 2 and one in Tier 3, were treated as Tier 2. Tier 3 service areas were the reference group. Certain nuances regarding economic distress tiers and the baccalaureate attainment of AAS completers could still be hidden in the data.

Sixth, the last year in which students in the dataset were measured was 2015. The dataset was compiled in the Fall of 2019 by the UNC System, and several students who entered in the latter years included in the dataset (e.g., 2014 or 2015) may be well on their way to the baccalaureate, but had not yet graduated.

Lastly, university contexts were not accounted for in this study. Once the AAS completer transferred, there were numerous confounding variables at the university level that could have potentially impacted educational attainment and student academic success.

Implications for Research

The findings from the present study show evidence that baccalaureate attainment for AAS completers is a function of student, academic, community college, and community (i.e., county) characteristics. Future research should consider research methods that account for nested data to study AAS students' baccalaureate attainment.

This study makes a significant contribution to the research literature by focusing on three contexts simultaneously: (1) students, (2) community colleges, and (3) the community-level. Controlling for the three contexts, the researcher found variables in

each level that had a statistically significant association with the baccalaureate attainment of AAS completers.

Substantial support for the conceptual model for community college student success in occupational programs developed by Hirschy et al. (2011) was found. Statistically significant relationships among a community college's disciplinary focus, a college service area's economic distress tier, and baccalaureate attainment were found after the researcher controlled for student and academic factors. These findings suggest that community college and community contexts can and do influence baccalaureate attainment beyond the student-level. More research is needed on the topic of AAS student success, but the findings of the present study support the Hirschy et al. (2011) model and suggest that AAS student success is not solely a function of individual-level characteristics. Future research using the Hirschy et al. (2011) model should use methods that account for hierarchically structured data to examine occupational student success as a function of multiple contexts.

Policy Implications

There are several policy implications when considering the findings of the present study. Bilateral articulation agreements, or 2 + 2, provide seamless access to the baccalaureate from an AAS program of study to the same program major at a four-year institution, allowing the student to transfer and receive junior status (Bers, 2013). More importantly, these agreements allow the AAS completer to use all of the credits from the occupational program at the community college toward the baccalaureate. Ideally, uniform, statewide articulation agreements for most AAS to BS programs would widen access to both public and private colleges and universities across the state for AAS

completers. As of now, the UNC System only includes a select few AAS programs in certain uniform, statewide articulation agreements (e.g., nursing, early childhood education, and engineering are the only three AAS programs with uniform articulation throughout the state), independent of the CAA, while the majority of AAS programs rely on bilateral articulation agreements between individual institutions (NCCCS, 2014). College Foundation of North Carolina (2020) puts it succinctly:

> At present, the CAA does not articulate the AAS…Individual universities and community colleges have very specific program articulations which govern the transfer of credit earned in these degree programs. Information on these programs is available from the academic advisor/counselor or the college catalog (para. 18).

That is, one by one, AAS program faculty and leaders in each community college must petition individual colleges and universities to receive the AAS degree in full upon admission to a baccalaureate program. Not only do these vary across community colleges, depending on their individual agreements, but there is currently no central repository for these bilateral articulation agreements across the 58 community colleges. In fact, the Transfer Advisory Committee (TAC), who are authorized to interpret CAA policy in North Carolina, have explicitly stated in the CAA that they will not track bilateral articulation agreements between individual community college programs and four-year programs in the UNC system (NCCCS, 2014).

Findings from the present study strongly support the need for more articulation agreements between AAS programs of study and public universities in the UNC system. By default, relying solely on bilateral agreements places the AAS completer at an immediate disadvantage due to the limit on college choice (i.e., the degree will only

transfer to the institution(s) that have bilateral agreements with the community college of origin). Considering that (1) Black and Hispanic students in the present study were not able to apply as many credit hours toward the baccalaureate as White students; (2) students receiving Pell were not able to transfer as many credit hours as non-Pell students; (3) students who transferred from *high CTE* community colleges and community colleges that served Tier 1 and 2 counties were significantly less likely to earn the baccalaureate than students from *high transfer* community colleges and Tier 3 counties; and (4) Hispanic students and Pell recipients were significantly less likely to earn the baccalaureate than White and non-Pell students, failure to establish strong partnerships with UNC system schools allows these inequities to remain embedded in the state's public system of higher education. Given the present state of North Carolina's statewide articulation agreements, a strong push to secure more 2 + 2 agreements, especially among *high CTE* community colleges and institutions serving counties in Tier 1 and Tier 2, is vital to bridge significant equity and attainment gaps in career and technical education, and it is actionable *now*, without the approval of IHE governing bodies.

Another sensible solution that is supported by the present study's findings is the need to increase the number of applied baccalaureate degree programs offered by UNC institutions. A nontraditional baccalaureate degree, the applied baccalaureate, provides a workaround for states having problems articulating the AAS to traditional BS/BA programs by allowing AAS core credits to be applied to major hours at the baccalaureate level (Floyd, Skolnik, & Walker, 2005; Floyd et al., 2012). Kujawa (2013) discovered a "heating up" (p. 357) effect of AAS students' aspirations toward the baccalaureate when

AAS to BAS pathways were available. It is important that AAS students feel they have options as they aspire to higher-level credentials. As the present study's findings suggest, low SES students and populations of color transfer fewer credits than more affluent, White students to the baccalaureate. In the case of Hispanic students and Pell recipients, both populations are significantly less likely than White students and non-Pell recipients to earn the baccalaureate. Applied baccalaureate pathways may not only address inequities across race/ethnicity and SES, but perhaps the availability of these programs will "heat up" these students' aspirations toward a baccalaureate.

The final policy solution related to pathways from the AAS to the baccalaureate is the community college baccalaureate (CCB). McKinney et al. (2013) found that community colleges that offered at least one CCB did so because they wanted to increase access for place-bound students living and working their local communities. Findings from the present study suggest that (1) the vast majority of AAS students who transfer are older than 24; (2) students 25 and older earn the baccalaureate at a lower rate than younger students; and (3) as a student's age increase, the likelihood of baccalaureate attainment decreases. Further, research by Hirschy et al. (2011) suggest that AAS students are more likely to work full-time and have dependents in their households. CCBs may be an affordable, viable solution for many place-bound, older students who live and work their local communities.

Findings from the present study on the variables of cumulative GPA and cumulative transfer hours support the movement in North Carolina to eliminate D grades from college-transfer courses. Both cumulative GPA and cumulative transfer hours are positively and significantly associated with baccalaureate attainment. That is, for every

unit increase in GPA and cumulative transfer hours applied to the baccalaureate, a student's likelihood of baccalaureate attainment increases. While this is not mandatory across the North Carolina Community College system, several institutions are implementing this "best practice" in an effort to facilitate transfer. Considering the findings from the inferential models in this study, it would be wise for all North Carolina community colleges to eliminate D grades from college-transfer courses for better alignment with the CAA.

Certain variables in the present study, such as race/ethnicity and Pell status may not be easily manipulated through direct policy measures. Yet other, indirect interventions might prove useful. Qualitative methods aimed at these variables of interest may uncover specific nuances that inform community college and university practices aimed at mitigating the negative effects associated with these student characteristics and baccalaureate attainment.

Recommendations for Future Research

Findings from the present study inform several recommendations for future research on AAS student success. First is the need to amplify the voices of community college students in AAS programs. Qualitative studies in AAS students' perceptions and experiences are extremely limited in number (see, e.g., Kujawa, 2013). More qualitative studies on AAS students will undoubtedly uncover nuances and actionable data that remain undetected through quantitative analyses.

Next is the need to examine AAS student success by degree program or career cluster. Perhaps some degree programs are transferring students better than others, or have higher likelihoods of baccalaureate completion. A strong research base in this area

would provide important insights and best practices for community college leaders about various AAS programs in their respective institutions. Similarly, future research should investigate AAS transfer by program major. That is, include an AAS program variable and the transfer major at the university as explanatory variables on an outcome of interest. Perhaps variations in baccalaureate attainment are due to the selection of specific majors by specific populations of students. In addition, more research is needed to determine if, or how often, AAS completers change majors after transferring to a four-year institution.

The third recommendation is to use more advanced statistical techniques to control for the effects of time-varying covariates, such as Pell status, GPA, or attempted credit hours on baccalaureate attainment. Multilevel growth models using *time* as a level in the data hierarchy allow the researcher to examine the effects of certain covariates as they are measured at different points in a student's enrollment (Raudenbush & Bryk, 2002).

The fourth recommendation for future research involves a comparison study between AAS completers and AA/AS completers. Descriptive research shows that these populations are vastly different (see, e.g., Hirschy et al., 2011), yet more research on student success outcomes among these two groups is needed. Further, qualitative studies would shed light on additional differences across these two student populations.

Lastly, research on the labor market outcomes of AAS completers would prove timely, and strongly aligns with the federal government's agenda on community colleges and the workforce. Research on both post-baccalaureate labor market outcomes and post-

AAS labor market outcomes would lend substantial insight to the success of students in occupational programs at the community college.

Conclusion

This study is significant in light of the federal government's increased focus on college-to-career pathways and vertical transfer, and North Carolina's solidified plan for 2 million North Carolinians to have a high-quality postsecondary credential by 2030. In times of economic recession, baccalaureate holders have been the least impacted by unemployment. Yet, AAS completers are uniquely disadvantaged in their access to the baccalaureate due to the occupational focus and technical nature of their associate degree.

Given that the federal government's focus on career and technical education is at an all-time high with the most recent reauthorization of Perkins V, the *Strengthening Community Colleges Act*, and provisions in the *College Affordability Act*, the time is ripe for research and discourse on the vertical transfer and baccalaureate attainment of AAS students. As more studies on AAS student success are produced in other states, it will be important to compare and contrast findings to those in our own state.

As the findings from the present study suggest, AAS completers' baccalaureate attainment is shrouded in a number of inequities. Yet, these students can and do earn the baccalaureate at impressive rates. Empirical research must continue to bridge critical gaps in the knowledge base on AAS students in an effort to create more equitable access to the baccalaureate.

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