

Dynamic Influence of Family on College and Career Choices of Underrepresented Minorities in the Biomedical Sciences

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Abstract

This study examines the dynamic influence family exerts on the college and career choices of underrepresented minorities in the biomedical sciences. Three research questions address the following issues: 1) the importance of family influence on students' academic decisions, 2) the way in which this influence change over time, and 3) some of the factors leading to college students' level of dependence on family as they pursue their education. The study utilizes focus group (n=38) and survey (n=47) data from students at progressive educational stages to measures how family influence changes over time spanning from high school completion through Ph.D. attainment. Results indicate heavy reliance on family for support in high school (95%) and community college (100%), whereas fewer university undergraduates look to family for support as they pursue their degrees. Graduate students display a return to reliance on family for support as they pursue their education (graduate (75%) and post-baccalaureate students (41%)). To better understand the academic orientation of parents and families of underrepresented minorities in the biomedical fields, we analyzed a survey (n=69) from parents and families of undergraduates, revealing many parents lack the cultural capital necessary to guide their students as they pursue a Ph.D.

Keywords: family, parents, cultural capital, STEM, academic, postsecondary

Introduction

The purpose of this research study to investigate the dynamic influence of family members on students' college and career decisions. While much has been studied with respect to social capital and self-efficacy, the changing role of parental influence over time, sometimes referred to as attachment-individuation theory (Lyons-Ruth, 1991), has not specifically focused on changes that take place amongst underprivileged and low socioeconomic status (SES) students in the biomedical sciences. Our study focuses on this temporal fluctuation spanning from high school through PhD entry, particularly in the Science Technology Engineering and Mathematics (STEM) fields.

In this paper we first present our research questions and corresponding hypotheses characterizing dynamics in parental influence on Under Represented Minorities (URMs) in the biomedical sciences, further examining salient factors contributing to these changes. Next, we explore theoretical underpinnings in the literature on college student development, particularly focusing on attachment-individuation theory and its role in contributing to reduced dependence on family as students progress through their academic careers.

A subsequent examination of how cultural capital positively or negatively impacts the decisions URMs make regarding college and career choices is presented, specifically emphasizing how socioeconomic factors and the role of the family influences student achievement and the ability to navigate college pathways.

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After a review of the literature, we describe our population and present our data collection techniques, involving the presentation of salient questions through survey questions and focus groups to measure changes in parental or family influence over time. In addition, we collect survey data from families of students who participated in the 2014 MORE Annual Parent/Family Open House to further analyze how family factors fundamentally impact students' college and career choices. We present our results utilizing descriptive and inferential statistics depicted visually via graphs and discuss suggestions for future research.

1.1. Research Questions

Research Question #1: How important is family influence in college and career decisions?

Hypothesis #1: Family influence is most pronounced at early ages up through high school as students contemplate their careers and college choices.

Research Question #2: How does family influence on students' career and academic choices change over time?

Hypothesis #2: Family influence and the importance of family factors diminish over time as a student progresses through his or her academic career.

Research Question #3: What are some of the factors leading to college students' level of dependence on family influence in graduate school and career choices?

Hypothesis #3: Families of URM students in the STEM fields typically lack the social and cultural capital necessary to guide their students through the academy.

2. Background

Attachment-individuation, formulated by Lyons and Ruth (1991), characterizes the tension between preserving bonds with caregivers on the one hand and establishing individual goals and objectives within the context of these relationships on the other. Lyons and Ruth (1991) draw from attachment theory, a psychological construct developed by Bowlby (1988) referring to the emotional ties individuals attribute to significant figures who perform various roles in their lives. Healthy attachment patterns have been linked to greater resilience later in life (Kalsner & Pistole, 2003). As healthy attachment to the primary caregiver creates a stable, safe and predictable bond in children, premature separation threatens the wellbeing and psychosocial functioning of a child that can last into his or her adult years.

Nevertheless, as children transition into adolescence and early adulthood, they experience a natural separation from caregivers and begin to develop autonomy, which manifests as increased responsibility and competence in fulfilling adult social roles (Levinson, 1978). Autonomy development for college students can be understood as the separation process they experience with their primary caregivers as they find their place as capable participants in their newfound academic communities. Significant research has been conducted on the college student transition, a focal point in time useful for examining the influence of parental attachment on overall cognitive, academic, and psychosocial development (Cullaty, 2011; Edelman, 2013; Fass & Tubman, 2002; Kalsner & Pistole, 2003; Mudhovozi, 2012; Taub, 1997).

Incorporating a phenomenological research design, Mudhovozi (2012) discussed the adjustment process of first-year university students, corroborating the notion that parental influence decreases in the face of new found freedoms. In order to successfully integrate into the university, students needed to renegotiate parental relationships and develop a sense of autonomy and independence as they entered into their respective academic communities. Utilizing a longitudinal, qualitative design, Edelman (2013) similarly examined the effects of parental involvement on the college student transition. Six college freshman were asked about their perceptions of how parental involvement during college transition affected their development of independence and autonomy. Several relevant themes emerged from these interviews, including the notion that parental relationships changed over time, with caretakers being perceived as promoting greater independence and autonomy for their children. Cullaty (2011) showed that maintaining supportive, as opposed to intervening relationships, establishing adult-to-adult relationships, relinquishing unnecessary control, and fostering responsibility in their college age children positively contributed to the development of autonomy. Nevertheless, Taub (1997) found that while autonomy increased as students progressed through their academic careers, parental attachment did not significantly decrease with the increase in autonomy. The paucity of research pertaining to the influence parents and family exert on URMs in postsecondary education (Carney-Hall, 2008; Kalsner & Pistole, 2003), however, necessitates further exploration.

These students enter the university less equipped than their privileged counterparts to successfully navigate the academic rigors and educational pathways of the STEM fields (Fries-Britt, Younger, & Hall, 2010; MacLachlan, 2012; Perna, Gasman, Gary, Lundy-Wagner, & Drezner, 2010; Slovacek, Whittinghill, Flenoury, & Wiseman, 2012; Strayhorn, 2010). Educational research on academic achievement of URMs underscores the influence of family socioeconomic status, typically defined as income or parental education, on student achievement (Yink & Veazey, 2011; Oseguera & Rhee, 2006; Lareau, 1999). Analyzing the relationship between family background and achievement, Roscigno (2000) found various components of familial structure, particularly factors such as family income, parental education, and familial cohesion, had a differential influence on educational outcomes for African-Americans and Hispanics, who lagged behind relative to Whites. Oseguera and Rhee (2006) further analyzed this differential influence, utilizing hierarchical generalized linear models to measure the effect of parental socioeconomic status on student retention for URMs relative to non-URMs. Though it is well-known that socioeconomic status generally correlates positively with the pursuit of postgraduate study, Oseguera and Rhee (2006) showed URM students' financial concerns have a particularly strong impact on their probability of persisting in education.

Given that parental influence has a distinct effect on URMs in comparison to their privileged counterparts, an investigation of how changes over time occur within this specific population is crucial. Fass and Tubman (2002) examined the relationship between parental attachment, cognition, psychosocial functioning, and academic achievement amongst multicultural college students ($n=357$). Results from hierarchical multiple regression analyses indicated that greater parental attachment was a positive predictor of scholastic achievement, further serving as a protective factor during the college student transition. Kalsner and Pistole, (2003) studied the college adjustment process in a multiethnic sample, focusing on the roles of attachment, separation-individuation, and ethnic identity. Results from Asian, Asian Indian, Black, Hispanic, and White biomedical undergraduates showed that an increase in individuation led to greater interpersonal adjustment, less psychological distress, a greater sense of obligation, and successful adaptation to college. Nevertheless, greater attachment in the form of reliance on family members for advice resulted in enhanced psychological wellbeing and a greater sense of obligation. Whereas Kalsner and Pistole (2003) examined the change in parental influence amongst multiethnic biomedical undergraduate students over time (a main focus of our study), the span from high school through college and eventual PhD attainment has yet to be investigated.

Furthermore, attachment-individuation theory has accounted for changes in parental influence over time for the general population, especially during college student transition, yet it does not sufficiently explain why these changes occur in URMs in the STEM fields. Due to socioeconomic factors, including family income and parental education, we hypothesize that many parents of URMs do not have the previous knowledge and experience necessary to guide students through college. Though there are many exceptions of parents who are supportive of their students as they pursue their degrees. To focus on interventions for addressing the social, economic, racial and cultural influences on an individual's outcome, scholars have proposed the notion of cultural capital as the causal mechanism for explaining the achievement gap facing underprivileged populations.

According to Bourdieu (1977), cultural capital corresponds to "the appropriation of symbolic wealth socially designated as worthy of being sought and possessed" (as cited in Grinberg & Goldfarb, 2015, p.57). Bourdieu (1973) conceives of cultural capital as a cultivated set of "knowledge, skills, and competence" that children acquire from their environment, including family background as well as other social features (as cited in Ovink & Veazey, 2011, p. 371). These specialized skills, utilized in varying contexts, contribute to potential positive or negative outcomes for a child, either by providing the social skills and networks necessary to access rarified academic and career opportunities, or by hindering their awareness of and ability to participate in these communities. Claussen and Osborne (2012) corroborate the notion that "students who possess cultural capital of a form that is incongruent with the culture of the school, or who lack it altogether, are at a distinct disadvantage" (p. 59). A case study conducted by Biology Undergraduate Scholars Program (BUSP) (Ovink & Veazey, 2011), an undergraduate intervention program proven successful in increasing minority retention and achievement in the life sciences at the University of California, Davis, helps illustrate how cultural capital can influence student outcomes. Though primarily academic in nature, BUSP included a program specifically aimed at developing URM students' social and cultural capital by providing opportunities for inclusion into the academic community, professional networking, and paid undergraduate research experiences (Ovink & Veazey, 2011).

As many BUSP alumni were first generation college students, a majority lacked familiarity with academic culture and norms. For students from enriched environments, particularly those with college-educated parents, exposure to adult role models with higher education achievement cultivates this familiarity. Further, institutionally reproduced standards of evaluation that present a familiar rubric to students with college-educated parents may seem arbitrary and confusing to students who were not raised in such enriched environments.

By providing access to mentors with familiar cultural background, BUSP facilitated the transfer of the cultural capital necessary for students to participate in academic society. The importance of this mentoring is underscored in student interviews, which revealed URMs learned a great deal about college-going culture from the personalized advice and direct interventions of academic advisors (Ovink & Veazey, 2011). One such student and nurse practitioner, Maricela, highlighted how this advice increased her cultural awareness, or *habitus*. I was the first one in my family to go to college... so [my parents] really didn't know how to help me or advise me... Getting into the BUSP program where you had these advisors you could talk to was so important. They were there in terms of how to choose courses, what needed to be in your schedule, when you were taking what. They were always making us aware of what course requirement we needed, making sure we were doing what we were supposed to be doing. To have that guidance was what really made the difference for us (Ovink & Veazey, 2011, p. 379). The guidance Maricela received, so crucial to successful navigation of higher educational institutions, helped compensate for the potentially constraining influence of intergenerational cultural capital transfers.

3. Methodology

3.1. Population and Sample

We collected data from five sources (see Table 1): 1) a focus group consisting of 21 Upward Bound seniors from the greater Los Angeles area; 2) a survey consisting of responses from 6 CSULA Bridges to the Baccalaureate Participants comprised of community college students; 3) a focus group consisting of 17 MARC U*STAR and MBRS-RISE undergraduates (mostly seniors) at California State University, Dominguez Hills; 4) a survey consisting of responses from 13 CSULA Bridges to the PhD Participants, including five matriculated Master of Science candidates and eight program alumni; 5) a survey consisting of responses from 29 Title V-B Expanding Opportunities for Pre-Health Professionals; and 6) a survey consisting of responses from a total of 69 parents, families, and influential friends of undergraduate MORE candidates who participated in the 2014 MORE Annual Open House at California State University, Los Angeles. See Table 1 for a list of data sources.

High School Students

The California State University, Los Angeles was awarded four US Department of Education (USDOE) grants to continue operating the TRIO Upward Bound (UB) Programs – 1) UB Los Angeles Regular, 2) UB Math/Science Los Angeles, 3) UB Pasadena Regular and 4) UB Math/Science Pasadena – on its campus. The goal of the Upward Bound Programs is to increase the rate at which middle and high school participants complete secondary education and enroll in and graduate from institutions of postsecondary education. The partnering high schools in this study include Garfield High School and Wilson High School, Blair High School, John Muir High School, Pasadena High School and Marshall Fundamental High School. The focus group of UB students (n=21) we spoke to in order to measure a baseline in parental influence consisted of 60% females and 40% males, with the following ethnic composition: 82.9% Hispanic, 9.1% African American, 4.9% Asian, 1.1 White, 0.8% American Indian/Alaskan Native, 0.4% Native Hawaiian/Pacific Islander and 0.8% multiethnic.

Community College Students

The Bridges to the Future Program is an initiative of the National Institutes of Health (NIH) that prepares minority students for careers in biomedical research. Targeting community college students, this is funded by a grant from the National Institutes of General Medical Sciences (a division of the NIH) and is collaboration among four schools:

East Los Angeles College, Los Angeles City College, Pasadena City College, and California State University Los Angeles. Comprised of 71% females and 29% males, the Bridges to the Future Program participants identified as 93% Hispanic and 7% Mixed. Six of these students participated in our survey.

College Students

The CSU Dominguez Hills MBRS-RISE (*Minority Biomedical Research Support - Research Initiative for Scientific Enhancement*) and MARC U*STAR (*Minority Access to Research Careers – Undergraduate Student Training in Academic Research*) programs received their renewal funding in May 2012 and June 2014 respectively. The *mission* of both of these NIH programs is to train underrepresented minorities for graduate studies and a career in biomedical sciences research.

During the period of May 2014 – February 2015, the MBRS-RISE program consisted of seventeen (17) undergraduate scholars. This cohort had slightly more male (59%) representation than female (41%). RISE Scholars are diverse in their ethnic background with Pacific Islander/Filipino (5%), Lebanese-American (6%), however, most are of Hispanic (47%) and African American (35%) background. This RISE cohort was primarily comprised of students majoring in the behavioral sciences - Psychology (47%) and Sociology (12%). Biochemistry (17%), Biology (6%), Microbiology (6%), Physics (6%) and Chemistry (6%) were also represented and consisted of less than ½ of the majors. Most (53%) students were in their senior year of college, with 35% having already graduated in the Spring 2014 semester.

Master of Science Students and Alumni

The Los Angeles Basin Bridges (LABB) Program has been in existence since 1994 on the California State University, Los Angeles campus. LABB is funded through the National Institutes of Health (NIH) Bridges to the Doctorate Program. The *mission* of LABB is to increase the number of CSULA minority and underrepresented master students who transfer to major research universities and complete the Ph.D. degree in biomedical science disciplines. LABB fellows are expected to complete the Master of Science degree in a biomedical field within 24 months. Each student is placed in a research lab, participates in a project of original research and acquires the skills required to write and defend a thesis, publish in peer-reviewed journal(s), present at national scientific conferences, and present at departmental seminar or other on-campus program functions. The program further provides intense advising, mentoring and academic support necessary for students to become confident and successful graduate students and capable participants in the scientific community. Comprised of 54% males and 46% females, the ethnic makeup of the 13 LABB participants (5 students and 8 alumni) is as follows: 77% Hispanic, 15% African American, and 8% Pacific Islander. We received 12 responses to our survey protocol as one alumni did not respond to the race question.

Title V-B post-baccalaureate students

Title V-B Expanding Opportunities for Pre-Health Professionals is a federal program funded by the US Department of Education Promoting Post baccalaureate Opportunities for Hispanic Americans (PPOHA) which provides academic support for pre-health professionals and assists them as they apply to health professional schools. This support program serves post-baccalaureate students who are interested in the following professions: medicine (allopathic, osteopathic and chiropractic), optometry, veterinary medicine, dentistry, pharmacy, podiatry, and physician assistant. Title V-B at California State University, Los Angeles offers post baccalaureate certificate programs which provide students with the requisite coursework, health science activities, and information necessary for admission to medical schools or health profession schools. Comprised of 52% males and 48% females, the ethnic makeup of the Title V-B Expanding Opportunities for Pre-Health Professionals is 24% Hispanic, 14% African American, 14% Caucasian, 38% Asian and 10% Middle Eastern.

MORE Students and Families

The MORE program implements academic interventions to impact traditionally underrepresented students in the sciences, at a California State University, Title V Hispanic-Serving Institution. On this campus, 73% of incoming freshman come from families making less than \$24,000 per year, and 80% are awarded some form of financial aid (Slovacek et al., 2012).

Moreover, incoming students have traditionally attended historically low-performing public high schools; approximately 80% of freshmen are required to take at least one remedial course in either English or mathematics prior to enrolling in university-level coursework. Composed of 64% females and 36% males, the ethnic makeup of MORE students is as follows: 82% Hispanic, 9% African American, and 7% Pacific Islander.

During the 2014 academic year, the MORE program held an Annual Open House to inform students' families of their ongoing research. Approximately 150 students, families and friends attended the event. A total of 69 parents, families and friends completed the Open House Evaluation Survey – 53 English and 16 Spanish. Mothers (37.7%), fathers (23.2%) and siblings (17.4%) comprised the majority of Open House participants. Partner (4.3%), husband (2.9%), wife (1.4%) and grandfather (1.4%) were also present. Those indicating "other" (11.6%) were friends, cousin, girlfriend, niece and brother's girlfriend.

Table 1: Population and Sample Characteristics

Program	Funding Source	Level	Type of Data	N
CSULA Upward Bound	USDOE	High School	Focus Group	21
CSULA Bridges to the Baccalaureate	NIGMS	Community College	Survey	6
CSUDH MARC U*STAR and MBRS-RISE	NIGMS	University Undergraduates	Focus Group	17
CSULA Bridges to the Ph.D.	NIGMS	Graduates (Current M.S. & Alumni)	Survey	12
Title V-B Expanding Opportunities for Pre-Health Professionals	USDOE	University Post-baccalaureates	Survey	29
CSULA: MORE Programs (Open House)	USDOE	Parents & Families	Survey	69

*All groups are targeted to serve Underrepresented Minorities in the city of Los Angeles

4. Data Collection and Instruments

4.1. Methodology

All data was collected during a one academic year period 2014-2015. Two student focus groups comprised of MARC U*STAR and MBRS-RISE (n=17) undergraduates (mostly seniors) and Upward Bound high school seniors (n=21) were conducted initially to establish a baseline and to later determine how family influence changes over time, spanning from high school completion to college undergraduates planning to pursue a PhD. A set of guiding question was administered to each focus group asking various questions regarding their educational experience and how their family played a role in furthering their education. Survey questions regarding the dynamic role of family influence on students' college and career choices were further administered to 6 CSULA Bridges to the Baccalaureate Participants comprised of community college students, 13 CSULA Bridges to the PhD Participants, including five matriculated Master of Science candidates and eight program alumni and 29 Title V-B Expanding Opportunities for Pre-Health Professionals. To gain a clearer picture of the role parents and family play in the education of URM students in the biomedical sciences, a survey was administered to 69 parents, families, and influential friends of undergraduate MORE candidates who participated in the 2014 MORE Annual Open House at California State University, Los Angeles.

4.2. Data Analysis

The methodology used to drive this longitudinal analysis of the relationship between academic progress in science careers and family influence in guiding career choices is tentatively called "discrete cohort trajectory analysis." We chose this approach because a traditional cohort analysis would typically identify science interested high school students and track them for the next dozen or so years. Obviously this duration of a longitudinal study suffers from several serious challenges. First, the decade or longer length of such a longitudinal study is impractical and almost no government agencies fund such long term research efforts. While some medical studies could involve long term time frames, typically multi-year education studies are much shorter (up to five years) in duration. Costs of very long term studies are accordingly much more expensive. Also, the research team would need to be fairly stable over a decade.

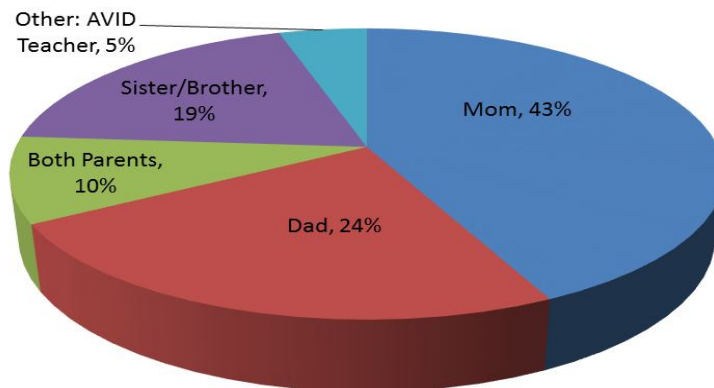
Discrete cohort trajectory analysis examines intake student groups at progressive points in time to determine the dynamic influence of family on their college and career choices. High school students, community college students, undergraduates, post-baccalaureates, Master of Science degree students and alumni in Ph.D. programs were assessed through surveys and focus groups during a relatively short time frame – 6 months.

Descriptive statistics were utilized to analyze the influence that the various family factors had on students' decisions to further their education and eventually earn a PhD. Data was entered into Statistical Package for the Social Sciences (SPSS) software and means were derived from student responses. Graphs depicting results were then developed. A Spearman's correlation was further calculated to characterize the relationship between estimated age and family influence. A qualitative analysis of parent responses from the 2014 MORE Annual open house was conducted to flesh out parent and family understanding of the various academic expectations, skills and competencies required to succeed in the STEM fields.

4.3. Results

In Figure 1 below we see that 95% of Upward Bound high school seniors indicated their family members were their biggest supporters as they pursued college. This result supports our first hypothesis, namely, that family influence is most pronounced at early ages up through completion of high school as students contemplate their careers and college choices. This is not surprising given the high levels of dependence these students have on their parents, including shelter, food, transportation, advice and counseling on emerging adolescent issues and other needs.

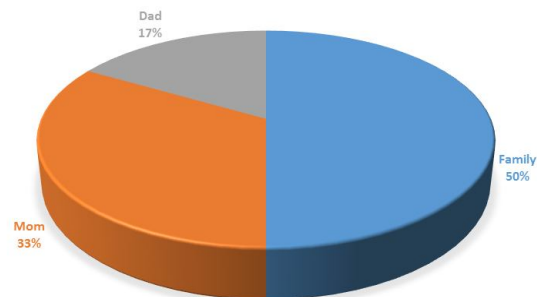
Figure 1: Who is your biggest supporter as you pursue college? (High School Students)



Upward Bound Program (Los Angeles & Pasadena), Senior Class of 2015 (n=21)

Figure 2 below looks nearly identical to Figure 1 with respect to the influence of family on college choice, indicating that 100% of the community college students viewed their family to be their biggest supporters which is similar to the 95% of high school students in the focus group. Given that community college is generally regarded as a transitional stage between high school and enrollment in a four year university, a strong dependence on the family is concomitant with the view that these students have not yet fully entered into their desired academic career paths, and therefore have not begun the accompanying process of separation from their primary caregivers.

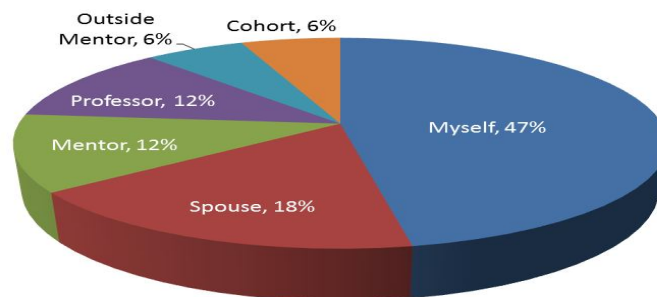
Figure 2: Who is your biggest supporter as you continue to pursue college work? (Community College Students)



CSULA Bridges to the Baccalaureate Participants (2014-15), n=6

Figure 3 below reveals the persons MARC U*STAR and MBRS-RISE undergraduates at CSU Dominguez Hills perceived to be their biggest influencers as they pursued their UG degrees. No students reported family (except for the 18% reporting 'spouse') as a source of support, signifying a radical shift from the perceptions of high school students who primarily relied on family for support (95%). According to Figure 3, it further becomes clear that the academic community (including professors, 12%, mentors, 12% and their cohort members, 6%) begins to play a key role in a students' education, with spouses (18%) and outside mentors (6%) additionally acting as academic advocates. This change from the high school and community college groups suggests strong support for the attachment-individuation theory (Lyons-Ruth, 1991).

Figure 3: Who has been your biggest supporter as you pursue an UG degree? (Undergraduate Students)

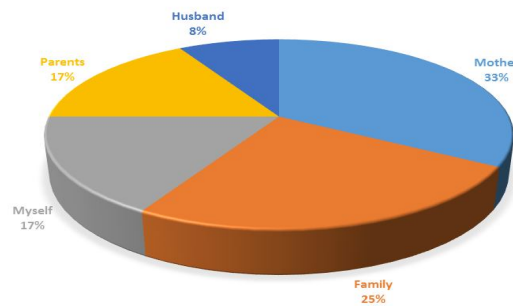


CSU Dominguez Hills: MARC U*STAR and MBRS-RISE Student Focus Group (n=17)

Figure 4 below from the CSULA NIH Bridges to the Doctorates program presents a surprising result from the Master of Science candidates and alumni as it represents a disruption in the previously established trend of reduced dependence on family over time, evidencing a return to reliance on family for support (75%) as students progress through their academic and career pathways. This result corroborates Fass and Tubman (2002), who established that perceived attachment to primary caregivers amongst multicultural students is indicative of broader measures of social functioning and may further serve as a protective factor during key life transitions. It is possible at this late stage in a URM's academic career, particularly in the STEM fields, that selection for persistence and retention of students with supportive families, which in turn leads to resilience and healthy social functioning in minorities, has already taken place.

Whereas significant research has been conducted on the role of parental influence during the college student transition (Cullaty, 2011; Edelman, 2013; Fass & Tubman, 2002; Kalsner & Pistole, 2003; Mudhovozi, 2012; Taub, 1997), we see that more research on how family influences students' academic and career choices at the graduate level and beyond is warranted. While the previous groups supported attachment-individuation theory at the high school and undergraduate level, this fourth group somewhat contradicts it.

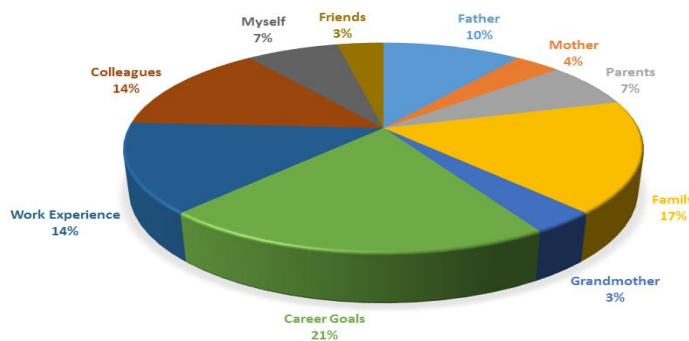
Figure 4: Who or what has been your biggest supporter or motivator or motivation as you have pursued your current degree? (Master of Science Students and Alumni)



CSULA Bridges to the PhD Participants (2014-15), n=12

In Figure 5 below, we see that (n=29) post-Baccalaureate, Pre-Health Professionals relied on family members for support 41% of the time. We continue to observe a trend wherein students return to reliance on family for support after completion of the B.A., thus challenging our hypothesis that students experience reduced dependence on family over time with regards to college and career choices. Compared to Figure 4, we see that almost half (41%) of the Title V-B Pre-Health professionals (n=29) relied on family for support in contrast to 75% of the CSULA Bridges to the PhD Participants (n=12). In terms of non-familial influences, personal factors (42%) comprised a similar amount of impetus as families (41%) for students to pursue their degrees, with students listing career goals (21%), work experience (14%) and myself (7%) in their responses. Finally, 17% of students looked to social networks, including colleagues (14%) and friends (3%) for academic support.

Figure 5: Who or what has influenced you the most on your pursuit of your next degree and career goal? (Post-baccalaureate Students)



Title V-B Expanding Opportunities for Pre-Health Professionals (2015), n=29

To describe the relationship between estimated age and family influence, a Spearman's bivariate correlation was calculated ($r = -.230$, $p = .034$). This result indicates that there is a significant negative trend characterized as reduced dependence on family as students progress through their academic careers.

4.3.1. MORE Open House

Previous experience with the MORE program has shown that academic interventions for students (i.e., research experience, mentoring, financial assistance, and academic support) coupled with explicit parental outreach, according to the MORE program Principal Investigator, facilitated successful college transition and career attainment for underrepresented populations. On Saturday, September 20, 2014 the MORE Programs held their first Annual Open House at California State University, Los Angeles' Student Union. Its main purpose was to inform parents, siblings, relatives and significant others of their MORE students' research. To further educate parents, the MORE programs leadership provided an overview of the MORE programs and its various components, as well as what it entails to pursue and succeed in PhD studies. Approximately 150 MORE students, their families, and influential friends attended the Open House and completed surveys about their experience.

Intended to assess the efficacy of the MORE Open House, the MORE programs leadership had a total of 69 parents, families, and influential friends complete an Open House Evaluation Survey. Mothers, fathers and siblings comprised the majority of Open House Participants. Partners, husbands, wives, and grandfathers were also present. Those indicating "other" were friends, cousins, girlfriends, nieces and a brother's girlfriend. Aimed at gauging and improving parent knowledge of the MORE programs, the survey questions asked whether family members 1) better understood their MORE student's work in academic research, 2) had any concern about their MORE Student pursuing the PhD, 3) were comfortable with their student studying for the PhD outside of California, 4) would like to know more about PhD studies in the sciences, 5) thought PhD studies for their MORE program participant would create financial hardships for the family, and 6) thought there was something else the MORE programs could do to better support their MORE student's decision to become a PhD level scientist.

The survey found that family outreach interventions have an overwhelmingly positive effect in mitigating the hindrance socioeconomic factors pose to students' pursuit of postgraduate study in the sciences. Nearly all (93%) parents, families, and friends agreed that they had a greater understanding of the MORE students' academic and research work. Most (79.4%) relatives of the MORE students indicated they would be comfortable with their MORE student studying outside of California, a mobility commonly required to advance in higher education in biomedical fields. Nevertheless, those who were not so comfortable constituted a significant share (20.6%) of survey respondents. Financial considerations may have motivated some of this discomfort. In many low-income, minority households students are expected to work to contribute to the family finances. Though 65% of participants believed postgraduate study would not create financial hardships and 69% reported no concerns about their students pursuing PhD studies, other families were less confident that advanced study wouldn't be disruptive. Future open houses could presumably incorporate sessions specifically addressing these issues, exploring these families' concerns and helping foster a supportive environment that encourages students interested in advanced study to realize their potential.

A qualitative analysis of parent responses from the 2014 MORE Annual Open House Interviews revealed the limited degree to which parents possessed cultural capital, a necessary criteria for successful transmission of requisite academic knowledge, skills and competencies to the child. When parents were asked what they would like to know about PhD studies in the sciences, one parent inquired, "*How does the university help their scholars after the program? Finding jobs after their program?*". This response reveals a lack of background knowledge with the program, which is designed to get students admitted into Ph.D. programs to continue their education, as opposed to preparing them for the job market upon graduation. Moreover, it may evidence the parent's lack of awareness that students are often institutionally financed when admitted to PhD programs, unlike Master's degrees, and that wages statistically tend to increase as education levels increase. Another parent asked, "*What school will he be able to go to?*", indicating that the parent was unaware of potential institutions offering PhD's in the biomedical sciences and the competitive application process. Furthermore, one parent inquired about the differences in advantages gained by earning a Masters versus a PhD., showing a lack of familiarity with the benefits of investing in human capital and subsequent returns on senior level scientific preparation. Finally, one parent wanted to know how research was published, evidencing insufficient understanding of the peer review process and the rigors necessary for his/her child to excel in postgraduate study in the biomedical sciences.

Due to the low parental education levels of their family members, the resultant lack of academic cultural capital places already underprepared URMs at a disadvantage compared to their privileged counterparts, who typically tend to take this knowledge for granted or are guided by higher SES family members.

5. Discussion and Conclusions

A substantial body of research has shown that URMs are underprepared to meet the rigorous demands of STEM curricula in the biomedical sciences (Fries-Britt et al., 2010; MacLachlan, 2012; Perna et al., 2010; Slovacek et al., 2012; Strayhorn, 2010). As URM status corresponds to socioeconomic and cultural factors that are often determined by the family, we have examined how parental and familial influence has contributed to the decisions these students make regarding college and career choices over time. Our results corroborate our first hypotheses, namely, that family influence is most pronounced at early ages up through high school as students contemplate their careers and college choices. High school students (95%) and community college students (100%) indicated their family members were their biggest supporters as they pursued their education. Given the latter result, we further speculated that community college students have not yet initiated the process of separation and subsequent autonomy development due their academic standing, which may not correspond to their desired goals of transferring to an undergraduate program. Our second hypothesis, which posits that family influence and the importance of family factors diminish over time as students progress through their academic careers, was challenged by our results. Whereas the influence that family exerts on students' college and career choices did diminish for the undergraduates, we witnessed a return to reliance on family members for support from the Master of Science students and alumni (75%) as well as from the post-baccalaureate pre-health professionals (41%). These results are concomitant with Taub's (1997) findings, which indicate that autonomy development does not necessitate separation from, or reduced attachment to the family. Nevertheless, Spearman's correlation showed a significant trend of reduced dependence on family for academic support over time ($r = -.230$, $p = .034$).

In light of these findings, we suggest future avenues for research via an examination of sample selection effects, in this case, the effect that educational advancement of parents and families has on our sample population, which would lead to a clearer picture of the role family exerts on students' college and career choices. It is possible that students who pursue graduate level degrees may have parents and families who are more supportive and/or have higher educational backgrounds. This effect would help explain our results for the graduate level and post-baccalaureate students, who did not descriptively exhibit reduced dependence on family over time compared to the undergraduates. Methods for characterizing the effects educational advancement has on our results could include examining the correlation of the following two factors on dynamic family influence: 1) parent/family educational backgrounds and 2) students' perceived levels of familial support as they advance their academic careers.

Whereas attachment-individuation theory helps to explain a shift over time to reduced dependence on the family, it does not fully explain why this shift also occurs in URMs in the biomedical sciences. Unlike their privileged counterparts, many of these families are not as fully prepared to guide their students in making college and career choices. This lack of familiarity with the academy was evidenced by a MORE parent who wanted the university to provide employment upon completion of the MORE program without considering the possibility of enrolling their child in a PhD program. Knowledge of how wages tend to increase after obtaining a PhD versus a BS, generally taken for granted in middle and upper class white populations, may be lacking in many of these families. It is therefore critical that academic intervention programs impart the required academic expectations, skills and navigational tools upon their students in order to adequately prepare URMs for the rigorous demands of the STEM fields. Accordingly, we focused on the relationship between MORE Open House parent perceptions and the constraining power of social and cultural capital present in these populations, and subsequently turn to providing suggestions for how academic intervention programs in the STEM fields can augment negative intergenerational transfers in order to reduce socio-cultural disparities.

It is critical that academic intervention programs for URMs in the biomedical sciences provide ample mentoring and academic support for their students in order to compensate for the lack of academic knowledge and skills otherwise passed down by caretakers from privileged classes. Furthermore, explicit parental outreach components should be integrated into academic intervention programs for URMs, as they lead to greater understanding and subsequent encouragement and support from parents and family members.

This understanding includes the rigorous demands placed on academics in the STEM fields, less worry about financial considerations, and increased support for sending their children away from home to study (although further parental education on these issues is warranted). Examples of outreach interventions include inviting parents to open houses, workshops and seminars on the status of their students' education as well as involving families in their students' academic growth (i.e., attending poster sessions and professional presentations). Reaching out to parents is critical as research has shown healthy parental attachment in college years acts as a protective factor for URMs (Fass & Tubman, 2002). Therefore, cultural and social capital should be augmented both by 1) compensating for negative transfers via internal university efforts (providing research support, mentorship, and academic advisement), and 2) increasing academic knowledge, skills, and competencies in the caregivers themselves (i.e., providing parent/family outreach).

Suggestions for future research involve expanding the sample size and breadth of the investigation to include more institutions serving students with greater socioeconomic status and higher parental education. A comparison of the general population with URMs in the STEM fields would highlight salient factors contributing to reduced dependence on family as student's progress through their academic careers, potentially resulting in significant discrepancies between factors as they pertain to underprivileged populations versus the general mainstream. Administering our focus group protocol to a broader sample would also enhance the robustness of our examination by allowing for an extrapolation of findings to similar populations, namely, URMs in the biomedical fields beyond the greater Los Angeles area. Furthermore, our one-shot data collection method administered to separate populations of high school, community college, four year undergraduate and graduate students could be further developed by utilizing a pre-post-test design on the same population over time. This longitudinal approach would allow us to study how each individual student's perceptions of parental influence fluctuated, using the student's past beliefs as their own control group.

Further questions to consider include asking students to identify the persons they consider to be included in their family unit. The traditional notion of parents, siblings and relatives constituting the family may be outmoded and students could potentially turn to other significant figures who play important roles in their lives for support, referring to these individuals as family. Another question to consider pertains again to our data collection methods, which consisted of presenting oral focus group questions to two groups of students and surveys to the other groups. It is possible that students who presented their responses orally in front of their peers were motivated to provide responses they perceived would align with their peers' values. Similarly regarding our data collection methods, the questions we asked to the various groups of students were worded somewhat differently, which could introduce unnecessary variation to their responses.

In final consideration, an investigation of the efficacy surrounding parental outreach components of academic intervention programs for URMs in the biomedical sciences would recapitulate the value of such efforts and pave the way for best practice policies. Furthermore, the role that culture plays in academic decisions of URMs incites further research potential, particularly by examining how family traditions might conflict with efficient, decision-based navigation through the STEM fields (i.e. career choices, moving away from home, working to pay for school, etc.).

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Table 1: Population and Sample Characteristics

Program	Funding Source	Level	Type of Data	N
CSULA Upward Bound	USDOE	High School	Focus Group	21
CSULA Bridges to the Baccalaureate	NIGMS	Community College	Survey	6
CSUDH MARC U*STAR and MBRS-RISE	NIGMS	University Undergraduates	Focus Group	17
CSULA Bridges to the Ph.D.	NIGMS	Graduates (Current M.S. & Alumni)	Survey	12
Title V-B Expanding Opportunities for Pre-Health Professionals	USDOE	University Post-baccalaureates	Survey	29
CSULA: MORE Programs (Open House)	USDOE	Parents & Families	Survey	69

*All groups are targeted to serve Underrepresented Minorities in the city of Los Angeles

Figure 1: Who is your biggest supporter as you pursue college? (High School Students)

Figure 2: Who is your biggest supporter as you continue to pursue college work? (Community College Students)

Figure 3: Who has been your biggest supporter as you pursue an UG degree? (Undergraduate Students)

Figure 4: Who or what has been your biggest supporter or motivator or motivation as you have pursued your current degree? (Master of Science Students and Alumni)

Figure 5: Who or what has influenced you the most on your pursuit of your next degree and career goal? (Post-baccalaureate Students)