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Investigating identity, sense of belonging, and early career transitions for Hispanic engineering graduates of an HSI (Work in Progress)

Dr. Lori Marie Houghtalen, University of Texas at El Paso

Lori Houghtalen is an Assistant Professor in the Department of Engineering Education and Leadership at The University of Texas at El Paso. Dr. Houghtalen's research interests include career transitions of students and engineering faculty and engineering leadership assessment. Her teaching experience has been focused on designing industry-based senior capstone courses and leadership and professional development for undergraduate engineering students.

Dr. Roger V. Gonzalez P.E., University of Texas at El Paso

Roger V. Gonzalez is the inaugural chairman and professor of the Department of Engineering Education and Leadership. He is the Mike Loya Endowed Chair in Engineering. He also serves as the Director of the Engineering Leadership program for the College of Engineering. Dr. Gonzalez earned a B.S. in Mechanical Engineering in 1986 from UTEP. He earned his M.S. in Biomedical Engineering and Ph.D. in Mechanical Engineering from The University of Texas at Austin and was a Post-Doctoral Fellow at the premier Rehabilitation Institute of Chicago and Northwestern Medical School. Professor Gonzalez has been recognized for scholarly work, education innovation, and socio-entrepreneurial humanitarian efforts. He is known and respected for actively incorporating students into all three of these areas.

Among many highlights of his scholarly work, he is a Fellow of the American Society of Mechanical Engineers (ASME) and a Fellow of the American Institute for Medical and Biological Engineering (AIMBE) and was awarded a prestigious National Institutes of Health (NIH) National Research Service Award for his work in neuromuscular control and musculoskeletal biomechanics in children with juvenile rheumatoid arthritis. Dr. Gonzalez's scholarly work includes over 100 publications in journals and conference proceedings.

For his efforts and innovation in engineering education, Dr. Gonzalez has received the American Society of Engineering Educators (ASEE) Teaching Award, the Minnie Stevens Piper Foundation Award, and LeTourneau University's top research and scholarship award. He was also a Finalist for the IEEE Global Humanitarian Engineer of the Year award in 2013. He serves as an engineering program evaluator for the Accrediting Board for Engineering and Technology (ABET).

Dr. Gonzalez was awarded a faculty fellowship by UTEP and the University College London (UCL), where he served as a Visiting Professor, to spend the 22-23 academic year traveling throughout the United Kingdom visiting over 25 universities in England, Wales, Scotland, Ireland, and The Netherlands. His research focused on how professional development plays a role in engineering education and how approaches to broadening access impact higher education.

Dr. Gonzalez is the Founder, former CEO, and President of LIMBS International (www.limbs.org), one of the most recognized international providers of low-cost prosthetic components. LIMBS is a 501(c)3 non-profit humanitarian organization that designs, creates, and deploys prosthetic devices to transform the lives of amputees in the developing world by restoring their ability to walk. Since its founding in 2004, the LIMBS Knee has helped thousands of amputees in over 50 countries on four continents.

Samahara Quintana Chavez, University of Texas at El Paso
Juno Alvarez Morales, University of Texas at El Paso
Guillermo Beckmann, University of Texas at El Paso

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Introduction

As of 2023, Latinos constitute 9.4% of the engineering workforce in the U.S. despite comprising 19.1% of the U.S. population and 18.5% of the U.S. workforce [1]. Engineering programs at Hispanic-Serving Institutions (HSIs) are in a position to contribute to meeting the talent needs of the engineering workforce while also broadening the participation of Hispanic[1] engineers who have historically been underrepresented in the practice of engineering. However, many students in this population attend a university very close to home; data from a 2018 survey of U.S. undergraduates shows that Hispanic/Latino students attend school closer to home than any other race/ethnic group, with a median distance from home to institution of 11 miles [2]. It follows that a significant number of Hispanic graduates of an undergraduate engineering program who seek to enter the engineering workforce face, for the first time, the prospect and challenge of relocating away from home.

For example, over 95% of students (more than 22,000) at the research team's university commute to campus. In 2023, the metro area in which the university is located had approximately 4550 jobs in architecture and engineering, and the growth rate for the 2018-2023 time period was just over 10% [3]. Meanwhile, the university graduated 878 engineers in the 2022-2023 academic year; of those, 554 were undergraduates [4]. So, while the metro area adds approximately 455 jobs per year for architecture and engineering, the university is graduating more engineers, even just at the undergraduate level, than the local economy can employ. Thus, many of our students confront the reality that engineering employment opportunities (and salaries) improve if they are willing to relocate.

Recent feedback from one engineering department's early career alumni has suggested that those who have chosen to relocate for work sometimes struggle with cultural acclimation to a new environment and the extent to which these early career engineers feel a conflict between their cultural identity and their environment varies, even for engineers employed within the same industry. To better serve our students and their future employers, we seek to understand what factors may influence Hispanic engineers' acclimation to and retention in a different region and cultural environment, especially for engineers who graduated from Hispanic-serving commuter (as opposed to primarily residential) campuses. As a starting point, the research team seeks to investigate whether family cultural context, identity, and sense of belonging play a role in the post-relocation acclimation. Sense of belonging is a theoretical lens that examines how individuals feel accepted, valued, and included within a community, such as an engineering

[1] Readers will notice some inconsistency with terminology. To clarify, in this work, we describe the population of interest as Hispanic, given the cultural environment of the university and the students we serve. In fact, the population of interest is predominantly Mexican-American. Literature relevant to our work often describes a broader group and uses varying terminology, including, for example, *Latino*, *Latine*, and *Latinx*. Throughout this paper, we utilize the terminology used in the source when referring to statistics or findings in existing literature, respecting the diversity of perspectives in our field.

environment. Identity, as a theoretical construct, refers to how individuals perceive themselves and are perceived by others within social, cultural, and professional contexts.

In this work-in progress paper, we discuss a pilot study designed to answer the following research question: **to what extent is the post-relocation acclimation by early-career Hispanic engineering graduates from an engineering department at an HSI commuter campus influenced by family cultural context, identity, and sense of belonging?** We will describe some relevant literature and theoretical frameworks, our methods, and present preliminary results from the early stages of pilot data collection.

Literature and Theoretical Frameworks

College graduates often face challenges as they transition to professional engineering environments; this transition is a known point of departure from the engineering profession [5], [6], [7]. According to Trevelyan [8], a key challenge is that academic preparation does not always match what employers expect in the workplace. He states that engineering education tends to focus on technical skills, with less emphasis on teamwork, communication, and socio-technical competencies that are critical for workplace success. For Hispanic engineers, especially those graduating from commuter campus HSIs and experiencing a geographic transition, these challenges can be combined with additional cultural and social factors, making the transition even more difficult.

Over the last several decades, substantial progress has been made in understanding the transition of Hispanic and Latinx students *into* the college environment (e.g. [9], [10], [11]) and the experience of Hispanic and Latinx students in undergraduate engineering programs (e.g., [12], [13], [14], [15], [16], [17]). However, there is a distinct gap in the literature regarding these groups' transition from engineering undergraduate programs into the workforce. As a starting point to understand the school-to-work transition experiences of Hispanic engineers, we associate our work with the theoretical frameworks of sense-of-belonging and identity.

Hurtado and Carter [9] conducted influential work to analyze the saliency of Latino student's sense of belonging in a university setting. They found various factors that can impact the sense of belonging, including the student's group affiliations, ease of transition, and the racial/ethnic climate of the university. Of specific relevance to our work, they developed and validated a survey instrument that included questions about an individual's sense of belonging on campus; we adapted this instrument as explained in the Methods section below. The theoretical framework of identity has been increasingly applied in engineering education in the context of forming engineering identity in students, partly because we increasingly understand the correlation between engineering identity and persistence in an engineering degree program. Kendall et al. [18] explored the development of engineering identity in Latinx students specifically; one finding from the study was that Latinx students at HSIs (compared to Latinx students at Predominantly White Institutions (PWIs)) are more likely to feel connected to engineering and plan to work in the field. Patrick et al. [19] examine the sense of belonging in Latine and white engineering students who attend a Hispanic serving institution, the importance a student places on their racial/ethnic/gender identity, and the correlation between their identity and their sense of belonging. They found that racial/ethnic centrality was higher among Latine engineering students and that gender centrality was higher for women. The authors developed

and validated an adaptation of the Hurtado and Carter scale for a sense of belonging from the university campus context to engineering, as well as an adaptation of the Multidimensional Inventory of Black Identity (MIBI) [20] to measure race/ethnicity and gender identity centrality.

Methods

As defined earlier, the research question that this pilot study seeks to answer is: *to what extent is the post-relocation acclimation by early-career Hispanic engineering graduates from an engineering department at an HSI commuter campus influenced by family cultural context, identity, and sense of belonging?* Our population of interest is alumni who have graduated in the last 8 years from one engineering department at the research team's university. The university is a large research-intensive 4-year public HSI situated near the U.S.- Mexico border, where approximately 85% of undergraduate students identify as Hispanic, and over 95% of students at the university commute to campus.

Our starting point in developing the survey was to have a mix of (1) questions informed by a literature review of survey instruments in work transition literature broadly, (2) original questions specific to this project and our population of interest, and (3) questions about the sense of belonging and engineering identity, originating in social and behavioral science but from instruments adapted, validated, and applied in engineering education research. Our motivation for including questions in the latter group was to investigate how and to what extent a sense of belonging and identity are related to how an individual experiences their transitions into a new geographic location for work. The items for sense of belonging were adapted from the Hurtado and Carter scale [9], similar to how Patrick et al. adapted the Hurtado and Carter scale from, for example, "I see myself as a part of the campus community" to "I see myself as part of the engineering community at my institution" [19]. A summary of the general constructs in the pilot survey along with sources (where relevant) and example items is shown in Table 1.

The team used the QuestionPro application to create and deploy the survey. QuestionPro was selected for its user-friendly interface, data analysis features, and methods to ensure the participant's data remains secure. Furthermore, it is the survey platform supported by the research team's institution. Each section and item was designed to gather information from the participants without asking for identifying information such as their name or address. Only one of the survey questions requires a response from the participant; this question is at the beginning of the survey and serves as the consent notice and screening question. The rest of the questions do not require a response from the participants to continue with the remainder of the survey.

In the education and family background section, the team seeks to understand the participant's educational background (including geographic location for elementary, high school, and university) to provide insight into previous geographic transitions, if any, the individual has experienced. We also asked participants about how their family may have influenced their decisions about considering a geographic relocation during their transition from college to work. The engineering identity and identity centrality sections prompt the participants to consider their

Construct	Number of Questions	Source	Example
Screening	1	N/A	This survey is intended for working engineers who are over the age of 18 and have earned a bachelor's degree in engineering.
Educational Background	8	N/A	Were you the first person in your household to go to college?
Family cultural context	7	N/A	During your childhood and/or adolescence, did you have a grandparent living with you?
Home and work context	4	N/A	What is the approximate % of your work time that you spend working at your primary workplace (as opposed to working in the field, remotely, etc.)?
Engineering Identity	2	Borrego et al. [23]	Which diagram best describes the level of overlap between your identity and the identity of an engineer?
Demographics	4	N/A	How would you describe your ethnicity?
Racial/Ethnic and Gender Identity Centrality	16	Patrick et al. [19]	(Considering your own race/ethnicity, please indicate the degree to which you agree or disagree with each of the following statements...) In general, my race/ethnicity is an important part of my self-image.
Sense of belonging	9	adapted from Hurtado and Carter [9]	(To what extent to you disagree or agree with the following statements…) I see myself as part of the engineering community where I work.
Acclimation to new environment	12	N/A	Have you developed a new hobby or participated in any cultural or community experiences since you started working? If yes, please give some examples.

Table 1: Summary of pilot survey items by general construct

engineering, ethnicity, race, and gender identity and how these attributes influence their self-image. It was important for the team to allow the participants to self-identify their ethnicity, race, and gender. To facilitate this, the research team followed best practices in identity research [21], [22] and used open-ended prompts for participants to describe their identities in their own words. The acclimation sections of the survey provide the researchers with insight into the participant's experience with acclimating to their work and community environments.

The survey was tested for clarity by several upper-level undergraduate students, revised according to feedback, and approved by the Institutional Review Board at the researchers' institution. Data collection began in mid-December 2024 and is ongoing. As of the writing of

this draft, we have twenty-one completed responses, which is approximately 20% of our pilot study population.

Initial Results and Analysis

A study of the earliest responses has revealed some interesting insights. We share them here, acknowledging that they are based on a small sample size and are not intended to be robust or transferrable. These early insights are intended to inform next steps in the research. A summary of the data is included in Table 2. 14 respondents self-identified as Male, and 6 respondents self-identified as Female. (1 respondent declined to report this information.)

Data Summary:

	Yes		No	
	n	**%**	**n**	**%**
1st Generation to attend college	8	38.1%	13	61.9%
1st in Household to attend college	5	23.8%	16	76.2%
Identify as Hispanic, Latinx, and/or Chicano	19	90.5%	2	9.5%
Have relocated for work	13	61.9%	8	38.1%

Table 2: Data summary

Cultural Identity

Over 90% of respondents identify as Hispanic, Latinx, and/or Chicano, with 64% reporting Spanish as their first language. While Spanish remains prevalent in familial contexts, there is a noticeable shift towards bilingualism or English dominance in social and professional interactions. Cross-cultural engagement was a notable theme, with all participants reporting friendships across racial and ethnic lines. Simultaneously, involvement in professional affinity groups such as SHPE (Society of Hispanic Professional Engineers) highlights efforts to maintain cultural identity within professional spaces.

Engineering Identity

An interesting observation emerging from the data is that participants who have relocated for work tend to have a stronger sense of engineering identity, demonstrated by their responses on a scale measuring engineering identity developed by Borrego et al [23]. There is one outlier, a respondent who reports a current “complete overlap” between their personal identity and the identity of an engineer (see Figure 1). The fact that respondents who have relocated also report more overlap when reflecting on their identity as a student (Figure 2) implies that there may be a relationship between the strength of engineering identity in an individual and their likelihood to relocate. This relationship will be probed in further research, specifically in interviews during a forthcoming qualitative research phase.

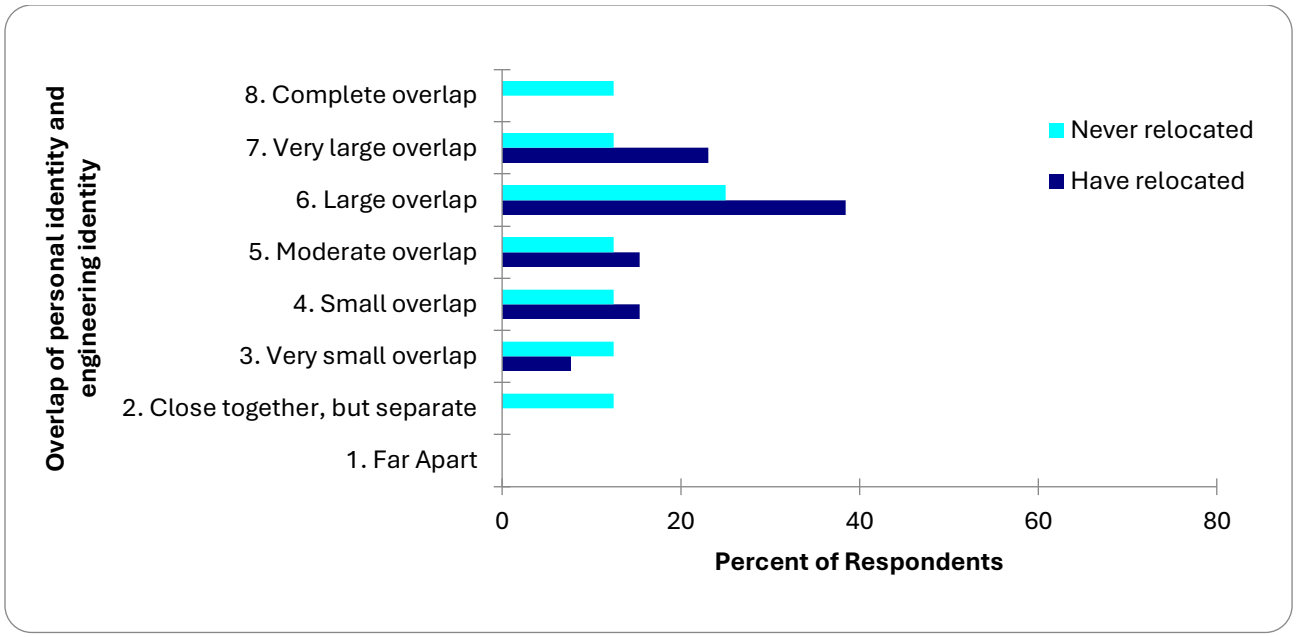

Figure 1: Current Engineering Identity for Relocated and Never Relocated Participants

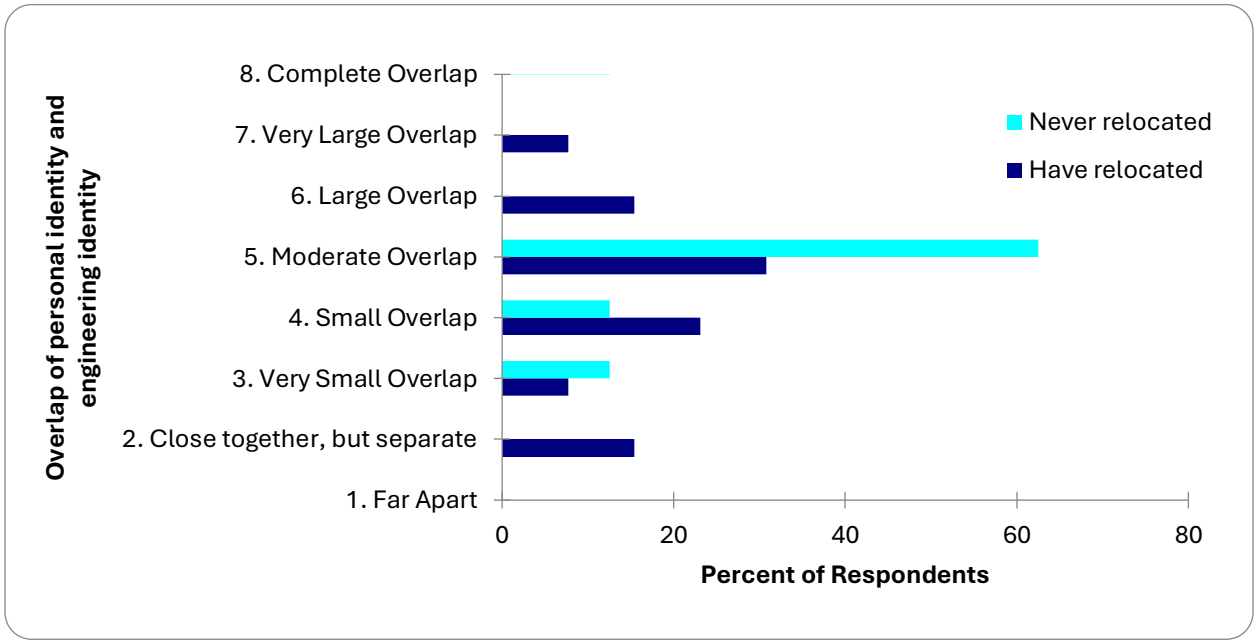

Figure 2: Engineering Identity as a Student for Relocated and Never Relocated Participants

Professional Integration and Sense of Belonging

The data so far indicate that participants feel a strong connection to their workplaces, with high levels of satisfaction and effective mentorship frequently reported. (See Figures 3 and 4.) However, the respondents who have experienced relocation indicate mixed experiences adapting to their new communities. While they expressed belonging to their workplace, connections to their living communities were comparatively weaker. Also, it is noteable that only 46.15% of

relocated respondents were "very satisfied" with their current job, compared to 75% of non-relocated respondents.

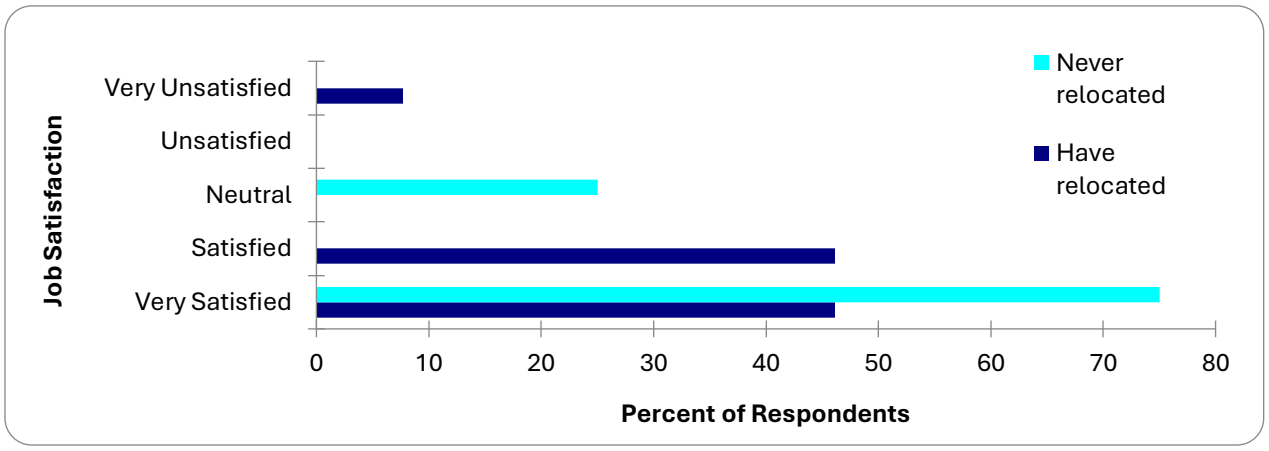

Figure 3: Job Satisfaction for Relocated and Never Relocated Respondents

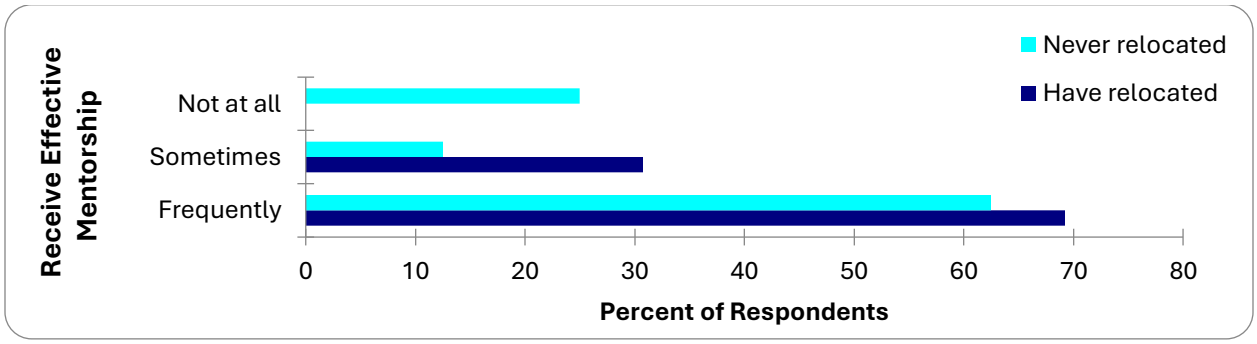

Figure 4: Frequency of Effective Mentorship for Relocated and Never Relocated Respondents

Support for transition

Survey responses so far show that challenges sustaining familial ties can impact adaptation to a new environment. Participants have suggested interventions, such as increased travel opportunities or remote work flexibility, that could support these engineers' well-being.

Family Cultural Context

We were surprised to find that so far there does not seem to be a meaningful relationship between family dynamics around relocating and whether a respondent has relocated or not. The percentage of respondents reporting “a lot” of pressure from family to stay in their hometown after graduating is somewhat higher for individuals who have never located, but the data doesn’t indicate that respondents who have never relocated are subjected to significantly more pressure to stay in their hometown compared to respondents who have relocated (see Figure 5). Similarly, the data does not suggest that respondents who have relocated were subjected to more pressure to leave their hometown (see Figure 6).

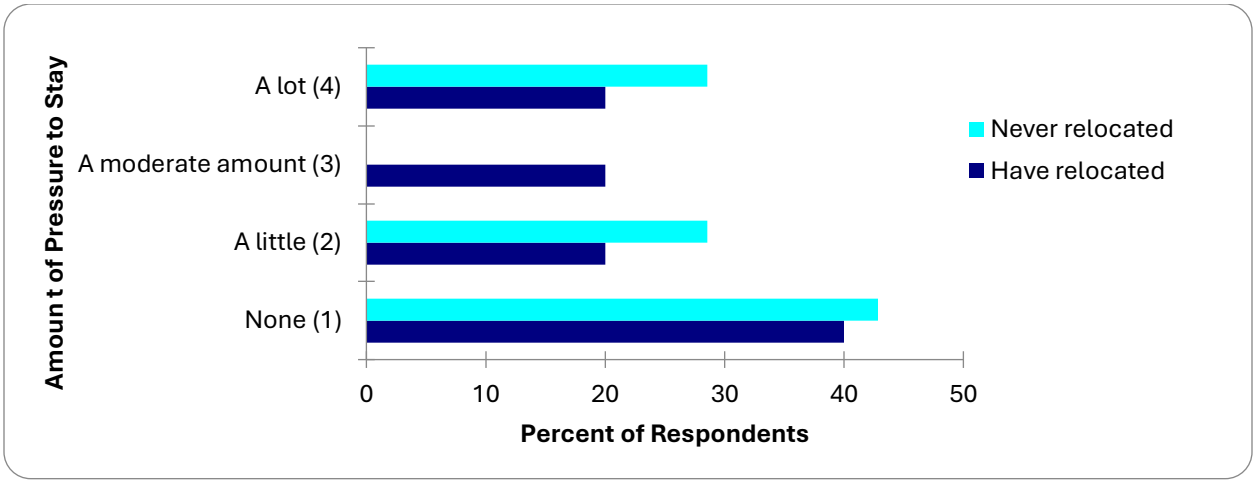

Figure 5: Amount of Pressure from Family to **Stay** in Home Town for Relocated and Never Relocated Respondents

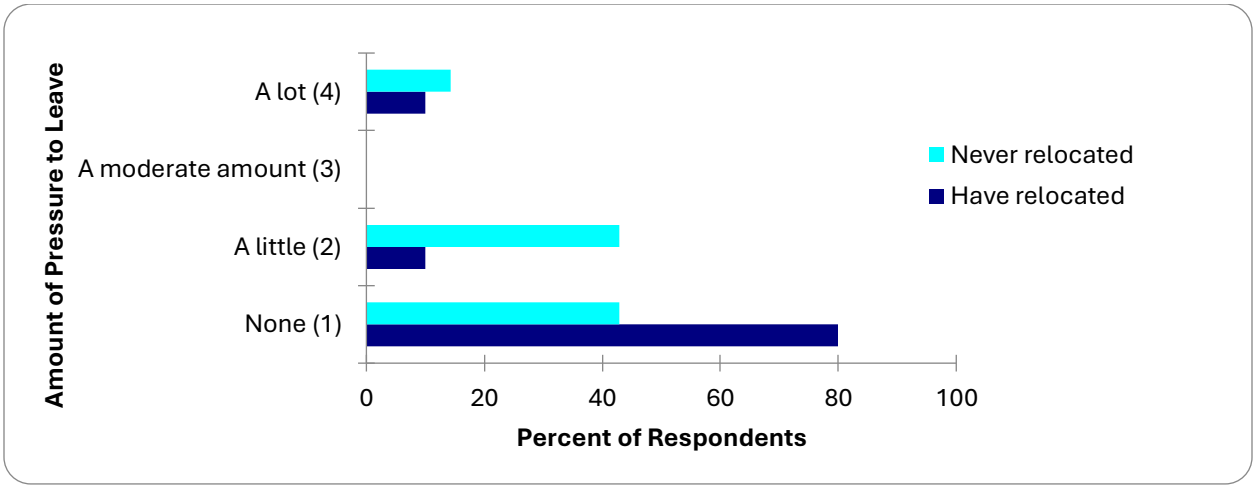

Figure 6: Amount of Pressure from Family to **Leave** Home Town for Relocated and Never Relocated Respondents

One attribute that *is* emerging as potentially significant, however, is whether an individual is the first in their household to attend college. Those individuals are significantly less likely to relocate for work (see Figure 7). Interestingly, there does not seem to be any significance related to first generation status with respect to likelihood to relocate (see Figure 8). This suggests that pressure to stay near family may be particularly directed towards older siblings in a family; this is another dimension the research team intends to probe in future research.

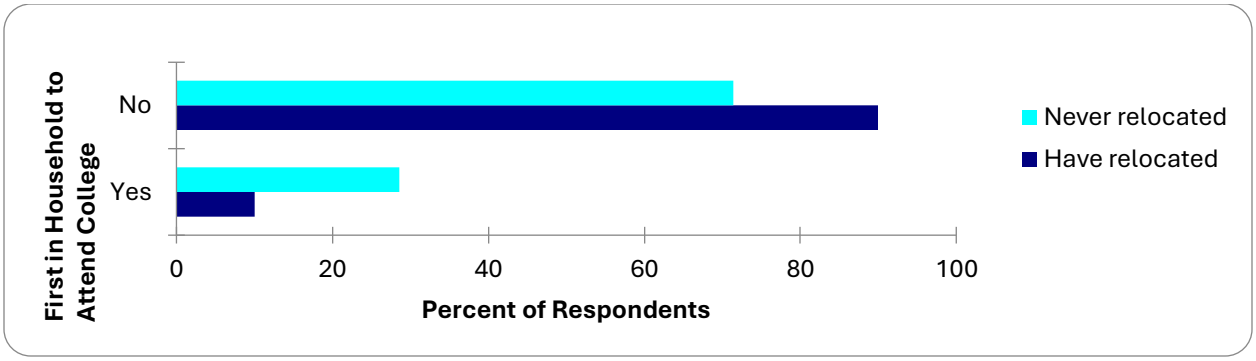

Figure 7: First in Household to Attend College for Relocated and Never Relocated Respondents

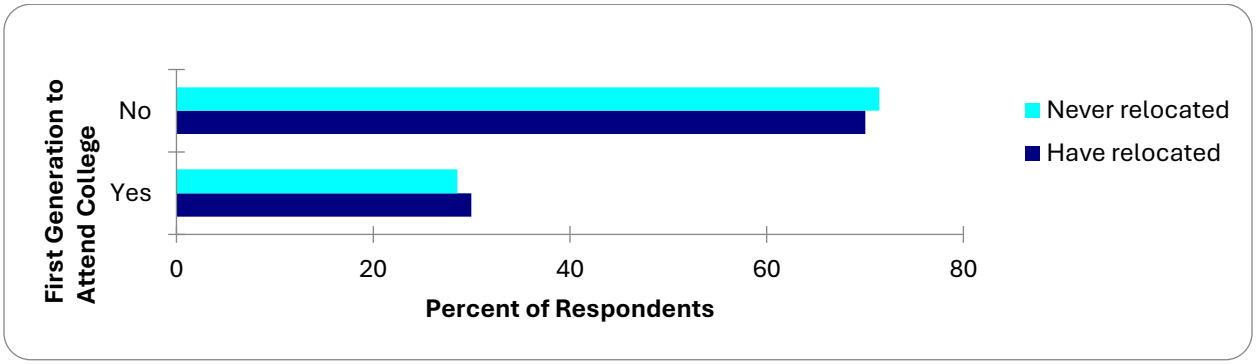

Figure 8: First Generation to Attend College for Relocated and Never Relocated Respondents

Conclusion and Future Work

This pilot study is the first step in a broader mixed-methods exploratory study of the research question. Our IRB approval extends to a qualitative phase, during which we will interview selected participants who completed our survey. We intend to design future studies that expand the scope of work to a broader study population (including additional HSI commuter campuses) and would include formal validation of our survey instrument.

The implications of this work are to provide targeted support at the university level leading up to the transition and in the work environment after the transition so that Hispanic engineering graduates of Hispanic-serving commuter campuses are better supported in transitioning to the national engineering workforce.

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