# Student Mobility and Educational Outcomes among Ontario Colleges and Universities

## Comparing Access to STEM Fields, Graduation Rates and Timely Completion among Northern and Southern Ontario Students

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**David Zarifa, PhD**
**Professor and Canada Research Chair**
**davidz@nipissingu.ca**

**Yujiro Sano, PhD**
**Postdoctoral Research Fellow**

**Avery Beall, MA**
**Project Facilitator**

**Department of Sociology**
**Nipissing University**

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## Overview of the Study

Around the globe, student transfer patterns have become increasingly complex, and rates continue to proliferate (Taylor & Jain, 2017; Jenkins & Fink, 2015). Higher education pathways have taken on numerous shapes and sizes to accommodate delayed entry, prolonged enrolment, attributable in large part to a balancing act of multiple life course obligations (e.g., work, family). Likewise, student mobility at Ontario's colleges and universities has become increasingly diverse and non-linear, as students encounter multiple starts, stops, and co-enrol in multiple programs (St-Denis et al., 2021; Li, 2010). As transfer becomes more entrenched in higher education, it remains especially important to continue to monitor how transfer students perform within their higher education programs.

At the same time, a growing area of student mobility research points to the importance of examining regional differences in educational trajectories within Canada. Youth from the northernmost parts of Canada's provinces often face significant proximity and socio-demographic barriers to attending postsecondary education, accessing various types of postsecondary education, and accessing the STEM fields (Science, Technology, Engineering, and Mathematics) (Zarifa et al., 2022; Hango et al. 2021; Zarifa et al. 2018). In 2020, several new studies investigated the magnitude of a variety of transfer pathways across colleges and universities, the characteristics of students who take the various routes, and the migration flows of transfer students, revealing numerous differences across Northern and Southern Ontario colleges and universities (Sano et al. 2020; Zarifa et al. 2020; Hillier et al. 2020).

This study extends that work and similarly draws upon several administrative data sources included in Statistics Canada's ELMLP (Education and Labour Market Longitudinal Platform). Specifically, we use the 2009 to 2017 years of the Postsecondary Student Information System (PSIS) (for further details, see Statistics Canada, 2018) as well as family tax data from the T1 Family Files. These data provide the optimal source for examining the following three key educational outcomes for transfer students in Ontario's college and university sectors: 1) access to the STEM fields, 2) university graduation and timely completion, and 3) college graduation and timely completion.

# Key Findings

## Part 1: Access to STEM Fields

- Overall, 28.26% of students in Ontario colleges and universities major in STEM fields.
- While 28.67% of students in Southern Ontario major in STEM fields, only 20.21% of students in Northern Ontario institutions do the same.
- In Southern Ontario, students in non-transfer college (NTC), university to university (UU), university to college (UC), college to university (CU), college to college (CC), and swirler pathways are all significantly less likely to major in STEM fields in comparison to non-transfer university students.
- For Southern Ontario, NTU shows the highest probability (0.3163), followed by UU (0.2883), UC (0.2510), swirlers (0.2375), NTC (0.2074), CC (0.1336), and CU (0.714).
- For Northern Ontario students, only those taking NTC, UU, CU, and CC pathways show significantly lower odds of majoring in STEM fields compared to NTU students.
- In Northern Ontario, however, the ordering is slightly different than what we observe in Southern Ontario. In the North, the UC pathway (0.2510) shows the highest probability of entering STEM, followed by swirlers (0.2236), NTU (0.2163), UU (0.1773), NTC (0.1602), CC (0.1332) and CU (0.1190).

## Part 2: University Graduation and Timely Completion

- About 32.9% of students in Ontario colleges and universities do not graduate from university within six years, while 36.8% and 30.3% do so within four and six years.
- The proportion of students who graduate from university within four years is similar between northern (35.2%) and southern students (36.9%); however, the prevalence of graduating from university within six years is much lower among northern students (24.4%) than southern students (30.6%).
- For Southern Ontario, in comparison to non-transfer students, transfer students show higher probabilities of taking six years to complete their degrees (0.3882 vs. 0.3023) as well as not complete their degrees (0.4360 vs. 0.3199), and are over half as likely to complete their degrees in four years (0.3778 vs. 0.1758).
- At Northern Ontario institutions, the predicted probabilities of not completing university are substantially higher than those from Southern Ontario institutions for both transfer and non-transfer students, as transfer students in Northern Ontario are 52.37% likely to not complete their degrees, while their counterparts in Southern Ontario were 43.60% likely to not complete their degrees.
- Interestingly, the probabilities for completing degrees on time (in four years), were slightly higher among Northern Ontario non-transfer students (0.3778 vs. 0.3805) and lower among transfer students (0.1758 vs. 0.1145). In terms of six-year completion,

transfer students (0.3619) had significantly higher probabilities of completing in this time frame than non-transfer students (0.2282).

## Part 3: College Graduation and Timely Completion

- Overall, 61.9% of students in Ontario colleges graduate within three years of starting their programs.
- For Ontario as a whole, transfer students show a significantly lower probability of completing their college programs within three years (0.4109 vs. 0.6395).
- Comparing regions, our results indicate that 70.5% of students in Northern Ontario graduate from college within three years compared to only 61.1% in Southern Ontario.
- In both Southern and Northern Ontario institutions, transfer students are less likely to graduate from college within three years than non-transfer students.
- In Southern Ontario institutions, transfer students show considerably lower probabilities (0.4045) of completing their programs compared to non-transfer students (0.6309).
- For Northern Ontario, both transfer (0.4735) and non-transfer students (0.7265) have higher probabilities of completing their college programs compared to those at Southern colleges (0.4045 and 0.6309 respectively).

# Introduction

Around the globe, student transfer patterns have become increasingly complex, and rates continue to proliferate (Taylor & Jain, 2017; Jenkins & Fink, 2015). Higher education pathways have taken on numerous shapes and sizes to accommodate delayed entry, prolonged enrolment, attributable in large part to a balancing act of multiple life course obligations (e.g., work, family) (Davies & Mehta, 2018; Deil-Amen, 2015). Likewise, student mobility at Ontario's colleges and universities has become increasingly diverse and non-linear, as students encounter multiple starts, stops, and co-enrol in multiple programs (St-Denis et al., 2021; Li, 2010).

As transfer becomes more entrenched in higher education, it remains especially pertinent to continue to monitor the educational choices and performance of transfer students throughout their higher education programs. Recent studies in Ontario certainly underscore the importance of comparing the educational outcomes of transfer and direct-entry students, often attributable to differences across transfer pathways (for example, see Walters et al., 2021; Walters et al., 2020; Davies & Pizarro Milian, 2020; Finnie et al., 2020; Drewes et al., 2012; Stewart & Martinello, 2012). At the same time, a growing area of student mobility research points to the importance of examining regional differences in educational trajectories within Canada. Much like their counterparts in the Territories, youth from Canada's provincial North often face significant proximity and socio-demographic barriers to accessing postsecondary education, accessing various types of postsecondary education, and majoring in the STEM fields (Science, Technology, Engineering, and Mathematics) (Zarifa et al., 2022; Hango et al., 2021; Zarifa et al., 2018).

In a series of ONCAT research briefs in 2020, we separated out regions within larger geographic areas to understand how relationships might be different within pockets of the province of Ontario. Specifically, our studies investigated the magnitude of a variety of transfer pathways across colleges and universities, the characteristics of students who take the various routes, and the migration flows of transfer students, revealing numerous differences across Northern and Southern Ontario colleges and universities (Sano et al., 2020; Zarifa et al., 2020; Hillier et al., 2020). This work produced new insights into the transfer patterns of students in northern institutions, as well as other regions in Ontario. PSIS administrative data linked to tax data allowed us to overcome a number of limitations to using nationally-representative survey data to examine postsecondary pathways in Northern Ontario.

This study extends that foundational work and similarly draws upon several administrative data sources included in Statistics Canada's ELMLP (Education and Labour Market Longitudinal Platform). Specifically, we use the 2009 to 2017 years of the Postsecondary Student Information System (PSIS) (for further details, see Statistics Canada, 2018) as well as family tax data from the T1 Family Files. These data provide the optimal source for examining regional differences in the following three key educational outcomes for transfer students in Ontario's college and university sectors: 1) access to the STEM fields, 2) university graduation and timely completion, and 3) college graduation and timely completion.

In particular, this research explores the following three sets of research questions:

1. **Access to STEM Fields**: To what extent are transfer students majoring in the STEM fields in Ontario colleges and universities? Are transfer students in Northern and Southern Ontario majoring in STEM fields at the same rates? To what extent does transfer status impact one's likelihood of majoring in the STEMs, once taking into consideration other relevant factors?

2. **University Graduation and Timely Completion**: To what extent are transfer students graduating university at different rates than their non-transfer counterparts? Do transfer students in Northern and Southern Ontario graduate university at different rates? How do transfer pathways relate to the timely completion of university programs? Are there regional differences (Northern and Southern Ontario) in transfer students' likelihood of completing their university programs on time?

3. **College Graduation and Timely Completion**: To what extent are transfer students graduating college at different rates than their non-transfer counterparts? Do transfer students in Northern and Southern Ontario graduate college at different rates? How do transfer pathways relate to the timely completion of college programs? Are there regional differences (Northern and Southern Ontario) in transfer students' likelihood of completing their college programs on time?

To answer each set of research questions, we employ a common methodological approach. First, we begin by comparing the relative percentages of students across our transfer measures as well as our educational outcomes. Second, we estimate unadjusted bivariate regression models to assess the marginal relationships between transfer status and each of our outcomes: STEM fields, university completion and college completion. Third, we draw upon adjusted binary logistic and multinomial logistic regressions to take into consideration other key factors simultaneously. In addition, we graph the predicted probabilities from these models to assess and compare the relative impact of transfer pathways on educational outcomes. Across all sets of analyses, we investigate the situation as a whole for all colleges and universities in Ontario before proceeding to dig deeper and analyse the situation separately for students at Northern and Southern Ontario institutions. Finally, we conclude this study by highlighting some of key areas of differences across the two locales and discuss the key implications of these findings.

## Part 1: Access to STEM Fields

As higher education systems continue to expand and diversify in many countries (see Marginson 2016), researchers concerned with postsecondary access have expanded their sights to examine access to the various pathways within higher education (Gerber & Cheung, 2008; Bastedo & Gumport, 2003). On many occasions, access to lucrative fields of study and more recently access to the STEMS (sciences, technology, engineering and mathematics) has been shown to be far from equal across all socio-demographic groups (Hango et al., 2019; Triventi et al., 2017; Thomsen 2015; Gabay-Egozi et al., 2015; Alon and DiPrete, 2015; Chang et al., 2014; Davies et al., 2014; Hango, 2013; Morgan et al., 2013; Riegle-Crumb et al., 2012; Zarifa 2012; Barone 2011). This important point of selection impacts future education and employment outcomes, not the least of which is earnings (Betts et al., 2007; Davies & Hammack, 2005).

Postsecondary transfer students in STEM fields have become a population of interest internationally in the past decade. Researchers have typically focused on attrition and retention rates (Aulck & West, 2017), persistence and graduation rates (Zhang, 2021, 2019; Zhang et al., 2019; Dika & D'Amico, 2015), and early employment outcomes (Jelks & Crain, 2020). A rather large body of policy-relevant studies have sought to determine key academic, cultural, and institutional factors that might improve student success as well as those that might negatively impact students' abilities to succeed in STEM fields (Dinh & Zhang, 2020; Elliot & Lakin, 2020a, 2020b; Yeo et al., 2020; Lopez & Jones, 2017; Wang et al., 2017; Starobin, 2016; Wang 2016, 2015; Jackson & Laanan, 2015; Kruse et al., 2015; Wang, 2013; Reyes, 2011).

In Canada, much of the research on STEM access and inequalities similarly tends to centre around socio-demographic groups and the barriers they face in pursuing these fields of study. Typically, researchers have underscored the barriers (and stubbornness of those barriers) preventing women and racialized minorities from accessing the STEMs (e.g., Hango 2013). However, few studies have zeroed in on the experiences of transfer students in the STEMs (e.g., Maier & Robson, 2020), and even fewer have assessed how large or small the disparities across transfer and non-transfer groups might be in their ability to access the STEM fields (e.g., Davies & Pizarro Milian, 2020). Moreover, sector-wide comparisons in Ontario, with the objective of understanding potential regional differences in accessing the STEMs, have also been largely neglected in the existing literature. As such, we begin by first reviewing several recent studies that have looked at transfer students in the STEMs in Ontario, before turning to our empirical analysis of transfer student STEM access.

Using Statistics Canada's Education and Labour Market Longitudinal Platform (ELMLP), Finnie et al. (2020) linked the Postsecondary Student Information System (PSIS) and T1 Family Files (T1FF) to track transfer and field-switching patterns among university graduates in Ontario. Overall, among all Ontario students who entered postsecondary education in 2009 (n = 58,410), only 2% transferred from their original institution to another; 0.9% of transfer students did not change their field of study, while 1.2% changed their field of study (Finnie et al., 2020: 14). The

remaining students stayed at their institution and in their original field of study (79.3%) or changed their field of study (18.7%). Among all students who graduated (n = 22,130), roughly 25% graduated with a STEM degree. Interestingly, Finnie et al. (2020: 15) also reported that students in STEM fields, with the exception of engineering and architecture, tend to have a moderately high likelihood of changing their field of study (20%), though students are more likely to stay within their original field of study as they move further into their degree (i.e., third through fifth years). In fact, only education and humanities students have a higher rate of changing their field of study.

A recent qualitative study by Maier and Robson (2020) described the experiences of 20 STEM and non-STEM students in Southern Ontario to understand the motivations for transferring within the university to college (UC) pathway. Of the 20 students, only two students followed a strict 4-year pathway in a single university program followed by a transfer to the same college program; the remaining 18 students transferred across programs and fields, stopped out and returned, and attempted different programs at different institutions. Moreover, they found that STEM students took both STEM fields and non-STEM fields after their transfer, suggesting potential retention difficulties among STEM fields. When asked, students described academic, economic, personal struggles and goal changes, personal and parental expectations, and college factors as transfer motivations. Most commonly, students described the lack of preparedness for university after high school, lack of academic accommodations at their institutions, and feelings of failure when they struggled academically at university. Students felt as though they were failing themselves and their parents—with a particularly elevated sense of failure among second generation Canadian students—for leaving university to pursue college education.

Finally, another study in Southern Ontario (with an approach closest to ours here) by Davies and Pizarro Milian (2020) linked administrative data from the Toronto District School Board and the University of Toronto to investigate the compare access to the STEM fields across direct-entry and transfer groups. Overall, they found that nearly 40% of direct-entry students entered STEM fields compared to only 27% of transfers (Davies & Pizarro Milian, 2020: 3). Access to STEM also varied considerably across transfer sub-categories. When separating out by transfer types (i.e., the prior institution attended), their analyses revealed that international university transfers and Ontario university transfers showed the highest levels of STEM access (34% and 30% respectively), followed by those who transferred from Ontario colleges (22%) and Canadian universities (20%; Davies & Pizarro Milian, 2020: 3). Moreover, in their multivariate models, significant differences in direct-entry and transfer access to STEM emerged in both unadjusted models as well as when controlling for high school academics, age, gender, and median neighbourhood family income. However, these differences completely attenuated, when additional demographic controls were introduced in saturated models (Davies & Pizarro Milian, 2020).

To our knowledge, no existing studies have examined the relationship between transfer pathways and STEM access in Northern Ontario, nor have any compared system-wide patterns across northern and southern regions of Ontario. However, recent research points to key

differences in STEM access across Northern and Southern Canada. Specifically, using the Youth in Transition Survey (YITS-A), Hango et al. (2021) examined the field of study choices in college and university of northern and rural youth in Canada with a focus on STEM fields. Ultimately, their results revealed that the location a student resides in has a significant impact on their field of study choice, even when controlling for other student characteristics, including sociodemographic, parental and family, and student aspirations and academic characteristics. Students residing in southern areas of Canada were more likely to access STEM university programs than students residing in northern, urban areas in Canada; however, students residing in northern areas of Canada were more likely to access non-university STEM programs than students residing in southern areas of Canada. While these findings certainly underscore the importance of understanding how students from different regions might have varied levels of access to the STEMs, it still remains unclear the extent to which transfer student access to the STEM fields varies across northern and southern regions of Ontario.

## Transfer Pathways and Access to STEM Fields in Ontario Institutions

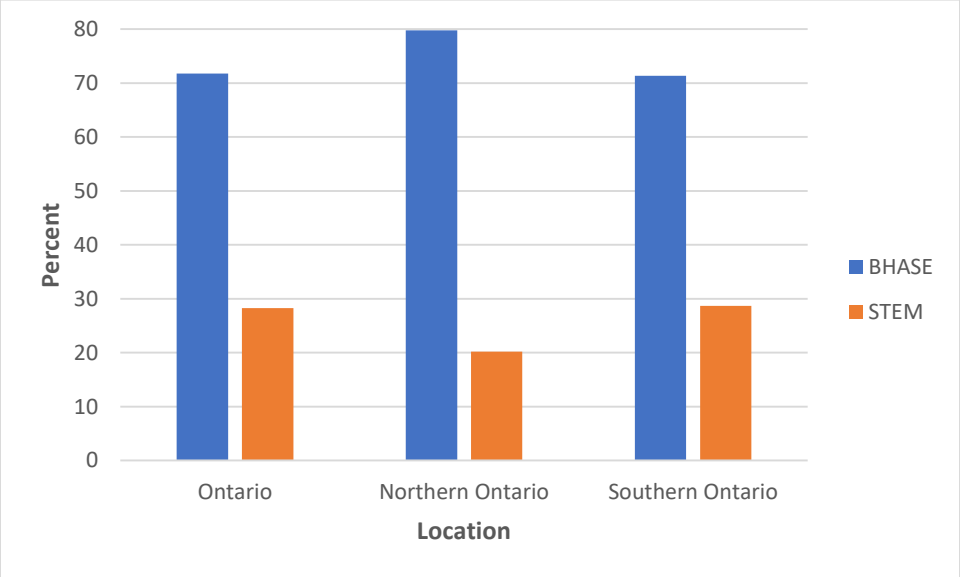
In this section, we first examine the prevalence of STEM majors among Ontario college and university students before turning to student pathways. Table 1.1 shows our univariate findings from the PSIS-T1FF data. Overall, we can see that that 28.26% of students in Ontario colleges and universities major in STEM fields. Moreover, some interesting regional differences emerge in STEM field uptake. The results displayed in Figure 1.1 show how the distributions of students majoring in the STEM fields across northern and southern regions of Ontario compare in relation to the province as a whole. Interestingly, while 28.67% of students in southern institutions major in STEM fields, only 20.21% of students in northern institutions do the same.

***Table 1.1 STEM Subsample Characteristics by Region of Institution, PSIS-T1FF 2009-2017.***

| | Overall | South | North |
|---|---|---|---|
| **STEM** | | | |
| No | 71.74 | 71.33 | 79.79 |
| Yes | 28.26 | 28.67 | 20.21 |
| **Transfer type** | | | |
| NTU | 73.74 | 73.78 | 73.02 |
| NTC | 16.80 | 16.84 | 15.92 |
| UU | 1.79 | 1.76 | 2.31 |
| UC | 2.48 | 2.45 | 3.00 |
| CU | 2.51 | 2.50 | 2.78 |
| CC | 1.89 | 1.88 | 1.98 |
| Swirlers | 0.79 | 0.78 | 0.99 |
| **Location of school** | | | |
| South | 95.12 | | |
| North | 4.88 | | |
| **Registration status** | | | |
| Full-time | 94.18 | 94.44 | 89.05 |

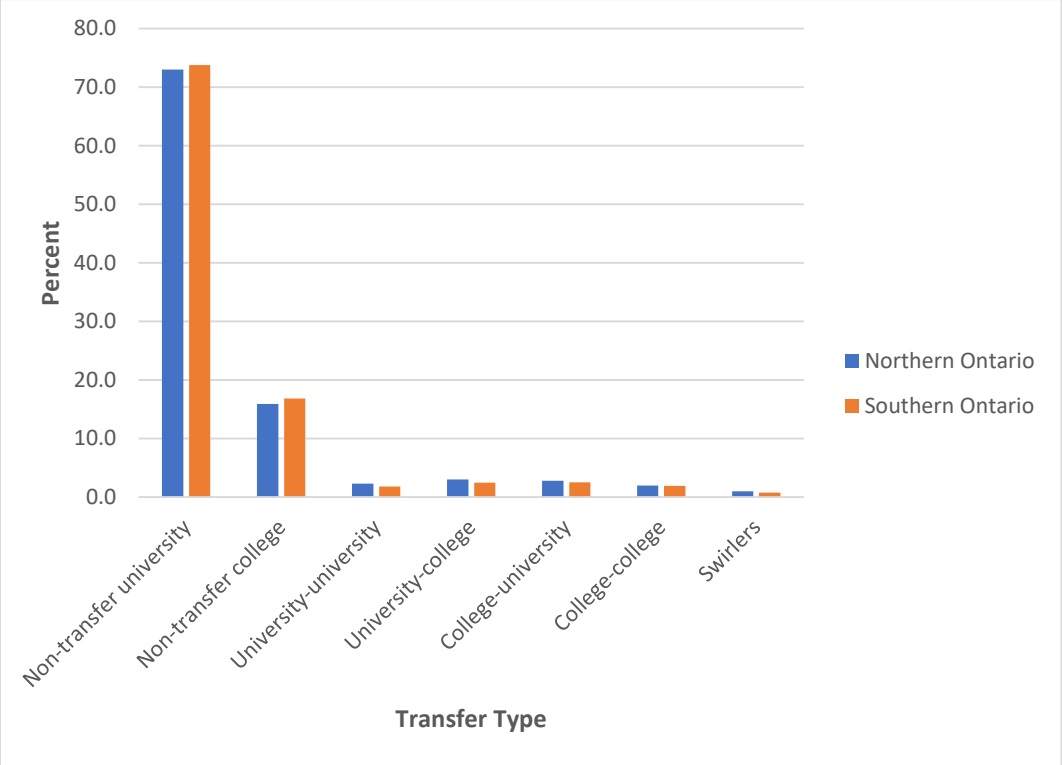
| | | | |
|---|---|---|---|
| Part-time | 5.82 | 5.56 | 10.95 |
| **Year of enrolment** | | | |
| 2015 | 14.02 | 14.03 | 13.87 |
| 2014 | 14.11 | 14.10 | 14.42 |
| 2013 | 14.70 | 14.67 | 15.26 |
| 2012 | 13.86 | 13.88 | 13.65 |
| 2011 | 13.84 | 13.85 | 13.65 |
| 2010 | 13.89 | 13.86 | 14.46 |
| 2009 | 15.57 | 15.61 | 14.68 |
| **Age** | | | |
| 21≤ | 83.40 | 84.01 | 71.50 |
| 22≥ | 16.60 | 15.99 | 28.50 |
| **Sex** | | | |
| Men | 45.07 | 45.37 | 39.07 |
| Women | 54.93 | 54.63 | 60.93 |
| **Parental income** | | | |
| Lowest | 20.00 | 20.23 | 15.42 |
| Lower | 19.98 | 20.03 | 18.97 |
| Middle | 19.99 | 19.77 | 24.20 |
| Higher | 20.01 | 19.73 | 25.45 |
| Highest | 20.02 | 20.23 | 15.96 |
| **Family composition** | | | |
| Couple | 87.42 | 87.55 | 84.95 |
| Lone | 12.58 | 12.45 | 15.05 |
| **Family size** | | | |
| ≤3 | 32.35 | 32.12 | 36.87 |
| ≥4 | 67.65 | 67.88 | 63.13 |
| Total | 560,200 | 532,890 | 27,310 |

*Figure 1.1 Distribution of STEM Majors Across Ontario Regions: PSIS-T1FF, 2009 to 2017*



To get an initial sense of student mobility levels in Ontario, Figure 1.2 displays the relative distributions of college and university students across postsecondary education (PSE) pathways. Overall, the graph illustrates that about three quarters of students are non-transfer university (NTU) students in both Northern (73.02%) and Southern Ontario (73.78%), while about 16% are non-transfer college (NTC) students in Northern (15.92%) and Southern Ontario (16.84%). Interestingly, students from Northern Ontario institutions show higher relative percentages across all transfer pathways. Specifically, the prevalence of university to university (UU) transfer and university to college (UC) transfer is slightly higher among northern students (2.31% and 3.00% for UU and UC, respectively) than southern students (1.76% and 2.45% for UU and UC, respectively). Similarly, the prevalence of college to university (CU) transfer and college to college (CC) transfer is also slightly higher among northern students (2.78% and 1.98% for UU and UC, respectively) than southern students (2.50% and 1.88% for UU and UC, respectively). We also find that more northern students (0.99%) are categorized as swirlers than southern students (0.78%). The relative distributions of several other key institutional, demographic, and family characteristics in Ontario, Southern Ontario, and Northern Ontario can be found in Table 1.1.

***Figure 1.2 Distribution of Transfer Types Across Ontario Regions: PSIS-T1FF, 2009 to 2017***



## The Relationship Between Transfer Pathways and Access to STEM Fields in Ontario Institutions

To assess the relationship between transfer pathways and access to STEM fields, we turn to a series of statistical models. Specifically, Table 1.2 shows the findings from our binary logistic regression analyses, which predict the odds of a student majoring in the STEM fields. Models 1, 3 and 5 include only our transfer variable of interest, and Models 2, 4 and 6 include all other variables.

***Table 1.2 Binary Logistic Regression Analyses Predicting Majoring in STEM Fields, PSIS-T1FF 2009-2017.***

| | Overall | | South | | North | |
|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| **Transfer type** | | | | | | |
| NTU | - | - | - | - | - | - |
| NTC | 0.54*** | 0.55*** | 0.53*** | 0.55*** | 0.78*** | 0.67*** |
| UU | 0.79*** | 0.86*** | 0.80*** | 0.87*** | 0.73** | 0.76* |
| UC | 0.73*** | 0.73*** | 0.71*** | 0.71*** | 1.16 | 1.17 |
| CU | 0.16*** | 0.17*** | 0.15*** | 0.16*** | 0.51*** | 0.46*** |
| CC | 0.33*** | 0.32*** | 0.32*** | 0.32*** | 0.65*** | 0.53*** |
| Swirlers | 0.68*** | 0.67*** | 0.67*** | 0.66*** | 1.15 | 1.05 |
| **Location of school** | | | | | | |
| South | | - | | | | |
| North | | 0.72*** | | | | |
| **Registration status** | | | | | | |
| Full-time | | - | | - | | - |
| Part-time | | 0.57*** | | 0.59*** | | 0.29*** |
| **Year of enrolment** | | | | | | |
| 2015 | | - | | - | | - |
| 2014 | | 0.95*** | | 0.94*** | | 1.07 |
| 2013 | | 0.88*** | | 0.88*** | | 0.95 |
| 2012 | | 0.87*** | | 0.88*** | | 0.86** |
| 2011 | | 0.85*** | | 0.85*** | | 0.80*** |
| 2010 | | 0.78*** | | 0.78*** | | 0.75*** |
| 2009 | | 0.72*** | | 0.72*** | | 0.72*** |
| **Age** | | | | | | |
| 21≤ | | - | | - | | - |
| 22≥ | | 0.59*** | | 0.56*** | | 1.14*** |
| **Sex** | | | | | | |
| Men | | - | | - | | - |
| Women | | 0.41*** | | 0.41*** | | 0.28*** |
| **Parental income** | | | | | | |
| Lowest | | - | | - | | - |
| Lower | | 0.88*** | | 0.88*** | | 0.95 |
| Middle | | 0.85*** | | 0.85*** | | 1.00 |
| Higher | | 0.84*** | | 0.84*** | | 1.08 |
| Highest | | 0.80*** | | 0.80*** | | 1.10 |
| **Family composition** | | | | | | |

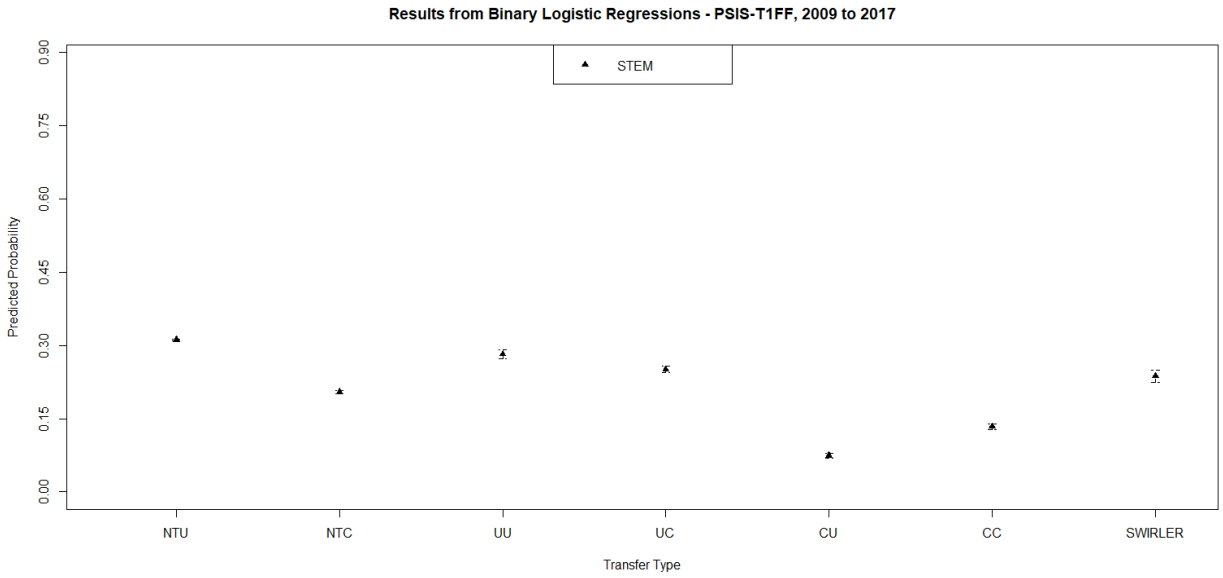
| | | | | | | |
|---|---|---|---|---|---|---|
| Couple | | - | | - | | - |
| Lone | | 0.71*** | | 0.70*** | | 0.89* |
| **Family size** | | | | | | |
| ≤3 | | - | | - | | - |
| ≥4 | | 1.03*** | | 1.03*** | | 1.06 |
| Log likelihood | -327863.63 | -312169.96 | -313567.11 | -299274.81 | -13699.06 | -12568.49 |
| LR chi2 | 11340.27*** | 42727.61*** | 11464.79*** | 40049.40*** | 93.00*** | 2354.14*** |
| Pseudo R2 | 0.017 | 0.064 | 0.018 | 0.063 | 0.003 | 0.086 |

*p<0.05, **p<0.01, ***p<0.001. Reference group is BHASE (i.e., non-STEM fields).

For Model 1, the results show that transfer type is indeed a significant predictor of field of study at the bivariate level. In particular, students who take the NTC (OR=0.54, p<0.001), UU (OR=0.79, p<0.001), UC (OR=0.73, p<0.001), CU (OR=0.16, p<0.001), CC (OR=0.33, p<0.001), and swirler (OR=0.68, p<0.001) pathways are all significantly less likely to major in STEM fields than NTU students in Ontario. In Model 2, we can see that these results remain largely consistent, even after accounting for a range of institutional, demographic, and family factors. Specifically, NTC (OR=0.55, p<0.001), UU (OR=0.86, p<0.001), UC (OR=0.73, p<0.001), CU (OR=0.17, p<0.001), CC (OR=0.32, p<0.001), and swirler (OR=0.67, p<0.001) students are all significantly less likely to major in STEM fields than NTU students in Ontario.

To further grasp these differences, in Figure 1.3, we plot the predicted probabilities (and 95% confidence intervals) of attending a STEM program across the various PSE pathways. Overall, NTU (0.3116), UU (0.2825), UC (0.2510) and swirlers (0.2374) show the highest probabilities of entering STEM programs.

***Figure 1.3 Predicted Probabilities of STEM by Transfer Type – Ontario: PSIS-T1FF, 2009 to 2017***



In addition to transfer type, our results also show that several of our control variables are also significantly associated with students' field of study. Most notably, consistent with our descriptive statistics, Northern Ontario students are significantly less likely to major in STEM fields than their Southern Ontario counterparts (OR=0.72, p<0.001). Similarly, part-time students are less likely to major in STEM fields than full-time students (OR=0.57, p<0.001). We also find some evidence of increasing access to STEM fields over time, as students who enrolled in 2009 (OR=0.72, p<0.001), 2010 (OR=0.78, p<0.001), 2011 (OR=0.85, p<0.001), 2012 (OR=0.87, p<0.001), 2013 (OR=0.88, p<0.001), and 2014 (OR=0.95, p<0.001) are all less likely to major in STEM fields than those who did in 2015. In terms of demographic factors, older (OR=0.59, p<0.001) and female (OR=0.41, p<0.001) students are less likely to major in STEM fields than their younger and male counterparts. For family factors, students whose parental income belongs to the highest (OR=0.80, p<0.001), higher (OR=0.84, p<0.001), middle (OR=0.85, p<0.001), and lower (OR=0.88, p<0.001) category are less likely to major in STEM fields than their lowest counterparts. Moreover, students from single-parent families are less likely to major in STEM fields than those from two-parent families (OR=0.71, p<0.001), and those from larger families have a higher likelihood of majoring in STEM fields in comparison to those from smaller families (OR=1.03, p<0.001).

## The Relationship Between Transfer Pathways and Access to STEM Fields in Southern Ontario Institutions

To further grasp the regional differences uncovered above, we estimate separate models for Southern Ontario in Models 3 and 4 and separate models for Northern Ontario in Models 5 and 6 (see Table 1.2). For Southern Ontario, Model 3 shows that transfer type is a significant predictor of field of study at the bivariate level within that region, suggesting that NTC (OR=0.53, p<0.001), UU (OR=0.80, p<0.001), UC (OR=0.71, p<0.001), CU (OR=0.15, p<0.001), CC (OR=0.32, p<0.001), and swirler (OR=0.67, p<0.001) students are all significantly less likely to major in STEM fields than NTU students. In Model 4, we find that these results remain largely consistent even after accounting for a range of institutional, demographic, and family factors. Specifically, NTC (OR=0.55, p<0.001), UU (OR=0.87, p<0.001), UC (OR=0.71, p<0.001), CU (OR=0.16, p<0.001), CC (OR=0.32, p<0.001), and swirler (OR=0.66, p<0.001) students are all significantly less likely to major in STEM fields than NTU students in Southern Ontario.

In addition to transfer type, much like our province-wide analyses above, there are a number of control variables that are also significantly associated with field of study in Southern Ontario. For example, part-time students are less likely to major in STEM fields than full-time students (OR=0.59, p<0.001). We also find that students who enrolled in 2009 (OR=0.72, p<0.001), 2010 (OR=0.78, p<0.001), 2011 (OR=0.85, p<0.001), 2012 (OR=0.88, p<0.001), 2013 (OR=0.88, p<0.001), and 2014 (OR=0.94, p<0.001) are all less likely to major in STEM fields than those who did in 2015. In terms of demographic factors, older (OR=0.56, p<0.001) and female (OR=0.41, p<0.001) students are less likely to major in STEM fields than their younger and male counterparts. For family factors, we find that students whose parental income belongs to the

highest (OR=0.80, p<0.001), higher (OR=0.84, p<0.001), middle (OR=0.85, p<0.001), and lower (OR=0.88, p<0.001) category are less likely to major in STEM fields than their lowest counterparts. Moreover, students from single-parent family are less likely to major in STEM fields than those from two-parent families (OR=0.70, p<0.001), while those from larger families have a higher likelihood of majoring in STEM fields (OR=1.03, p<0.001).

## The Relationship Between Transfer Pathways and Access to STEM Fields in Northern Ontario Institutions

For Northern Ontario, consistent with the findings from Southern Ontario, Model 5 estimates reveal that transfer type is also significantly associated with field of study at the bivariate level. That is, NTC (OR=0.78, p<0.001), UU (OR=0.73, p<0.01), CU (OR=0.51, p<0.001), and CC (OR=0.65, p<0.001) students are all less likely to major in STEM fields than NTU students, while the UC and swirler pathways are not significantly different from the NTU pathway. Although their magnitude and significance are partially attenuated, these results remain largely unchanged in Model 6, even after accounting for theoretically-relevant control variables. Specifically, we find that NTC (OR=0.67, p<0.001), UU (OR=0.76, p<0.05), CU (OR=0.46, p<0.001), and CC (OR=0.53, p<0.001) students all remain significantly less likely to major in STEM fields than NTU students.

In addition to transfer type, there are a wide range of control variables that are significantly associated with field of study in Northern Ontario. For example, part-time students are less likely to major in STEM fields than full-time students (OR=0.29, p<0.001). We also find that students who enrolled in 2009 (OR=0.72, p<0.001), 2010 (OR=0.75, p<0.001), 2011 (OR=0.80, p<0.001), and 2012 (OR=0.86, p<0.01) are all less likely to major in STEM fields than those who did in 2015. In terms of demographic factors, older students are more likely to major in STEM fields than younger students (OR=1.14, p<0.001), although female students are less likely to do so than male students (OR=0.28, p<0.001). Interestingly, parental income and family size are not significantly associated with field of study, yet we observe that students with single-parent family are less likely to major in STEM fields than their two-parent counterparts (OR=0.89, p<0.05). The predicted probabilities and 95% confidence intervals for all covariates in the models presented in Table 1.2 are displayed in Table 1.3.

***Table 1.3 Predicted Probabilities from Binary Logistic Regressions Predicting Majoring in STEM Fields, PSIS-T1FF 2009-2017.***

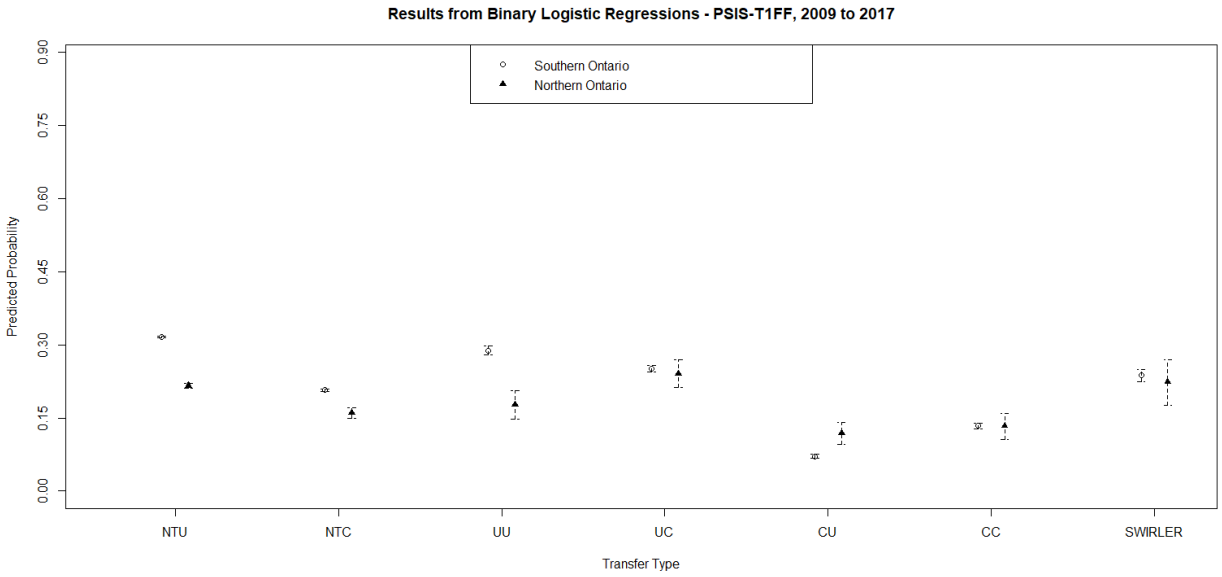
| | Overall | | | South | | | North | | |
|---|---|---|---|---|---|---|---|---|---|
| | Margins | 95% CI | | Margins | 95% CI | | Margins | 95% CI | |
| **Transfer type** | | | | | | | | | |
| NTU | 0.3116 | 0.3103 | 0.313 | 0.3163 | 0.3148 | 0.3177 | 0.2163 | 0.2108 | 0.2218 |
| NTC | 0.2045 | 0.2019 | 0.2071 | 0.2074 | 0.2047 | 0.2101 | 0.1602 | 0.1499 | 0.1704 |
| UU | 0.2825 | 0.2737 | 0.2912 | 0.2883 | 0.2792 | 0.2973 | 0.1773 | 0.1478 | 0.2069 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| UC | 0.251 | 0.244 | 0.2581 | 0.251 | 0.2437 | 0.2583 | 0.2409 | 0.2129 | 0.2689 |
| CU | 0.0745 | 0.07 | 0.079 | 0.0714 | 0.0669 | 0.076 | 0.119 | 0.0968 | 0.1412 |
| CC | 0.1337 | 0.1272 | 0.1401 | 0.1336 | 0.1269 | 0.1402 | 0.1332 | 0.1066 | 0.1597 |
| Swirlers | 0.2374 | 0.2252 | 0.2496 | 0.2375 | 0.2249 | 0.2502 | 0.2236 | 0.1767 | 0.2704 |
| **Location of school** | | | | | | | | | |
| South | 0.2852 | 0.284 | 0.2864 | | | | | | |
| North | 0.2278 | 0.2227 | 0.2328 | | | | | | |
| **Registration status** | | | | | | | | | |
| Full-time | 0.2873 | 0.2861 | 0.2885 | 0.291 | 0.2898 | 0.2922 | 0.2169 | 0.2118 | 0.2219 |
| Part-time | 0.1914 | 0.1866 | 0.1962 | 0.2001 | 0.195 | 0.2052 | 0.0784 | 0.0683 | 0.0885 |
| **Year of enrolment** | | | | | | | | | |
| 2015 | 0.312 | 0.3089 | 0.3151 | 0.3163 | 0.3131 | 0.3195 | 0.223 | 0.2102 | 0.2357 |
| 2014 | 0.3017 | 0.2986 | 0.3047 | 0.3049 | 0.3017 | 0.3081 | 0.2339 | 0.2212 | 0.2466 |
| 2013 | 0.287 | 0.284 | 0.29 | 0.2905 | 0.2874 | 0.2936 | 0.2148 | 0.2028 | 0.2268 |
| 2012 | 0.286 | 0.2829 | 0.289 | 0.2904 | 0.2872 | 0.2935 | 0.1999 | 0.1876 | 0.2121 |
| 2011 | 0.2798 | 0.2768 | 0.2828 | 0.2846 | 0.2814 | 0.2877 | 0.1889 | 0.1768 | 0.201 |
| 2010 | 0.2643 | 0.2613 | 0.2673 | 0.2688 | 0.2657 | 0.2719 | 0.18 | 0.1685 | 0.1914 |
| 2009 | 0.251 | 0.2482 | 0.2537 | 0.2551 | 0.2522 | 0.258 | 0.1751 | 0.1638 | 0.1864 |
| **Age** | | | | | | | | | |
| 21≤ | 0.2962 | 0.2949 | 0.2975 | 0.301 | 0.2997 | 0.3023 | 0.1974 | 0.192 | 0.2027 |
| 22≥ | 0.2034 | 0.2005 | 0.2063 | 0.2005 | 0.1975 | 0.2035 | 0.2167 | 0.2065 | 0.2268 |
| **Sex** | | | | | | | | | |
| Men | 0.3785 | 0.3766 | 0.3803 | 0.3812 | 0.3794 | 0.3831 | 0.3237 | 0.3149 | 0.3324 |
| Women | 0.2034 | 0.202 | 0.2048 | 0.2079 | 0.2064 | 0.2093 | 0.1215 | 0.1165 | 0.1265 |
| **Parental income** | | | | | | | | | |
| Lowest | 0.3094 | 0.3066 | 0.3122 | 0.3144 | 0.3115 | 0.3172 | 0.1981 | 0.1852 | 0.211 |
| Lower | 0.2847 | 0.2821 | 0.2873 | 0.2893 | 0.2866 | 0.292 | 0.1904 | 0.1797 | 0.2011 |
| Middle | 0.2782 | 0.2757 | 0.2807 | 0.2825 | 0.2799 | 0.2852 | 0.1984 | 0.189 | 0.2077 |
| Higher | 0.2763 | 0.2738 | 0.2788 | 0.2799 | 0.2773 | 0.2825 | 0.2094 | 0.2001 | 0.2187 |
| Highest | 0.268 | 0.2655 | 0.2704 | 0.271 | 0.2685 | 0.2735 | 0.2118 | 0.2005 | 0.2232 |
| **Family composition** | | | | | | | | | |
| Couple | 0.2898 | 0.2886 | 0.2911 | 0.2941 | 0.2929 | 0.2954 | 0.2045 | 0.1994 | 0.2095 |
| Lone | 0.2288 | 0.2255 | 0.2322 | 0.231 | 0.2276 | 0.2345 | 0.1873 | 0.1738 | 0.2008 |
| **Family size** | | | | | | | | | |
| ≤3 | 0.2785 | 0.2763 | 0.2808 | 0.2828 | 0.2805 | 0.2851 | 0.1965 | 0.188 | 0.2049 |
| ≥4 | 0.2843 | 0.2829 | 0.2858 | 0.2884 | 0.2869 | 0.2898 | 0.2051 | 0.1992 | 0.2111 |

## Comparing the Relative Differences in STEM Uptake Across Northern and Southern Ontario

To get a visual sense of the regional and pathway differences, we plot the predicted probabilities of STEM attendance across transfer type and across regions in Figure 1.4. For Southern Ontario, the relative ordering of the pathways is quite similar to the Ontario-wide scenario described above in Figure 1.3. NTU shows the highest probability (0.3163), followed by UU (0.2883), UC (0.2510), swirlers (0.2375), NTC (0.2074), CC (0.1336), and CU (0.714). In Northern Ontario, however, our plot reveals that the ordering is slightly different than what we observe in Southern Ontario (and in Ontario as a whole). In the north, the UC pathway (25.10) shows the highest probability of entering STEM, followed by swirlers (0.2236), NTU (0.2163), UU (0.1773), NTC (0.1602), CC (0.1332) and CU (0.1190).

***Figure 1.4 Predicted Probabilities of STEM by Transfer Type and Region: PSIS-T1FF, 2009 to 2017***



## Part 2: University Graduation and Timely Completion

A second key objective of this study is to assess the extent to which student mobility impacts postsecondary completion and the length of time it takes to do so. In the existing literature, transfer student graduation rates have varied widely. Rates have varied across time periods, postsecondary institutions, higher education sectors, and the types of programs and degrees students transfer to and from, typically ranging from about 40% to 70% from the 1990s through to the late-2010s (Pretlow et al., 2020; Xu et al., 2018; Johnson & King, 2017; Kopko & Crosta, 2016; Monaghan & Attewell, 2015; Melguizo et al., 2011; Radford et al., 2010; Peter & Forrest Cataldi, 2005; Hoachlander et al., 2003; Berkner et al., 2002; Cuccaro-Alamin, 1997; McCormick, 1997).

In comparison to non-transfer or direct-entry students, most researchers have found graduation rates tend to be lower among transfer students at both colleges and universities when compared to direct-entry students (Davies & Pizarro Milian, 2020; Walters et al., 2020; Monaghan & Attewell, 2015; Melguizo et al., 2011; Radford et al., 2010; Peter & Forrest Cataldi, 2005; Hoachlander et al., 2003; Berkner et al., 2002; Cuccaro-Alamin, 1997; McCormick, 1997). Yet, a smaller handful of studies have reached the opposite conclusion, where transfer students outperform non-transfer students and demonstrate higher levels of completion (Pretlow et al., 2020; Johnson & King, 2017).

When looking specifically among bachelor's degree graduates, international studies (largely from the United States) show similar degrees of varied outcomes, as transfer students typically range from 45% to 65% in their completion of a bachelor's degree (Chen et al., 2019; Melguizo et al., 2011; Skomsvold et al., 2011; Wang, 2009; Peter & Forrest Cataldi, 2005; Koker & Hendel, 2003; Livingston & Wirt, 2003; Cuccaro-Alamin, 1997). In general, non-transfer students typically complete their bachelor's degrees at a slightly higher and faster rate compared to transfer students (Chen et al., 2019; Skomsvold et al., 2011; Li, 2010; Radford et al., 2010; Berkner et al., 2002; McCormick, 1997). However, prior research in the United States does reveal a few exceptions to the rule, where transfer students graduate with their bachelor's degrees at both higher and faster rates than their non-transfer student counterparts (Nutting, 2011; Carroll, 1989).

Part of these differences in findings are attributable to the width of the timely completion window that researchers employ to allow bachelor's students time to complete their programs. Put differently, studies vary in the length of time that is given to allow students enrolled to complete their degrees. Overall, the most common window to capture university completion is six years. However, some studies capture bachelor's degree timely completion rates as low as under four years, while others follow their trajectories for as many as nine years (Zhu, 2021; Lin et al., 2020; Pretlow et al., 2020; Chen et al., 2019; Saw, 2019; Xu et al., 2018; Zarifa et al., 2018; Melguizo et al., 2011; Nutting, 2011; Skomsvold et al., 2011; Li, 2010; Peter & Forrest Cataldi, 2005; Koker & Hendel, 2003; Livingston & Wirt, 2003; Cuccaro-Alamin, 1997). For instance,

among a sample of over 10,000 students from the Beginning Postsecondary Longitudinal Study (1996-2001) from the United States, Hoachlander et al. (2003: 28) reported about 35% of CU transfers had earned a bachelor's degree within six years of entry. Moreover, Peter & Forrest Cataldi (2005) used the same sample of students in the Beginning Postsecondary Longitudinal Study, but employed a shorter time frame for completion. Not surprisingly, they found slightly lower graduation rates, with 10% of students having earned a bachelor's degree in four years or less, and 27% having earned a bachelor's degree in more than four years (Peter & Forrest Cataldi, 2005: 20). Such differences in measurement and analysis make it challenging for making timely completion and graduation rate comparisons across different samples and subsamples of transfer and non-transfer students.

Another key factor that contributes to the inconsistencies in the existing literature is the type of transfer pathway under investigation. For university to university pathways, the graduation rate tends to be higher. For example, drawing on about 11,700 students from the Beginning Postsecondary Longitudinal study of 1990-1994, McCormick (1997: 26, 39) reported that only 12% of university to college transfer students earned a bachelor's degree compared to about 43% of university to university students who did the same. Similarly, Pretlow et al. (2020) also reported significant disparities across transfer pathways. Of the students who followed the university to college transfer pathway, 25% graduated with a bachelor's degree, which was higher than both the certificate and associate degree graduation rates (7% and 13%, respectively; Pretlow et al., 2020: 16).

Despite differing higher education structures, Canadian researchers are reaching similar conclusions as their international counterparts. Graduation rates in Ontario universities tend to vary within the sector as well as across the regions. The most recent data available for all Ontario universities is from the 2011-2012 academic year cohort who graduated by 2018 (see CUDO Key Performance Indicators on cudo.ouac.on.ca for previous graduation rates). Across the entire province, approximately 75% of university students from the 2011 cohort graduated by 2018 (Council of Ontario Universities, 2021). Among students in Northern and Southern Ontario, graduation rates differed for university students. Among universities in Northern Ontario with available graduation rates, approximately 79% of students across all programs graduated within six years of entering their program (Council of Ontario Universities, 2021).[1] Among thirteen universities in Southern Ontario, approximately 75% of students across all programs graduated within six years of entering their program (Council of Ontario Universities, 2021).

Many researchers have used various institutional and administrative data from Ontario and Canada to analyze bachelor's degree graduation rates. Research on the graduation rates of transfer students across the mid to late 2000s show varying graduation rates as well as a mixture of evidence for both lower and higher graduation rates among transfer and direct-entry students (Davies & Pizarro Milian, 2020; Smith et al., 2016; Martinello & Stewart, 2015; Drewes et al.,

[1] This figure includes only Lakehead University and Nipissing University. At the time of our search, Algoma University and Laurentian University rates were not posted.

2012; Bell, 1998). For instance, both Bell (1998) and Smith et al. (2016) analyzed longitudinal data to determine timely completion of CU students earning bachelor's degrees at York University. Bell's (1998: 32) findings suggest that close to half (46%) of CU students graduate early or on time compared to 62% of direct-entry student. CU students in Smith's (2016: 23) study had similar rates, with just over half (56%) completing their 3-year degrees and 69% completing their 4-year degrees early or on time. Findings of both studies suggest that CU transfer students entering York may have slightly lower timely completion rates compared to direct-entry students, but over half of CU transfer students complete their degrees on time (Smith et al., 2016; Bell, 1998).

At Brock University, Martinello & Stewart (2015: 30) found 23% of CU transfer students graduated within three years or less, and 46% graduated in four years, compared to 4% and 36% for direct-entry students, respectively. In fact, CU transfer students at Brock University had a complete graduation rate of 69%, substantially higher than direct-entry students' 40% graduation rate (Martinello & Stewart, 2015: 30). At Trent University, Drewes et al., (2012) found varying rates across three separate intake cohorts (Drewes et al., 2012). The 2007 CU cohort had a graduation rate of 51%; the 2008 CU cohort saw a slight decrease in graduation rate (32%); and the 2009 CU cohort saw a further decrease in graduation rate (17%; Drewes et al., 2012: 13).

Most recently, Davies & Pizarro Milian (2020) linked several cohorts of Toronto District School Board high school administrative data from the 2000's to University of Toronto data up to 2018/2019. One of their tasks was to compare graduation rates across direct-entry and transfer groups. Their window for graduation roughly spanned about 15 or so years across multiple cohorts. Ultimately, when looking at the raw percentages, their study found 68.5% of direct-entry students completed their degrees compared to only 52.7% of transfer students (Davies & Pizarro Milian, 2020: 3). Breaking down the findings further, the authors found that 40.7% of college to university transfers, 56.9% of those from another Ontario university or another Canadian university, and 53.1% from another international university graduated. Davies & Pizarro Milian (2020) found that by and large, these differences remained significant, even when taking into consideration a battery of socio-demographic and high school academic differences.

While the studies above shed light on several institutions in Southern Ontario, it remains unclear how these relationships might look across Ontario as a whole, and how they might differ for universities in Northern Ontario.

## Transfer Pathways, University Graduation Rates, and Timely Completion in Ontario Institutions

In order to understand the situation surrounding transfer pathways and timely university completion in Ontario, we now turn to our analyses with the PSIS-T1FF. As in Part 1 of this report, we first examine the situation across the entire province before turning to our region-specific analyses.

To get an initial sense of how long it's taking students in Ontario to complete their degrees, we begin by assessing the univariate findings for our university graduation subsample (for further details, see Appendix A) are shown in Table 2.1. Given our focus on university completion and transfer students, we limit our discussion to hone in on only those two key variables here.[2] First, in terms of university completion, as shown in Figure 2.1, we can see that 32.9% of students in Ontario do not graduate from university within six years, while 36.8% and 30.3% do so within four years and six years, respectively (67.1% combined). It is noteworthy that a greater proportion of northern students (40.3%) do not graduate from university within six years in comparison to southern students (32.5%). In addition, while the proportion of students who do graduate from university within four years is similar between northern (35.2%) and southern students (36.9%), the prevalence of graduating from university within six years is much lower among northern students (24.4%) than southern students (30.6%). Second, according to Figure 2.2, there is a very small proportion of transfer students, accounting for only 4.5% of university students in Ontario. However, when we look at its regional variation, the relative proportion of transfer students is considerably larger among northern universities (10.2%) than it is among southern universities (4.2%).

***Table 2.1 University Completion Subsample Characteristics by Region of Institution, PSIS-T1FF 2009-2017.***

| | Overall | South | North |
|---|---|---|---|
| **University completion** | | | |
| No completion | 32.9 | 32.5 | 40.3 |
| Four-year completion | 36.8 | 36.9 | 35.2 |
| Six-year completion | 30.3 | 30.6 | 24.4 |
| **Ever transferred** | | | |
| No | 95.5 | 95.8 | 89.8 |
| Yes | 4.5 | 4.2 | 10.2 |
| **Location of school** | | | |
| South | 95.6 | | |
| North | 4.4 | | |
| **Field of study** | | | |
| BHASE | 66.0 | 65.5 | 77.8 |
| STEM | 34.0 | 34.5 | 22.2 |
| **Age of respondents** | | | |
| 21≤ | 88.3 | 88.4 | 85.2 |
| 22≥ | 11.7 | 11.6 | 14.8 |
| **Sex** | | | |
| Men | 44.4 | 44.9 | 34.1 |
| Women | 55.6 | 55.1 | 65.9 |
| **Family composition** | | | |
| Couple | 89.4 | 89.5 | 86.9 |
| Lone | 10.6 | 10.5 | 13.1 |
| **Family size** | | | |
| ≤3 | 31.4 | 31.4 | 31.8 |

[2] For other institutional, demographic, and family characteristics across Ontario, Southern Ontario, and Northern Ontario, please see Table 2.1.

| | | | |
|---|---|---|---|
| ≥4 | 68.6 | 68.6 | 68.2 |
| **Parental income** | | | |
| Lowest | 20.0 | 20.0 | 13.0 |
| Lower | 20.0 | 20.0 | 20.3 |
| Middle | 20.0 | 20.0 | 24.9 |
| Higher | 20.0 | 20.0 | 25.4 |
| Highest | 20.0 | 20.0 | 16.4 |
| Total | 39800 | 38050 | 1750 |

*Figure 2.1 Distribution of University Completion Across Ontario Regions: PSIS-T1FF, 2009 To 2017*

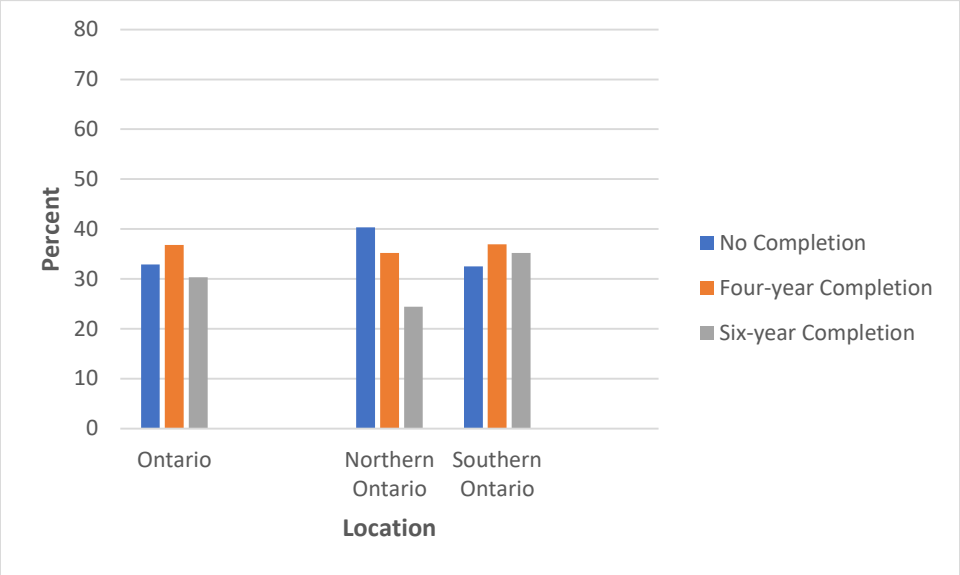
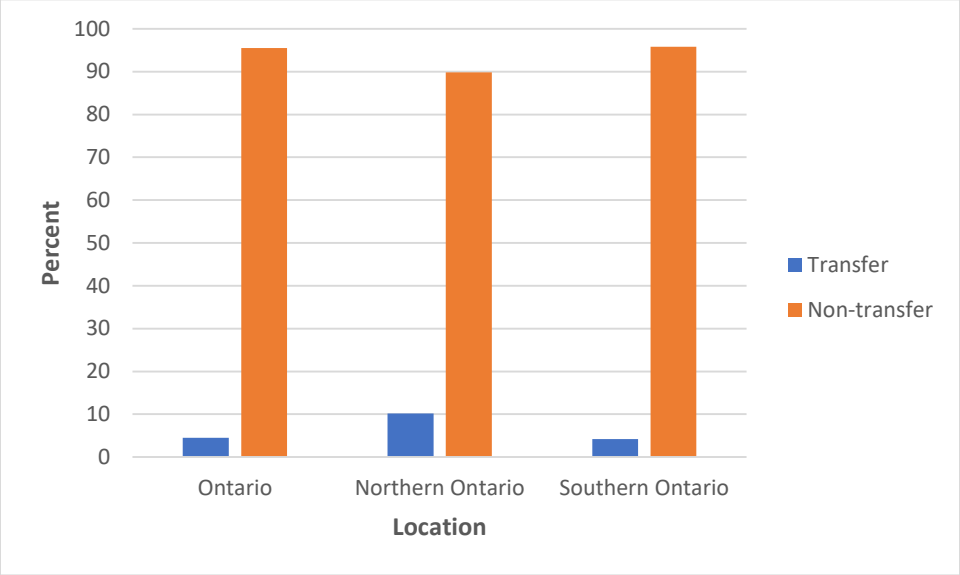


*Figure 2.2 Distribution of Transfer Status Across Ontario Regions: PSIS-T1FF, 2009 To 2017*




## The Bivariate Relationships Between Transfer Pathways and University Graduation and Timely Completion in Ontario Institutions

To understand the extent to which transfer pathways influence one's likelihood of completing university in a timely manner, we now turn to a series of binary logistic regression models. In Table 2.2, the findings from our unadjusted bivariate regression analyses are shown. Model 1 includes all Ontario institutions, and Models 2 and 3 separate out southern and northern institutions respectively.

*Table 2.2 Unadjusted Multinomial Logistic Regressions Predicting University Completion by Region of Institution, PSIS-T1FF 2009-2017.*

| | Overall | | South | | North | |
|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 3 | |
| | Four-year | Six-year | Four-year | Six-year | Four-year | Six-year |
| | RRR | RRR | RRR | RRR | RRR | RRR |
| **Have ever transferred** | | | | | | |
| No | - | - | - | - | - | - |
| Yes | 0.34*** | 0.90* | 0.36*** | 0.90^ | 0.23*** | 1.19 |
| LR Chi2 | 328.71*** | | 273.31*** | | 59.85*** | |
| Pseudo R2 | 0.0038 | | 0.0033 | | 0.0158 | |
| Log likelihood | -43454.32 | | -41558.432 | | -1865.5891 | |

^p<0.1, *p<0.05, **p<0.01, ***p<0.001; Reference group for the dependent variable is *no completion*. Relative risk ratios (RRR) are presented.

For all Ontario universities, the results for Model 1 suggest that transfer students are significantly less likely to graduate from university within four years (RRR=0.34, p<0.001) and six years (RRR=0.90, p<0.05) in comparison to non-transfer students in Ontario.[3] In Model 2, among Southern Ontario universities, we find similar results, as transfer students are less likely to graduate from university within four years (RRR=0.36, p<0.001) and six years (RRR=0.90, p<0.1) in comparison with non-transfer students. In Model 3, for Northern Ontario, we can see that transfer students are less likely to graduate from university within four years than non-transfer students (RRR=0.23, p<0.001), but unlike the Ontario-wide and Southern Ontario analyses above, there is no statistical significance for six-year completion. In other words, there is no significant difference in the likelihood of Northern Ontario transfer students completing their degrees in six years versus not completing their degrees at all.

## The Multivariate Relationships Between Transfer Pathways and University Graduation and Timely Completion in Ontario Institutions

In order to examine the extent to which these relationships hold, when considering all other relevant factors at the same time, we now turn to adjusted binary logistic regression models. Table 2.3 shows the findings from these multivariate analyses. Once again, in Model 1, we include students at all Ontario universities, and in Models 2 and 3, we include only Southern and Northern Ontario university students respectively.

***Table 2.3 Adjusted Multinomial Logistic Regressions Predicting University Completion by Region of Institution, PSIS-T1FF 2009-2017.***

| | Overall | | South | | North | |
|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 3 | |
| | Four-year | Six-year | Four-year | Six-year | Four-year | Six-year |
| | RRR | RRR | RRR | RRR | RRR | RRR |
| **Transfer status** | | | | | | |
| Non-transfer | - | - | - | - | - | - |
| Transfer | 0.31*** | 0.98 | 0.32*** | 0.96 | 0.21*** | 1.21 |
| **Location of school** | | | | | | |
| South | - | - | | | | |
| North | 0.71*** | 0.67*** | | | | |
| **Field of study** | | | | | | |
| BHASE | - | - | - | - | - | - |
| STEM | 0.58*** | 1.22*** | 0.57*** | 1.23*** | 0.68** | 0.91 |
| **Gender** | | | | | | |
| Men | - | - | - | - | - | - |
| Women | 1.27*** | 0.87*** | 1.27*** | 0.87*** | 1.26^ | 0.79^ |
| **Age of respondents** | | | | | | |
| 21≤ | - | - | - | - | - | - |
| 22≥ | 3.34*** | 0.59*** | 3.39*** | 0.59*** | 2.72*** | 0.59* |

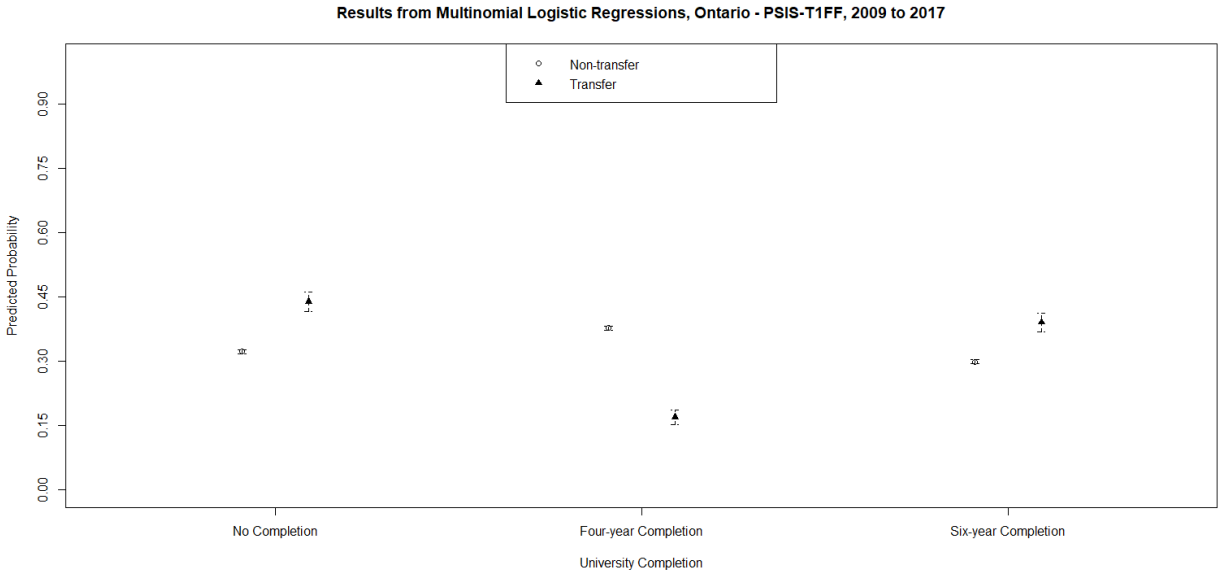
[3] RRR refers to the relative risk ratio (i.e., exponentiated multinomial logit coefficients). RRRs indicate how the risk of the outcome for one group compares to the risk of falling in the outcome's reference group. An RRR > 1 indicates that the comparison outcome is more likely. If the RRR < 1, then the outcome is less likely to occur than the reference category.

| | | | | | | |
|---|---|---|---|---|---|---|
| **Family composition** | | | | | | |
| Couple | - | - | - | - | - | - |
| Lone | 0.87*** | 0.86*** | 0.88** | 0.86*** | 0.77 | 0.83 |
| **Family size** | | | | | | |
| ≤3 | - | - | - | - | - | - |
| ≥4 | 0.99 | 1.07* | 1.00 | 1.07* | 0.90 | 1.06 |
| **Parental income** | | | | | | |
| Lowest | - | - | - | - | - | - |
| Lower | 1.07 | 1.02 | 1.05 | 1.01 | 1.44^ | 1.04 |
| Middle | 1.22*** | 1.02 | 1.22*** | 1.03 | 1.32 | 0.79 |
| Higher | 1.30*** | 1.01 | 1.29*** | 1.02 | 1.46^ | 0.79 |
| Highest | 1.41*** | 0.95 | 1.43*** | 0.96 | 1.06 | 0.82 |
| LR Chi2 | 3855.25*** | | 3664.47*** | | 168.24*** | |
| Pseudo R2 | 0.0442 | | 0.0439 | | 0.0444 | |
| Log likelihood | -41691.048 | | -39862.852 | | -1811.3917 | |

^p<0.1, *p<0.05, **p<0.01, ***p<0.001; Reference group for the dependent variable is *no completion*. Relative risk ratios (RRR) are presented.

In a general sense, the results in Model 1 indicate that institutional, demographic, and family factors are all significantly associated with university completion in Ontario. For transfer status, our results look quite similar to the unadjusted models above, as transfer students remain significantly less likely to graduate from university within four years than non-transfer students (RRR=0.31, p<0.001). However, when adding the effects of these other factors to the mix, there is no longer a significance difference on six-year completion between transfer and non-transfer students. To further grasp the differences across transfer and non-transfer students, Figure 2.3 displays the predicted probabilities of university completion across transfer status. Transfer students (0.4391 vs. 0.3231) show significantly higher probabilities of not completing their degrees as well as taking six years to complete their degrees (0.3909 vs. 0.2990), while non-transfer students are over twice as likely as transfer students to complete their degrees in four years (0.3779 vs. 0.1701).

*Figure 2.3 Predicted Probabilities of University Completion by Transfer Type – Ontario: PSIS-T1FF, 2009 to 2017*




In Model 1, we also include a covariate that allows us to capture northern and southern differences. Interestingly, the results suggest that northern students are less likely to graduate from university within four years (RRR=0.71, p<0.001) and six years (RRR=0.67, p<0.001) than their southern counterparts. In addition to regional differences, we also find that STEM students are less likely to graduate from university within four years (RRR=0.58, p<0.001), but are more likely to do so within six years (RRR=1.22, p<0.001) in comparison with their BHASE counterparts. For demographic factors, female students are more likely to graduate from university within four years (RRR=1.27, p<0.001), but are less likely to do so within six years (RRR=0.87, p<0.001) than male students. Similarly, older students are more likely to graduate from university within four years (RRR=3.34, p<0.001), but are less likely to do so within six years (RRR=0.59, p<0.001) than younger students. For family factors, we find that students with single parent are less likely to graduate from university within four years (RRR=0.87, p<0.001) and six years (RRR=0.86, p<0.001) than their couple counterparts. In addition, students from larger families are more likely to graduate from university within six years than those from smaller families (RRR=1.07, p<0.05). Finally, parental income is only significantly associated with four-year completion and not six-year completion, suggesting that students whose parental income belongs to the highest (RRR=1.41, p<0.001), higher (RRR=1.30, p<0.001), and middle (RRR=1.22, p<0.001) categories are all more likely to graduate from university within four years than their lowest counterparts. The predicted probabilities and 95% confidence intervals for all covariates in the models are displayed in Table 2.4.

*Table 2.4 Predicted Probabilities of University Completion for Ontario, PSIS-T1FF 2009-2017.*

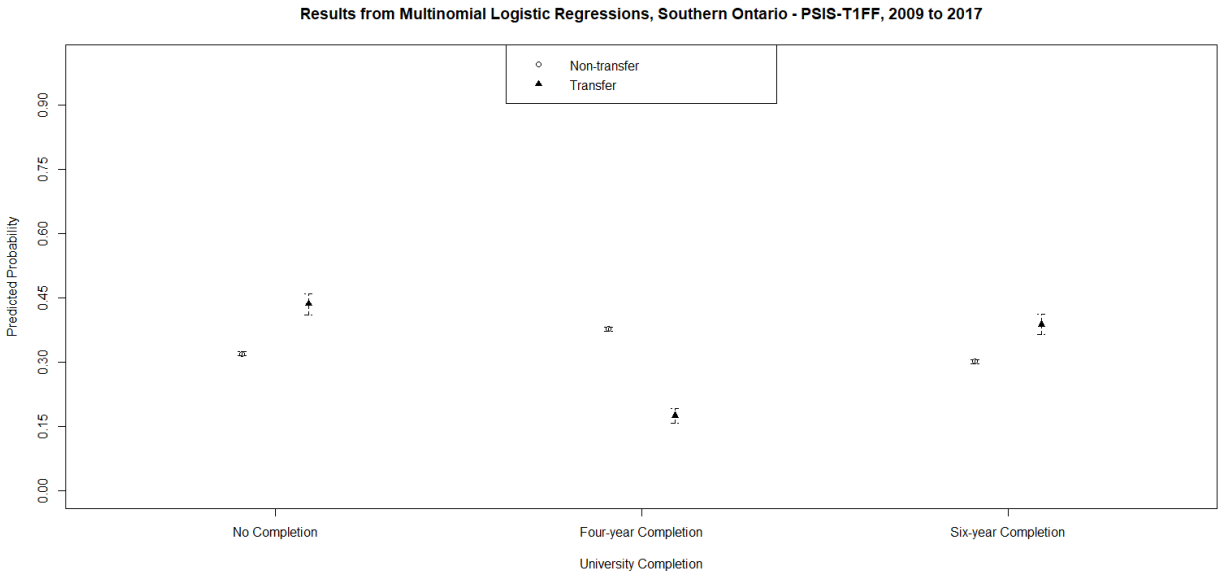
| | No Completion | | | Four-year Completion | | | Six-year Completion | | |
|---|---|---|---|---|---|---|---|---|---|
| | Margins | 95% CI | | Margins | 95% CI | | Margins | 95% CI | |
| **Transfer status** | | | | | | | | | |
| Non-transfer | 0.3231 | 0.3184 | 0.3278 | 0.3779 | 0.3732 | 0.3826 | 0.299 | 0.2945 | 0.3035 |
| Transfer | 0.4391 | 0.416 | 0.4622 | 0.1701 | 0.1535 | 0.1866 | 0.3909 | 0.3682 | 0.4135 |
| **Location of school** | | | | | | | | | |
| South | 0.3249 | 0.3202 | 0.3296 | 0.37 | 0.3653 | 0.3746 | 0.3051 | 0.3006 | 0.3097 |
| North | 0.4093 | 0.3863 | 0.4323 | 0.3334 | 0.3124 | 0.3544 | 0.2574 | 0.2367 | 0.278 |
| **Field of study** | | | | | | | | | |
| BHASE | 0.3163 | 0.3107 | 0.3219 | 0.4141 | 0.4083 | 0.42 | 0.2696 | 0.2642 | 0.275 |
| STEM | 0.3553 | 0.3471 | 0.3635 | 0.2788 | 0.2713 | 0.2863 | 0.3659 | 0.3578 | 0.3739 |
| **Gender** | | | | | | | | | |
| Men | 0.3358 | 0.3289 | 0.3428 | 0.3323 | 0.3255 | 0.3391 | 0.3318 | 0.325 | 0.3387 |
| Women | 0.3238 | 0.3176 | 0.33 | 0.3963 | 0.3901 | 0.4025 | 0.2799 | 0.274 | 0.2858 |
| **Age of respondents** | | | | | | | | | |
| 21≤ | 0.3441 | 0.3391 | 0.349 | 0.3298 | 0.3249 | 0.3346 | 0.3262 | 0.3213 | 0.3311 |
| 22≥ | 0.2176 | 0.2054 | 0.2297 | 0.6581 | 0.6442 | 0.672 | 0.1243 | 0.1145 | 0.1342 |
| **Family composition** | | | | | | | | | |
| Couple | 0.3251 | 0.3202 | 0.33 | 0.3699 | 0.365 | 0.3747 | 0.3051 | 0.3003 | 0.3098 |
| Lone | 0.3577 | 0.342 | 0.3733 | 0.3552 | 0.3401 | 0.3703 | 0.2871 | 0.2724 | 0.3019 |
| **Family size** | | | | | | | | | |
| ≤3 | 0.3326 | 0.3236 | 0.3416 | 0.3739 | 0.365 | 0.3828 | 0.2936 | 0.2848 | 0.3023 |
| ≥4 | 0.327 | 0.3212 | 0.3327 | 0.3659 | 0.3602 | 0.3716 | 0.3072 | 0.3017 | 0.3126 |
| **Parental income** | | | | | | | | | |
| Lowest | 0.3479 | 0.3371 | 0.3588 | 0.3318 | 0.3215 | 0.342 | 0.3203 | 0.3097 | 0.331 |
| Lower | 0.3391 | 0.3287 | 0.3495 | 0.3433 | 0.3333 | 0.3533 | 0.3176 | 0.3075 | 0.3277 |
| Middle | 0.3234 | 0.3132 | 0.3336 | 0.3713 | 0.3612 | 0.3815 | 0.3052 | 0.2954 | 0.3151 |
| Higher | 0.3177 | 0.3075 | 0.3279 | 0.385 | 0.3747 | 0.3953 | 0.2973 | 0.2874 | 0.3071 |
| Highest | 0.3135 | 0.3033 | 0.3237 | 0.4097 | 0.3993 | 0.4201 | 0.2767 | 0.2672 | 0.2863 |

## The Multivariate Relationships Between Transfer Pathways and University Graduation and Timely Completion in Southern Ontario Institutions

To drill down further into the regional differences uncovered above, we estimate Models 2 and 3 on each region separately. For Model 2, we include only those students who were enrolled at Southern Ontario universities. Overall, the results are quite similar to the province as a whole, as institutional, demographic, and family factors are significantly associated with university completion. Most notably, we find that transfer students are less likely to graduate from university within four years (RRR=0.32, p<0.001), and once again, there is no significant difference for six-year completion between transfer and non-transfer students.

In Figure 2.4, the predicted probabilities for completing university for students in Southern Ontario institutions are shown. Likewise, the picture here looks quite similar to that of the entire province of Ontario, as transfer students show higher probabilities of taking six years to complete their degrees (0.3882 vs. 0.3023) as well as not complete their degrees (0.4360 vs. 0.3199), and are over half as likely to complete their degrees in four years (0.3778 vs. 0.1758).

***Figure 2.4 Predicted Probabilities of University Completion by Transfer Type – Southern Ontario: PSIS-T1FF, 2009 to 2017***




Beyond the transfer relationships, we also find considerable similarities across all other covariates in the models. For instance, STEM students are less likely to graduate from university within four years (RRR=0.57, p<0.001), but are more likely to do so within six years (RRR=1.23, p<0.001) in comparison with their BHASE counterparts. For demographic factors, female students are more likely to graduate from university within four years (RRR=1.27, p<0.001), but

are less likely to do so within six years (RRR=0.87, p<0.001) than male students. Similarly, older students are more likely to graduate from university within four years (RRR=3.39, p<0.001), but are less likely to do so within six years (RRR=0.59, p<0.001) than younger students. For family factors, we find that students from single parent families are less likely to graduate from university within four years (RRR=0.88, p<0.01) and six years (RRR=0.86, p<0.01) than their those from two-parent families. In addition, students from larger families are more likely to graduate from university within six years than those from smaller families (RRR=1.07, p<0.05). Finally, parental income is only significantly associated with four-year completion and not six-year completion, suggesting that students whose parental income belongs to the highest (RRR=1.43, p<0.001), higher (RRR=1.29, p<0.001), and middle (RRR=1.22, p<0.001) categories are all more likely to graduate from university within four years than their lowest counterparts. The predicted probabilities and 95% confidence intervals for all covariates in the models are displayed in Table 2.5.

***Table 2.5 Predicted Probabilities of University Completion for Southern Ontario, PSIS-T1FF 2009-2017.***

| | No Completion | | | Four-year Completion | | | Six-year Completion | | |
|---|---|---|---|---|---|---|---|---|---|
| | Margins | 95% CI | | Margins | 95% CI | | Margins | 95% CI | |
| **Transfer status** | | | | | | | | | |
| Non-transfer | 0.3199 | 0.3152 | 0.3247 | 0.3778 | 0.3731 | 0.3826 | 0.3023 | 0.2976 | 0.3069 |
| Transfer | 0.436 | 0.4116 | 0.4604 | 0.1758 | 0.1582 | 0.1934 | 0.3882 | 0.3645 | 0.4119 |
| **Field of study** | | | | | | | | | |
| BHASE | 0.3129 | 0.3071 | 0.3187 | 0.4162 | 0.4102 | 0.4222 | 0.2709 | 0.2653 | 0.2764 |
| STEM | 0.3509 | 0.3426 | 0.3591 | 0.2787 | 0.2711 | 0.2864 | 0.3704 | 0.3622 | 0.3786 |
| **Gender** | | | | | | | | | |
| Men | 0.3324 | 0.3253 | 0.3395 | 0.3333 | 0.3264 | 0.3402 | 0.3343 | 0.3273 | 0.3412 |
| Women | 0.3201 | 0.3138 | 0.3264 | 0.3972 | 0.3909 | 0.4036 | 0.2827 | 0.2766 | 0.2888 |
| **Age of respondents** | | | | | | | | | |
| 21≤ | 0.3404 | 0.3353 | 0.3455 | 0.3305 | 0.3256 | 0.3355 | 0.3291 | 0.3241 | 0.3341 |
| 22≥ | 0.2133 | 0.2008 | 0.2257 | 0.6624 | 0.6481 | 0.6767 | 0.1244 | 0.1142 | 0.1345 |
| **Family composition** | | | | | | | | | |
| Couple | 0.3217 | 0.3167 | 0.3267 | 0.3704 | 0.3655 | 0.3754 | 0.3079 | 0.3031 | 0.3128 |
| Lone | 0.3532 | 0.3371 | 0.3692 | 0.3573 | 0.3418 | 0.3728 | 0.2895 | 0.2744 | 0.3047 |
| **Family size** | | | | | | | | | |
| ≤3 | 0.3297 | 0.3205 | 0.3389 | 0.374 | 0.3649 | 0.3831 | 0.2964 | 0.2874 | 0.3054 |
| ≥4 | 0.3231 | 0.3173 | 0.329 | 0.3669 | 0.3611 | 0.3727 | 0.31 | 0.3044 | 0.3156 |
| **Parental income** | | | | | | | | | |

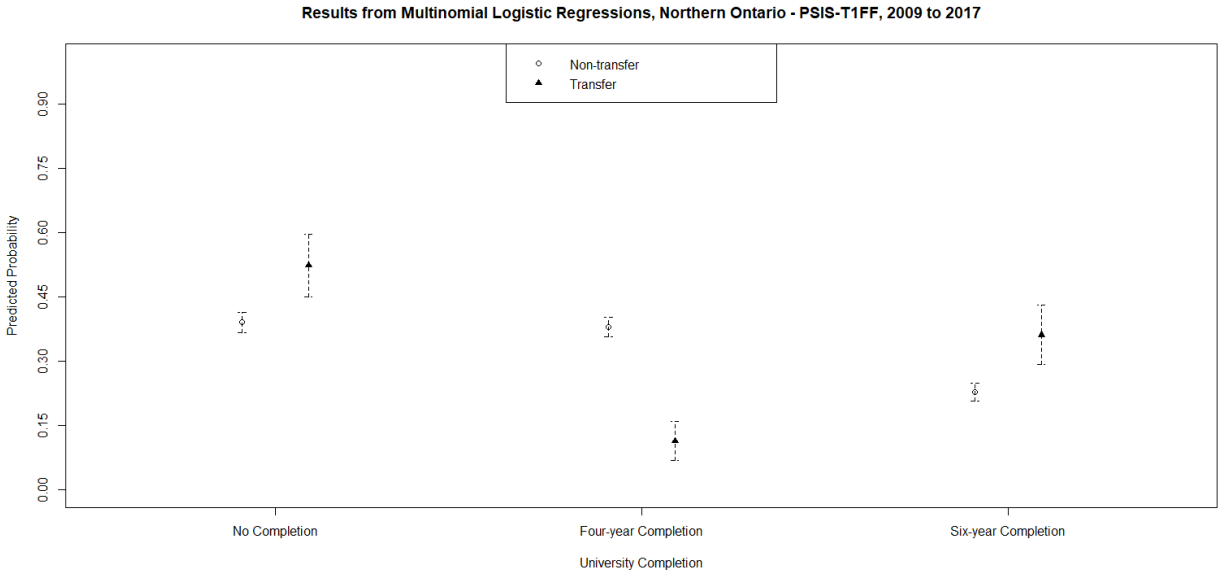
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lowest | 0.3442 | 0.3333 | 0.3552 | 0.3334 | 0.323 | 0.3438 | 0.3224 | 0.3116 | 0.3332 |
| Lower | 0.3376 | 0.3269 | 0.3482 | 0.3426 | 0.3323 | 0.3528 | 0.3199 | 0.3095 | 0.3302 |
| Middle | 0.3194 | 0.3089 | 0.3298 | 0.3713 | 0.3609 | 0.3818 | 0.3093 | 0.2991 | 0.3195 |
| Higher | 0.3142 | 0.3036 | 0.3247 | 0.3845 | 0.3739 | 0.3951 | 0.3014 | 0.2912 | 0.3115 |
| Highest | 0.3084 | 0.2981 | 0.3187 | 0.4133 | 0.4026 | 0.4239 | 0.2784 | 0.2686 | 0.2881 |

## The Multivariate Relationships Between Transfer Pathways and University Graduation and Timely Completion in Northern Ontario Institutions

Model 3 shows the models for only Northern Ontario students. In terms of transfer status, once again, we find that transfer students are less likely to graduate from university within four years than non-transfer students (RRR=0.21, $p<0.001$), although we do not uncover a significant difference for six-year completion between two groups. This finding is similar to that which we uncovered above in Southern Ontario universities.

In Figure 2.5, we plot the predicted probabilities of university completion across transfer status. Overall, the relative pattern is the same as Southern Ontario. However, it is important to note that the predicted probabilities of not completing university are substantially higher than those from Southern Ontario institutions for *both* transfer and non-transfer students. Specifically, transfer students in Northern Ontario are 52.37% likely to not complete their degrees, while their counterparts in Southern Ontario were 43.60% likely to not complete their degrees. Interestingly, the probabilities for completing degrees on time (in four years), were slightly higher among Northern Ontario non-transfer students (0.3778 vs. 0.3805) and quite a bit lower among transfer students (0.1758 vs. 0.1145). In terms of six-year completion, transfer students (0.3619) had significantly higher probabilities of completing in this time frame than non-transfer students (0.2282).

*Figure 2.5 Predicted Probabilities of University Completion by Transfer Type – Northern Ontario: PSIS-T1FF, 2009 to 2017*




Similar to Southern Ontario, Northern Ontario STEM students are also less likely to graduate from university within four years than their BHASE counterparts (RRR=0.68, p<0.01). For demographic factors, women and older students are more likely to graduate from university within four years (RRR=1.26, p<0.1 and RRR=2.71, p<0.001, respectively), but are less likely to do within six years (RRR=0.79, p<0.1 and RRR=0.59, p<0.05, respectively) than their male and younger counterparts. Interestingly, the impact of family factors on university completion is not statistically significant among northern students, except that students whose parental income belongs to higher (RRR=1.46, p<0.1) and lower (RRR=1.44, p<0.1) category are more likely to graduate from university within four years compared to students from the lowest parental income category. The predicted probabilities and 95% confidence intervals for all covariates in the models are displayed in Table 2.6.

*Table 2.6 Predicted Probabilities of University Completion for Northern Ontario, PSIS-T1FF 2009-2017.*

| | No Completion | | | Four-year Completion | | | Six-year Completion | | |
|---|---|---|---|---|---|---|---|---|---|
| | Margins | 95% CI | | Margins | 95% CI | | Margins | 95% CI | |
| **Transfer status** | | | | | | | | | |
| Non-transfer | 0.3914 | 0.3675 | 0.4152 | 0.3805 | 0.3572 | 0.4038 | 0.2282 | 0.2077 | 0.2486 |
| Transfer | 0.5237 | 0.451 | 0.5963 | 0.1145 | 0.0692 | 0.1597 | 0.3619 | 0.2924 | 0.4313 |
| **Field of study** | | | | | | | | | |
| BHASE | 0.3916 | 0.3658 | 0.4175 | 0.369 | 0.3443 | 0.3937 | 0.2394 | 0.2168 | 0.2619 |
| STEM | 0.4528 | 0.4034 | 0.5023 | 0.2959 | 0.2513 | 0.3405 | 0.2513 | 0.2094 | 0.2932 |
| **Gender** | | | | | | | | | |
| Men | 0.4087 | 0.3694 | 0.448 | 0.3094 | 0.2733 | 0.3454 | 0.282 | 0.2463 | 0.3177 |
| Women | 0.4036 | 0.3755 | 0.4318 | 0.3751 | 0.3483 | 0.402 | 0.2212 | 0.1975 | 0.245 |
| **Age of respondents** | | | | | | | | | |
| 21≤ | 0.4218 | 0.3967 | 0.4469 | 0.3133 | 0.2902 | 0.3365 | 0.2649 | 0.2425 | 0.2873 |
| 22≥ | 0.3059 | 0.2482 | 0.3636 | 0.5795 | 0.5185 | 0.6406 | 0.1146 | 0.0758 | 0.1534 |
| **Family composition** | | | | | | | | | |
| Couple | 0.398 | 0.3733 | 0.4228 | 0.3582 | 0.3347 | 0.3816 | 0.2438 | 0.2222 | 0.2654 |
| Lone | 0.4523 | 0.3803 | 0.5242 | 0.3177 | 0.2534 | 0.3819 | 0.2301 | 0.1698 | 0.2903 |
| **Family size** | | | | | | | | | |
| ≤3 | 0.3999 | 0.3552 | 0.4446 | 0.3705 | 0.3275 | 0.4135 | 0.2296 | 0.1912 | 0.268 |
| ≥4 | 0.4075 | 0.3786 | 0.4364 | 0.3449 | 0.318 | 0.3718 | 0.2476 | 0.2224 | 0.2727 |
| **Parental income** | | | | | | | | | |
| Lowest | 0.4192 | 0.3494 | 0.4889 | 0.2918 | 0.232 | 0.3516 | 0.289 | 0.2224 | 0.3557 |
| Lower | 0.3711 | 0.3203 | 0.422 | 0.362 | 0.3133 | 0.4106 | 0.2669 | 0.22 | 0.3138 |
| Middle | 0.4103 | 0.3648 | 0.4557 | 0.3654 | 0.3221 | 0.4087 | 0.2244 | 0.1863 | 0.2624 |
| Higher | 0.3959 | 0.35 | 0.4418 | 0.3867 | 0.3423 | 0.4312 | 0.2174 | 0.1799 | 0.2549 |
| Highest | 0.4364 | 0.3783 | 0.4944 | 0.317 | 0.264 | 0.3701 | 0.2466 | 0.1977 | 0.2955 |

## Part 3: College Graduation and Timely Completion

In step with the literature on the graduation and timely completion of bachelor's degree graduates, the length of time used to assess graduation rates for college programs also varies widely depending on the program and the transfer pathway. Typically, researchers have employed time frames for assessment that range from one to four years in length (Walters et al., 2021; Pretlow et al., 2020; Walters et al., 2020; Chen et al., 2019; Skomsvold et al., 2011; Radford et al., 2010; Horn, 2009; Berkner et al., 2007; Berkner et al., 2002; Cuccaro-Alamin, 1997). Unfortunately, in relation to the sheer volume of research on bachelor's graduation and timely completion, the existing Canadian research on college certificate or diploma completion rates is relatively modest by comparison. Necessarily, to provide additional context to inform our study on college graduation and timely completion of transfer students in Ontario, we draw upon a number of studies that were conducted on community college graduation rates in the United States.

Overall, among samples of community college transfer students in United States, researchers have reported wide ranges of graduation rates of certificates (2% to 42%) and associate degrees (4% to 23%), with some degree of variation attributable to differentiation across higher education sectors (e.g., private not-for-profit, private for-profit, public; Pretlow et al., 2020; Chen et al., 2019; Skomsvold et al., 2011; Radford et al., 2010; Horn, 2009; Berkner et al., 2002; Cuccaro-Alamin, 1997). Among UC transfer students, the completion rates for these college programs have shown to be consistently lower. For instance, Berkner et al. (2002) drew upon the Beginning Postsecondary Students (BPS) Longitudinal Study students who enrolled in 1995-96 through 2000-01 (n=10,370) in order to examine the completion rates over six years, comparing students who began at both 2-year and 4-year institutions. Overall, they found non-transfer students had higher rates of completion. In relation to the UC pathway, of the students who began at 4-year institutions, only 2% had earned an associate's degree or certificate, 7% were still enrolled with no degree earned, and 13% had left PSE altogether (Berkner et al., 2002:vi). Similarly, drawing on most recent cohorts of the BPS (2011-2012, followed up in 2017), Chen et al. (2019:12) found slightly more optimistic results, as among students who began their degrees at 4-year institutions, 2.3% had earned a certificate and 6% had earned an associate's degree within six years.

Turning to college to college pathways, interesting, both Skomsvold et al. (2011) and Radford et al. (2010) employed the 2004-2009 BPS to explore degree attainment with a six-year period and found similar outcomes among CC transfer and non-transfer students. That is, among students who first attended a 2-year institution and transferred, about 8.6% had earned a certificate, 13.5% earned an associate's degree compared to 8.4% and 15% of non-transfer students who earned a certificate and an associate's degree, respectively (Radford et al., 2010:9; see also Skomsvold, 2011: 30).

For Ontario's college system, recent key performance indicator estimates suggest that graduation rates for college students also vary widely across institutions. For 2018 to 2019 graduates, approximately 67.2% of college students across the province had graduated across 1, 2, 3, and 4-year programs (Government of Ontario, 2021).[4] Across the regions, the graduation rates for Northern Ontario colleges ranged from 63.4 to 76.3%, and for Southern Ontario colleges, they ranged from 63.1 to 74.1%. Interestingly, the average graduation rate among Ontario's six northern colleges was slightly higher (69%) in comparison to average rate for the 18 colleges in Southern Ontario (67%) (Government of Ontario, 2021). While these rates give some indication that perhaps regional differences might exist, they do not shed light on how much college completion rates might vary across transfer and non-transfer pathways.[5]

In fact, only a few recent studies have examined college graduation rates among transfer students in Ontario. For instance, in Northern Ontario, one study conducted by Confederation College (2012) found that their college transfer students graduated at a higher rate compared to their non-transfer counterparts. Data on about 1000 students who began their program in the Winter 2005 and completed their program in the Fall of 2010, revealed that 73% of transfer students completed their program, a considerably higher rate than the school's 2010-11 KPI overall graduation rate (61%) (Confederation College, 2012: 13).

In Southern Ontario, Smith's (2016) study (discussed in detail above) also analyzed university to college transfer students from York University to Seneca College (n = 5,413). Among their UC transfer students, 78% completed their program within the standard program length, typically ranging between 1 to 3 years (Smith et al., 2016: 6). Moreover, their findings revealed that the UC transfer students from York to Seneca had much higher timely completion rates than CU transfer students, which the authors largely attribute to students receiving more transfer credits and shorter program lengths (Smith et al., 2016).

Most recently, Walters et. al (2020) employed the Education and Labour Market Longitudinal Platform (ELMLP) to analyze (n=91,950) students aged 17 to 19 who entered postsecondary education in Ontario beginning in September of 2009. Walters et al. (2020) used six different pathways to analyze the student mobility: non-transfer university, non-transfer college, university to university, university to college, college to college, and college to university. Overall, Walters et al. (2020: 11) found graduation rates for non-transfer students were higher (82%) compared to transfer students (57%). When breaking it down by more detailed transfer pathways, non-transfer university students graduated at the highest rate (86%), followed by university to university transfer students (69%), non-transfer college students (67%), university

[4] For colleges, KPI Graduation rates are based on tracking individual students across one-year, two-year, three-year and four-year programs (see Key Performance Indicators on https://www.ontario.ca/page/college-graduation-satisfaction-and-job-rates). For instance, the rate we cite is based on students who started one-year programs in 2017 to 2018, two-year programs in 2015 to 2016, three-year programs in 2013 to 2014 and four-year programs in 2012 to 2013, and who had graduated by 2018 to 2019.

[5] Due to the nature of the PSIS files, linkage restrictions, the reporting structure, sample sizes, and our focus on northern institutions, our methodological approach in this study differs the provincial KPI measurement.

to college transfer students (56%), college to university transfer students (51%), and college to college transfer students (40%) (Walters et al., 2020: 13). Not surprisingly, non-transfer college students completed their programs on time the most of all postsecondary pathways (88% in 4 years or less), followed by non-transfer university students (58%; Walters et al., 2020: 13). These findings suggest transfer students take more time to complete their education compared to non-transfer students, not only among bachelor's degree graduates, but also among graduates from college programs.[6]

## Transfer Pathways, College Graduation Rates, and Timely Completion in Ontario

In order to understand the situation surrounding transfer pathways and timely college completion in Ontario, we turn to our analyses on a college graduation subsample from the PSIS-T1FF linked data (see Appendix A for details). Once again, we first examine the situation across the entire province before turning to our region-specific analyses.

Our univariate findings for our college graduation subsample are shown in Table 3.1. Given their importance to our study, we plot the both college completion as well as the transfer status across each of our locales in Figures 3.1 and 3.2. As shown in Figure 3.1, our results reveal that 61.9% of students in Ontario graduate from college within three years. It is important to note that there appears to be regional variations in college completion across Northern and Southern Ontario. Specifically, 70.5% of students in Northern Ontario graduate from college within three years; however, only 61.1% do so in Southern Ontario. In terms of transfer status, it is interesting that only 8.7% of students are transfer students in Ontario colleges (see Figure 3.2). When we look at this trend separately, unlike the differences we saw in the university sector, the relative proportions of transfer to non-transfer students are similar in Northern (8.5%) and Southern Ontario (8.8%) colleges. Additional univariate analyses for institutional, demographic, and family characteristics in Ontario, Southern Ontario, and Northern Ontario can be found in Table 3.1.

***Table 3.1 College Completion Subsample Characteristics by Region of Institution, PSIS-T1FF 2009-2017.***

| | Percentage | | |
|---|---|---|---|
| | Overall | South | North |
| **College completion** | | | |
| No | 38.05 | 38.90 | 29.50 |
| Yes | 61.95 | 61.10 | 70.50 |
| **Transfer status** | | | |
| Non-transfer | 91.26 | 91.24 | 91.55 |

[6] Walters et al. (2021) employed the ELMLP and additionally linked these data to Toronto District School Board (TDSB) student records, allowing for a specific subsample of 9,850 students who attended a TDSB secondary school to be analyzed in the September 2009 cohort. Walters et al. (2021) also examined the six different pathways described above. Ultimately, even within the TDSB-linked subsample, the results proved to be markedly similar, as transfer students tended to show lower graduation rates than their non-transfer counterparts.

| | | | |
|---|---|---|---|
| Transfer | 8.74 | 8.76 | 8.45 |
| **Location of school** | | | |
| South | 90.97 | | |
| North | 9.03 | | |
| **Field of study** | | | |
| BHASE | 82.88 | 82.70 | 84.7 |
| STEM | 17.12 | 17.30 | 15.3 |
| **Year of enrolment** | | | |
| 2011 | 19.97 | 20.64 | 13.5 |
| 2012 | 22.43 | 22.65 | 20.3 |
| 2013 | 32.02 | 31.35 | 38.6 |
| 2014 | 25.58 | 25.37 | 27.6 |
| **Sex** | | | |
| Men | 49.40 | 49.71 | 46.14 |
| Women | 50.60 | 50.29 | 53.86 |
| **Age of respondents** | | | |
| 21≤ | 72.77 | 72.99 | 70.50 |
| 22≥ | 27.23 | 27.01 | 29.50 |
| **Family composition** | | | |
| Couple | 81.39 | 81.58 | 79.50 |
| Lone | 18.61 | 18.42 | 20.50 |
| **Family size** | | | |
| ≤3 | 40.24 | 39.91 | 43.53 |
| ≥4 | 59.76 | 60.09 | 56.47 |
| **Parental income** | | | |
| Lowest | 20.00 | 20.14 | 18.71 |
| Lower | 20.00 | 20.14 | 18.71 |
| Middle | 20.00 | 20.06 | 19.24 |
| Higher | 20.00 | 19.80 | 22.12 |
| Highest | 19.99 | 19.87 | 21.22 |
| Total | 61,600 | 56,000 | 5,550 |

*Figure 3.1 Distribution of College Completion Across Ontario Regions: PSIS-T1FF, 2009 to 2017*

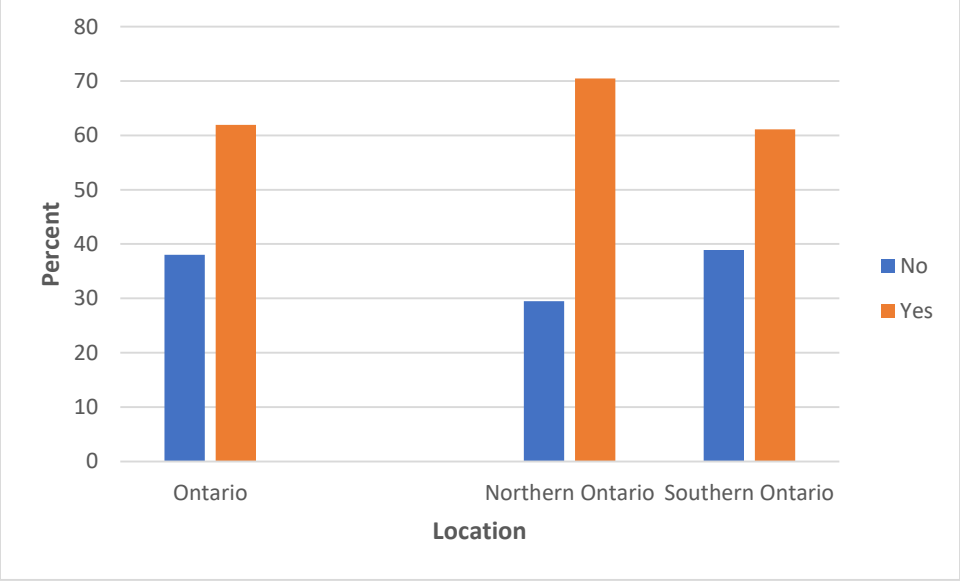
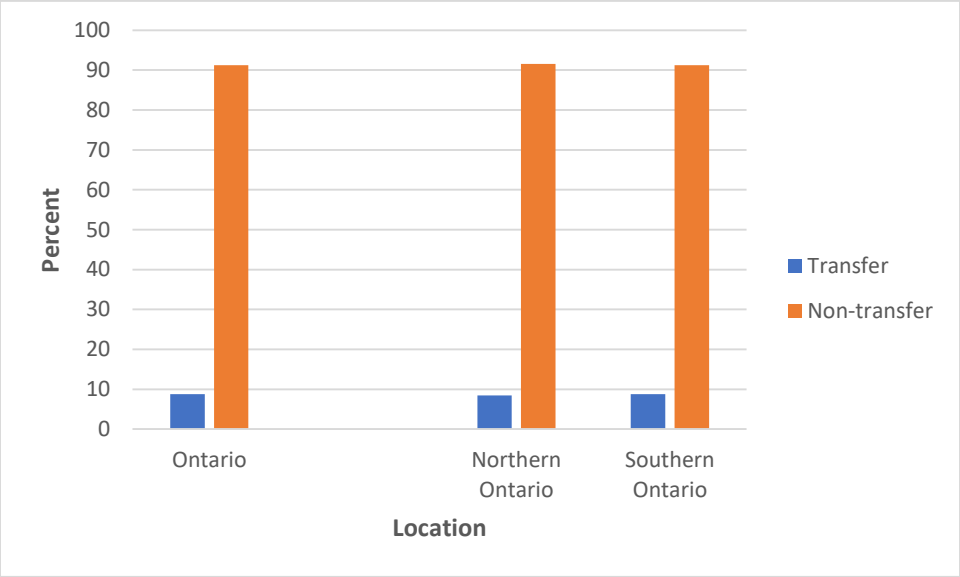


*Figure 3.2 Distribution of Transfer Status Across Ontario Regions: PSIS-T1FF, 2009 to 2017*




## The Multivariate Relationships Between Transfer Pathways and College Graduation and Timely Completion in Ontario Institutions

To understand the relationships between transfer pathways and college graduation and timely completion, we turn to a series of binary logistic regression models. Models 1 and 2 are estimated on all Ontario college students, while Models 3 and 4 and Models 5 and 6 are estimated on our Southern and Northern Ontario subsamples respectively.

At the outset, in Table 3.2, our unadjusted (i.e., bivariate) results indicate that transfer students are indeed significantly less likely to graduate from college within three years than non-transfer students in Ontario (OR=0.37, $p<0.001$). In Model 2, we add a number of key factors to the mix that might also impact college completion rates. For the transfer relationship, it remains largely consistent, even after accounting for these other theoretically-relevant factors on timely completion. This underscores the finding that transfer students are significantly less likely to graduate from college within three years than non-transfer students in Ontario (OR=0.38, $p<0.001$).

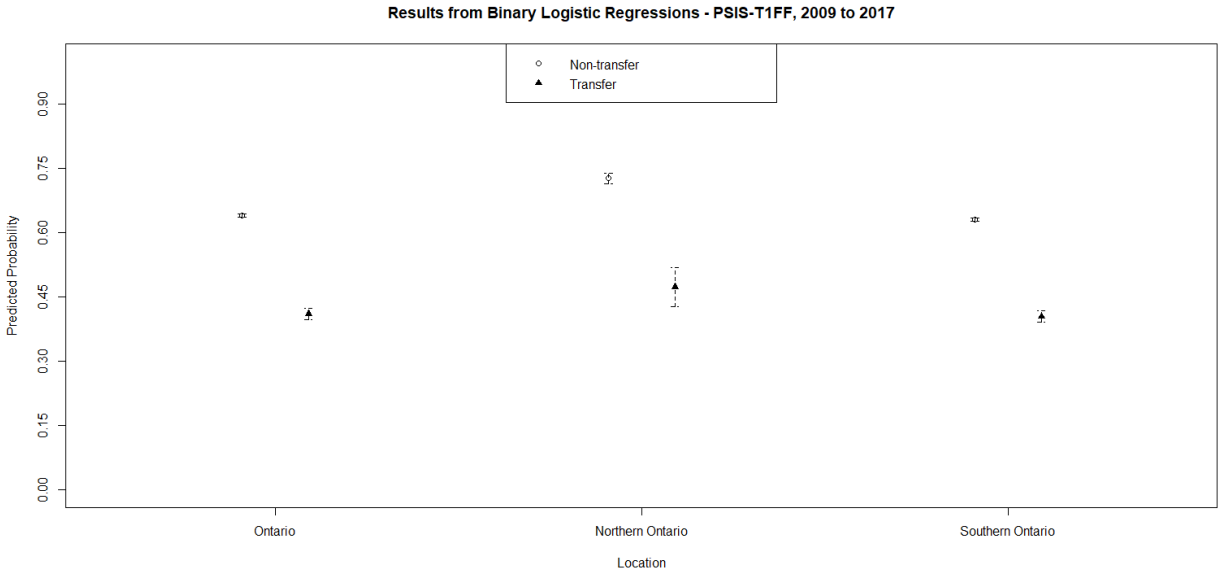
*Table 3.2 Binary Logistic Regressions Predicting College Completion by Region of Institution, PSIS-T1FF 2009-2017.*

| | Overall | | South | | North | |
|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| **Transfer status** | | | | | | |
| Non-transfer | - | - | - | - | - | - |
| Transfer | 0.37*** | 0.38*** | 0.37*** | 0.38*** | 0.33*** | 0.33*** |
| **Location of school** | | | | | | |
| South | | - | | | | |
| North | | 1.47*** | | | | |
| **Field of study** | | | | | | |
| BHASE | | - | | - | | - |
| STEM | | 0.74*** | | 0.73*** | | 0.93 |
| **Year of enrolment** | | | | | | |
| 2011 | | - | | - | | - |
| 2012 | | 1.02 | | 0.99 | | 1.61*** |
| 2013 | | 1.05 | | 1.03 | | 1.24* |
| 2014 | | 1.04 | | 1.05 | | 0.98 |
| **Gender** | | | | | | |
| Male | | - | | - | | - |
| Female | | 1.69*** | | 1.73*** | | 1.27*** |
| **Age of respondents** | | | | | | |
| 21≤ | | - | | - | | - |
| 22≥ | | 1.45*** | | 1.45*** | | 1.51*** |
| **Parental income** | | | | | | |
| Lowest | | - | | - | | - |
| Lower | | 1.25*** | | 1.22*** | | 1.61*** |
| Middle | | 1.43*** | | 1.42*** | | 1.61*** |
| Higher | | 1.64*** | | 1.61*** | | 2.01*** |
| Highest | | 1.58*** | | 1.56*** | | 1.93*** |
| **Family composition** | | | | | | |
| Couple | | - | | - | | - |
| Lone | | 0.92*** | | 0.92*** | | 1.04 |
| **Family size** | | | | | | |
| ≤3 | | - | | - | | - |
| ≥4 | | 0.96 | | 0.96* | | 1.05 |
| LR Chi2 | 1219.19*** | 3395.96*** | 1095.70*** | 3044.82*** | 125.22*** | 248.08*** |
| Pseudo R2 | 0.0149 | 0.0415 | 0.0146 | 0.0407 | 0.0186 | 0.0368 |
| Log likelihood | -40299.389 | -39211.001 | -36890.341 | -35915.779 | -3310.0862 | -3248.652 |

*p<0.05, **p<0.01, ***p<0.001

In Figure 3.3, the predicted probabilities of completing college across transfer pathways are shown for Ontario, Northern Ontario and Southern Ontario. We will consider the regional differences in turn below. At this point, for Ontario as a whole, we can see that transfer students show a significantly lower probability of completing their college programs within three years (0.4109 vs. 0.6395).

*Figure 3.3 Predicted Probabilities of College Completion By Transfer Type – Ontario: PSIS-T1FF, 2009 to 2017*




The results from Model 2 also reveal that a range of institutional, demographic, and family factors are associated with college completion. Of central importance to our study, the results indicate that northern students are significantly more likely to graduate from college within three years than their southern counterparts (OR=1.47, p<0.001). By contrast, students majoring in STEM fields are less likely to graduate from college within three years than those majoring in BHASE fields (OR=0.74, p<0.001). For demographic factors, female (OR=1.69, p<0.001) and older students (OR=1.45, p<0.001) are both more likely to graduate from college within three years than their male and younger counterparts. Finally, when it comes to family factors, we find that students whose parental income belongs to the highest (OR=1.58, p<0.001), higher (OR=1.64, p<0.001), middle (OR=1.43, p<0.001), and lower (OR=1.25, p<0.001) category are more likely to graduate from college within three years than their lowest counterparts. In addition, students from single-parent families are more likely to graduate from college within three years than those from two-parent families (OR=0.92, p<0.001).

## The Multivariate Relationships Between Transfer Pathways and College Graduation and Timely Completion in Southern Ontario Institutions

Turning to Southern Ontario, in Model 3, we observe that transfer students are less likely to graduate from college within three years than non-transfer students at the bivariate level

(OR=0.37, p<0.001). In Model 4, the relationship remains largely consistent even after accounting for all other factors in the model. That is, transfer students remain significantly less likely to graduate from college within three years than non-transfer students in Southern Ontario (OR=0.38, p<0.001).

Turning back to Figure 3.3, we can see that the difference across groups in Southern Ontario looks markedly similar to what we noticed Ontario-wide, as transfer students show considerably lower probabilities (0.4045) of completing their programs compared to non-transfer students (0.6309).

Model 4 also shows that several institutional, demographic, and family factors are also associated with college completion. Students majoring in STEM fields are less likely to graduate from college within three years than those majoring in BHASE fields (OR=0.73, p<0.001). For demographic factors, female (OR=1.73, p<0.001) and older students (OR=1.45, p<0.001) are both more likely to graduate from college within three years than their male and younger counterparts. Finally, when it comes to family factors, we find that students whose parental income belongs to the highest (OR=1.56, p<0.001), higher (OR=1.61, p<0.001), middle (OR=1.42, p<0.001), and lower (OR=1.22, p<0.001) category are more likely to graduate from college within three years than their lowest counterparts. In addition, students from single-parent families are more likely to graduate from college within three years than those from two-parent families (OR=0.92, p<0.001), while those from larger families have lower odds of graduating from college within three years in comparison to those from smaller families (OR=0.96, p<0.05).

## The Multivariate Relationships Between Transfer Pathways and College Graduation and Timely Completion in Northern Ontario Institutions

For Northern Ontario, we also estimate unadjusted and adjusted binary logistic regressions. In our unadjusted model, Model 5, we can see that transfer students are significantly less likely to graduate from college within three years than non-transfer students (OR=0.33, p<0.001). In Model 6, we include all other covariates of interest in the model. Indeed, the relationship remains largely consistent, even after accounting for these other factors. Specifically, transfer students remain significantly less likely to graduate from college within three years than non-transfer students (OR=0.33, p<0.001).

Interestingly, when comparing across regions, the predicted probabilities for Northern Ontario shown in Figure 3.3 indicate both transfer (0.4735) and non-transfer students (0.7265) have higher probabilities of completing their college programs compared to those at Southern colleges (0.4045 and 0.6309 respectively).

The results in Table 3.2 also demonstrate that several other factors impact one's likelihood of completing college in three years. First, students who enter the program in 2012 (OR=1.61, p<0.001) and 2013 (OR=1.24, p<0.05) are more likely to graduate from college within

three years than those who enter in 2011. For demographic factors, female (OR=1.27, p<0.001) and older students (OR=1.51, p<0.001) are both more likely to graduate from college within three years than their male and younger counterparts. Finally, when it comes to family factors, we find that students whose parental income belongs to the highest (OR=1.93, p<0.001), higher (OR=2.01, p<0.001), middle (OR=1.61, p<0.001), and lower (OR=1.61, p<0.001) category are more likely to graduate from college within three years than their lowest counterparts. The predicted probabilities and 95% confidence intervals for all covariates in each of the models presented in Table 3.2 are displayed in Table 3.3.

***Table 3.3 Predicted Probabilities Predicting College Completion by Region of Institution, PSIS-T1FF 2009-2017.***

| | Overall | | | South | | | North | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Margins** | **95% CI** | | **Margins** | **95% CI** | | **Margins** | **95% CI** | |
| **Ever transferred** | | | | | | | | | |
| No | 0.6395 | 0.6356 | 0.6434 | 0.6309 | 0.6268 | 0.635 | 0.7265 | 0.7144 | 0.7386 |
| Yes | 0.4109 | 0.3977 | 0.424 | 0.4045 | 0.3908 | 0.4183 | 0.4735 | 0.4282 | 0.5189 |
| **Location of school** | | | | | | | | | |
| South | 0.6121 | 0.6082 | 0.616 | | | | | | |
| North | 0.6949 | 0.683 | 0.7069 | | | | | | |
| **Field of study** | | | | | | | | | |
| BHASE | 0.6314 | 0.6272 | 0.6355 | 0.6238 | 0.6194 | 0.6281 | 0.7073 | 0.6945 | 0.7201 |
| STEM | 0.5641 | 0.5545 | 0.5736 | 0.5521 | 0.5421 | 0.5622 | 0.6933 | 0.6628 | 0.7238 |
| **Year of enrolment** | | | | | | | | | |
| 2011 | 0.6132 | 0.6049 | 0.6216 | 0.6065 | 0.5979 | 0.6152 | 0.6707 | 0.6377 | 0.7036 |
| 2012 | 0.6177 | 0.6099 | 0.6256 | 0.604 | 0.5958 | 0.6123 | 0.7625 | 0.7383 | 0.7867 |
| 2013 | 0.6231 | 0.6165 | 0.6297 | 0.614 | 0.607 | 0.621 | 0.7143 | 0.6956 | 0.7331 |
| 2014 | 0.6214 | 0.614 | 0.6288 | 0.6171 | 0.6094 | 0.6249 | 0.666 | 0.6429 | 0.6892 |
| **Gender** | | | | | | | | | |
| Male | 0.5597 | 0.5541 | 0.5654 | 0.5482 | 0.5423 | 0.5541 | 0.6794 | 0.6613 | 0.6974 |
| Female | 0.6785 | 0.6733 | 0.6838 | 0.6738 | 0.6682 | 0.6794 | 0.7271 | 0.7112 | 0.7429 |
| **Age of respondents** | | | | | | | | | |
| 21≤ | 0.5973 | 0.5928 | 0.6019 | 0.5888 | 0.584 | 0.5935 | 0.6813 | 0.6665 | 0.6961 |
| 22≥ | 0.6786 | 0.6714 | 0.6858 | 0.671 | 0.6633 | 0.6786 | 0.7599 | 0.7387 | 0.7812 |
| **Parental income** | | | | | | | | | |
| Lowest | 0.5492 | 0.54 | 0.5585 | 0.5434 | 0.5337 | 0.553 | 0.6036 | 0.5699 | 0.6372 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lower | 0.6001 | 0.5916 | 0.6086 | 0.5895 | 0.5806 | 0.5985 | 0.7063 | 0.6781 | 0.7345 |
| Middle | 0.6314 | 0.6231 | 0.6397 | 0.6243 | 0.6156 | 0.633 | 0.7054 | 0.6787 | 0.732 |
| Higher | 0.6603 | 0.6521 | 0.6685 | 0.6513 | 0.6426 | 0.66 | 0.7477 | 0.7237 | 0.7718 |
| Highest | 0.653 | 0.6447 | 0.6613 | 0.6445 | 0.6357 | 0.6533 | 0.7406 | 0.7155 | 0.7656 |
| **Family composition** | | | | | | | | | |
| Couple | 0.6228 | 0.6186 | 0.6271 | 0.6147 | 0.6102 | 0.6192 | 0.7034 | 0.6896 | 0.7172 |
| Lone | 0.6051 | 0.5954 | 0.6147 | 0.5947 | 0.5844 | 0.6049 | 0.7112 | 0.6828 | 0.7396 |
| **Family size** | | | | | | | | | |
| ≤3 | 0.6243 | 0.6179 | 0.6307 | 0.6168 | 0.61 | 0.6236 | 0.6991 | 0.6797 | 0.7186 |
| ≥4 | 0.6163 | 0.6111 | 0.6214 | 0.6071 | 0.6017 | 0.6125 | 0.7097 | 0.6931 | 0.7264 |

## Conclusions and Policy Implications

This study draws upon administrative and tax data in Ontario to provide a large-scale empirical assessment of the regional differences surrounding relationships between transfer pathways and several postsecondary educational outcomes. To get a sense of the climate in Ontario as a whole, we first conduct analyses for transfer students at colleges and universities across the province, and then proceed with region-specific analyses to further investigate relationships among Northern and Southern Ontario institutions. Our analyses employ the most recent Statistics Canada PSIS and T1 family tax data currently available in the ELMLP and make the following three pertinent contributions: 1) assesses the overall magnitude of uptake as well as the relationships between transfer pathways and majoring in STEM fields across regions of Ontario, 2) compares the extent to which transfer status relates to university completion and timely completion across regions of Ontario, and 3) investigates the relationship between transfer status and college completion and timely completion across regions of Ontario.

At the outset, it is important to note that across all of our analyses, the trends in Southern Ontario mirror those of Ontario as a whole. This is largely due to the substantially larger proportion of Southern Ontario students that comprise Ontario's college and university populations (n=532,890 in Southern Ontario; n=27,310 in Northern Ontario). That is, Southern Ontario trends tend to dominate province-wide analyses.[7] Moreover, it is only when Northern Ontario institutions as separated from the mix, that researchers and policymakers can adequately see the extent to which provincial trends might differ for Northern Ontario institutions. This alone is a unique contribution of this work, underscoring the importance of addressing regional dynamics for successful program and policy development.

Overall, our analyses in Part 1 of this study revealed several interesting differences in both the magnitude and the relationships between transfer pathways and access to the STEMs across Northern and Southern Ontario. First, in terms of the sheer magnitude, a greater proportion of students at Southern Ontario institutions are entering STEM programs. Specifically, our results showed that about 29% of students in Southern Ontario institutions majored in one of the STEM fields compared to only about 20% of students in Northern Ontario institutions. Second, our results for Southern Ontario revealed that non-transfer university students were significantly more likely to major in the STEM fields than all of the other pathways that we explored. Among transfer pathways, however, university to university transfer students showed the highest probability of entering the STEMs (0.2883), followed closely by university to college transfer students (0.2510), and swirlers (0.2375). Interestingly, transfer students who began at a college (CC and CU pathways) showed considerably lower probabilities of majoring in the STEM fields (0.1336 and 0.714 respectively), even when considering a range of other factors shown to influence STEM access. For students at Northern Ontario institutions, our findings were slightly

[7] As such, we do not recap the Ontario-wide findings here, but focus more on the regional similarities and differences across our analyses.

different. Not only did non-transfer university students (0.2163) have a high probability of entering a STEM field, but so too did students who transferred from university to college (0.2409) and swirlers (0.2236). University to university (0.1773) and non-transfer college students (0.1602) came next, followed by comparatively lower probabilities once again among college to college (0.1332) and college to university transfer students (0.1190).

For university graduation and timely completion (Part 2 above), several key findings emerged from our study. First, in terms of the raw estimates, our analyses revealed that similar proportions of students in Northern and Southern Ontario universities are completing their university degrees within four years (Northern Ontario, 35.2%; Southern Ontario, 36.9%). However, when turning to the proportions of students who graduated from university within six years, students at Northern Ontario institutions showed considerably lower proportions (24.4% vs. 30.6%). Second, when taking into consideration other relevant factors shown to influence graduation and timely completion, several additional findings emerged. For Southern Ontario, in comparison to non-transfer students, transfer students showed significantly higher probabilities of taking six years to complete their degrees (0.3882 vs. 0.3023) as well as not complete their degrees (0.4360 vs. 0.3199), and are over half as likely to complete their degrees in four years (0.3778 vs. 0.1758). At Northern Ontario institutions, our findings revealed that the predicted probabilities of not completing university are substantially higher than those from Southern Ontario institutions for both transfer and non-transfer students, as transfer students in Northern Ontario are 52.37% likely to not complete their degrees, while their counterparts in Southern Ontario were 43.60% likely to not complete their degrees. Interestingly, the probabilities for completing degrees on time (in four years), were slightly higher among Northern Ontario non-transfer students (Southern Ontario, 0.3778 vs. Northern Ontario, 0.3805) and quite a bit lower among transfer students (Southern Ontario, 0.1758 vs. Northern Ontario, 0.1145). In terms of six-year completion, transfer students (0.3619) had significantly higher probabilities of completing in this time frame than non-transfer students (0.2282).

Finally, in Part 3, our study also explored the extent to which transfer students experience difficulties completing their college programs in a timely fashion and uncovered several key findings. In terms of raw percentages, fully 61.9% of students in Ontario colleges graduate within three years of starting their programs. Comparing regions, our results indicate that 70.5% of students in Northern Ontario graduate from college within three years compared to only 61.1% in Southern Ontario. In both Southern and Northern Ontario institutions, transfer students are less likely to graduate from college within three years than non-transfer students. When controlling for a number of relevant factors that influence graduation and timely completion, in Southern Ontario institutions, transfer students showed considerably lower probabilities (0.4045) of completing their programs compared to non-transfer students (0.6309). For Northern Ontario, the general direction of the relationship was similar, with transfer students showing lower probabilities of competing their programs. However, both transfer (0.4735) and non-transfer students (0.7265) had comparatively higher probabilities of completing their college programs compared to those at Southern colleges (0.4045 and 0.6309 respectively).

Our comparisons across Northern and Southern Ontario colleges and universities have several key implications for policymakers, education administrators, and other relevant stakeholders in Ontario's higher education sector who may be concerned with the educational performance of transfer students.

In terms of STEM access, our findings above underscore the need for monitoring the rate of STEM field entry among transfer students. It is clear that direct-entry students are entering into these more lucrative streams at higher rates than their non-transfer counterparts, and there is a need to enhance access to the STEMs for transfer students, especially those transfer students who transfer college to college and college to university. Moreover, this unequal access to the STEMs was even more apparent among our Northern Ontario institutions, suggesting enhanced supports to open up access for students in these pathways may be needed. Certainly, part of these regional differences may be explained by relatively fewer STEM field opportunities currently available among northern institutions, as they typically house a smaller array of programs and fields of study (Hango et al., 2019). At the same time, it would be important to ensure that the postsecondary pathways for students leading into those new programs are fully articulated. While our findings here speak to the necessity of increasing access to the STEMs for transfer students, other research has shown that concerted efforts may be required to further support transfer students who do enter the STEMs, and in particular, those with certain socio-demographic characteristics (e.g., women, lower SES, visible minorities) (Starobin, 2016; Myers et al., 2015; Reyes, 2011). Researchers have pointed to a whole host of factors that might enhance success in STEM completion for transfer students (e.g., academic support services, mentoring, internships, increased interactions with faculty, faculty support; peer support; extracurricular activities), with many emphasizing on the necessity of offering these additional supports for particular "at risk" groups (e.g., women, lower SES) (Dinh & Zhang, 2020; Elliot & Lakin 2020a, 2020b; Lopez & Jones, 2017; Starobin, 2016; Jackson & Laanan, 2015; Myers et al., 2015; Reyes, 2011;).

Our graduation and timely completion results revealed that both university and college transfer students in Ontario are taking longer to complete their programs than their non-transfer peers. While testament to a broader trend of lengthier times to PSE completion (see Zarifa et al., 2018), these delays in completion increase costs for students and institutions (Korn, 2015; Carlozo, 2012; Knight, 2004; Pitter et al., 1996), put pressure on the availability of sufficient resources per student (Jenkins & Rodriguez, 2013; Hakkinen & Uusitalo, 2003), and ultimately lead to greater student debt and fewer years in the labour market to contribute to repayment, savings, and pensions (Volkwein & Lorang, 1996). Moreover, when we considered university graduates, retention of transfer students remains a concern. Not only were transfer students overrepresented among those who take longer to complete their degrees (six years), but what is perhaps more troubling is the fact that transfer students were overrepresented among those who do not complete their degrees. For Northern Ontario institutions, these trends were particularly evident, suggesting that while new policies to enhance the timely completion of

transfer university graduates in Ontario are highly warranted, they are especially needed in Northern Ontario.

For transfer students who graduate from college, timely completion also remains an issue of concern. Our findings certainly suggest that Ontario colleges may be in need of implementing additional measures to ensure more timely completion of diploma programs by transfer students. Yet, contrary to what we observed for university completion, the story on the timely completion of college programs is more positive in Northern Ontario than it is in Southern Ontario. That is, the timely completion of students (both transfer and non-transfer) was more prevalent at Northern Ontario institutions. Further investigation into the potential mechanisms behind these regional differences would certainly be beneficial for informing policies to ensure timely completion of programs. Certainly, for bachelor's degree completion, researchers consistently report more timely completion among those who begin their studies at university instead of college, being a woman, non-visible minority, and coming from a family within a higher income bracket (Zhu, 2021; Saw, 2019; Chen et al., 2019; Xu et al., 2018; Shapiro et al., 2017; Nutting, 2011; Wang, 2009). As such, future research that seeks to identify the socio-demographic, academic, and institutional characteristics of transfer students who take longer to complete their college and university programs is warranted.

# Appendix A. Data Sources, Sample, Variables, and Analytical Approach

## Data Sources

This study draws upon several data sources included in Statistics Canada's ELMLP (Education and Labour Market Longitudinal Platform). Specifically, we use the 2009 to 2017 years of Postsecondary Student Information System (PSIS) (for further details, see Statistics Canada, 2018) as well as family tax data from the T1 Family Files. PSIS is administrative data collected on all public and not-for-profit postsecondary institutions funded by a provincial Ministry of Education. There are several reasons why the PSIS is suitable for this study. For example, it provides a census of enrolments and graduates in all Canadian colleges and universities, collected annually since the 2005/2006 academic year, and yields approximately a 95% response rate. At the time of this writing, the 2017/2018 academic year is the most recent academic year available for analysis. Another strength of the PSIS is that it includes variables about the educational institutions, student demographics, and information about the program in which the student is enrolled. They are optimal for use in this study to investigate the characteristics of students who pursue various PSE pathways in Northern and Southern Ontario. Additionally, we use the PSIS-T1FF linkage to draw upon additional sociodemographic variables of relevance (e.g., parental income, family composition, family size, etc.).

Finally, as mentioned in further detail in prior reports (see Zarifa et al. 2020; Sano et al. 2020; Hillier et al. 2020), the PSIS administrative data overcome a number of limitations (i.e., small sample sizes, lack of institution identifiers) to using other nationally-representative survey data to examine PSE pathways in Northern Ontario that present themselves.

## Subsamples and Restrictions

*STEM Field Subsample*

For our field of study analyses, we restrict our sample in several important ways. First, we limit our sample to undergraduate students from Ontario postsecondary institutions. Specifically, this study excludes students who are enrolled in professional, graduate, and postgraduate programs (see Finnie, Dubois, & Miyairi, 2017). In addition, there are two different ways of selecting students in the PSIS, namely the 'enrolment cohorts' and the 'graduate cohorts.' We rely on the enrolment cohorts in our analysis and track students' school and type of postsecondary education mobility over two years. Specifically, we track seven different cohorts of students (i.e., 2009-11, 2010-12, 2011-13, 2012-14, 2013-15, 2014-16, and 2015-17) to construct our focal independent variable—students' transfer type. For example, for 2009, we first compare differences between 2009 and 2010 institution IDs and institution types. We then compare 2010 to 2011 institution IDs and institution types. Third, we combine observed differences across both comparisons and then combine into the pathway variable below. Finally, we pool these cohorts of students together, yielding sizeable analytical samples of 532,890 students in southern institutions and 27,310 students in northern institutions.

*University Graduation and Timely Completion Subsample*

For mapping out university graduation and timely completion, we also restrict our sample in several important ways. First, we limit our sample to university undergraduate students from Ontario postsecondary institutions. Specifically, we exclude students who are enrolled in college, professional, graduate, and postgraduate programs (see Finnie, Dubois, & Miyairi, 2017). In addition, there are two different ways of selecting students in the PSIS, namely the 'enrolment cohorts' and the 'graduate cohorts.' As in the subsample for field of study, we rely on the enrolment cohorts in our analysis and track students' school and type of postsecondary education mobility over time. Following Statistics Canada (2019), we use three years of information (i.e., 2009, 2010, and 2011) to identify new students. Particularly, we initially select entering students in 2011. However, it is possible that these students have already entered university programs previously. According to Statistics Canada (2019), tracking the same students for two additional years to find possible duplicates is likely to be a sufficient solution to minimize this potential bias. Consequently, we identify duplicates in 2009 and 2010 and drop them from our analytical sample. In addition, we track students from 2011 to 2012 and to 2013 to explore whether students change their institutional affiliation over time, which enables us to construct our independent variable—transfer status.

This process informs another sample restriction. Specifically, to create our independent variable, students need to either stay in the same institution or different institution between 2011 and 2013. Therefore, students who drop out of university programs during this period are excluded from analytical sample. Moreover, due to our focus on university completion, we also exclude students who are not part of university programs in 2013. Taking these restrictions into consideration, we construct our dependent variable—university completion—by tracking students from 2013 to 2017. To this end, we have analytical samples of 38,050 students in southern institutions and 1,750 students in northern institutions.

*College Graduation and Timely Completion Subsample*

We restrict our sample in this study in several important ways. For example, as we are interested in understanding college completion in Ontario, this study excludes students who are enrolled in university, professional, graduate, and postgraduate programs as well as college students in provinces other than Ontario (see Finnie, Dubois, & Miyairi, 2017). Similar to our other approaches, we rely on the enrolment cohorts in our analysis and track students' school and type of postsecondary education mobility over time. We follow Statistics Canada's recommendation to measure graduation rates over the period of three years after their initial enrolment for college students (Statistics Canada, 2019). Following Statistics Canada (2019), we use three years of information to identify new students. For example, we can identify initial enrolment by finding entering students in 2011. However, these students may have already entered college programs previously. According to Statistics Canada (2019), tracking the same students for two additional years to find possible duplicates is likely to be a sufficient solution to minimize this potential bias. Following this advice, we identify duplicates in 2009 and 2010 and drop them to capture new entering students in 2011. Considering that this study focuses on students' transfer pathway, we

track students for one year to explore whether they transfer between 2011 and 2012 and drop students in 2012 if they are not part of college program. We need at least one year to capture students' transfer pattern. Therefore, unfortunately, we are restricted to exclude students from college certificate programs, with an expected completion duration of one year. For this reason, we only include students from college diploma programs, with an expected completion duration of three years. With this sample restriction in mind, we further track these students in 2013 and 2014 to capture whether they graduate from college. Repeating this process, we include three other cohorts of students (i.e., 2012-2015, 2013-2016, and 2014-2017) to increase sample size and statistical power. To this end, our analytical sample includes 56,000 southern students and 5,550 northern students.

## Dependent Variables

### *STEM Fields*

To measure field of study differences, we create a binary variable that captures whether students major in business, humanities, health, arts, social science, and education (i.e., BHASE) or science, technology, engineering, and mathematics (i.e., STEM) (0=BHASE; 1=STEM).[8, 9]

### *University Graduation and Timely Completion*

This dependent variable captures whether students who start their programs in 2011 graduate from university within four years or six years (0=no completion; 1=four-year completion; 2=six-year completion).

### *College Graduation and Timely Completion*

This dependent variable captures college completion within three years since their initial enrolment (0=no completion; 1=completion).

## Independent Variables

### *Transfer Status*

Across all analyses, our focal independent variable captures student pathways. However, the measurement of transfer varied across analyses due to potential residual disclosure issues as well as insufficient sample sizes. For the STEM fields analyses, our focal independent variable

[8] Our field of study dichotomy first combines both 2-digit and 4-digit CIP 2016 (Classification of Instructional Program) codes and categorizes them in step with Statistic Canada's approved classifications (for details, see https://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=401856).

[9] We capture their field of study at the time of transfer for each cohort. For the 2009-11 cohort, for example, we capture whether students major in STEM or BHASE in 2011. This approach enables us to track students from 2009 to 2011 to identify students' transfer type, which is used as an independent variable to predict the field of study in 2011. We repeat this process for other cohorts and create a pooled sample to increase our sample size and statistical power.

concerns students' transfer pathways over two years since their initial PSE enrolment (0=non-transfer university; 1=non-transfer college; 2=university to university; 3=university to college; 4=college to university; 5=college to college; 6=swirlers). Due to sample size issues, for the university and college graduation and timely completion analyses, we employ dichotomous indicators of whether or not students transferred institutions during their programs. For university completion analyses, our focal transfer status variable captures whether or not students transferred at least once between 2011 and 2013 (0=non-transfer; 1=transfer).[10] For our college completion analyses, our focal transfer status variable captures whether or not students transferred at least once between 2011 and 2012 (0=non-transfer; 1=transfer).[11]

*Demographic, Program and Family Characteristics*

In step with prior reports (see Sano et al. 2020; Zarifa et al. 2020; Hillier et al. 2020), we include several demographic, program, and family characteristics in our analysis. In terms of demographics, we include measures for age (0=younger, 21 or less; 1=older, 22 or more), sex (0=males; 1=females), and the quintiles of gross parental income (0=lowest; 1=lower; 2=middle; 3=higher; 4=highest). Second, to account for family characteristics, we include the number of people in the family (0=smaller, 3 or less; 1=larger, 4 or more) and family type (0=two-parent; 1=lone-parent). When working with multiple cohorts, we also account for the academic year of initial enrolment, with the final categories contingent on the specific analyses (0=2015; 1=2014; 2=2013; 3=2012; 4=2011; 5=2010; 6=2009; or 3=2014; 2=2013; 1=2012; 0=2011). In some models, we also include institutional and program factors such as location of school (0=south; 1=north) and field of study (0=BHASE; 1=STEM).

In addition, there are several other demographic variables such as registration status, international student status and immigration status; however, we do not include these variables due to their small sample sizes. Moreover, due to data quality issues, and under the advisement of Statistics Canada, we were also unable to make use of the following variables available in the PSIS files: total transfer credits; Aboriginal or visible minority status; mother tongue; program duration; program duration units; co-op program indicator; credits needed to graduate; program credit units; cumulative credits for program; second specialization; and end date in program. It is important to recognize that our results here do not take into consideration other measures that have been shown to also influence educational outcomes. The PSIS data are limited by their lack measures of academic performance (GPA, student grades), measures of cultural capital (parental aspirations, parent education), measures of institutional environments, student engagement measures, peer influences, and high school experiences (see for example, Davies & Pizarro Milian, 2020; Zhang et al., 2019; Zhang, 2019; Wang, 2016). Should said measures become available to link to the ELMLP environment in the future, it would be important for future avenues of research to explore the impact of including these other factors in the mix.

[10] Transfer captures university to university as well as college to university mobility.
[11] Transfer captures college to college as well as university to college mobility.

## Analytical Approaches

*STEM Field Access*

To investigate the role of transfer type on field of study, we employ three separate analyses. First, we employ univariate analysis to understand the sample characteristics in Ontario, Northern Ontario, and Southern Ontario. Second, we use regression analyses to understand the relationship between transfer type and field of study. Six models, two models each for Ontario, Northern Ontario, and Southern Ontario, are built sequentially. In the first model, we estimate the bivariate association between transfer type and field of study. In the second model, we include additional covariates to account for the effects of institutional, demographic, and family factors. Considering that the dependent variable is binary in nature, we employ binary logistic regression analysis (Long and Freese, 2014; Long, 1997). These models enable us to map out the key characteristics of those who major in STEM fields in Ontario, Northern Ontario, and Southern Ontario. Finally, to aid in the interpretation of our findings, we also produce and graph the predicted probabilities and 95% confidence intervals from these models, holding all variables (except for the focal variable) at their sample means or proportions.

*University Graduation and Timely Completion*

To investigate the relationship between transfer status and university completion, we employ four separate analyses. First, we employ univariate analysis to understand sample characteristics in Ontario, Northern Ontario, and Southern Ontario. Second, bivariate regression analysis is used to understand the gross impact of transfer type on university completion. We build three separate models, one model each for Ontario, Northern Ontario, and Southern Ontario. Third, multivariate regression analysis is used to estimate the net impacts of the independent variable on university completion while accounting for institutional, demographic, and family variables. In step with the bivariate analysis approach, we produce three models, one model each for Ontario, Northern Ontario, and Southern Ontario. Due to the polytomous nature of the dependent variable, we rely on multinomial logistic regression analysis (Long and Freese, 2014; Long, 1997). Finally, we also produce and graph the predicted probabilities and 95% confidence intervals from these models to help visualize the relative differences across groups and regions.

*College Graduation and Timely Completion*

To investigate the role of transfer status on college completion, we employ three separate analyses. First, we employ univariate analysis to understand sample characteristics in Ontario, Northern Ontario, and Southern Ontario. Second, we use regression analyses to understand the relationship between transfer status and college completion. Six models, two models each for Ontario, Northern Ontario, and Southern Ontario, are built sequentially. In the first model, we estimate the bivariate association between transfer status and college completion. In the second model, we adjust for institutional, demographic, and family factors. Once again, this dependent variable is binary in nature, so we rely on binary logistic regression analysis. These models enable us to map out the key characteristics of those who graduate from college diplomas within three

years in Ontario, Northern Ontario, and Southern Ontario. Finally, to aid in the interpretation of our findings, we also produce and graph the predicted probabilities and 95% confidence intervals from these models.

# References


Alon, S., & DiPrete, T. (2015). Gender differences in the formation of a field of study choice set. *Sociological Science, 2*, 50-81.

Aulck, L., & West, J. (2017). Attrition and performance of community college transfers. *PLoS ONE, 12*(4), Article e0174683. https://doi.org/10.1371/journal.pone.0174683

Barone, C. (2011). Some things never change: Gender segregation in higher education across eight nations and three decades. *Sociology of Education, 84*(2), 157-176.

Bastedo, M.N., & Gumport, P.J. (2003). Access to what? Mission differentiation and academic stratification in U.S. public higher education. *Higher Education, 46*(3), 341-359.

Bell, S. (1998). College transfer students: A Canadian case. *Community College Journal of Research and Practice, 22*(1), 21-37.

Berkner, L., He, S., & Forrest, E. (2002). *Descriptive summary of 1995-96 beginning postsecondary students: Six years later.* National Center for Education Statistics. https://nces.ed.gov/pubs2003/2003151.pdf

Berkner, L., He, S., Mason, M., & Wheeless, S. (2007). *Persistence and attainment of 2003-04 beginning postsecondary students: After three years.* National Center for Education Statistics. https://nces.ed.gov/pubs2007/2007169.pdf

Betts, J.R., Ferrall, C., Finnie, R. (2007). *The role of university characteristics in determining post-graduation outcomes panel evidence from three recent Canadian cohorts*. Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2007292-eng.htm

Carlozo, L. (2012, March 27). *Why college students stop short of a degree.* Reuters. https://www.reuters.com/article/us-attn-andrea-education-dropouts-idUSBRE82Q0Y120120327

Carroll, C.D. (1989). *College persistence and degree attainment for 1980 high school graduates: Hazards for transfers, stopouts, and part-timers.* National Center for Education Statistics. https://nces.ed.gov/pubs89/89302.pdf

Chang, M.J., Sharkness, J., Hurtado, S., & Newman, C.B. (2014). What matters in college for retaining aspiring scientists and engineers from underrepresented racial groups. *Journal of Research in Science Teaching, 51*, 555-580.

Chen, X., Elliot, B.G., Kinney, S.K., Cooney, D., Pretlow, J., Bryan, M., Wu, J., Ramirez, N.A., & Campbell, T. (2019). *Persistence, retention, and attainment of 2011-12 first-time beginning postsecondary students as of spring 2017.* National Center for Education Statistics. https://nces.ed.gov/pubs2016/2016139.pdf

Confederation College. (2012). *Measures of Student Success and Student Experience Following University/College Transfers in Northwestern Ontario.* https://oncat.ca/sites/default/files/research/2012-5-Confederation-Measures-student-success-experience-following-university-college-transfers-northwestern-Ontario.pdf

Council of Ontario Universities. (2021). *Key performance indicators, degree completion rate for undergraduate cohort, new year 1 students.* Retrieved August 25, 2021, from https://cudo.ouac.on.ca/page.php?id=7&table=22#univ=1,2,3,8,9,11,12,14,16,17,21,22,23,24,25,27,28,29,30,31,32,33,34,42&topic=K&table_hidden=5&y=2018

Cuccaro-Alamin, S. (1997). *Postsecondary persistence and attainment.* National Center for Education Statistics. https://nces.ed.gov/pubs97/97984.pdf

Davies, S., & Hammack, F.M. (2005). The channeling of student competition in higher education: Comparing Canada and the U.S. *The Journal of Higher Education, 76*(1), 89-106.

Davies, S., Maldonado, V., & Zarifa, D. (2014). Effectively maintaining inequality in Toronto: Predicting student destinations in Ontario universities. *Canadian Sociological Association, 51*(1), 22-53.

Davies, S., & Mehta, J. (2018). The deepening interpenetration of education in modern life. In J. Mehta & S. Davies (Eds.), *Education in a new society* (pp. 83–114). Chicago: University of Chicago Press.

Davies, S. & Pizarro Milian, R. (2020). *Transfer student outcomes at the University of Toronto: GPA, access to STEM, and graduation.* Ontario Council on Articulation and Transfer.

Deil-Amen, R. (2015). The 'traditional' college student: A smaller and smaller minority and its implications for diversity and access institutions. In M. W. Kirst & M. L. Stevens (Eds.), *Remaking college: The changing ecology of higher education* (pp. 134–168). Stanford, CA: Stanford University Press.

Dika, S.L., & D'Amico, M.M. (2015). Early experiences and integration in the persistence of first-generation college students in STEM and non-STEM majors. *Journal of Research in Science Teaching, 53*(3), 368-383.

Dinh, T.V., & Zhang, Y.L. (2020). Engagement in high-impact practices and its influence on community college transfers' STEM degree attainment. *Community College Journal of Research and Practice.*

Drewes, T., Maki, K., Lew, K., Wilson, M., & Stringham, K. (2012). *An analysis of CAAT transfer students' academic performance at Trent University.* College-University Consortium Council. https://oncat.ca/sites/default/files/research/2012-18-FINAL-REPORT-Analysis-CAAT-transfer-students-academic-performance-Trent.pdf

Elliot, D.C., & Lakin, J.M. (2020a). Running the STEM gauntlet: The complicity of four-year universities in the transfer penalty. *Research in Higher Education, 61*, 540-565.

Elliot, D.C., & Lakin, J.M. (2020b). Unparallel pathways: Exploring how divergent academic norms contribute to the transfer shock of STEM students. *Community College Journal of Research and Practice.*

Finnie, R., Dubois, M., & Miyairi, M. (2017). How student pathways affect labour market outcomes: evidence from tax-linked administrative data. *Education Policy Research Institute*, University of Ottawa.

Finnie, R., Dubois, M., & Miyairi, M. (2020). *Schooling and Labour Market Outcomes of Ontario Transfer Students*. Education Policy Research Initiative & University of Ottawa.

Gabay-Egozi, L., Shavit, Y., & Yaish, M. (2015). Gender differences in fields of study: The role of significant others and rational choice motivations. *European Sociological Review, 31*(3), 284-297.

Gerber, T.P., & Cheung, S.Y. (2008). Horizontal stratification in postsecondary education: Forms, explanations, and implications. *Annual Review of Sociology, 34*, 299-318.

Government of Ontario. (2021). *College graduation, satisfaction and job rates.* Retrieved August 25, 2021 from https://www.ontario.ca/page/college-graduation-satisfaction-and-job-rates

Hakkinen, I., & Uusitalo, R. (2003). *The effect of a student aid reform on graduation: A duration analysis.* Working Paper, 2003:8. Department of Economics, Uppsala University. https://www.econstor.eu/bitstream/10419/82695/1/wp2003-008.pdf

Hango, D. (2013). *Gender differences in science, technology, engineering, mathematics and computer science (STEM) programs at university.* Statistics Canada. https://www150.statcan.gc.ca/n1/en/pub/75-006-x/2013001/article/11874-eng.pdf?st=j2_akBML

Hango, D., Zarifa, D., Pizarro Milian, R., & Seward, B. (2019). Roots and stems? Examining field of study choices among northern and rural youth in Canada. *Studies in Higher Education.* DOI: 10.1080/03075079.2019. 1643308

Hango, D., Zarifa, D., Pizarro Milian, R., & Seward, B. (2021). Roots and STEMS? Examining field of study choices among northern and rural youth in Canada. *Studies in Higher Education, 46*(3), 563-593.

Hillier, C., Sano, Y., & Zarifa, D. (2020). *Transfer pathways among Ontario colleges and universities: Characteristics of students who transfer across and within regions*. Ontario Council on Articulation and Transfer.

Hoachlander, G., Sikora, A.C., & Horn, L.J. (2003). *Community college students: goals, academic preparation, and outcomes.* National Center for Education Statistics. https://nces.ed.gov/pubs2003/2003164.pdf

Horn, L. (2009). *On track to complete? A taxonomy of beginning community college students and their outcomes 3 years after enrolling: 2003-04 through 2006.* National Center for Education Statistics. https://nces.ed.gov/pubs2009/2009152.pdf

Jackson, D.L., & Laanan, F.S. (2015). Desiring to fit: Fostering the success of community college transfer students in STEM. *Community College Journal of Research and Practice, 39*(2), 132-149.

Jelks, S.M.R., & Crain, A.M. (2020). Sticking with STEM: Understanding STEM career persistence among STEM bachelor's degree holders. *The Journal of Higher Education, 91*(5), 805-831.

Jenkins, D., & Fink, J. (2015). *What we know about transfer.* Community College Research Center. https://ccrc.tc.columbia.edu/media/k2/attachments/what-we-know-about-transfer.pdf

Jenkins, D., & Rodriguez, O. (2013). Access and success with less: Improving productivity in broad-access postsecondary institutions. *The Future of Children, 23*(1), 187-209.

Johnson, S.M., & King, S.B. (2017). The influence of student characteristics and the community college on bachelor's degree attainment. *Community College Journal of Research and Practice, 41*(10), 687-690.

Knight, J. (2004). Internationalization remodeled: Definition, approaches, and rationales. *Journal of Studies in International Education, 8*(1), 5-31.

Koker, M., & Hendel, D.D. (2003). Predicting graduation rates for three groups of new

advanced-standing cohorts. *Community College Journal of Research and Practice, 27*, 131-146.

Kopko, E.M., & Crosta, P.M. (2016). Should community college students earn an associate degree before transferring to a 4-year institution? *Res High Educ, 57,* 190-222.

Korn, M. (2015). *Big gap in college graduation rates for rich and poor, study finds.* The Wall Street Journal. http://opportunityamericaonline.org/wp-content/uploads/2015/02/BIG_GAP_IN_COLLEGE_GRADUATION_RATES_FOR_RICH_AND_POOR_STUDY_FINDS.pdf

Kruse, T., Starobin, S.S., Chen, Y., Baul, T., & Laanan, F.S. (2015). Impacts of intersection between social capital and finances on community college students' pursuit of STEM degrees. *Community College Journal of Research and Practice, 39*(4), 324-343.

Li, D. (2010). They need help: Transfer students from four-year to four-year institutions. *The Review of Higher Education, 33*(2), 207-238.

Lin, Y., Fay, M.P., & Fink, J. (2020). *Stratified trajectories: charting equity gaps in program pathways among community college students*. Community College Research Center. https://ccrc.tc.columbia.edu/media/k2/attachments/stratified-trajectories-program-pathways.pdf

Livingston, A., & Wirt, J. (2003). *The condition of education 2003 in brief*. National Center for Education Statistics. https://nces.ed.gov/pubs2003/2003068.pdf

Long, J. S. (1997). *Regression models for categorical and limited dependent variables.* Thousand Oaks, CA: Sage Publications.

Long, J. S., & Freese, J. (2014). *Regression models for categorical dependent variables using Stata, 3rd edition.* College Station, TX: Stata Press.

Lopez, C., & Jones, S.J. (2017). Examination of factors that predict academic adjustment and success of community college transfer students in STEM at 4-year institutions. *Community College Journal of Research and Practice, 41*(3), 168-182.

Maier, R., & Robson, K. (2020). Exploring university-to-college transfer in Ontario: A qualitative study of non-linear post-secondary mobility. *Canadian Journal of Higher Education, 50*(1), 82-94.

Marginson, S. (2016). The worldwide trend to high participation higher education: Dynamics of social stratification in inclusive systems. *Higher Education, 72*, 413-434.

Martinello, F., & Stewart, J. (2015). Transfers from college to one Ontario university: A four-year outcome study. *Canadian Journal of Higher Education, 45*(1), 18-36.

McCormick, A. (1997). *Transfer behavior among beginning postsecondary students: 1989-1994.* National Center for Education Statistics. https://nces.ed.gov/pubs97/97266.pdf

Melguizo, T., Kienzl, G.S., & Alfonso, M. (2011). Comparing the educational attainment of community college transfer students and four-year college rising juniors using propensity score matching methods. *The Journal of Higher Education, 82*(3), 265-290.

Monaghan, D.B., & Attewell, P. (2015). The community college route to the bachelor's degree. *Educational Evaluation and Policy Analysis, 37*(1), 70-91.

Morgan, S.L., Gelbgiser, D., & Weeden, K.A. (2013). Feeding the pipeline: Gender, occupational plans, and college major selection. *Social Science Research, 42*, 989-1005.

Myers, B., Starobin, S.S., Chen, Y., Baul, T., & Kollasch, A. (2015). Predicting community college student's intention to transfer and major in STEM: Does student engagement matter? *Community College Journal of Research and Practice, 39*(4), 344-354.

Nutting, A.W. (2011). Community college transfer students' probability of baccalaureate receipt as a function of their prevalence in four-year colleges and departments. *Education Economics, 19*(1), 65-87.

Peter, K., & Forrest Cataldi, E. (2005). *The road less traveled? Students who enroll in multiple institutions*. National Center for Education Statistics. https://nces.ed.gov/pubs2005/2005157.pdf

Pitter, G.W., LeMon, R.E., & Lanham, C. (1996). *Hours to graduation: A national survey of credit hours required for baccalaureate degrees*. Office of Academic Programs State University System of Florida. https://files.eric.ed.gov/fulltext/ED409776.pdf

Pizarro Milian, R., & Davies, S. (2020). Forecasting the impacts of the "future of work" on universities: A sociological perspective. *On the Horizon, 28*(1), 63-71.

Pretlow, J., Jackson, D., & Michael, B. (2020). *A 2017 follow-up: Six-year persistence and attainment at any institution for 2011-12 first-time postsecondary students*. National Center for Education Statistics. https://nces.ed.gov/pubs2020/2020238.pdf

Radford, A.W., Berkner, L., Wheeless, S.C., & Shepherd, B. (2010). *Persistence and attainment of 2003-02 beginning postsecondary students: After 6 years.* National Center for Education Statistics. https://nces.ed.gov/pubs2011/2011151.pdf

Reyes, M-E. (2011). Unique challenges for women of color in STEM transferring from community colleges to universities. *Harvard Educational Review, 81*(2), 241-263.

Riegke-Crumb, C., King, B., Grodsky, E., & Muller, C. (2012). The more things change, the more they stay the same? Prior achievement fails to explain gender inequality in entry to STEM college majors over time. *American Educational Research Journal, 49*(6), 1048-1073.

Sano, Y., Hillier, C., & Zarifa, D. (2020). *Transfer pathways among Ontario colleges and universities: Northern and southern differences in students who transfer.* Ontario Council on Articulation and Transfer.

Saw, G.K. (2019). Remedial enrollment during the 1st year of college, institutional transfer, and degree attainment. *The Journal of Higher Education, 90*(2), 298-321.

Shapiro, D., Dundar, A., Huie, F., Wakhungu, P.K., Yuan, X., Nathan, A., & Hwang, Y. (2017). *Tracking transfer: Measures of effectiveness in helping community college students to complete bachelor's degrees*. (Signature Report No. 13). Herndon, VA: National Student Clearinghouse Research Center. https://files.eric.ed.gov/fulltext/ED580214.pdf

Skomsvold, P., Radford, A.W., & Berkner, L. (2011). *Web tables—Six year attainment, persistence, transfer, retention, and withdrawal rates of students who began postsecondary education in 2003-04.* National Center for Education Statistics. https://nces.ed.gov/pubs2011/2011152.pdf

Smith, R., Decock, H., Lin, S., Sidhu, R., McCloy, U. (2016). *Transfer pathways in*

*postsecondary education: York Univeristy and Seneca College as a case study.* Higher Education Quality Council of Ontario. https://heqco.ca/wp-content/uploads/2020/03/Transfer-Pathways-in-PSE-ENG.pdf

Starobin, S.S. (2016). Deconstructing the transfer student capital: Intersect between cultural and social capital among female transfer students in STEM fields. *Community College Journal of Research and Practice, 40*(12), 1040-1057.

Statistics Canada. (2020). "Analytical Considerations for PSIS Variables." Statistics Canada RDC Documentation.

Statistics Canada. (2019). *Persistence and graduation indicators of postsecondary students, 2010/2011 to 2015/2016*. Technical Reference Guides for the Education and Labour Market Longitudinal Platform. Catalogue no. 37200001. Ottawa: Statistics Canada.

Statistics Canada. (2018). Postsecondary student information system (PSIS). Retrieved from http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=5017

St-Denis, X., Boujija, Y., & Sartor, S. (2021). *Statistical portrait and evaluation of labour market outcomes.* Ontario Council on Articulation and Transfer.

Stewart, J., & Martinello, F. (2012). Are transfer students different? An examination of first-year grades and course withdrawals. *Canadian Journal of Higher Edcuation, 42*(1), 25-42.

Taylor, J.L., & Jain, D. (2017). The multiple dimensions of transfer: Examining the transfer function in American higher education. *Community College Review, 45*(4), 273-293.

Thomsen, M.K. (2015). Parental time investments in children: Evidence from Denmark. *Acta Sociologica, 58*(3), 249-263.

Triventi, M., Vergolini, L., & Zanini, N. (2017). Do individuals with high social background graduate from more rewarding fields of study? Changing patterns before and after the 'Bologna process'. *Research in Social Stratification and Mobility, 51*, 28-40.

Volkwein, J.F., & Lorang, W.G. (1996). Characteristics of extenders: Full-time students who take light credit loads and graduate in more than four years. *Research in Higher Education, 37*(1), 43-68.

Walters, D., Brown, R., Parekh, G., Einmann, T., & Bader, D. (2020). *Student loan outcomes of Ontario transfer students.* Ontario Council on Articulation and Transfer.

Walters, D., Brown, R., Parekh, G., Reynolds, D., & Einmann, T. (2021). *Postsecondary borrowing patterns and graduation among transfer students in Ontario: The role of high school academic performance*. Ontario Council on Articulation and Transfer.

Wang, X. (2009). Baccalaureate attainment and college persistence of community college transfer students at four-year institutions. *Res High Educ 50*, 570-588.

Wang, X. (2013). Modeling entrance into STEM fields of study among students beginning at community colleges and four-year institutions. *Research in Higher Education, 54*, 664-692.

Wang, X. (2015). Pathway to a baccalaureate in STEM fields: Are community colleges a viable route and does early STEM momentum matter? *Educational Evaluation and Policy Analysis, 37*(3), 376-393.

Wang, X. (2016). Course-taking patterns of community college students beginning in STEM:

Using data mining techniques to reveal viable STEM transfer pathways. *Research in Higher Education, 57*, 544-569.

Wang, X., Chan, H., Soffa, S.J., & Nachman, B.R. (2017). A nuanced look at women in STEM fields at two-year colleges: Factors that shape female students' transfer intent. *Frontiers in Psychology, 8*(146), 1-15.

Xu, D., Ran, F.X., Fink, J., Jenkins, D., & Dundar, A. (2018). Collaboratively clearing the path to a baccalaureate degree: Identifying effective 2- to 4-year college transfer partnerships. *Community College Review, 46*(3), 231-256.

Yeo, H.J.T., Velez, A.L., Zamani-Gallaher, E., & Keist, J.A. (2020). *Hispanic-serving community colleges and STEM degree attainment in Florida.* Office of Community College Research and Leadership. https://files.eric.ed.gov/fulltext/ED609817.pdf

Zarifa, D. (2012). Choosing fields in an expansionary era: Comparing two cohorts of baccalaureate degree-holders in the United States and Canada. *Research in Social Stratification and Mobility, 30*(3), 328-351.

Zarifa, D., Hillier, C. & Hango, D. (2022). Location Matters: Education and Employment Inequalities in Northern and Rural Canada. In *Social Inequality in Canada, Seventh Edition*, edited by M. Hwang, E. Grabb, and J. G. Reitz. Don Mills, ON: Oxford University Press.

Zarifa, D., Kim, J., Seward, B., & Walters, D. (2018). What's taking you so long? Examining the effects of social class on completing a bachelor's degree in four years. *Sociology of Education, 91*(4), 290-322.

Zarifa, D., Hango, D., & Pizarro Milian, R. (2018). Proximity, prosperity, and participation: Examining access to postsecondary education among youth in Canada's provincial north. *Rural Sociology*, 83(2), 270-314.

Zarifa, D., Sano, Y., & Hillier, C. (2020). *Transfer pathways among Ontario colleges and universities: The magnitude of postsecondary transfer types and the characteristics of those who transfer.* Ontario Council on Articulation and Transfer.

Zhang, Y.L. (2019). Early academic momentum: Factors contributing to community college transfer students' STEM degree attainment. *Journal of College Student Retention: Research, Theory & Practice, 0*(0), 1-30.

Zhang, Y.L. (2021). STEM persisters, switchers, and leavers: Factors associated with 6-year degree attainment for STEM aspiring community college transfer students. *Community College Journal of Research and Practice.*

Zhang, Y.L., Adamuti-Trache, M., & Connolly, J. (2019). From community college attendants to baccalaureate recipients: A planned behavior model for transfer students in STEM fields of study. *The Journal of Higher Education, 90*(3), 373-401.

Zhu, Z. (2021). Improving graduation rates in the two-to-four pathway to bachelor's degrees. *Education, Finance & Policy.* https://doi.org/10.1162/edfp_a_00345