THE HEALTHY IMMIGRANT EFFECT ON ALCOHOL USE IN YOUTH

By

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DEDICATION

My dissertation is dedicated to my mother (Susan), and my two brothers (David and Moses). My mother's unconditional love and passion for learning has guided me every step of the way. The joy my brothers add to my life has fueled me through every hardship. With all my love and appreciation, I dedicate this major accomplishment to my mother and brothers.

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Abstract

This dissertation examined the Healthy Immigrant Effect (HIE) in relation to youth alcohol use. The HIE is a phenomenon in developed countries with recent immigrants reporting better health upon arrival compared to the majority population. Studies support the HIE for adult alcohol use, with more recent immigrants reporting less alcohol involvement than 2nd and 3+ generation immigrants. To move this field forward with implications for prevention, the HIE needed to be explored among Canadian youth. Moreover, I examined potential moderation by degree of assimilation into Canada's mainstream culture (acculturation), adherence to original culture's values (enculturation), and the role of country of origin (COO) drinking rates. Immigrants are a fast-growing population; understanding determinants of their alcohol consumption has implications for Canadian social and economic infrastructure. Study 1 (CoVenture trial) examined the HIE by comparing alcohol quantity and drinking onset across three adolescent groups (*N*=2713) of differing immigration statuses (defined by participants' and parents' place of birth) longitudinally from grades 7-11. Results revealed 1.5 generation immigrants reported the least alcohol use and later drinking onset compared to 3+ generation immigrants. Study 2 (UniVenture trial) compared four alcohol indicators (quantity, frequency, heavy episodic drinking, and alcohol-related problems) among undergraduates (*N*=1016; 1st and 2nd year) of differing immigration statuses. We also included moderated regression analyses of acculturation/enculturation by immigrant generation status on alcohol indicators, and the influence of COO drinking rates. First-and-a-half generation immigrants reported lower alcohol involvement than 3+ generation immigrants. Regarding moderation by levels of acculturation/enculturation, we found significant interactions between immigrant generation status and enculturation on alcohol frequency and alcohol-related problems. COO per capita alcohol consumption was positively associated with alcohol frequency and heavy episodic drinking among 1.5 and 2nd generation students. Overall, this dissertation supports the notion that immigration status is protective against alcohol use in youth. Therefore, this dissertation supports the inclusion of culturally sensitive alcohol use interventions in educational institutions to help preserve the HIE on alcohol use while facilitating immigrant youths' healthy integration into Canadian society. Future research should examine other moderators to the HIE (e.g., host country) and consider longitudinal measures of acculturation and enculturation.

List of Abbreviations and Symbols Used

α	Cronbach's alpha
ANOVA	Analysis of variance
AUDIT-C	Alcohol Use Disorders Identification Test – Consumption scale
β	Standardized slope
BIC	Bayesian information criterion
B-YAACQ	Brief Young Adult Alcohol Consequences Questionnaire
CCSA	Canadian Centre on Substance Use and Addiction
CPADS	Canadian Postsecondary Education Alcohol and Drug use Survey
CI	Confidence interval
COO	Country of origin
CFI	Cultural Formulation Interview
DF	Degrees of freedom
F	F statistic
HIE	Healthy immigrant effect
IRR	Incident rate ratio
LRDG	Low-Risk Alcohol Drinking Guidelines
M	Mean
N	Sample size
OCISO	Ottawa Community Immigrant Services Organization
OR	Odds ratio
p	P-value
r	Correlation coefficient

R^2	R-squared (percentage of the variance explained)
SD	Standard deviation
SE	Standard error
SES	Socioeconomic status
REB	Research Ethics Board
RMSEA	Root Mean Squared Error of Approximation
t	t-statistic
TLI	Tucker-Lewis Index
USA	United States of America
VIA	Vancouver Index of Acculturation
VIA-B	Vancouver Index of Acculturation - Brief
WHO	World Health Organization
X^2	Chi-squared statistic

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CHAPTER 1. INTRODUCTION

Whether we are aware of it or not, we experience the benefits of immigration every day. Whether it is your physician who was trained abroad or the server who hands you your favourite takeout meal, we live in an integrated society where people from all nations can come together and attempt to build a successful life in Canada. The complexities of leaving one place for another is no unique experience in human history. Innumerable people have left their homes and traveled to Canada in search of a better life for their family, to flee war and conflict, simply experience a new life, but most commonly for economic reasons (Paquet & Lawlor, 2022). The modern challenges immigrants face are numerous, such as discrimination, language barriers, hard-earned degrees not being respected, financial difficulties, and family separation (Lincoln et al., 2021). However, these challenges are not withstood in vain, and overcoming them only reinforces the tenacity that helped the immigrant to make the move to the new country in the first place. Immigrants, therefore, may possess certain attributes that lead many to have better health than the majority population in their new country upon arrival (De Maio, 2010). This dissertation explores the potential protective nature of the healthy immigrant effect (HIE) in youth, by examining various measures of alcohol use across different immigrant generations. The HIE is a phenomenon observed in several developed countries in which recent immigrants report better health upon arrival compared to the majority population (Moscicki et al., 1989). Background and further details on the HIE will be outlined throughout this dissertation. The literature review found in this dissertation was completed by consulting various sources and types of literature including scholarly articles, review articles, books, government reports,

industry reports, and media sources. Key search terms were centered around the HIE, alcohol use, heavy episodic drinking, immigration, culture, youth, college/university, Canadian history and policies and related concepts.

1.1. A History of Canada's Immigration Policies

I present the following overview of Canada's immigration policies to provide context to the policies and approach to immigration in place at the time of this dissertation. Welcoming immigrants is a proud part of Canada's history and identity. In 2021, Canada was rated the best country in the world for welcoming immigrants based on polling in 145 countries about their thoughts of immigrants living in their country, being neighbours, or even marrying into an immigrant family (Singer, 2021). Canada's current plan for immigration levels is ambitious and reflects the government's constant commitment to growing our population. Canada planned to welcome 465,000 new permanent residents in 2023, and plans to welcome 485,000 in 2024, and 500,000 in 2025 (Government of Canada, 2022d). Most of these new permanent residents (57.25% in 2023) fall under the *economic* immigrant category which includes the *federal high skilled worker* program and the *Atlantic immigrant program* among others. The *family* immigrant category represents 22.90% of the target in 2023 and includes spouses, partners, and children, as well as parents and grandparents. The *refugees and protected persons* immigrant category represents 16.41% of 2023's target. Lastly, the *humanitarian & compassionate and other* immigrant category represents only 3.43% of 2023's target. Canada's immigration goals for the last two categories are the only two that are decreasing every year. However the current percentages for these two categories are higher than in previous years; The *humanitarian & compassionate and other* category

represented 1.9% of the 2022 immigration target (Government of Canada, 2022b) and the *refugees and protected persons* category represented 14.83% of the 2021 target (Government of Canada, 2020). Within the target range, Canada welcomed 471,771 immigrants in 2023 and the country experienced its highest yearly growth rate since 1957 (Government of Canada, 2024). The 2021 Census revealed that foreign-born individuals make up 23% of Canada's population, with the most common places of birth among these individuals being India, the Philippines, and China (Government of Canada, 2022c).

While Canada is praised for having a multicultural society, a brief look into the history of the government's immigration policies reveals a darker side including racism, discrimination, and attitudes that contributed to the displacement of Indigenous peoples from their ancestral lands (Troper, 2022). See "Immigration Policy in Canada" by Gerald E. Dirks (2020) for an overview of Canada's immigration policy throughout history. In the 19th century, a pseudo "open-door" policy facilitated the immigration of mainly White individuals and groups to Canada and contributed to the settlement of Western Canada (Dirks, 2020). The first Immigration Act was passed in 1869 and emphasized the safety of immigrants as they entered Canada and protected them from exploitation. However, it still discriminated on the basis of class and disability (Dirks, 2020). From 1885 through the late 1940s, there were government policies in place to restrict Chinese immigration, including the Chinese Immigration Act in 1923 (Holland, 2007). The early 20th century had increased racial and national restrictions. Mainly European immigrations arrived in Canada between 1903 and 1913, and after the First World War, there were several political and economic disruptions that sparked more restrictive immigration policies that

continued until halfway through the 20th century. After the Second World War, economic growth and shifting social attitudes contributed to loosened restrictions (Falconer, 2020). The government finally removed racial discrimination as a component of the immigration system in 1962. The point system was introduced in 1967 and instead favoured individuals based on employable skills, level of education, English or French proficiency, and family relationships (Tannock, 2011). The Immigration Act of 1976 was a turning point for the country and, for the first time, clearly delineated the goals for Canada's immigration policy. Passed by Prime Minister Pierre Trudeau's Liberal government, the act sought the advancement of Canada's demographic, economic, social, and cultural objectives and made effort to encourage diversity and inclusion (Dirks, 2020). For years, individuals from Europe formed the major source of immigrants to Canada, but by the 1990s, immigrants from Asia, especially from China, India, and the Philippines dominated. Throughout the 1980s, policies and programs had a major economic focus as the government sought to increase Canada's workforce with skilled employees from around the world and to increase business and entrepreneurship (Dirks, 2020; Mitchell, 2001). Canada truly relies on these high skilled workers especially in the face of an aging population. Furthermore, Canada became the first country to pass a national multiculturism's law with the Canadian Multiculturalism Act of 1988 (Mata, 1994). This act seeks to defend the cultural heritage of each Canadian and combat discrimination while promoting the inclusion of multicultural programming across institutions and organizations (Mata, 1994). This history of immigration policy and culture towards immigration is important for understanding the context in which this dissertation is situated. We are currently in a "post-Multiculturism Act era" and Canada's current

policies are meant to attract immigrants who can contribute to the success of the social, culturation, and economic success of the country.

Most Canadian immigrants are welcomed through the *economic* immigrant category (Government of Canada, 2022d). Notably, the Express Entry immigrant points system admits individuals through the Federal Skilled Worker, Federal Skilled Trades, and Canadian Experience Class programs. Through the Comprehensive Ranking System, individuals receive a score out of 1200 that is mainly dependent on their age, language proficiency, level of education, and work experience (Major, 2023). There are nine categories that comprise the main reasons why an immigrant may be deemed inadmissible, including security reasons, human or international rights violations, and criminal history (Government of Canada, 2010). Canada's current immigrant policy also includes a medical exam, and an individual could be refused entry on the grounds of medical inadmissibility. The terms of medical inadmissibility are if an individual is considered to be a danger to public health or public safety, or if the individual would bring excessive burden to Canada's health or social services (Immigration, 2021). Given these criteria, it stands to reason that an individual who requires intensive treatment for an alcohol use disorder may be denied entry. Being unable or unwilling to support oneself or one's family financially is another reason why an individual may not be able to immigrate to Canada. Children of adult immigrants are also subject to medical examination whether they are immigrating alongside their parents or are being sponsored by a parent already in Canada. See developmental considerations for HIE below for further elaboration.

1.2. The Healthy Immigrant Effect (HIE)

The healthy immigrant effect (HIE) is a phenomenon observed in several developed countries in which recent immigrants report better health compared to the majority population (Moscicki et al., 1989). This effect is particularly prominent upon arrival to the new country (Vang & Ng, 2023). Since immigrants are often thought to be under a lot stress or have less financial or social resources, this effect is also studied under the terms "immigrant paradox" (Alamilla et al., 2020; Marks et al., 2014; Tilley et al., 2021), "nativity health paradox" (Turner et al., 2006), and "healthy migrant effect" (Blair & Schneeberg, 2014). Moreover, studies differ in the terminology used to compare individuals born outside of the host country versus individuals born in the host country. Some choose to use "first-generation" to refer to individuals born outside the host country of any age (Barsties et al., 2017) while others prefer to use "1.5 generation" to specify that the immigrant relocated as a child (Boyd, 2009; Rumbaut, 2012). Other terms used are "foreign-born" (Cook et al., 2013) vs. "native-born" (Vang et al., 2017) or "native" (Amundsen et al., 2005). To bring attention to the youth sample used in this dissertation, and since all participants included are considered immigrants, I prefer to use the term "1.5 immigrant generation status".

A systematic review of the HIE in Canada presents evidence of the HIE in the areas of physical health, mental health, and substance use across the lifespan (Vang et al., 2017). Since Canada's immigration policy favours the selection of individuals who will not place burden on the healthcare system (Immigration, 2021; Lu & Ng, 2019) it follows that on arrival, immigrants are likely to be in good health. Firstly, foreign-born status has shown to be protective against asthma, arthritis, cancer, and some cardiovascular-related problems in Canada (Betancourt & Roberts, 2010; Newbold &

Danforth, 2003). Importantly, this protective effect of immigrant generation status appears to weaken over time as years spent in Canada increases the risk of reporting chronic disease (Betancourt & Roberts, 2010; Vang et al., 2017). Next, immigrants to Canada are less likely to report anxiety disorders, depression, or other mood disorders (Aglipay et al., 2013; Ali, 2002; Puyat, 2013). In Ali's (2002) report on the mental health of Canadian immigrants, it was found that the odds of reporting alcohol dependence increased as years of residence in Canada increased but even immigrants who had been in Canada for 20 to 29 years had a third of the risk compared to the Canadian-born population. While there are some exceptions (c.f., Gotsens et al., 2015; John et al., 2012), as a whole, the literature supports the notion that the HIE is strongest among recent immigrants, and that the protective effect of immigrant generation status dissipates over time (De Maio, 2010; Vang et al., 2017). One possible explanation is that the more immigrants settle into the host country, the more they become exposed to and later adopt practices from the native population that negatively affect their health. I will elaborate on this concept when I discuss acculturation later in this chapter.

According to social learning theory (Bandura, 1977), immigrants may become influenced by the behaviours of members of the host population and engage in practices they would not normally engage in, such as fast-food consumption or heavy episodic drinking (HED, formally referred to as "binge drinking"). Social learning theory is indeed a theory of how the process of acculturation occurs. Another possibility for the dissipation of the HIE could be due to immigrant cohort effects[1]. Cohort effects refer to differences in health metrics across generations, often associated with different

[1] Cohort generation should be distinguished from immigrant generation status

environmental exposures or major structural changes in society (Keyes et al., 2010). Studies differ in how they analyze duration effects but ten years is the average metric used to differentiate between recent and established immigrants (Vang et al., 2017). Immigrant cohort effects may explain these differences particularly over longer periods of time. Cohorts may differ in the availability and quality of the infrastructure that was in place to support them as new immigrants. This includes but is not limited to awareness of and access to mental health resources, support in navigating the healthcare system and the ease with which adult immigrants can gain employment that matches their education and skillset. There is some evidence to suggest immigrant cohort effects in Canada. In an examination of intra-and inter-cohort trends in mood and anxiety disorders between 2003 to 2013, Mason and colleagues (2024) demonstrated that later cohorts were more likely to report poorer mental health upon arrival to Canada compared to earlier cohorts. The authors note that despite having more employment history than earlier cohorts, recent cohorts are earning less on entry and are experiencing greater gaps in their earnings relative to the Canadian-born population (Picot & Sweetman, 2011). Following the 1980s, Canada's main sources of immigration were no longer Western European, but included more countries that spanned Asia and beyond (Dirks, 2020). Changes in earnings across cohorts may therefore be attributed to labour market conditions, language proficiency, education qualifications, and potential discrimination based on culture/ethnicity/race (Picot & Sweetman, 2011).

Along the same vein, the economic and social infrastructure available to support an immigrant may vary based on location factors such as rural vs metropolitan regions. Canada currently has an Atlantic Immigration Program meant to quickly fill employment

positions that would otherwise be left vacant across Canada's four Atlantic provinces with several rural communities (Government of Canada, 2022a). While this may favour skilled immigrants wishing to enter Canada quickly, they may face other challenges living in rural communities such as racism and discrimination (Vaswani et al., 2023) and a more strained healthcare system. Indeed, Canadian rural communities have a history of difficulties retaining family physicians (Wilson et al., 2020). Varying combinations of these factors may impact the overall health of a new immigrant to Canada.

1.2.1. Mechanisms of the HIE

One of the most proposed explanations for the HIE is the "healthy migrant selection effect" or selection bias hypothesis which explains that it is the healthiest immigrants at baseline who can withstand migration or whom the host country will approve for immigration following medical screening (Lu & Ng, 2019). Moreover, the HIE may occur because less healthy and less financially successful immigrants may return to their home countries (Vang et al., 2017). This negative selection bias is called the "salmon effect" and has been largely studied in Latino populations in the US and immigrants across Europe (Berchet & Jusot, 2012; Vang et al., 2017). The selection bias is most likely part of the reason the HIE is found in Canada, given the medical component of the immigration policy. However, selection effects are more likely to be relevant for indicators of physical health that would comprise the medical examination as opposed to indicators of mental health that are not screened with the same rigour. Importantly, refugees in Canada are exempt from being denied entry into Canada based on the medical admissibility test (Lu & Ng, 2019). The HIE is weaker among refugees and a Canadian study found a health advantage only among female refugees with less

severe chronic conditions such as asthma, back pain, migraines, and other conditions (Lu & Ng, 2019). For the studies that comprise this dissertation, we made no distinction between refugees and immigrants.

1.2.2. Impact of the HIE on Health

The HIE has been studied across various outcomes, particularly in Canada, the United States, the United Kingdom, and Australia (Kennedy et al., 2015). The HIE is more likely to be detected in countries that accept large numbers of immigrants, compared to several countries in Europe in which the immigrant population consists largely of refugees who have particular vulnerabilities (Moullan & Jusot, 2014; Vang & Ng, 2023). For instance, a study comparing professional Iraqi refugees and professional Iraqi immigrants to the United States of similar backgrounds found that refugees reported more unemployment compared to immigrants (Jamil et al., 2012). Indeed, refugees have often undergone intense stressors and must adapt to a new life while managing complex mental health challenges; therefore, it is no surprise that even when comparing those of similar background, psychological treatment response is poorer in refugees compared to immigrants (Jamil et al., 2010). Evidence of the HIE has been found in Spain, but immigrants to France, Belgium, and Sweden tend to have poorer health compared to the national population (Berchet & Jusot, 2012; Hernández-Quevedo & Jiménez-Rubio, 2009; Leão et al., 2009; Lorant et al., 2008; Moullan & Jusot, 2014). Differences across European countries and beyond could be attributed to differences in the economic and social infrastructure immigrants must interact with in their new country (Moullan & Jusot, 2014). This includes whether an immigrant's credentials are appropriately recognized which could impact the type of employment they obtain and can include the

presence or absence of support navigating the health care system, knowledge of official languages, and general social support available for immigrants. Income is a powerful social determinant of health; more years spent in lower socioeconomic classes is associated with elevated risks of self-reporting only fair/poor health and reporting a chronic health problem among the Canadian population (Vanzella-Yang & Veenstra, 2021). Therefore, the economic and health systems in place in the host country are important factors that drive the specificity of the HIE.

1.3. Developmental Considerations of HIE

Importantly, the main proposed mechanisms of the HIE (i.e., selection bias, salmon effect/bias) do not directly apply to children. Firstly, children of adult immigrants wishing to enter Canada are not as heavily screened as are their parents (Immigration, 2021). If children are under 22 years old and do not have a spouse or partner, they can be included as a dependent on the parent's immigration application. Accordingly, it is the parents' level of education, employable skills, and financial capabilities that are being examined. While children entering Canada with their parents are subject to medical examination, dependent children, spouses, and common-law partners who are being sponsored cannot be denied entry because of medical inadmissibility (Immigration, 2021). Next, the decision to migrate is often made by the parent, and not the child (Vang et al., 2017). Thus, it is not surprising that the previously mentioned systematic review of the HIE in Canada (Vang et al., 2017) failed to find robust evidence for the HIE among youth. Indeed, the literature studying youth is more heterogenous compared to adults in that support for the HIE has been demonstrated in only certain areas of health. For instance, O'Loughlin and colleagues (2010) found evidence for the HIE in smoking in

that the proportion of children in Canada who reported lifetime smoking was lowest among first-generation children (15%), and increased among second-generation (24%) and third-generation children (29%). Moreover, they found that the risk of smoking increased amongst immigrant children as length of residence in Canada increased (O'Loughlin et al., 2010). Beiser and colleagues (2002) found that foreign-born Canadian children had lower levels of emotional and behavioural problems even though they were more likely to live in poverty compared to Canadian-born children. However, research does not entirely support the HIE in youth. Research in the areas of nutrition and asthma do not show systematic advantages of foreign-born status over Canadian-born status among immigrant children and in some cases, demonstrate a disadvantage (Vatanparast et al., 2013; H.-Y. Wang et al., 2008). Some areas of health are met with inconsistent results across studies (Vang et al., 2017). For example, a longitudinal Canadian study found that first-generation adolescents had a slower rate of unhealthy weight gain compared to second and third-generation students despite finding no differences in BMI at baseline in childhood (Maximova et al., 2011). Conversely, a nation-wide study found that that first-generation immigrant adolescents had higher BMI than their third-generation counterparts (Quon et al., 2012). In addition, Hamilton and colleagues (2009) found that first-generation students reported less illicit drug use compared to second and third-generation students, and that second-generation students reported less illicit drug use compared to third-generation students. However, they also found that first-generation students reported more psychological distress compared to second-generation students and no differences in psychological distress were found between second and third-generation students.

The inconsistent support for the HIE in youth may be occurring because the generational differences are too small to detect amongst children who are typically quite healthy (Vang et al., 2017). Indeed, the measures used to examine differences may be sensitive to detect changes only as youth age and health behaviours become more divergent (Vang et al., 2017). Parental factors may also explain the presence or absence of the HIE in youth. Apart from parents' own modelling of substance use, parents may attempt to exert psychological or behavioural control to limit their children's exposure to substances (Shek et al., 2020). Parental psychological control refers to parents' attempts at influencing their children's emotional state or thinking processes (Barber, 1996). A parent may try to instill fear or guilt in their child in attempts to reduce their child's/adolescent's substance use. Parental behavioural control covers any attempt by the parent to govern their child's behaviours (Barber, 1996). Broadly, parents may exhibit behavioural control in the forms of monitoring the child's actions, placing boundaries on their social activities, or discouraging certain friendships. For example, a longitudinal study amongst Chinese adolescents found that both paternal and maternal behavioural control, and the quality of the parent-adolescent relationship, were negative predictors of baseline levels of substance use (Shek et al., 2020). In addition, maternal behavioural control and the quality of the mother-adolescent relationship predicted a slower rate of increase in adolescent substance use. Levels of parental monitoring have been shown to differ significantly between ethnicities, and between countries of origin (COO). A study on American youth found parental monitoring was highest among African American adolescents compared to Mexican American and non-Hispanic White adolescents (Tragesser et al., 2007). In the same study, African American adolescents also reported

lower levels of marijuana use. An Australian study found adolescents born in India, Southern Asia, and Africa reported higher levels of parental monitoring and parental disapproval of alcohol use, and decreased own (adolescent) alcohol use compared to Australian-born adolescents (Chan et al., 2016). Amongst these immigrants in Australia, parental monitoring and parental disapproval of alcohol use partially mediated the association between birth place and alcohol use (Chan et al., 2016).

On the one hand, immigrant parents may monitor their child's behaviour more than non-immigrant parents out of fear/concern about Western influences. These may lead to controlling behaviours that might impact an immigrant youth's access to alcohol. On the other hand, immigrant parents may be under a lot of stress, and may be working long hours, such that they are less able to spend time monitoring their children compared to non-immigrant parents. This perspective is supported by an Israeli study that found immigrant adolescents reported lower levels of parental monitoring compared to native born adolescents (S. D. Walsh et al., 2014). Another developmental consideration of the HIE pertains to the importance of peer influences on behaviour. While parents may model and encourage healthy behaviours, an immigrant youth may be more influenced by their peer circle than by parents. For example, Schuler and colleagues (2019) found that among adolescents, best friend substance use was a stronger predictor of substance use compared to older sibling or parent use. In sum, the factors involved in the HIE likely differ between youth and adults and should be the subject of more research. This dissertation was completed in Canada and given the unique history of government immigration policy, the next section will discuss the context in which this research is situated.

1.4. Alcohol Use in Canada

Alcohol use remains a prominent part of Canadian culture. It is highly normalized in Canadian society and often present at social gatherings. For many, alcohol is associated with pleasurable experiences, facilitates social connection, and boosts one's mental state (Public Health Agency of Canada, 2016). Unlike in some other countries (e.g., Pakistan, Qatar), in Canada, alcohol sales are not restricted by religion nor do citizens require permits to access alcohol. Canada. In contrast to the overall acceptance of alcohol use, its misuse is associated with various physical, social, and financial risks. Firstly, alcohol is a carcinogen associated with head and neck, breast, colorectal, esophageal, liver, stomach, and pancreatic cancers (Canadian Cancer Society, 2023). It is also a primary cause of liver diseases and a risk factor for most kinds of cardiovascular diseases (Arora et al., 2022; Paradis et al., 2023). Secondly, beyond the individual, excessive alcohol use, particularly in the form of HED, is a risk factor for acute impairment that could lead to social harms such as domestic violence, child abuse, and neglect, and physical harms such as bodily injury (Paradis et al., 2023). Lastly, in 2020, there were $19 billion in social costs due to alcohol use and after accounting for $13 billion in revenue from alcohol sales, Canada was left with a $6 billion deficit due to alcohol's social costs to society (Sherk, 2024). In 2017, alcohol was the most costly substance used in the country (Canadian Substance Use Costs and Harms Scientific Working Group, 2020). Costs related to the criminal justice system, productivity loses, and other direct costs were approximately $2.8 billion. Costs related to healthcare were $5.4 billion and, that same year, 20% of violent crimes had associations with alcohol use (Canadian Substance Use Costs and Harms Scientific Working Group, 2020).

In 2011, the Canadian Centre on Substance Use and Addiction (CCSA) published Canada's first Low-Risk Alcohol Drinking Guidelines (LRDGs; Butt et al., 2011). The goal of the LRDG is to provide Canadians with recommendations on how to use alcohol in such a way that minimizes the associated risks based on the current literature. The 2011 guidelines were in place over the course of data collection for this thesis. To mitigate against the risk of long-term health consequences, women were recommended to have a maximum of 10 drinks per week with a maximum of two drinks in a day, while men were recommended to have a maximum of 15 drinks per week with no more than three drinks in a day (Butt et al., 2011). To mitigate against shorter-term risk of injury and harm, it was recommended that women do not exceed three standard drinks on a single occasion, and men not exceed four standard drinks on a single occasion. In general, awareness of the LRDG is low, with only 16% of students in Canadian colleges and universities reporting having heard of them during the 2019-2020 Canadian Postsecondary Education Alcohol and Drug use Survey (CPADS; Government of Canada, 2021). It is unsurprising therefore that young adults between 20-24 years of age represent the age group who is least likely to consume alcohol within the guidelines (Paradis et al., 2023). While 88% of postsecondary students reported consuming alcohol within the recommendations for minimizing long-term risk (i.e., overall number of weekly drinks), only 36% of students report consuming alcohol within the recommendations for minimizing short-term risk (i.e., increased drinks on single occasion). This contrast illustrates the pervasiveness of HED in this population.

In 2023, the CCSA updated the LRDGs, now referred to as Canada's Guidance on Alcohol and Health. Taking a much stricter stance, the CCSA concluded that the risks

associated with weekly alcohol consumption are low for individuals who consume two or less drinks per week, moderate with three to six drinks per week, and high for those who consume more than seven drinks per week (Paradis et al., 2023). In addition, they concluded consuming more than two drinks per drinking occasion is associated with greater risk of harm to oneself and others. In their report, the CCSA stresses to Canadian drinkers that cutting back their alcohol use even by one or two drinks a week can have positive effects on their health and that given the various risks associated with excessive use, the appropriate message to promote is "it is okay not to drink alcohol" (Paradis et al., 2023). The CCSA report supports proposed government policy changes that mandate there be health warning labels on alcoholic beverages, a policy move that the World Health Organization (WHO) also supports (World Health Organization, 2023).

Meanwhile, Ontario is home to the largest proportion of recent immigrants in Canada and the provincial government has been persistent in pushing policy that will allow alcohol to be sold in convenience stores (Government of Canada, 2022e; Gray, 2023). Alcohol has been widely available in convenience stores in Quebec following policy changes that allowed for the privatization of wine sales in 1978 (Trolldal, 2005). Alcohol is already available in many grocery stores across the province and the Government of Ontario website advertises that "consumers have more choice and convenience as Ontario is expanding the number of retail stores where alcohol can be sold" (Government of Ontario, 2022). Interestingly, while individuals can use a store locater to find their nearest alcohol outlet, there is no clear link to any resources or messaging about responsible drinking. On the surface, there appears to be a conflicting message as Canadian culture clearly embraces alcohol use, while health advocacy groups

are painting a less accepting picture. This can create a landscape that is difficult to navigate for newcomers to Canada, particularly for those who are now adjusting to living in a country where the availability and acceptability of alcohol is much higher than in their COO.

1.5. Acculturation

As previously mentioned (De Maio, 2010; Vang et al., 2017), the protective nature of the HIE appear to diminish over time. The underlying mechanisms behind this decline in immigrant health are not well understood, but one widely-held explanation can be summarized as the "acculturation hypothesis" (Vang et al., 2017). Acculturation is defined as the sociocultural and psychological change that stems from the interaction between two or more cultural groups and/or members (Berry, 2005). Acculturation is a complex phenomenon that can be examined at the group level or the individual level (Berry, 2005). Changes at the group level include changes in social infrastructure and traditions. For example, a university may choose to allow students to miss a class without penalty if it falls on a significant cultural holiday after many students of a particular cultural group voice concerns. The focus for this dissertation will be acculturation at the individual level, which pertains to psychological and behavioural changes. Examples of acculturation at the individual level include shifts in attitudes towards substance use to be more similar to the attitudes of others in the host country or the adoption of new languages spoken in the host country. Therefore, the acculturation hypothesis predicts that, through the process of being in contact with a new host country, immigrants adopt new behaviours over time that lead to poorer health. Acculturation has been generally associated with risky behaviours such as early sexual initiation, substance use prior to

sexual intercourse, and increased rates of smoking (Rahman et al., 2024; Song et al., 2004).

Cabassa (2003) provide a detailed framework of contextual factors that influence acculturation that I will briefly summarize. The first set of factors considers the prior immigration context including the society of origin context. For example, such factors can include social and gender norms as they pertain to alcohol use. Involvement in the decision to immigrate is also considered here which is important since youth typically do not hold as much power as adult immigrants in this decision. The second set of factors considers the immigration context and includes the type of immigrant group. For instance, a recent immigrant through Canada's *economic* category may be more likely to have the financial resources and social connections to go out drinking on the weekend compared to an immigrant brought in through the *humanitarian & compassionate* category. Thirdly, the settlement context considers the host country's environment. This would include Canada's gender and social norms regarding alcohol use which are in brief, often more egalitarian in terms of gender norms and more permissive regarding alcohol use (Hussman & Goldstein, 2019). Lastly, there are various individual factors that interact with the acculturation process. These include time spent in the new country and age at which they immigrated which were previously discussed. The level of dissonance between the culture of origin and host country would also impact the acculturation process. Stark differences between the two cultures may either drive an individual to deliberately preserve aspects of their original culture or may lead an individual to fully embrace the new culture and abandon original practices and behaviours. Navigating the cultural dissonance between the original and host culture and

may be particularly challenging among adolescents of 1.5 and 2nd immigrant generation status as they venture through the vulnerable period of identity formation while being influenced by both peers and parents (Kanwal, 2022).

A unidimensional view of acculturation only focuses on the adoption of new behaviours while the bidimensional view of acculturation also considers the impact of enculturation. Enculturation is the process in which an individual learns and adheres to their traditional cultural heritage and is related to the process of forming their ethnic identity (Zimmerman et al., 1996). The process of integrating to a new culture while remaining connected to one's heritage culture can be complex. When individuals face problems relating to their acculturation, this is called "acculturative stress" (Berry, 1998). The process of acculturation and enculturation are not mutually exclusive, and the combination of higher or lower acculturation and enculturation can be categorized into four strategies of acculturation: integration, assimilation, separation, and marginalization (Berry, 2005). The integration strategy, where individuals have a strong orientation towards the new, majority culture, while maintaining strong values in their original culture, is considered the most adaptive. Individuals who have a strong orientation towards the mainstream culture but have rejected their original culture have chosen an assimilation strategy. Choosing to withdraw from the mainstream society and claiming only the original culture is the separation strategy. Rejecting both the mainstream culture and the original culture represents the marginalization strategy and is associated with the worst outcomes. A recent systematic review of acculturation strategies revealed that most studies conclude that marginalization is associated with worse depressive symptoms

compared to the other three strategies, while the integration strategy is associated with the least depressive symptoms compared to the other three strategies (Choy et al., 2021).

There are several limitations related to measuring acculturation. Firstly, it is common in the literature for studies to use proxy measures as opposed to direct measures of acculturation. Length of stay in the new country is commonly used (Lee et al., 2011; O'Loughlin et al., 2010) and was the most frequent measure of acculturation in Vang and colleague's (2017) systematic review. Proxy measures used in American studies include self-rated English proficiency and interview language choice (English vs. other) which is considered less subjective than self-declared proficiency (Lee et al., 2011). While proxy measures have contributed to our understanding of the correlates of acculturation, they fail to provide rich data on what domain of acculturation is most impactful and neglect the importance of cultural orientations and values (Cabassa, 2003).

Religion, for many is an additional cultural experience that can also influence how an immigrant integrates into a new culture. For example, religion is an important aspect of Latino culture and positive religious coping with stress related to acculturation has been shown to be associated with less alcohol use among recent Latino immigrants to the US (Sanchez et al., 2015). Research supports a protective effect of religion on alcohol use (Jankowski et al., 2018). A large scale latent class analysis study demonstrated that among university students of diverse faiths and cultural backgrounds in the US, varying aspects of religion including religious involvement and intrinsic religious motivation were protective against hazardous alcohol use (Jankowski et al., 2015). Importantly, not all members of a group adhere to the cultural or religious norms regulating alcohol use and religion/faith should not be confounded with country of origin. Alcohol use is

recorded even among countries with cultural or religious sanctions against alcohol (E.g., Afghanistan; World Health Organization, 2022). Regardless, religion is an additional factor to consider in the experience of acculturation.

As with other psychological phenomena, acculturation measures vary in content focus, intended population group, and structure, which can contribute to mixed research findings. Importantly, there is a need to operationalize the definition of acculturation and its various domains, shift from unidimensional measures, and better capture the fluid nature of acculturation (Cabassa, 2003). Many different tools have been developed to directly measure the complex nature of acculturation. Examples include the Acculturation Rating Scale for Mexican Americans-II (ARMSA; Cuellar et al., 1995), the Stephenson Multigroup Acculturation Scale (SMAS; Stephenson, 2000), the Abbreviated Multidimensional Acculturation Scale (AMAS; Zea et al., 2003), and the Vancouver Index of Acculturation (VIA; Paulhus, 2013). Few acculturation measures have been developed in Canada.

1.6. Current HIE in Alcohol Use Research

Past Canadian and international research supports the HIE in alcohol use in both adult and youth samples (Ali, 2002; Cosmo et al., 2011; Cristini et al., 2015; Hamilton et al., 2009, 2014; Ross, 1995). Among adults, recent immigrants to Canada report lower rates of alcohol dependence and are at a lower risk of developing an alcohol use disorder compared to the majority population (Ali, 2002; Ross, 1995). Among adult immigrants in Ontario, lifetime, past year, and risky drinking was generally lower among foreign-born respondents compared to Canadian-born respondents and respondents of European descent (Agic, 2017). Among youth samples, non-European immigrant adolescents

reported significantly lower rates of alcohol use compared to native-Swedish adolescents (Johnson & Svensson, 2021). In the same study, first-generation immigrants reported significantly less alcohol use compared to second-generation immigrants. Additionally, among first-generation immigrants, longer residence in Sweden was associated with increased alcohol use. Finally, research has demonstrated that immigrant adolescents born in Asia and Africa are less likely to drink compared to Australian-born adolescents (Chan et al., 2016). More examples of empirical evidence for the HIE are detailed in Chapters 2 and 4.

The literature also supports a positive association between acculturation and alcohol use and a protective effect of enculturation (Alamilla et al., 2020; Lui & Zamboanga, 2018b; Sirin et al., 2022). A meta-analysis of the of the relationship between acculturation and alcohol use among immigrant youth yielded a significant small and positive relationship. The authors concluded that acculturation is a risk factor for alcohol use among immigrant youth (Sirin et al., 2022). A meta-analysis of acculturation and alcohol use among Hispanic immigrants to the US yielded small and positive relationships between acculturation and drinking intensity, HED, and risky alcohol use (Lui & Zamboanga, 2018a). More empirical support for the relationships between acculturation, enculturation, and alcohol use are detailed in Chapter 4.

1.6.1. Current gaps in the literature

The current literature on the HIE for alcohol use is mainly comprised of American studies (Greene & Maggs, 2018; Sirin et al., 2022) and some European studies (Cristini et al., 2015; Johnson & Svensson, 2021). A stronger Canadian presence in this literature is needed given our unique make up and increasing immigrant intake. As previously alluded

to, India was the top place of birth of recent immigrants to Canada from 2016 to 2021. This was the first time this has happened, and Indian immigrants made up 18.6% of the recent immigrant population. Immigrants from the Philippines and China made up 11.4% and 8.9% of the immigrant population, respectively (Statistics Canada, 2022). With 23% of the population being foreign-born, Canada has the highest proportion of immigrants in the G7 countries. In comparison, 13.6% of the American population is foreign-born (United States Government, 2021). In 2021, Mexico is by far the top place of birth of immigrants to the United States, representing 23.6% of the immigrant population. At a distant second, 6% of US immigrants are from India, and 5.3% from China (Migration Policy Institute, 2021). Furthermore, more Canadian research is also needed as the racial and ethnic makeup of Canada and the US also differs. For instance, Latin Americans make up just 1.6% of the Canadian population while Hispanic or Latino individuals make up 19.1% of the US population (Government of Canada, 2022g; *U.S. Census Bureau quickFacts*, 2022). With these differences in the demographic makeup of immigrants between Canada and the US also comes differences in the religiosity of immigrants, which may impact alcohol use. As previously stated, religion is an important component of Latino culture and is protective against hazardous alcohol use (Sanchez et al., 2015). Hinduism is the major religion in India and the permissiveness of alcohol use varies, but research suggests some of those who practice Hinduism may be amenable to moderate alcohol use while critical of heavy alcohol use (Luczak et al., 2014).

Next, more Canadian research on the HIE for alcohol use that targets adolescence is needed. Adolescence is a period of identity development where personal autonomy and peer relationships become particularly salient to the individual (Özdemir et al., 2016).

The choice for an adolescent to engage in alcohol use is influenced by social and cultural factors (Cristini et al., 2015); therefore, it is important to have research that is directly generalizable to the Canadian social context. Furthermore, there is a need for Canadian research on the HIE for alcohol use specific to the emerging adult developmental period. Emerging adulthood captures the ages of 18-25 years and represents a unique period of life where the full responsibilities of adulthood have not yet materialized and individuals are exploring various social roles (Arnett, 2000). In Canada, emerging adults have the highest rates of heavy drinking across the lifespan (Government of Canada, 2022f) and a Canadian multi-cohort study revealed rates of four different indices of alcohol use peaked at age 21 before gradually subsiding by age 25 (Thompson et al., 2014). Next, Canadian research on the role of acculturation and enculturation as it pertains to the HIE for alcohol use is lacking. Given the increasing diversity of the Canadian population and numerous harms associated with heavy drinking, research that furthers our understanding of the nature, trajectory, and correlates of immigrant alcohol use in Canada is crucial. Unless otherwise stated, throughout this dissertation, I will use the term "youth" as a collective term that includes both adolescents and emerging adults.

1.7. Dissertation Aims

To address these gaps in the literature, the three aims of the current dissertation were as follows. Firstly, to address the general lack of Canadian data, I wished to expand research on the HIE in alcohol use to a Canadian context. Accordingly, this dissertation is comprised of two studies of the HIE for alcohol use. Study 1 (Chapter 2) was situated in the metropolitan city of Montreal, Quebec. Study 2 (Chapter 4) was comprised of data that was collected across five representative Canadian universities in British Columbia,

Ontario, Quebec, and Nova Scotia. Secondly, as previously stated, the paucity of Canadian research with youth samples and longitudinal designs represents additional gaps in the current HIE literature. As such the second aim of the dissertation was to expand the breadth of research on the HIE in alcohol use among adolescents and emerging adults by broadening the measures of alcohol use, accounting for other variables that could influence alcohol use, and employing a longitudinal design. Study 1 was comprised of longitudinal data on alcohol quantity and drinking grade onset that was collected from high school students and included additional analyses considering socioeconomic status and alcohol attitudes. Study 2 had a diverse sample of first- and second-year undergraduate students within the age-group traditionally considered as emerging adulthood (aged 18-25; Arnett, 2000) and included four alcohol indicators (quantity, frequency, HED, alcohol-related problems). Lastly, there is a need within the HIE literature to systematically consider the role of acculturation and enculturation. Therefore, the final aim of the dissertation was to explore the role of acculturation and enculturation in the HIE for alcohol use which was directly addressed by the inclusion of acculturation and enculturation measures in Study 2. I chose to employ a quantitative design across both studies to remain consistent with the current literature, maximize sample size, and compare my results to available Canadian survey data. Study 2 is limited to a cross-sectional design due to arrangements already in place prior to my involvement with the UniVenture research team.

CHAPTER 2. STUDY 1: TESTING THE HEALTHY IMMIGRANT EFFECT ON YOUTH ALCOHOL USE: A 5-WAVE LONGITUDINAL STUDY

The manuscript prepared for this study is presented below. Readers are advised that Lydia Muyingo, under the co-supervision of Drs. Sean Mackinnon and Sherry Stewart, was responsible for data analysis and interpretation, and the writing of the report. Lydia interpreted the findings of her study, wrote the initial draft of the manuscript, and received and incorporated feedback from her co-authors. The study then was presented at three conferences as a poster, and one conference as an oral presentation, and the resultant manuscript is in preparation for submission for peer review for publication. The full references for the conference presentations are as follows:

Muyingo, L., Mahmound, M., Saade, A., Sherry, S.B., Stewart, S.H., Conrod, P. Examining the healthy immigrant effect on youth substance use. Talk presented to the Professional & Research Education Program (PREP) Graduate Student Research Day, Halifax, Nova Scotia, Canada (2020, June).
*Meeting held virtually due to COVID19.

Muyingo, L., Mahmound, M., Saade, A., Sherry, S.B., Stewart, S.H., Conrod, P. (2020, June). Examining the healthy immigrant effect on youth substance use. Poster presented to the 43rd Annual Research Society on Alcoholism (RSA) Scientific Meeting, New Orleans, Louisiana. *Meeting was held virtually due to COVID19.

Muyingo, L., Mahmound, M., Saade, A., Sherry, S.B., Stewart, S.H., Conrod, P. (2020, June). Examining the healthy immigrant effect on youth substance use. Poster presented to the 81st Annual National Convention of the Canadian Psychological Association (CPA), Montreal, Quebec, Canada.
*Meeting held virtually due to COVID-19. **Preliminary data was presented at this conference.

Muyingo, L., Mahmound, M., Saade, A., Sherry, S.B., Mackinnon, S., Stewart, S.H., Conrod, P. (2021, June). Examining the healthy immigrant effect on youth alcohol use. Poster presented to the 82nd Annual National Convention of the Canadian Psychological Association (CPA), Virtual Conference.
**Final analyses were presented at this conference. Supplemental analyses were also completed at this point.

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Abstract

Purpose: The healthy immigrant effect (HIE) is a phenomenon observed in developed countries in which recent immigrants report better health compared to the majority population. Canadian research on the HIE in youth alcohol use is rare and international studies have almost exclusively employed cross-sectional designs. The main purpose of the present study was to examine the HIE by comparing two measures of alcohol use over time across three adolescent groups of differing immigration statuses. **Methods:** We examined the HIE by comparing alcohol use quantity and drinking onset longitudinally from grades 7-11 across 1.5, 2nd, and 3+ immigrant generation status youth (*N*=2713). **Results:** Significant differences were found between immigration generation statuses consistent with the HIE: individuals of 1.5 immigrant generation status reported lower drinking quantity and later onset drinking compared to individuals of 3+ immigrant generation status. Additional analyses revealed socioeconomic status (SES) and alcohol norms to be significant predictors of alcohol use. Differences in immigrant youth alcohol use may be explained by group differences in SES and alcohol norms. **Conclusion:** Results suggest recent immigration status is a protective factor against alcohol use in youth. Future research should examine moderators to the HIE including host country.

Keywords: alcohol, immigration, longitudinal, youth.

Testing the Healthy Immigrant Effect on Youth Alcohol Use: A 5-Wave Longitudinal Study

Alcohol consumption is an important facet of North American culture. It is popular among youth, with 25.6% of Canadians aged 12 to 17 years reporting drinking in 2018 (Statistics Canada, 2019). Despite its overall approval in society, underage drinking is associated with numerous negative consequences including school difficulties, unprotected sexual activity, impaired driving, and violence (Centers for Disease Control and Prevention, 2022). Moreover, heavy alcohol use is a contributing factor to over 200 health problems, including cardiovascular diseases, cancers, and gastrointestinal diseases (Paradis et al., 2023). Considering these adverse consequences, research geared towards predicting and preventing problematic alcohol use is crucial.

2.1.1. Healthy Immigrant Effect (HIE)

The HIE is a phenomenon observed in several developed countries in which recent immigrants report better physical or mental health compared to the majority population (Chen et al., 1996; Statistics Canada, 2014). The HIE and its underlying mechanisms are well researched in adults (Vang et al., 2017). It is widely thought that individual and policy-level selection processes are key driving forces behind the HIE. Individuals who decide to immigrate may possess genetic or other health advantages compared to individuals not able to withstand the migration (Vang et al., 2017). Next, policy-level immigration policies often favour the selection of healthier immigrants. For example, Canada's immigration process includes a physical exam, and immigrants can be refused entry for health reasons. Canada's immigration process also favours individuals who already have proficiency in English or French and a higher education (Vang et al.,

2017). These processes may also contribute to the HIE as it pertains to alcohol use. The HIE related to alcohol use could be a reflection of an "unhealthy" British/American/ Canadian comparator: since the 2019 Global Drug Study reported the UK, US, and Canada are the top three most intoxicated countries in the world (Wintsock et al., 2019), immigrants to these countries are likely to be healthier regarding alcohol use.

Factors related to country-of-origin socialization may also be mechanisms of the HIE for alcohol use. These include socioeconomic status (SES) and sociocultural norms and attitudes towards alcohol. Cook and colleagues (Cook et al., 2021) found immigrants with higher family income had a lower risk of alcohol use disorder compared to immigrants with the lowest incomes. The associations between SES and alcohol consumption may also extend to subjective SES. To assess subjective SES status, Hamilton and colleagues (2014) used a measure of subjective social status where youth rated their family based on how they measured up to Canadian society in the areas of wealth, education, and socially-respected jobs. They found that at low to average levels of subjective SES status, youth of 1.5 immigrant generation status (referred to as "first-generation" by the authors) were less likely to report regular alcohol use than second and third generations, but no differences among immigrant groups were found at high levels of subjective SES. The authors suggest that subjective SES among 1.5 immigrant generation status youth may be related to acculturation in that higher levels of subjective SES reflect higher status beliefs influenced by their social networks. This higher status with peers in turn may reflect greater acquisition of values and norms endorsed by the dominant culture. Next, a longitudinal study of Latino adolescent immigrants in the US found adhering to collectivist values was associated with perceived social disproval of

alcohol use (i.e., injunctive norms) which negatively predicted intention to drink (Lorenzo-Blanco et al., 2016). In sum, the HIE is a multifaceted phenomenon with mechanisms likely comprised of individual, policy, and sociocultural factors.

2.1.1.1 Evidence for the HIE in Youth Alcohol Use

A recent meta-analysis of the relationship between acculturation and youth alcohol use provides considerable insight to the HIE on youth alcohol use. The meta-analysis (Sirin et al., 2022) found for studies conducted in the US (versus "other countries"), acculturation (including immigrant generation status) was significantly positively associated with alcohol outcomes including quantity, frequency, and HED. Their results support the notion that the HIE may be a nation-specific effect; however, since countries outside the US were clumped into an 'other' category, evidence for the HIE in other developed countries may have been obscured. Additional research has provided support for the HIE in developed countries. For instance, first- and second-generation immigrant adolescents in New Zealand were found to have a significantly lower risk of alcohol use compared to their non-immigrant counterparts (Cosmo et al., 2011). To our knowledge, only two studies of the HIE on youth alcohol use have been conducted in Canada, and they both provide quantitative support for the presence of the HIE. The first cross-sectional study (Hamilton et al., 2009) found 1.5 immigrant generation status youth reported significantly less alcohol use than second-generation youth, who in turn reported less use compared to 3^{+} immigrant generation status youth. The second cross-sectional study found among those of low to average self-perceived social status, youth of 1.5 immigrant generation status were significantly less likely to

report regular alcohol use compared to no use than second- and third-generation youth (Hamilton et al., 2014).

As time spent in the host country increases, the HIE appears to weaken (De Maio, 2010; Lu & Ng, 2019). Indeed, the protective factor of new immigrant generation status against alcohol dependence decreased among adult immigrants as time spent in Canada increased (Ali, 2002). This dissipation of the HIE may also be true for immigrant youth; length of residence in the host country was the strongest predictor of immigrant youth alcohol use in the aforementioned meta-analysis of the relationship between acculturation and alcohol use (Sirin et al., 2022). It is likely that exposure to 'Western' lifestyle including risky behaviours, alcohol outlet density, and immersion in sociocultural attitudes that support excessive drinking may explain why longer-term immigrants experience less healthy drinking compared to recent immigrants in Canada (Kwak, 2016).

2.1.1.2 Limitations of HIE Research in Adolescents

Most research on the HIE has been adult-focused and researchers have called for more studies with youth (De Maio, 2010). This would help establish the presence or absence of the HIE in adolescents across alcohol outcomes as prior research has tended to focus on drinker status (i.e. drinker vs abstainer) or frequency, with less emphasis placed on indices of risky drinking like age of onset (Hamilton et al., 2014; Park et al., 2014). Furthermore, the mechanisms underlying the HIE in adolescents requires further research as key hypotheses regarding the HIE in adults such as individual and policy-level selection do not typically concern youth. Importantly, longitudinal research on the HIE in adolescent substance use is scarce; most studies are cross-sectional (Cosmo et al., 2011; Cristini et al., 2015; Hamilton et al., 2009; Newbold & Neligan, 2012; O'Loughlin et al.,

2010). Longitudinal research is needed to further our understanding of the presence, strength, and trajectory of the HIE and to help establish causal relationships. This is particularly important for adolescents given the many social and physical changes during this developmental period (Özdemir et al., 2016). Moreover, most studies of the HIE on youth alcohol use have used American samples; only two of 28 samples in Sirin and colleagues' meta-analysis were not focused on Latinx and Asian immigrants (Sirin et al., 2022). These trends in the extant literature demonstrate the need for longitudinal HIE research concerning immigration to countries outside the US by a broader range of immigrant populations. For instance, due to Canada's universal healthcare program, treatment for mental health and addictions is freely available, which is a stark contrast to the American healthcare system (Health Canada, 2019). Therefore, the main objective of the present study was to further examine the HIE by comparing, longitudinally, two measures of alcohol use across three adolescent groups of differing immigration generation statuses: 1.5 (Rumbaut, 1976), 2^{nd}, and 3^{+}immigrant generation status.

2.2. Hypotheses

Based on past research (Agic et al., 2016), we expected to find a significant HIE across both alcohol measures. Specifically, we first hypothesized we would find a significant HIE on drinking onset, such that recent immigrants would report a later onset compared to youth of 2^{nd} and 3^{+} immigrant generation status. Considering previous research supporting the HIE (Agic et al., 2016; Barsties et al., 2017), we also hypothesized those of 1.5 immigrant generation status would report lower quantities of alcohol use over time compared to second and 3^{+} immigrant generation status youth. Lastly, we expected those of 2^{nd} immigrant generation status would report a later onset

and less alcohol use over time compared to youth of 3^+ immigrant generation status. For H2 and H3, we explored main effects for immigrant generation status (i.e., collapsing across time) and time by immigrant generation status interactions (i.e., does the rate of change in alcohol consumption over time vary by immigrant generation status?). To assess the robustness of the effect of immigrant generation status on alcohol quantity, we conducted exploratory analyses including SES and alcohol attitudes as additional predictors.

2.3. Method

2.3.1. Participants

We analyzed data from the CoVenture trial, a five-wave longitudinal survey of secondary school students in Montreal, Québec, Canada. The CoVenture project is a randomized controlled trial of the PreVenture program, a personality-based intervention for substance use. Details regarding recruitment strategy and trial protocol are published elsewhere (O'Leary-Barrett et al., 2017). Briefly, the PreVenture protocol was implemented within a cluster-randomized controlled trial design study. Data were gathered from 31[2] public and private, English- and French-speaking schools. Data collection was approved by research ethics board (REB) at the host institution, the University of Montreal (L'UdeM). Fifteen schools were randomly selected for the PreVenture intervention, and only high-risk participants were recruited for the intervention. Participants were classified as high-risk if they scored one standard deviation or more above their school's means on at least one of the personality risk scales on the Substance Use Risk Profile Scale (Woicik et al., 2009).

[2]One school was comprised of an English and French division; therefore, analyses were done on 32 school clusters.

A total of 3966 students participated in at least one wave of the CoVenture trial (including non-alcohol related measures). Participants were in grade seven at baseline and were surveyed once a year until grade 11. Participants' mean age was 12.88 years at baseline and 49.21% of the sample was female. Not all participants completed the alcohol measures; 2713 unique participants provided at least one datapoint across all waves for the alcohol quantity analyses. See Appendix A for a participant flowchart illustrating the number of participants included in the alcohol quantity analyses, lifetime abstainers, and missing data.

2.3.2. Measures

Alcohol use outcomes were measured with a modified and validated version of the "Detection of Alcohol and Drug Problems in Adolescents" questionnaire (DEP-ADO; Landry et al., 2004). The DEP-ADO is a self-report measure of substance use patterns and associated harms that has been used to identity youth at risk of substance use disorders (Currie et al., 2004; Landry et al., 2004). It has excellent test-retest reliability (r =.94), and acceptable-to-good internal consistency (α = .61-.86; Landry et al., 2004) and good face validity, construct validity, and concomitant criterion referenced validity.

2.3.2.1 Drinking Grade of Onset

Participants were asked annually, "Have you used alcohol in your lifetime and if so, how often?" to determine drinking onset. Participants selected one of the following, "Never (Not even a sip)," "Occasionally," "Approximately once a month," "Weekends or once or twice during the week," "3 times or more a week but not every day," or "Every day." We defined drinking onset by the participant's grade level when they first endorsed

drinking at least “Occasionally.” Participants who consistently responded “Never (Not even a sip)” were classified as ‘lifetime abstainers.’

2.3.2.2 Alcohol Quantity

Only participants who indicated they were not lifetime abstainers were asked about alcohol quantity via the following open-ended item: “During the last 12 months, how many alcoholic drinks do you usually have when you drink?” Participants had to freely type the number of drinks.

2.3.2.3 SES

SES was assessed with a modified version of the Family Affluence Scale II (FAS II; Currie et al., 2004) and included six items which probed indicators of wealth, e.g., “How many cars does your family own?” The items were summed to indicate a total score out of ten for each participant. The FAS is used internationally and has adequate internal consistency for a short scale ($\alpha = .58$), good test-retest reliability (ICC>0.75), and good external validity (Liu et al., 2012).

2.3.2.4 Alcohol Attitudes

Developed by the National Health Service (Fuller, 2004), attitudes towards the acceptability of drinking were assessed by four statements preceded by “Do you think it is OK for someone your age to do the following”: “try drinking alcohol to see what it’s like”,” try getting drunk to see what it’s like”, “drink alcohol once a week”, and “get drunk once a week”. Students rated each statement: “it’s not OK” (scored as 1), “I don’t know” (scored as 2), or “it’s OK” (scored as 3).

2.3.2.5 Immigrant Generation Status

Consistent with prior research on immigrant adolescent alcohol use (Eitle et al., 2009), immigrant generation status was determined through a combination of three items inquiring about the place of birth of participants, and both their parents. For each item, participants chose from the following options: "Canada or US[3]," "Europe," "Africa," "Caribbean," "East Asia," "South Asia," "Middle East," "South or Central America," "Other," "Don't know." Participants were categorized as 1.5 immigrant generation status if their place of birth was not "Canada or US", 2nd immigrant generation status if they answered, "Canada or US" for themselves but not for least one parent, and 3^+ immigrant generation status if their answers to all three items were "Canada or US". Participants who answered "Don't know" were excluded.

2.3.3. Procedure

We used R (version 4.0) and the "glmm" package to conduct analyses.[4] For the alcohol quantity analyses, to limit the influence of extreme values, we recoded to 20, responses of participants who indicated they typically consumed over 20 drinks (0.7% of the sample at Wave 1, 1.13% in Wave 2, 0.8% in Wave 3, 0.5% in Wave 4, 0.2% in Wave 5). Prior research has used a similar approach (Richmond-Rakerd et al., 2017). Since some schools were randomized into the PreVenture intervention, we adjusted for the clustering within schools. Participants without alcohol quantity data (excluding lifetime abstainers) and no demographics data to determine immigrant generation status

[3] We did not differentiate between Canada and the US because "U.S. immigrants" are more like Canadians than are other immigrants, carry relative privilege over other immigrants, and often differ in their motivations for immigration (e.g., less likely to be fleeing persecution or desperately searching for a better life) (Croucher, 2011).

[4]Due to ethical restrictions, we are unable to share the study data. However, data analysis syntax can be found at https://osf.io/f5v39/?view_only=c4fafe922a5744e2b446d12296b776f4

were excluded. Due to missing data and lifetime abstainers, the sample sizes used for the analyses of drinking onset and alcohol quantity differed.

2.3.3.1 Model Comparisons

Prior to selecting the final model, we analyzed the data using different parameters to determine the best fitting model. We considered the distribution of the data, random vs fixed slopes, how to code grade (i.e., categorical vs. numerical), and clustering on school. We selected the model with the best fit as indicated by the lowest BIC value (Raftery, 1995). The selected model had a BIC value of 26,351. See Appendix B for a table summary of BIC values. As commonly experienced with complex data, nearly all random slopes models failed to converge (Zhang & Chen, 2013). To further validate our decision to describe the data with a negative binomial distribution, we ran a model using a Poisson distribution with random intercepts, grade coded as a numerical variable (i.e., linear relationship), and without school clustering, which resulted in notable poor fit (ΔBIC = 6174). A negative binomial model with random intercepts, grade coded as a numerical variable, and no clustering on school, resulted in poorer fit (ΔBIC = 228). A negative binomial model with random intercepts, grade as a numerical variable, and clustering on school resulted in poorer fit (ΔBIC = 74). A negative binomial model with random intercepts, grade coded as a categorial variable, and clustering on school also resulted in poorer fit (ΔBIC = 135). Therefore, the selected model consisted of a negative binomial distribution with random intercepts and slopes, grade coded as a numerical variable (1-5), and clustering on school (BIC = 26,979). The final model consisted of grade, immigrant generation status, and the interaction between grade and immigrant generation status

predicting alcohol quantity. The exploratory model also includes SES and alcohol attitudes as additional predictors.

2.3.4. Data Analysis

We employed a chi-squared test of independence to analyze drinking grade of onset by immigrant generation status. Participants were assigned a number ranging from 7-11 to indicate the grade they were in in the year they first reported drinking alcohol at least "Occasionally" (i.e., no longer lifetime abstainers). To analyze the HIE on alcohol quantity longitudinally, we employed a generalized linear mixed model fit by maximum likelihood (Laplace Approximation), which uses all available data. We determined a negative binomial distribution was most appropriate for the positively skewed alcohol quantity variable. Alcohol data are typically analysed with this distribution as it can handle data that are over-dispersed or with excess zeros (Navarro & Foxcroft, 2019; Zeileis et al., 2008). We fit a negative binomial distribution with a log link after rounding the alcohol quantity variable to the nearest integer, as this distribution requires count data. The final model was a generalized linear mixed model with participants nested within schools. In this model, alcohol quantity was predicted by time, immigrant generation status, and the time x immigrant generation status interaction, with random slopes and intercepts. We used Type II sums of squares in our analysis of deviance tests (Navarro & Foxcroft, 2019).

2.4. Results

2.4.1. Drinking Grade of Onset

A total of 2760 students of 1.5 (n= 272), 2nd (n=727), and 3^{+} immigrant generation status (n=1761), excluding n=2377 students who were lifetime abstainers across waves,

were included in analyses. The median drinking onset among those of 1.5 and 2nd immigrant generation status was grade 8, whereas the median drinking onset among those of 3+ immigrant generation status was grade 7. Grade of drinking onset was not equally distributed across immigrant generation status, χ^2 (8, N = 2760) = 22.49, p=*.004,* Cramer's V = 0.06. The chi-square contingency table appears in Table 2.1.

First, a greater percentage of 3+ and 2nd immigrant generation status youth reported earlier onset compared to 1.5 immigrant generation status youth. For instance, 25.72% of 3+ immigrant generation status youth and 22.70% of 2nd immigrant generation status youth reported beginning drinking in grade 8, while only 18.75% of 1.5 immigrant generation status youth reported beginning drinking in grade 8. Second, a greater percentage of 1.5 and 2nd immigrant generation status youth had a later drinking onset compared to 3+ immigrant generation status youth. For example, 8.46% of 1.5 immigrant generation status youth and 6.88% of 2nd immigrant generation status youth reported they began drinking in grade 11, while only 2.10% of 3+ immigrant generation status youth reported beginning drinking in grade 11.

2.4.2. Alcohol Quantity

See Table 2.2 for the descriptive statistics for alcohol quantity by immigrant generation status and grade. See Figure 2.1 for a graph of the final model predicting alcohol quantity by immigrant generation status longitudinally.

The final model indicated a significant effect of grade [$\chi^2(1) = 965.52$, $p < .001$], with reported alcohol quantity increasing longitudinally across all immigrant groups. The model also yielded a significant effect of immigrant generation status on alcohol quantity [$\chi^2(1) = 10.01$, p =.007]. We compared the model-predicted, estimated marginal means of

alcohol quantity for each group. Collapsed across all waves, youth of 1.5 immigrant generation status reported the lowest alcohol quantity (M = 1.71 drinks, SE = 0.12), followed by youth of 2nd immigrant generation status (M = 1.88 drinks, SE = 0.10), and then youth of 3+ immigrant generation status (M = 1.93 drinks, SE = 0.09).

The interaction between grade and immigrant generation status on alcohol quantity was also significant [$\chi^2(1) = 9.21$, $p = .01$], indicating the rate of change in alcohol quantity related to grade was not equal across immigrant groups. This interaction is best understood by examining Figure 2.1. See Table 2.3 for a summary of the estimated marginal means across each grade by immigrant generation status, pulled from Figure 2.1. These means differ from the raw means reported in Table 2.2 as they are model-predicted values.

Differences between the groups particularly emerged in grades 9-11. Third and later immigrant generation status youth reported the steepest increase in alcohol quantity between grades 9 and 10 (M_{diff} = 0.74), followed by youth of 2nd immigrant generation status (M_{diff} = 0.61) and youth of 1.5 immigrant generation status (M_{diff} = 0.50). Similarly, the 3+ immigrant generation status youth reported the steepest increase in alcohol quantity between grades 10 and 11 (M_{diff} = 1.05), followed by 2nd immigrant generation status(M_{diff} = 0.82) and 1.5 immigrant generation status youth (M_{diff} = 0.64). Lastly, a summary of the random effects is found in Table 2.4. The model predictors (i.e., grade, immigrant generation status, interaction between grade and immigrant generation status) accounted for 17.1% of the variance in alcohol quantity (marginal R^2). Once accounting for the random effects (i.e., school-level variance), the model predicted 55.5% of the variance in alcohol quantity (conditional R^2).

See Appendices C-D for SES and alcohol attitudes descriptive statistics, separated by immigrant generation status and grade. See Appendix E for a figure of the exploratory model predicting alcohol quantity by immigrant generation status longitudinally, adjusted for SES and alcohol attitudes. The exploratory model indicated significant positive effects of grade [$\chi^2(1) = 452.31$, $p < .001$], SES [$\chi^2(1) = 8.20$, $p < .01$], and alcohol attitudes [$\chi^2(1) = 473.31$, $p < .001$] on alcohol quantity. The main positive effect of immigrant generation status was reduced to non-significance [$\chi^2(2) = 5.53$, $p = .06$], as was the interaction between grade and immigrant generation status [$\chi^2(2) = 4.88$, $p = .08$]. The exploratory model predictors (i.e., grade, immigrant generation status, interaction between grade and immigrant generation status, SES, and alcohol attitudes) accounted for 19.8% of the variance in alcohol quantity. Accounting for random effects (i.e., school-level variance), the exploratory model predicted 57.7% of the variance in alcohol quantity.

2.5. Discussion

Canadian research on the HIE in youth alcohol use is rare and international studies have almost exclusively employed cross-sectional designs. We sought to examine the HIE longitudinally on two measures of alcohol use in an adolescent sample, and explored time by immigrant generation status interactions for drinking onset. We hypothesized youth of 1.5 immigrant generation status would report later onset, and less alcohol use (collapsed across the five years) compared to youth of 2nd and 3^{+} immigrant generation status. We also expected 2nd immigrant generation status youth would report a later onset compared to 3^{+} immigrant generation status youth. Our results support the HIE on drinking onset and alcohol quantity. First, a greater percentage of 1.5 immigrant

generation status youth reported a later drinker onset than 2nd and 3+ immigrant generation status youth, and a greater percentage of 3+ immigrant generation status youth reported an earlier drinking onset than youth of 1.5 and 2nd immigrant generation status. Next, supporting our hypotheses, 1.5 immigrant generation status youth reported the least amount of alcohol use collapsed across the five years, compared to youth of both 2nd and 3+ immigrant generation status, and youth of 2nd immigrant generation status reported less alcohol use collapsed over time compared to youth of 3+ immigrant generation status.

2.5.1. Grade of Onset

Our analyses were performed on the grade at which students first reported drinking at least "Occasionally." However, grade and age are correlated constructs. Within each immigrant generation status, most students (47.49% of 1.5 immigrant generation, 45.12% of 2nd immigrant generation, 50.77% of 3+ immigrant generation status) reported drinking in grade 7, where students were on average 12.82 years old. According to national surveys, the average Canadian student reports having their first alcoholic drink at 13.40 years old, comparable to our sample (Government of Canada, 2019). Moreover, our results demonstrated youth of 1.5- and 2nd immigrant generation status had a later onset compared to youth of 3+ immigrant generation status. The protective effect of new immigration status on drinking onset may dissipate with time or across generations as immigrants become influenced by their earlier-onset drinking peers or through acculturation (i.e., the psychological and behavioural changes an individual experiences after contact with another culture; Berry, 2005). Further research on the correlates of drinking onset among youth of 2nd immigrant generation status is needed as

we also found a greater proportion of 3^{+} and 2^{nd} immigrant generation status youth reported earlier onset compared to youth of 1.5 immigrant generation status.

Despite differences in median onset, our results show students of any immigrant generation status are susceptible to underage drinking. The social and physical consequences related to early onset drinking include a greater risk of alcohol problems later in life, low academic performance, and violence, among other adverse outcomes [40-43].

2.5.2. Alcohol Quantity

Large surveys of youth alcohol use typically refer to drinker status in lieu of alcohol quantity. Approximately 68% of our sample reported some quantity of alcohol use between grades 7-11. Our data was collected between 2012 and 2017. The Canadian Student Tobacco, Alcohol, and Drugs Survey reported 44% of high school students engaged in alcohol use in 2017 (Government of Canada, 2018). Notably, 54.3% of Quebec students in grades 7-11 reported drinking which is higher than the national average but below our findings (Government of Canada, 2018). The legal drinking age in Quebec is younger than many other Canadian provinces, and Montreal has one of the highest alcohol outlet densities in Quebec, which may explain our sample's high rate of drinking (Ngamini Ngui et al., 2015). Our study's finding of a significant interaction between immigrant group and time suggests significant differences in alcohol quantity among immigrant groups may emerge later in high school. Since the prevalence of HED increases as students progress through high school (Government of Canada, 2019), the HIE may be undetectable in early adolescents with low base rate drinking.

Youth of 1.5 immigrant generation status reported the lowest SES and least permissive alcohol attitudes in our sample (see Appendices C-D), and immigrant generation status differences in alcohol quantity became non-significant when SES and alcohol attitudes were included in the analysis. Our findings therefore suggest significant differences in immigrant youth alcohol use may be explained by immigrant generation differences in SES and alcohol attitudes. SES was a significant positive predictor of alcohol use and may reflect greater access to financial resources to secure alcohol and less parental supervision in higher SES youth populations (Ashbourne et al., 2012). Moreover, research suggest recent immigrants are more likely to report lower levels of SES and greater levels of underemployment compared to later generations (e.g., lower status jobs despite pre-immigration education/qualifications; Chan et al., 2016; Hamilton et al., 2014). Next, our study aligns with other research showing the significant positive effect of alcohol attitudes on youth alcohol quantity (Cristini et al., 2015). Recent immigrant youth may be more likely to view drinking as unacceptable based on their culture of origin's injunctive norms and parental socialization; immigrant parents, out of fear of the dominant culture's influence on their children, may increase their monitoring behaviours (Nakhaie & Kazemipur, 2012; Paradis et al., 2023). When the effect of SES and alcohol attitudes were broken down separately during supplemental analyses, it was revealed that alcohol attitudes were primarily driving differences in quantity across immigrant generation statuses, suggesting a potential mechanism of the HIE.

2.5.3. Implications

This study is among the largest longitudinal studies of the HIE in youth alcohol use, the first longitudinal study of the HIE on youth alcohol use in Canada, and the first

longitudinal study to assess the HIE on drinking onset. Our study supports the presence of the HIE on alcohol use in adolescents in Montreal, Canada. Our data suggest the HIE on alcohol quantity may be strongest in later high school grades as students are typically learning to drink. Indeed, among students of 1.5 immigrant generation status, the normal growth/trajectory of alcohol quantity is dampened compared to students of 2^{nd} and 3^{+} immigrant generation status. Our exploratory analyses suggest the HIE may be explained by immigrant group differences in SES and alcohol attitudes. These findings are consistent with prior research on the HIE in youth alcohol use (Barsties et al., 2017; Sirin et al., 2022) but extends this prior work by accounting for clustering and using negative binomial distributions, random slopes, and robust estimates on complex data. Instead of assuming independence of observations like in most statistical analyses, accounting for the fact that individuals are clustered within schools yields more robust estimates (Tabachnick & Fidell, 2013).

Canada's Guidance on Alcohol and Health recommends youth delay drinking as long as possible (Paradis et al., 2023). Indeed, our results support the inclusion of school-based alcohol prevention and intervention programs that also target permissive alcohol attitudes as well as sources of influence on those attitudes like injunctive norms (Stephens et al., 2022). Increased tolerance towards alcohol use is likely to rise among youth of 1.5 immigrant generation status over time with greater exposure to 'Western' lifestyle influences and motivations to be accepted in their peer group that may suppress the protective effects of recent immigrant generation status. Indeed, an epidemiologic survey found immigrants to the US who arrived as children were more likely to have a substance use disorder than those who arrived as adolescents (Salas-Wright et al., 2018).

Therefore, while our study demonstrates that immigrant youth may drink less overall, it does not negate the possibility of them developing problematic drinking habits as they age.

2.5.4. Limitations and Future Directions

While longitudinal designs allow for complex analyses and help establish temporal precedence compared to cross-sectional designs, our study still faced limitations. Namely, our sample had substantial missing data due to participant dropout over time. Next, our study lacked measures of race and ethnicity, therefore we could not consider whether being situated among those of the same ethnic group would be related to better outcomes, a health phenomenon known as "ethnic density" (Shaw et al., 2012). Similarly, given the distribution of the data, we grouped all immigrants together and therefore could not assess country of origin as a moderator. The distribution of place of birth data can be found in Appendices F-H. Of note, approximately 1/3 youth of 1.5 immigrant generation status reported being born in Europe. Since several European countries are among the top drinking countries in the world (Word Health Organization, 2022), it's likely that the magnitude of the HIE observed in our study would be larger among youth from non-European countries. Relatedly, the HIE may be specific to immigrants who are heavily screened (e.g., children of professional families) as opposed to refugees escaping traumatic home countries and we did not make a distinction between these two types of immigrants in our study. Moreover, our study did not have data on age of migration. Since research has shown that earlier age of migration is associated with greater risk of mood disorders and substance use among immigrant children in Canada (Salami et al, 2022), the magnitude of the HIE may be weaker among youth with earlier

ages of migration. The underlying mechanisms underlying the HIE in adolescents requires further research as the proposed mechanisms regarding the HIE in adults such as individual and policy-level selection do not typically concern youth. Therefore, family and peer factors such as parental control and modelling may explain differences in alcohol use outcomes in immigrant youth (Cristini et al., 2015). Our exploratory analyses with SES and alcohol attitudes represent preliminary steps in identifying mechanisms. Lastly, further research on the role of acculturation in conjunction with the potential protective role of enculturation on the HIE is needed (Alamilla et al., 2020).

Importantly, our sample had overall low levels of drinking in terms of quantity. Moreover, ours was a general sample of school-attending youth and not a clinical sample of young people with substance use disorders. Students had to be attending school to participate meaning we cannot speak to patterns in those youth who have dropped out of school. Research suggests teens who engage in polysubstance use and who primarily consume alcohol are more likely to drop out of high school compared to non-using peers (Kelly et al., 2015). Moreover, our study languages were limited to English and French. Next, though we adjusted for school clustering, a random half our participants were subjected to an intervention which may have influenced our findings. A follow-up study from the CoVenture trial assessing the efficacy of the intervention demonstrated that there was a preventative effect on substance use disorder emergence (Conrod et al., in press). Therefore, the protective effect of the intervention may have tempered the drinking behaviour of the heaviest drinking youth in our sample, who are likely to be of 3^{+} immigrant generation status. The magnitude of the HIE in our study may therefore be underestimated. Our significant effects were small in magnitude (Cohen, 1988); however,

given the vulnerability of the youth brain to alcohol use, further insight into predictors of youth drinking is meaningful for intervention (Public Health Agency of Canada, 2016). Moreover, it is possible some students may have underreported their alcohol use due to social desirability reasons; however, measures were taken by the research team to ensure students were well-informed about the confidentially of their data (e.g., names were not attached to data, student data was not communicated to school or parents).

Future research should clarify the nuances behind alcohol use patterns among youth of 2nd immigrant generation status. Our study found those of 2nd immigrant generation status resembled those of 3+ immigrant generation status regarding alcohol quantity and occasionally reported similarly to those of 1.5 immigrant generation status regarding drinking onset. Drinking onset may be more influenced by parental factors shared between youth of 1.5 and 2nd immigrant generation status, while the quantity that 2nd immigrant generation status youth drink may be more influenced by social factors shared with 3+ immigrant generation status youth.

Lastly, our results suggest differences in alcohol quantity among immigrant groups may emerge later in high school. Research suggests immigrant youth are more socially isolated than their non-immigrant peers; therefore, they may be less likely to attend social gatherings involving alcohol which typically increase in frequency as teens age (Cherng, 2015). Longitudinal studies that capture the transition to post-secondary education would be beneficial to further understanding the HIE. Notably, emerging and young adults 20-29 years old represent the highest percentage of problematic drinkers in Canada (Public Health Agency of Canada, 2016). Immigrant children may thus be

exposed to increased pressure to engage in heavy drinking and may benefit from tailored preventative interventions before leaving high school.

2.5.5. Conclusion

We found evidence of the HIE on alcohol use (both drinking onset and quantity) in a representative sample of Montreal's adolescent population. This research will contribute to the understanding of potential differences of the HIE on alcohol use between adults and adolescents. Future research on the mechanisms underlying the HIE will be beneficial to preventing the decrement of the advantages of immigrant generation status for immigrant youth while still allowing for their adaptation to Canadian culture.

Table 2.1. *Drinking Grade of Onset Chi-Square Contingency Table*

		Immigrant Generation Status			
Drinking Grade of Onset		1.5	2	3^{+}	Total
7	Observed	130	328	894	1352
	Expected	133.24	356.12	862.63	1352.00
	% Within row	9.62%	24.26%	66.12%	100.00%
	% Within column	47.79%	45.12%	50.77%	48.99%
	% Of total	4.71%	11.88%	32.39%	48.99%
8	Observed	51	165	453	669
	Expected	65.93	176.22	426.85	669.00
	% Within row	7.62%	24.66%	67.71%	100.00%
	% Within column	18.75%	22.70%	25.72%	24.24%
	% Of total	1.85%	5.98%	16.41%	24.24%
9	Observed	32	103	232	367
	Expected	36.00	96.67	234.16	367.00
	% Within row	8.72%	28.06%	63.22%	100.00%
	% Within column	11.76%	14.17%	13.17%	13.30%
	% Of total	1.16%	3.73%	8.41%	13.30%
10	Observed	36	81	145	262
	Expected	25.82	69.01	167.17	262.00
	% Within row	13.74%	30.92%	55.34%	100.00%
	% Within column	13.24%	11.14%	8.23%	9.49%
	% Of total	1.30%	2.93%	5.25%	9.49%
11	Observed	23	50	37	110
	Expected	10.84	28.97	70.18	110.00
	% Within row	20.91%	45.45%	33.63%	100.00%
	% Within column	8.46%	6.88%	2.10%	3.99%
	% Of total	0.83%	1.81%	1.34%	3.99%
Total	Observed	272	727	1761	2760
	Expected	272.00	727.00	1761.00	2760.00
	% Within row	9.86%	26.34%	63.80%	100.00%
	% Within column	100.00%	100.00%	100.00%	100.00%
	% Of total	9.85%	26.34%	63.80`%	100.00%

Note. % within row = percentage of total observations of each immigrant generation status represented within each row grade of onset. % within column = percentage of total observations within each drinking grade of onset represented within each column of immigrant generation status.

Table 2.2. *Descriptive Statistics for Alcohol Quantity by Immigrant Generation Status and Grade*

	Immigrant Generation Status	**Mean**	***SD***	**Mdn**	**N**	**% of Total**
Grade 7	1.5 Gen	1.47	2.56	1	83	10.01
	2nd Gen	1.41	2.60	1	181	21.83
	3+ Gen	1.61	2.68	1	565	68.15
	Total	1.55	2.65	1	829	100
Grade 8	1.5 Gen	1.94	3.17	1	98	7.97
	2nd Gen	1.88	2.92	1	274	22.29
	3+ Gen	1.98	2.82	1	857	69.73
	Total	1.95	287	1	1229	100
Grade 9	1.5 Gen	2.66	3.68	1	121	7.79
	2nd Gen	2.25	2.55	1	357	22.97
	3+ Gen	2.71	3.12	2	1076	69.24
	Total	2.6	3.05	2	1554	100
Grade 10	1.5 Gen	2.73	2.28	2	156	8.22
	2nd Gen	2.78	2.68	2	436	22.98
	3+ Gen	3.40	3.10	3	1305	68.79
	Total	3.21	2.96	2	1897	100
Grade 11	1.5 Gen	3.00	3.28	2	156	10.48
	2nd Gen	3.10	2.62	2	454	30.51
	3+ Gen	3.74	2.86	3	878	59.00
	Total	3.47	2.86	3	1488	100
Total	1.5 Gen	2.11	2	1.5	266	9.44
	2nd Gen	2.41	2.3	2	716	25.40
	3+ Gen	2.73	2.4	2	1837	65.17
	Total	2.59	2.35	2	2819	100

Note. These data are raw data and thus differ from the model-predicted means. Descriptive statistics refer to average number of drinks per drinking occasion.

Table 2.3. *Estimated Marginal Means of Alcohol Quantity by Immigrant Generation Status*

Grade	1.5 Generation		2nd Generation		3+ Generation	
	EMM	(95%CI)	*EMM*	(95%CI)	*EMM*	(95%CI)
7	0.92	(0.74 – 1.15)	0.95	(0.81 – 1.10)	0.88	(0.77 – 0.98)
8	1.21	(1.01 – 1.44)	1.28	(1.13 – 1.46)	1.25	(1.11 – 1.37)
9	1.58	(1.37 – 1.83)	1.73	(1.55 – 1.93)	1.77	(1.59 – 1.93)
10	2.08	(1.82 – 2.37)	2.34	(2.11 – 2.60)	2.51	(2.27 – 2.74)
11	2.72	(2.34 – 3.15)	3.16	(2.83 – 3.54)	3.56	(3.20 – 3.90)

Note. Data are backtransformed from the log scale. Model-predicted values. EMM = Estimated marginal means.

Table 2.4. *Random effects*

	Final model	Exploratory model
	Value	Value
σ^2	0.49	0.42
$\tau_{00\ Baseline}$	0.88	1.03
$\tau_{00\ School}$	0.06	0.04
$\tau_{11\ Baseline * grade}$	0.02	0.04
$\rho_{01\ Baseline}$	-0.85	-.87
ICC	0.46	0.47
$N_{Baseline}$	2713	2621
N_{school}	32	32
Observations	6751	6038
Marginal R^2 / Conditional R^2	0.171 / 0.555	0.198/0.577

Note. The variables in this table are descriptive statistics related to the random effects in the model, and thus do not have associated *p*-values. Final model: Random effects for the final model of time, immigrant generation status, and the interaction between time and immigrant generation status predicting alcohol quantity.
Exploratory model: Random effects for the final model of time, immigrant generation status. The interaction between time and immigrant generation status, alcohol norms, and SES predicting alcohol quantity. σ^2 = residual variance, τ_{00} = random intercepts. τ_{11} = random slope. ρ_{01} = correlation between intercept and slope, ICC = intraclass correlation, $N_{Baseline}$ = sample size for individuals, N_{School} = sample size for schools.

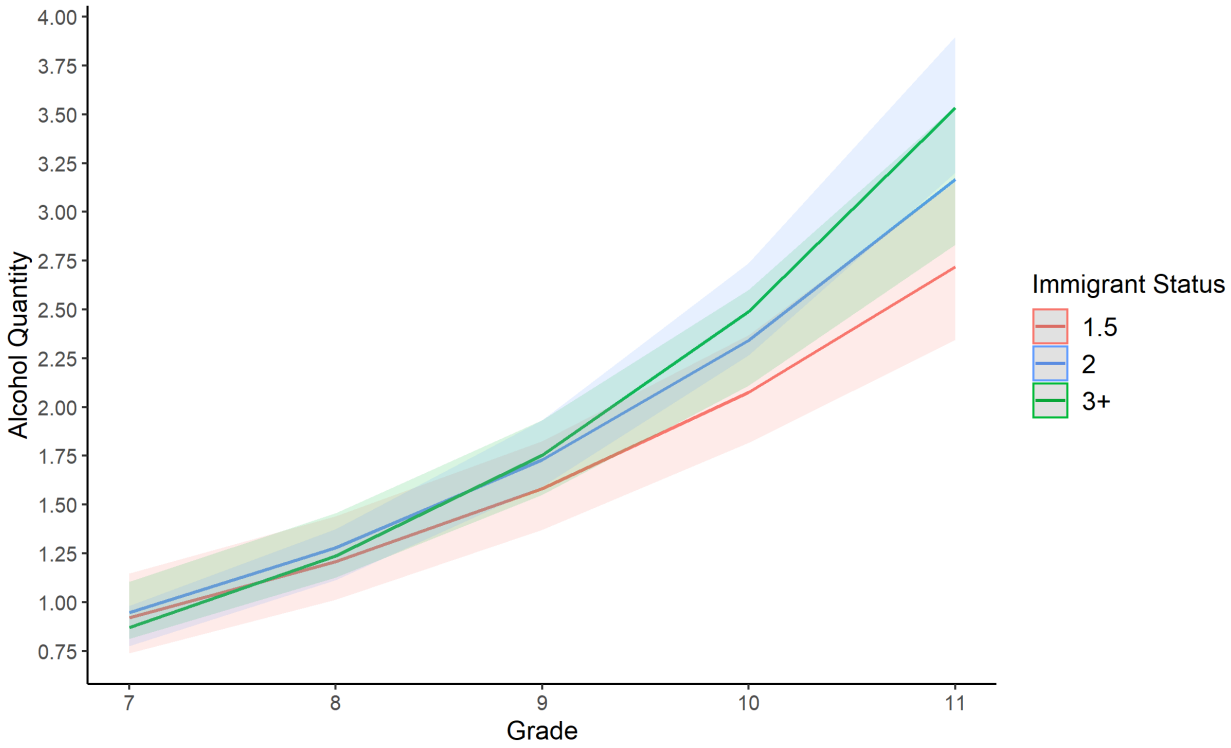

Figure 2.1. *Model-predicted alcohol quantity by immigrant generation status and grade. Note: Data has been back transformed from the log scale to the original metric.*

CHAPTER 3. TRANSITION FROM STUDY 1 TO STUDY 2

The results of Study 1 provided strong evidence of the HIE for alcohol use among adolescents residing in Montreal, Canada. The longitudinal design, analytic method, and sample size were great strengths of Study 1. At the final wave of data collection, participants in the study were in their final year of high school and while generational differences were present, it was unclear how robust these differences would be as immigrants transition to university. To address this, Study 2 studied first- and second-year university students across Canada. This is a key developmental period to capture as students have entered legal drinking age, and many have left home for the first time and are now at risk of being influenced by campus drinking culture.

A significant weakness of Study 1 was its limited demographic information. We addressed this by expanding our gender items and, essential to our research objectives, included an item inquiring about the respondent's heritage culture. We were then able to consider the role of country of origin (COO) alcohol use rates for respondents who provided sufficient data. We also had the opportunity to expand our measures of alcohol use from two measures (quantity, drinking onset) to four measures (quantity, frequency, HED, and alcohol-related problems) to include alcohol indicators that are specifically relevant for the emerging adulthood population. Next, while Study 1 proposed socioeconomic status (SES) and alcohol attitudes as potential drivers of the differences in alcohol use across immigrant generation status groups, no measures of acculturation or enculturation were included. We addressed this by adding direct measures of acculturation and enculturation in Study 2 though administration of a modified, brief version of the Vancouver Index of Acculturation (VIA; Paulhus, 2013). By expanding

our sample from one diverse city to five universities across the country, we can more confidently claim to have a generalized sample of the Canadian immigrant student population.

CHAPTER 4. STUDY 2: EXAMINING THE HEALTHY IMMIGRANT EFFECT ON ALCOHOL USE IN EMERGING ADULTS

The manuscript prepared for this study is presented below. Readers are advised that Lydia Muyingo, under the co-supervision of Drs. Sean Mackinnon and Sherry Stewart, was responsible for some selection of measures, data analysis and interpretation, and the writing of the report. Lydia interpreted the findings of her study, wrote the initial draft of the manuscript, and received and incorporated feedback from her co-authors. The study then was presented at a conference as a poster, the abstract was submitted for another upcoming conference, and the resultant manuscript is in preparation for submission for peer review for publication. The full reference for the conference presentation and submission is as follows:

Muyingo, L., Mackinnon, S., Conrod, P., Keough, Krank, M., Thompson, K., & Stewart, S.H. (2022, June). *Examining the healthy immigrant effect on alcohol use in emerging adults*. Poster presented at the 83rd Annual National Convention of the Canadian Psychological Association (CPA), Calgary, Alberta.

Muyingo, L., Mackinnon, S., Yunus, F., Saade, A., Sherry, S.B., Conrod, P., Keough, Krank, M., Thompson, K., & Stewart, S. H. (2024, April). *Examining the healthy immigrant effect on alcohol use in emerging adults.* Abstract submitted for the 3rd Annual National Conference for Black Excellence in STEMM, Ottawa, Ontario.

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Abstract

Objective: Prior research on the healthy immigrant effect (HIE) for alcohol use has not explored the impact of heterogeneity of the immigrant population related to assimilating into a country's mainstream culture (acculturation), adherence to original culture's values (enculturation), or country of origin (COO) drinking rates. We examined whether the HIE on alcohol use in emerging adults is moderated by acculturation/enculturation.

Method: We compared four alcohol indicators (quantity, frequency, heavy episodic drinking [HED], and alcohol-related problems) across undergraduates from five universities (*N*=1016) of differing immigration statuses defined by participants' and parents' birthplace. We extended work on the HIE by analyzing main effects and interactions of acculturation and enculturation with immigrant generation status on alcohol indicators, as well as the impact of COO drinking rates.

Results: Immigrant groups differed in ways consistent with the HIE across all four alcohol outcomes; for instance, 1.5 immigrant generation status students reported the lowest alcohol quantity, followed by 2nd immigrant generation and then 3^{+} immigrant generation status students. We found significant interactions between immigrant generation status and enculturation on alcohol frequency and alcohol-related problems. Unexpectedly, enculturation was *positively* associated with alcohol frequency and alcohol-related problems in students of 1.5 immigrant generation status. COO per capita alcohol consumption was positively associated with alcohol frequency and HED among students of 1.5 and 2nd immigrant generation status.

Conclusion: While more recent immigration generation status is associated with lower alcohol involvement in emerging adult undergraduates, enculturation may be a risk for more frequent and problematic drinking in 1.5 immigrant generation status students.
Keywords: Immigrant, Healthy Immigrant Effect, heavy episodic drinking, alcohol-related problems, emerging adults, college drinking, enculturation, acculturation

Examining the Healthy Immigrant Effect on Alcohol Use in Emerging Adults

Alcohol use remains a prominent aspect of Canadian culture, despite its associations with numerous adverse health outcomes including certain cancers, liver disease, accidental bodily harm, and violence (Paradis et al., 2023). In general, the risks associated with alcohol use increase the more drinks an individual typically consumes per week (Paradis et al., 2023). HED is typically defined as consuming 5+ standard drinks per occasion for males or 4+ standard drinks for females on a single drinking occasion (Wechsler et al., 1994). Other definitions have used 6+ drinks (regardless of sex) as a marker for HED (Bush et al., 1998). HED is associated with an increased risk of physical and sexual violence, gastrointestinal inflammatory conditions (acute pancreatitis, gastritis), cardiovascular diseases (stroke, hypertension, heart attacks), and the advancement of an alcohol use disorder (Paradis et al., 2023). Among youth, HED is also associated with physical injury, dating violence, and decreased academic achievement (Paradis et al., 2023).

The university context is a risk factor for HED. Emerging adults (aged 18-25 years old) who attend university consume more alcohol compared to their same-aged non-attending peers (Arnett, 2000; Timberlake et al., 2007). Indeed, excessive alcohol use is normalized on university campuses and alcohol is often present at social gatherings. Emerging adulthood is a developmental stage between adolescence and adulthood marked by independence from parents, self-discovery, and exploration (Arnett, 2000), potentially explaining why emerging adults are among the heaviest drinkers in Canada (Government of Canada, 2022f). Indeed, this period of experimentation, coupled

with campus drinking culture (Henderson et al., 2018), could result in problematic alcohol use and its associated risks.

4.1.1. Healthy Immigrant Effect (HIE)

The healthy immigrant effect (HIE) is a phenomenon observed in many developed countries in which recent immigrants report better health compared to the majority population (Chen et al., 1996). The HIE is widely thought to result from a selection bias, where healthier potential immigrants are able to withstand the various costs (physical, social, and financial) associated with the immigration process (Gee et al., 2004). With respect to mental health and addiction, recent immigrants to Canada report lower rates of depression and are at a lower risk of developing an alcohol use disorder compared to the native born population (Ali, 2002; Ross, 1995). However, research has shown that the odds of reporting alcohol dependence increases as time spent living in Canada increases among adult immigrants (Ali, 2002) and immigrants who have lived in Canada for over 10 years are 31% more likely to report high levels of stress compared to more recent immigrants (Wang & Palacios, 2017). The decline in immigrant well-being overtime in Canada may be a result of the of social, environmental, and systematic challenges known to face immigrants such as racism and employment discrimination among adults (Nakhaie & Kazemipur, 2012; Samuel, 2009) and social isolation among youth (Cherng, 2015). We define individuals of 1.5 immigrant generation status as those who arrived to Canada as children, individuals of 2^{nd} immigrant generation status as those born in Canada but who have at least one foreign born parent, and individuals of 3^{+} immigrant generation status as those whose parents and self were born in Canada (Rumbaut, 2012).

4.1.2. Evidence for the HIE in Emerging Adult Alcohol Use

Prior literature supports the presence of the HIE for emerging adult alcohol use. In the United States, first generation university students were more likely to be abstainers, less likely to engage in HED, less likely to desire being drunk, and reported fewer alcohol-related problems than third generation students (Greene & Maggs, 2018). Among Latino college students in America, Grindal and colleagues (2019) found that students of 3^{+} immigrant generation status reported greater heavy drinking than both students of 1^{st} and 2^{nd} immigrant generation status. A greater understanding of additional factors relevant to emerging adults that could influence these immigrant group differences is needed as the social challenges thought to impact the HIE pertain mainly to the parents of emerging adults.

4.1.3. Acculturation, Enculturation and Alcohol Use

Enculturation refers to the degree to which an individual adheres to their original culture's values and norms (Zimmerman et al., 1996). Enculturation has been found to be protective against problematic alcohol use among youth and emerging adults across various cultural groups (Alamilla et al., 2020). For instance, collectivist values were protective against heavy alcohol use among Hispanic immigrant youth in the US (Schwartz et al., 2014) and adhering to their Indigenous heritage culture was associated with fewer alcohol-related problems among Indigenous university students in Canada (Currie et al., 2011). Given evidence of its protective nature against alcohol use, research on the HIE for alcohol use that systematically considers the role of enculturation is needed.

Acculturation is an important factor when considering alcohol use levels in immigrant populations. Acculturation is defined as the sociocultural and psychological change that stems from the interaction between two or more cultural groups and/or members (Berry, 2005). A meta-analysis of the relationship between acculturation and alcohol indicators among Asian Americans across 39 studies revealed a small positive association (r = .06) between acculturation and alcohol consumption including intensity of hazardous use, but no significant association with alcohol-related problems (Lui & Zamboanga, 2018b). A similar meta-analysis among Hispanic immigrants to the US across 88 studies revealed significant small positive associations (r ranged from .05 to .1) between acculturation and drinker status, drinking intensity, HED, and alcohol-related problems, but not drinking frequency (Lui & Zamboanga, 2018a). Proxy measures of acculturation include time spent in country, official language proficiency, and nativity status (Lee et al., 2011). For instance, Greene and Maggs (2020) used nativity status as a proxy measure of acculturation and found that US-born Asian-American college students reported greater alcohol frequency and HED frequency compared to foreign-born Asian-Americans who were assumed to have stronger adherence to traditional Asian cultural values. Moreover, Edkins and colleagues (2017) found that being born outside of Canada was negatively associated with HED, but only for male students. Authors have called for more research that uses bidimensional measures of acculturation (as opposed to using acculturation as an umbrella term that includes both acculturation and enculturation), thereby considering the multidimensional nature of acculturation, instead of using proxy measures which are typically unidimensional measures (Greene & Maggs, 2018).

Country of origin (COO) factors are also important to consider when discussing the impact of acculturation and enculturation on alcohol use and overall differences in alcohol use among immigrants. For example, among immigrant middle-aged adult men in Taiwan, the relationships of acculturation and enculturation with drinking patterns varied based on COO per capita consumption in reference to Taiwan's per capita consumption (Chen & Chien, 2018). Among men from lower COO per capita countries (deemed "dry ethnic drinking cultures"), acculturation was positively associated with low-risk drinking and enculturation was negatively associated with low-risk drinking. Among those from higher COO per capital countries (deemed "wet ethnic drinking cultures"), acculturation was negatively associated with hazardous drinking and enculturation was positively associated with hazardous drinking. Moreover, among immigrant adolescents across 23 countries, higher COO per capita consumption was associated with more frequent lifetime alcohol use and drunkenness (Barsties et al., 2017). Among foreign-born Asian Americans between 24-32 years old, COO drinking prevalence predicted alcohol dependence symptoms (Cook et al., 2013). Generally, research supports the positive association between acculturation and alcohol use and the positive association between COO alcohol indicators and alcohol consumption in the host country.

4.1.4. Limitations of HIE Research in Emerging Adults

The majority of the research in the HIE in alcohol use with emerging adults has been conducted in the United States with an emphasis on Latinx and Asian-American immigrants (Alamilla et al., 2020; Greene & Maggs, 2020; Grindal et al., 2019). Given the differences in the cultural composition and immigration policies between the US and Canada (Masud & Tung, 2019), more Canadian research is needed. Our Canadian sample

addresses this gap in the literature. Moreover, extant Canadian research has not considered differences in generational statuses and has not examined the role of acculturation and enculturation on the HIE in alcohol use in emerging adulthood (Edkins et al., 2017). Our study uses a bidimensional measure of acculturation which allows us to also consider the interaction between acculturation and enculturation, which has been identified as a future research direction (Greene & Maggs, 2018). Moreover, previous research on the HIE for alcohol use among emerging adults has not systematically considered the role of COO drinking rates on current drinking behaviour. Our study includes COO drinking rates as a proxy measure of alcohol norms for a given country. Canadians drink more than the global population and are among the heaviest drinkers in the developed world (Wintsock et al., 2019). Therefore, considering COO per capita rates is important to our understanding of the HIE as some immigrants will have come from countries with drinking rates that are discrepant from Canada's, and others from countries with drinking rates that are more consistent with those in Canada. However, a gap remains in research that considers the relationship between COO consumption practices and alcohol use among emerging adult immigrants.

4.1.5. Hypotheses

The purpose of this study was to examine the HIE in alcohol use in Canadian emerging adults attending various universities across the country. First, we predicted that we would find evidence for a HIE across four alcohol indicators (alcohol frequency, alcohol quantity, HED, and alcohol-related problems), with the 3^{+} immigrant generation status group reporting significantly greater alcohol indicators compared to the 1.5 and 2^{nd} immigrant generation status groups. Second, among students of 1.5 and 2^{nd} immigrant

generation status only,[5] we predicted acculturation would be positively associated, and enculturation negatively associated, with all alcohol indicators. Hypotheses regarding the interaction between acculturation/enculturation and immigrant generation status on alcohol indicators were exploratory.[6] Finally, we predicted that greater COO per capita alcohol consumption would be associated with greater alcohol indicators among individuals of 1.5 and 2nd immigrant generation status.

4.2. Method

4.2.1. Participants

We collected and analyzed original data from the UniVenture survey (2020-21 data collection), a survey associated with a screening for a trial of a personality-targeted program for improving undergraduates' substance misuse and mental health across five representative Canadian universities in British Columbia, Ontario, Quebec, and Nova Scotia (Morris et al., 2023; Yunus et al., 2022). N=1318 1st and 2nd year undergraduates (77.8% women; M [SD] age = 19.27 [1.39] years) participated in the cross-sectional survey. Eighteen percent of 1.5 immigrant generation status students, 12.9% of 2nd immigrant generation status students, and 33% of 3+ immigrant generation status students reported living in residence. Forty-four percent of 1.5 immigrant generation status students self-identified as international students, representing 95% of all international students included in the sample. Data was collected online (September 2020-March

[5] We excluded 3+ immigrant generation status students from analyses because they are likely to report high levels of acculturation to Canadian values since both the respondent and parents would been exposed to Canadian values since birth. We were interested in the acculturation and enculturation experience among students of 1.5 and 2nd immigrant generation status whose exposure to heritage culture values are likely to be more recent and salient.

[6] Students of 2nd immigrant generation status have unique acculturation/enculturation experiences in that they share parental factors with students of 1.5 immigrant generation status and social factors with students of 3+ immigrant generation status. This may lead to differing relationships between acculturation/enculturation and alcohol indicators.

2021), prior to eligible participants receiving any intervention. Data collection was REB approved by all five participating institutions.

4.2.2. Measures

4.2.2.1 Immigrant Generation Status

Consistent with prior research on emerging adult immigrant alcohol use, immigrant generation status was determined through a combination of three items inquiring about participants' and both parents' places of birth (Greene & Maggs, 2018). For each item, participants chose from the following options: "Canada or US[7]," "Europe," "Africa," "Caribbean," "East Asia," "South Asia," "Middle East," "South or Central America," "Other [please specify]," "I prefer not to say," or "Don't know." Participants were categorized as 1.5 immigrant generation status if their own place of birth was not "Canada or US," 2nd immigrant generation status if they answered, "Canada or US" for themselves but not for one/both parent(s), and 3+ immigrant generation status if they answered "Canada or US" to all three items. Those answering "I prefer not to say" or "Don't know" to any of these three items (n=44) were excluded. See Appendices I-K for the distribution of place of birth data.

4.2.2.2 Gender

Participants selected their gender from the following options: "Man," "Woman," "Transgender," "Non-binary," "Two-spirt," "Other" [please specify]. Since women represented 77.8% of the sample, and transgender/non-binary/two-spirit/other individuals had low sample sizes (2.0% of sample), to include those of every gender in our analyses,

[7]We did not differentiate between Canada and the US because "U.S. immigrants" to Canada are more similar to Canadians than are other immigrants, carry privilege over other immigrants, and differ in motivations for immigration (i.e., less likely to immigrate for humanitarian reasons) (Croucher, 2011).

we created a categorical variable for gender that consisted of "Not woman" and "Woman."

4.2.2.3 Drinking Behavior

Participants were asked if they had used alcohol in the past 6 months. For participants who said yes, we administered three indices of past six-month drinking behavior each measured with a single item from the three-item Alcohol Use Disorders Identification Test – Consumption scale (AUDIT-C; Bush et al., 1998). The AUDIT-C has excellent psychometric properties and concurrent validity in undergraduates (Barry et al., 2015). It has been used internationally to assess campus alcohol policies and to assess the impact of community alcohol use intervention programs in the university population (Cousins et al., 2014; Oh et al., 2020). Each item is answered on a 5-point scale (scored 1-5). Responses of "I prefer not to say," were coded as missing. Participants were given the following definition of a single drink: 341 mL of 5% beer or cider, 142mL/5oz of 12% wine, or 43mL/1.5oz of 40% distilled alcohol like rum or vodka (Paradis et al., 2023). Alcohol frequency was measured using the first item from the AUDIT-C (Bush et al., 1998). Participants were asked, "How often did you have a drink containing alcohol in the past six months?" and selected from the following options: "Never", "Monthly or less", "2-4 times a month", "2-3 times a week", and "4 times a week or more". Alcohol quantity was measured using the second item from the AUDIT-C (Bush et al., 1998). Participants were asked "How many drinks containing alcohol did you have on a typical day when you were drinking in the past six months?" and selected from the following options: "1 or 2", "3 or 4", "5 or 6", "7 to 9", and "10 or more". HED frequency was assessed with the third item from the AUDIT-C (Bush et al., 1998). Participants were

asked “How often did you have six or more drinks on one occasion in the past six months?” and selected from the following options: “Never”, “Less than monthly”, “Monthly”, “Weekly”, and “Daily or almost daily”.

4.2.2.4 Alcohol-Related Problems

Among drinkers, alcohol-related problems were assessed with the Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ; Kahler et al., 2005). The B-YAACQ has good internal consistency (α= 0.84), concurrent validity with the AUDIT (Saunders et al., 1993), and little item redundancy (Kahler et al., 2008). The B-YAACQ consists of 24 items that inquire about various negative consequences and risky behaviours relating to alcohol use such as negative physical symptoms after drinking or operating a vehicle while intoxicated. For each item, participants selected: “Yes in the past 30 days,” “Yes but not in the past 30 days,” or “No.” We coded “Yes in the past 30 days” as 1 and “Yes, but not in the past 30 days” or “No” as 0. The total sum score (possible range = 0-24) was used as our indicator of past month alcohol-related problems.

4.2.2.5 Acculturation and Enculturation

We used an author-compiled brief version of the Vancouver Index of Acculturation (VIA) to assess acculturation (i.e., orientation towards Canadian culture) and enculturation (i.e., orientation towards heritage culture; Ryder et al., 2000). We called this the VIA-Brief (VIA-B). The original VIA (Paulhus, 2013) has 20 items and covers various aspects of life that are relevant to the process of acculturation and enculturation including engagement in social activities, entertainment, and cultural practices of the mainstream culture (i.e., Canada) and heritage culture (i.e., original culture). Participants freely entered their heritage culture prior to completing the VIA-B.

Participants were instructed to identify the heritage culture that has influenced them the *most* if they are of several backgrounds. Participants who still identified more than one culture were classified based on their first response. For each VIA-B item, participants rated their level of agreement with the statement on a scale ranging from Disagree [1] to Agree [9]. The original VIA is based on a two-factor model with 10 items pertaining to acculturation and 10 items to enculturation. To develop our abbreviated VIA, we initially used the 10 items with the highest factor loadings as examined in a published factor analysis of the VIA on immigrants to Canada (Testa et al., 2019) for our indicators of acculturation (five items) and enculturation (five items).

To validate this short form in the current dataset, we conducted an exploratory factor analysis (maximum likelihood, oblimin rotation) of these 10 items, which did not produce a clear factor structure. After removing 4 items that had highly similar wording, the finalized short form had six items (three acculturation items and three enculturation times). For this 6-item version, parallel analysis suggested a 2-factor structure, with factor loadings ranging from 0.52 to 0.85 with no cross-loadings. Overall, the enculturation factor explained 29.1% of the variance and the acculturation factor explained an additional 25.7% of the variance. More details on the development of the VIA-B are included in Appendices L-P. Total subscale scores were calculated via averages. Analyses including acculturation and enculturation were only conducted with individuals of 1.5 and 2nd immigrant generation status (see footnote 5).

4.2.2.6 Country of Origin Per Capita Alcohol Consumption

We referred to WHO statistics to determine COO per capita (15+) consumption and extracted the total data for each country (Tran et al., 2020; World Health

Organization, 2022). The most recent data available from WHO was collected in 2019. The WHO reports data from their comprehensive platform called the Global Information System on Alcohol and Health (World Health Organization, 2022). Data is obtained through various sources including WHO surveys, government data, organizations, and publicly available international and national data (Poznyak et al., 2014). See Appendix Q for the WHO data extracted for analyses. Participants' COOs were determined from their heritage culture identified in the VIA-B. Responses that could not be linked to a specific country (e.g., "African") were coded as missing (n=31). Since students of 2nd immigrant generation status were born in Canada, the heritage culture identified by the students and therefore their COO reflects their parents' demographics. The COO of the first country identified was used for participants who recorded multiple heritage cultures despite being instructed to identify the culture that influenced them the most. COO per capita alcohol consumptions statistics were verified by a second reviewer. Inter-rater agreement was 88% and discrepancies were resolved by returning to the original WHO data.

4.2.3. Procedure

Participants were recruited through flyers, social media, on-campus presentations, word of mouth, and/or direct emails. Participants provided informed consent and completed the self-reported survey through REDCap (Research Electronic Data Capture) software (Harris et al., 2019). Participants received either a $15.00 Amazon gift card or partial academic credit (0.5 bonus points) as compensation. Participants completed the survey in English at four sites and translated to French at the one French-speaking institution.

4.2.4. Data Analysis

We used R (version 4.1.3) to conduct analyses (R Core Team, 2022). The first cluster of analyses included the entire sample of the three immigrant groups. To examine the HIE on alcohol frequency and quantity, using the "robustbase" package (Maechler et al., 2022), we conducted robust one-way ANOVAs with immigrant generation status as the predictor, comparing 20% trimmed means across immigrant groups. To account for familywise error, we used a Holm correction for post-hoc tests.

Next, with immigrant generation status as the sole predictor, we employed zero-inflated hurdle models using the "pscl" package (Zeileis et al., 2008) to assess the HIE on HED frequency and alcohol-related problems. Hurdle models involve two steps by breaking down the outcome into two components: a yes/no occurrence of any HED or alcohol-related problems (zero-inflated portion using logistic regression), and on the non-zero positive values for HED frequency and severity of alcohol-related problems (count model using negative binomial regression with a log link). To run the zero-inflated analyses on HED frequency, we recoded the variable (originally on a 1-5 scale) to span from 0-4. Consistent with prior research on the HIE in emerging adults, the reference category for immigrant generational status was the 3^{+} generation group (Greene & Maggs, 2018). We used different data analysis strategies because the HED frequency and alcohol-related problems had substantial zero-inflation whereas the alcohol frequency and quantity did not.

We then explored relationships between immigrant generation status and alcohol indicators after accounting for gender; we conducted robust two-way ANOVAs with

immigrant generation status and gender as predictors[8] and included gender as a covariate in the hurdle models. We compared differences between the three immigrant groups for women and not-women (men/non-binary). Significant interactions between immigrant generation status and gender from the robust ANOVAs were probed using robust t-tests[9] with the "WRS2" package (Mair & Wilcox, 2020).

Among individuals of 1.5 and 2nd immigrant generation status only, we used robust linear regressions to examine the relationship between immigrant generation status, acculturation, enculturation, and the interaction between acculturation and enculturation on alcohol frequency and alcohol quantity. We used hurdle models to examine the same relationships and interactions between immigrant generation status, acculturation, and enculturation on HED frequency and alcohol-related problems. For ease of interpretation, when interaction terms were not significant, we report the model statistics without the interaction terms. The same set of analyses (robust linear regressions, hurdle models) were then conducted with COO per capital alcohol consumption included as an additional predictor.

All continuous predictor variables (i.e., acculturation, enculturation, COO per capita alcohol consumption) were mean centered prior to robust regression analyses and the immigrant generation status variable was effect coded (1.5 immigrant generation status = -0.5; 2nd immigrant generation status = 0.5) prior to analyses. Significant interactions in the robust regression analyses were probed with simple slope plots. Due to

[8] We could not conduct robust ANCOVA's because the function in WRS2() is only available for predictors with two independent groups and our immigrant generation status variable has three independent groups.

[9] Since an adjusted critical value was used for the robust two-way ANOVAs, degrees of freedom are not reported (R Documentation, n.d.).

missing data, the sample sizes used for analyses differed across the alcohol outcome variables.

4.3. Results

See Table 4.1 for the bivariate correlations between immigrant generation status, acculturation, enculturation, and the alcohol indicators. Approximately 78.35% (*n*=1028) of the sample indicated they had used alcohol in the past six months. A maximum of 1016 students of 1.5 immigrant generation (*n*= 158), 2nd immigrant generation (*n*=180), and 3+ immigrant generation status (*n*=678) were included in analyses due to missing data (*n*'s across four alcohol indicators ranged from 1006-1016). See Table 4.2 for the raw descriptive statistics for acculturation, enculturation, and all alcohol indicators by immigrant generation status. After accounting for missing data, women accounted for 79.1% of the sample (*n*=803). Internal consistencies were adequate for the VIA-B acculturation subscale (α=0.77), the enculturation subscale (α=0.80), and the B-YAACQ (α=0.89).

4.3.1. HIE Across All Immigrant Groups

4.3.1.1 Alcohol Frequency and Alcohol Quantity

We found a statistically significant main effect of immigrant generation status on alcohol frequency, $F(2, 138.8) = 10.11$, $p < .001$. Post-hoc tests revealed significant differences between students of 1.5 and 3+ immigrant generation status, $M_{diff} = -0.51$, $p < .001$, and significant differences between students of 2nd and 3+ immigrant generation status, $M_{diff} = -0.49$, $p < .001$, with higher frequency of alcohol use among students of 3+ immigrant generation status (Table 4.3). Similarly, analyses revealed a statistically significant main effect of immigrant generation status on alcohol quantity, $F(2, 214.4) =$

20.71, $p < .001$. The post-hoc tests again revealed significant differences between students of 1.5 and 3^+ immigrant generation status, trimmed $M_{diff} = -0.50$, $p < .001$, and significant differences between 2^{nd} and 3^+ immigrant generation status, trimmed $M_{diff} = -0.43$, $p=0.04$, with 3^+ immigrant generation status students reporting higher quantity (Table 4.3). With gender as an additional predictor, the significant main effect of immigrant generation status remained for both alcohol frequency ($p = .001$) and quantity ($p = .001$), but the main effect of gender was not significant for frequency ($p = .124$) or quantity ($p = .062$). For alcohol quantity only, the interaction between gender and immigrant generation status was significant ($p = .014$; see Table S6). The trimmed mean difference between individuals of 1.5 and 3^+ immigrant generation status was larger for men/non-binary participants ($M_{diff} = 0.94$) compared to the same contrast in women ($M_{diff} = 0.42$).[10] Conversely, the trimmed mean difference between individuals of 2^{nd} and 3^+ immigrant generation status was larger among women ($M_{diff} = 0.75$) than among men/non-binary participants ($M_{diff} = 0.18$). See Appendices R-S for a tabled summary.

4.3.1.2 HED Frequency

We estimated a negative binomial hurdle model for HED frequency with immigrant generation status as the predictor variable, using the 3^+ immigrant generation status group as the reference category (Table 4.4). In the logistic regression portion, we predicted the non-zero positive values vs. zeros (no HED). The odds of having at least one HED episode was somewhere between 1.96 and 4.00 times less for students of 1.5

[10] The difference between immigrant generation status groups 1.5 and 3^+ among men/non-binary participants was initially statistically significant but did not remain significant after correcting for the familywise error rate.

immigrant generation status compared to students of 3^+ immigrant generation status.[11] Similarly, the odds of having at least one HED episode was somewhere between 1.35 and 2.70 times less in students of 2nd immigrant generation status than students of 3^+ immigrant generation status. The count portion of the model includes the non-zero values only. Of those students who engaged in any HED, those of 1.5 immigrant generation status reported between 32% and 67% less frequent HED and those of 2nd immigrant generation status reported between 1% and 38% less frequent HED compared to students of 3^+ immigrant generation status.[12] Immigrant generation status accounted for 7.1% of the variance in HED frequency (R^2 adjusted). See Appendix T for a summary of results for the model accounting for gender. Briefly, referring to the logistic regression portion of the model, the odds of having at least one HED episode for women were somewhere between 1.04 and 2.08 times less than men/non-binary participants. The count portion of the model revealed that among those who reported at least one HED episode, women reported between 17% to 41% less frequent HED compared to men/non-binary participants ($p < .001$). Lastly, the differences between those of 2nd and 3^+ immigrant generation status in the count portion of the model were no longer significant after accounting for gender ($p = .058$).

4.3.1.3 Alcohol-related Problems

[11] To ease interpretation for odds ratios in-text throughout, we first took the inverse (1/OR) of the upper and lower limits of the 95% confidence interval for odds ratio reported in tables. Because the 3^+ immigrant generation status group is the reference category, and because the model is predicting the non-zero positive values, an OR less than 1.0 means that students of 1.5 and 2nd immigrant generation status are more likely to report zero HED episodes relative to the 3^+ immigrant generation status students.

[12] These percentages are derived from 95% confidence interval around the incident rate ratios (IRRs) in Table 4.4, which are exponentiated slopes. An IRR of 0.47 means that a one-unit increase in X is associated with a 1-0.47 = 53% decrease in Y. Since the 3^+ immigrant generation status students are the reference category, an IRR less than 1.0 means that students of 1.5 and 2nd immigrant generation status report less frequent HED than students of 3^+ immigrant generation status.

We estimated a negative binomial hurdle model for the number of alcohol-related problems endorsed over the last thirty days. We regressed number of problems onto immigrant generation status and compared students of 1.5 immigrant generation status to students of 3^+ immigrant generation status, and students of 2^{nd} immigrant generation status to students of 3^+ immigrant generation status (see Table 4.5). The odds of having at least one alcohol-related problem were somewhere between 2.08 and 4.35 times less for students of 1.5 immigrant generation status compared to students of 3^+ immigrant generation status. Similarly, the odds of having at least one alcohol-related problem were somewhere between 1.56 and 3.03 times less for students of 2^{nd} immigrant generation than students of 3^+ immigrant generation status. Of those students who had at least one alcohol-related-problem, those of 1.5 immigrant generation status reported between 2% and 43% fewer alcohol-related-problems when compared to those of 3^+ immigrant generation status and there were no significant differences in the number of alcohol-related problems between students of 2^{nd} and 3^+ immigrant generation status. Immigrant generation status accounted for 32.2% of the variance in alcohol-related problems (R^2 adjusted). See Appendix U for a summary of results after accounting for gender. Briefly, both the logistic regression and count portions of the model failed to find significant gender differences in alcohol-related problems. All above-reported results remained the same after accounting for gender.

4.3.2. Acculturation and Enculturation

4.3.2.1 Alcohol Frequency

The robust linear regression predicting alcohol frequency failed to converge; thus, we reverted to standard ordinary least squares regression. We failed to find a statistically

significant relationship between acculturation and alcohol frequency, 95% CI β [-0.03, 0.12] or between enculturation and alcohol frequency, 95% CI β [-0.07, 0.09]. There were no significant interactions between acculturation and enculturation, or between immigrant generation status and acculturation. The interaction between immigrant generation status and enculturation was significant, 95% CI β [-0.24, -0.01]. See Table 4.6 for a summary and Figure 4.1 for an illustration of the interaction between immigrant generation status and enculturation predicting alcohol frequency. The plot revealed the expected negative relationship between enculturation and alcohol frequency for students of 2nd immigrant generation status, but unexpectedly a positive relationship between enculturation and alcohol frequency for students of 1.5 immigrant generation status. The model predictors accounted for 1.5% of the variance in alcohol frequency (R^2 adjusted). Since the overall R^2 was very small, the lower-bound confidence interval for the interaction is close to 0, and the model assumptions were not met (i.e., non-normally distributed residuals), this result should be considered uncertain. See Appendix V for a summary of results after accounting for gender and COO per capita consumption. The robust linear regression model failed to find a significant relationship between gender and alcohol frequency (95% CI β [-0.49, 0.13]); however, the CI for the relationship between COO per capita consumption and frequency did not include zero (95% CI [0.02, 0.10]) suggesting greater frequency in those immigrating from heavier drinking countries. All other results were the same as the above-reported analyses.

4.3.2.2 Alcohol Quantity

The robust linear regression model failed to find a relationship between acculturation 95% CI β [-0.05, 0.10] or enculturation with alcohol quantity, 95% CI β [-

0.10, 0.03]. There were no significant interactions involving acculturation, enculturation, and immigrant generation status. Immigrant generation status was significantly associated with alcohol quantity, 95% CI β [0.02, 0.55], with greater alcohol quantity in students of 2nd immigrant generation status than in students of 1.5 immigrant generation status (Table 4.7). The model predictors accounted for 2.3% of the variance in alcohol quantity (R^2 adjusted). No relationships were found between acculturation, enculturation, and alcohol quantity after adjusting for gender, 95% CI β [-0.53, 0.20], and COO per capita consumption, 95% CI β [-0.03 – 0.04] (See Appendix W).

4.3.2.3 HED Frequency

We estimated a negative binomial hurdle model for past six-month HED frequency. We regressed HED frequency onto immigrant generation status, acculturation, enculturation, the interaction between acculturation and enculturation, and the interactions of immigrant generation status with acculturation and enculturation (Table 4.8). The logistic regression portion failed to find any significant relationships between the predictors and the odds of reporting any HED. The count portion of the model revealed that among those who reported HED, 2nd immigrant generation status students reported somewhere between 23% and 261% more frequent HED than 1.5 immigrant generation status students, holding other predictors constant. This suggests that among students of 1.5 and 2nd immigrant generation status, being of 1.5 immigrant generation status is protective not against the sole occurrence of any HED, but against increased HED frequency among those with at least one occurrence of HED. There were no significant effects involving acculturation or enculturation. The model predictors accounted for 1.8% of the variance in HED frequency (R^2 adjusted). See Appendix X for

a summary of the results of the final model after accounting for gender and COO per capita consumption. For the logistic regression portion of the model, for every unit increase in COO per capita consumption, the odds of at least one HED episode were somewhere between 1.003 and 1.19 times greater, holding other predictors constant. The previous pattern of results remained the same controlling gender and there were no significant effects of gender.

4.3.2.4 Alcohol-Related Problems

We estimated a negative binomial hurdle model for the number of alcohol-related problems endorsed over the last 30 days. We regressed alcohol-related problems onto immigrant generation status, acculturation, enculturation, the interaction between acculturation and enculturation, and the interactions of immigrant generation status with acculturation and enculturation (Table 4.9). For the logistic regression portion of the model, the interaction between immigrant generation status and enculturation was significantly related to a reduced likelihood of reporting any alcohol-related problems (OR = 0.67, p=.008). To aid interpretation, we created a figure that back-transformed values into predicted probabilities of having at least one alcohol-related problem. Figure 4.2 reveals enculturation was negatively related to the probability of having at least one alcohol-related problem for students of 2nd immigrant generation status, as expected, yet unexpectedly positively related for students of 1.5 immigrant generation status. For the count portion of the model, among those who reported at least one alcohol-related problem, students of 2nd immigrant generation status reported between 35% and 232% more alcohol-related problems compared to students of 1.5 immigrant generation status. The model predictors accounted for 36.5% of the variance in alcohol-related problems

(R^2 adjusted). See Appendix Y for a summary of results after accounting for gender and COO per capita consumption. In sum, the pattern of results remained the same, and we failed to find significant relationships involving either gender or COO per capita consumption.

4.4. Discussion

Canadian research on the HIE for emerging adult alcohol use is rare and has not examined the role of acculturation and enculturation on alcohol indicators. We examined the HIE cross-sectionally on three measures of alcohol use and one measure of alcohol-related problems in students across five Canadian universities. We hypothesized we would find a significant HIE across all four alcohol indicators with 3^+ immigrant generation status students reporting greater alcohol indicators compared to students of 1.5 and 2^{nd} immigrant generation status. Secondly, among students of 1.5 and 2^{nd} immigrant generation status only, we predicted acculturation would be positively associated and enculturation negatively associated with all alcohol indicators. We explored immigrant generation status by acculturation/enculturation interactions. Finally, we predicted that greater COO per capita alcohol consumption would be associated with greater alcohol indicators. Results for the overall HIE were consistent with past research but extend findings to the Canadian context and support the HIE for alcohol frequency, quantity, HED frequency, and alcohol-related problems among emerging adults (Greene & Maggs, 2018; Grindal et al., 2019): 3^+ immigrant generation status students reported significantly greater frequency, quantity, HED frequency, and alcohol-related problems compared to both students of 1.5 and 2^{nd} immigrant generation status. We failed to find a significant relationship between acculturation and any alcohol indicator but did find significant

interactions between immigrant generation status and enculturation on alcohol frequency and the likelihood of reporting any alcohol-related problem(s). Enculturation showed the expected negative association with alcohol frequency and alcohol-related problems for 2nd immigrant generation status students but was unexpectedly positively associated with both alcohol indices in 1.5 immigrant generation status students. COO per capita alcohol consumption showed the expected significant positive association with two of the alcohol outcomes (alcohol frequency and likelihood of HED) among students of 1.5 and 2nd immigrant generation status.

4.4.1. Alcohol Frequency and Quantity

Among the entire sample, 78.35% of participants reported using alcohol in the past six months. The Canadian Postsecondary Education Alcohol and Drug Use Survey (CPADS) captured the drinking behaviors of students aged 17-25, studying at a Canadian university or college/CEGEP in 2019 (Government of Canada, 2021). It revealed that in the previous year, 80.70% of first and second-year students had consumed alcohol, which is comparable to our study's rates. Alcohol frequency was significantly higher among 3^+ immigrant generation status students compared to students of 1.5 and 2nd immigrant generation status. First and second-year Canadian students in 2018 reported drinking on average 4.6 drinks on a typical day (Government of Canada, 2021), which is comparable to our study where the average drinking quantity was 2.21 (2 = "3 or 4 drinks"). Quantity was again significantly highest among those of 3^+ immigrant generation status in our sample. The differences in alcohol frequency and quantity between immigrant generation statuses might be explained by differences in level of engagement in campus culture. Indeed, students who are more integrated into campus culture would have greater

opportunities to drink compared to those who are not. For instance, involvement in sororities and fraternities predicts increased alcohol use and problems over the first two years of university (Capone et al., 2007). Moreover, such groups are historically White and racialized students of 1.5 and 2nd immigrant generation status may feel unwelcomed or face barriers to joining (Park, 2012). Research has shown that Black immigrants especially are more likely to be engaged in campus organizations that are aligned with their racial and ethnic identities instead of participating in predominantly White organizations (Griffin & McIntosh, 2015). We found a significant interaction between immigrant generation status and enculturation that revealed enculturation may be protective against alcohol frequency among 2nd immigrant generation status students which is consistent with past literature (Alamilla et al., 2020) and our hypotheses, but also found that enculturation was a risk factor among 1.5 immigrant generation status students. While we must be cautious in interpreting this result, it may be that greater enculturation leaves students of 1.5 immigrant generation status more vulnerable than students of 2nd immigrant generation status to discrimination and acculturative stress (stress relating to problems adapting to the host culture) and associated maladaptive coping (Berry, 1998). Indeed, Whitbeck and colleagues (2004) found a positive association between enculturation and discrimination in Indigenous adults. While they also found that enculturation had a protective effect on alcohol use, enculturation did not buffer against the effects of discrimination on alcohol use. Moreover, a systematic review of the relationship between discrimination and alcohol outcomes supported a positive association between discrimination and alcohol consumption and alcohol-related problems (Gilbert & Zemore, 2016). Of the studies specifically measuring racial/ethnic

discrimination, the relation between discrimination and alcohol outcomes was mediated by anger, post-traumatic stress, and depressive symptoms (Gilbert & Zemore, 2016). Already alienated by recent immigrant generation status, 1.5 immigrant generation status students with higher enculturation may face greater discrimination and emotional distress which may lead to their more frequent drinking relative to 2nd immigrant generation status students.

Lastly, we found that COO per capita consumption was positively associated with alcohol frequency among students of 1.5 and 2nd immigrant generation status. Adjusting to university and navigating the drinking culture can be challenging for any student, but perhaps immigrants coming from countries that drink more on average have an easier time assimilating to the Canadian college drinking environment and therefore engage in more frequent alcohol use. These students may also be more likely to use alcohol to cope with the stresses of university if their cultural background is more accepting of alcohol consumption.

4.4.2. HED Frequency

We found 3+ immigrant generation status students reported significantly greater HED frequency compared to those of 1.5 and 2nd immigrant generation status. Our results are consistent with a previous Canadian study that found Canadian-born university students reported greater HED frequency than foreign-born students (Edkins et al., 2017). Across our sample, 66.2% of students reported at least one instance of HED in the past 6 months.[13] Differences in HED frequency across immigrant groups may again be

[13] The CPADS survey reported 56.6% of first- and second-year students engaged in heavy drinking. However, our results are not directly comparable due to definitional and measurement differences (Government of Canada, 2021).

reflective of differences in level of engagement in campus organizations like sororities and fraternities and their corresponding heavy drinking cultures. In addition, being more immersed in campus culture and being around those engaging in HED may lead to increased binging. For example, students who live in residences are more likely to engage in HED compared to students living off campus (Chaloupka & Wechsler, 1996; Cross et al., 2009). Interestingly, 33% of 3^{+} immigrant generation status students in our sample reported living in residence, compared to just 12.9% of 2^{nd} immigrant generation status students and 18% of 1.5 immigrant generation status students. In line with social norms theory (Perkins & Berkowitz, 1986), students of 3^{+} immigrant generation status may be more integrated into the campus community and may therefore find HED more acceptable to their peers and believe it to be more common compared to students of 1.5 and 2^{nd} immigrant generation status.

The few gender differences found in our study were in the presence/absence and overall frequency of HED, which were both higher among men/non-binary participants compared to women, and in the interaction between gender and immigrant generation status on alcohol quantity. We found that the mean difference between 1.5 and 3^{+} immigrant groups was larger for men/non-binary participants ($M_{diff} = 0.94$) compared to the same contrast in women ($M_{diff} = 0.42$), and that the trimmed mean difference between the 2^{nd} and 3^{+} immigrant groups was larger among women ($M_{diff} = 0.75$) than among men/non-binary participants ($M_{diff} = 0.18$). While it is generally understood that men drink more than women due to a combination of biological and cultural reasons (e.g., differences in alcohol metabolism rates, gender norms), a review of birth cohort effects and gender differences in alcohol use and problems provides strong support that the

gender-gap is narrowing, a phenomenon known as 'convergence' (Harris et al., 2019; Keyes et al., 2011; Sudhinaraset et al., 2016; The Alcohol Pharmacology Education Partnership, 2023). Our study grouped men and non-binary participants together due to the very limited sample size in the latter, therefore we are unable to draw conclusions specifically related to non-binary individuals. However, previous research that has demonstrated that non-binary participants had higher odds of reporting HED and heavy drinking compared to cisgendered females (Azagba et al., 2019).

4.4.3. Alcohol-related Problems

Approximately 59.0% of our participants reported experiencing at least one alcohol-related problem in the past month, comparable to the 55.6% of first and second year students across Canada (Government of Canada, 2021). We found that 3^{+} immigrant generation status students reported significantly more alcohol-related problems compared to students of 1.5 and 2^{nd} immigrant generation status. Since 3^{+} immigrant generation status students in our sample are already drinking more heavily and reporting more frequent HED compared to students of 1.5 and 2^{nd} immigrant generation status, the former are also more likely to report alcohol-related problems such as alcohol hangover.

We found a significant interaction between enculturation and immigrant generation status on alcohol-related problems in that greater enculturation was, as expected, negatively associated with the probability of reporting at least one alcohol-problem for 2^{nd} immigrant generation status students, but unexpectedly positively associated for 1.5 immigrant generation status students in a pattern identical to that seen for this same interaction for alcohol frequency. Again, enculturation may be related to greater experiences of discrimination for students of 1.5 immigrant generation status as it

may exacerbate challenges related to adapting to Canadian culture. Indeed, a one-year longitudinal study among Asian American immigrants found that racial discrimination was indirectly associated with greater alcohol-related problems at follow-up through increased drinking to cope (Le & Iwamoto, 2019). In addition, a large proportion of the 1.5 immigrant generation status students identified as international students (44%) and are thus more likely than 2nd immigrant generation status students to be in Canada without their immediate family. Enculturation therefore may be protective against alcohol outcomes when one is also surrounded by one's family with shared values and norms.

4.4.4. Implications

This study, to our knowledge, is among the largest studies of the HIE in emerging adult alcohol use and the first study of the HIE on emerging adult alcohol use in Canada to include alcohol outcomes in addition to HED, expanding upon the little Canadian research in this population (Edkins et al., 2017). Our results support the presence of the HIE on several alcohol indicators in emerging adults across a large sample of Canadian university students from across the country. Findings are consistent with prior research in the HIE in emerging adult alcohol use in an American sample (Greene & Maggs, 2018), but extend this prior work by accounting for acculturation, enculturation, gender, and COO per capita consumption. Results suggest acculturation may not be relevant to the HIE in undergraduates, but enculturation may be a risk for frequent and problematic alcohol use in 1.5 immigrant generation status students yet protective among 2nd immigrant generation status students.

Our study supports the inclusion of culturally sensitive adaptations to campus alcohol use safety initiatives. While students of 1.5 and 2nd immigrant generation status

reported fewer alcohol indicators compared to students of 3^+ immigrant generation status, they are still at risk of frequent and problematic drinking, particularly students of 1.5 immigrant generation status with greater enculturation. Therefore, we emphasize the importance of universities offering a welcoming atmosphere, having awareness of issues related to inclusion and diversity in campus organizations (Berray, 2019; Lewis & Shah, 2021), and facilitating "dry" social events. As an example for student support of these initiatives, Calnan and Davoren (2022) published a focus group study across two Irish universities with diverse members of the student body (including international students), evaluating a pilot version of the REACT alcohol prevention programme. Students were in favour of increased "dry" environments on campus and expressed a desire to have more diverse student facilitators of the program that reflects the growing diversity of students. We also encourage educational institutions to be mindful in their attempts to integrate immigrant students into campus life to prevent any unintended effects of reducing the HIE. Thus, these efforts must be balanced with educational and skills-based programs to help such students not adopt the health risk behaviors of 3^+ immigrant generation status students in relation to alcohol use patterns and adverse consequences. Culturally relevant education about alcohol use may especially be relevant for immigrants coming from a culture where alcohol use is more normalized.

4.4.5. Limitations and Future Directions

While our multi-site study has the advantage of generalizability, there are several limitations. Firstly, our study was cross-sectional in nature and longitudinal Canadian research on the HIE in undergraduates is needed to make stronger causal arguments and examine how the HIE changes over time as immigrant students acculturate. Secondly,

due to the free-text field for the heritage culture item as opposed to a drop-down menu and fatigue effects since these were the final items in the long survey, we had substantial missing data in our VIA-B, which may partly explain why we failed to find the expected significant relationships between acculturation and alcohol indicators. See Appendix Z for the VIA-B used in the study. Our study was also limited to English and French. Next, analyses pertaining to students of 1.5 immigrant generation status should be interpreted with some caution as 44% of the sample identified as international students who by definition can be considered as temporary residents as opposed to permanent residents. The high percentage of international students represents a potential confound in determining if it is recent immigrant generation status or being an international student that is driving the effects observed for 1.5 immigrant generation status students. International students face unique challenges in academia such as language barriers and social isolation (Hunt et al., 2017). Hunt and colleagues (2017) found acculturative stress among international students to be a moderator between the relationship between alcohol use and alcohol-related consequences in that this relationship was stronger among those with greater stress. To test for the potential confound of international student status, we conducted supplemental analyses that demonstrated no statistically significant differences in alcohol outcomes between those who identified as international students and not among students of 1.5 immigrant generation status (see Appendix AA). Therefore, we do not consider the inclusion of international students to be a significant limitation. Next, our study did not include measures of discrimination, acculturative stress, or sorority/fraternity membership; therefore, some of our interpretations are speculative. Furthermore, our study did not assess the magnitude of the HIE by function of province,

racialized status or socioeconomic status. In addition, due to social desirability reasons, some students may have underreported their alcohol involvement, however measures were taken by the research team at each site to make sure students understood their data will be kept confidential (e.g., names were not connected to their data, student data was not reported to the university or parents). Next, our study did not have sufficient data on age of migration which is an important factor to consider. For instance, Torres and colleagues (2019) found that earlier age of migration (childhood versus adolescence) among immigrant women to the US was associated with greater odds of heavy episodic drinking. Lastly, our study did not include analyses on the role of ethnicity or race on the HIE. Such analysis would be helpful to assess ethnicity density, which is a phenomenon observed in which individuals' health is better when located around those of the same ethnic group (Shaw et al., 2012). Future research should consider environment-specific factors such as these on the HIE in emerging adults. Moreover, future research should analyze differences in motives, expectancies, and positive consequences of alcohol use across immigrant groups. University students often experience positive consequences to drinking such as having a good time and feeling less stressed or relaxed that may reinforce later drinking behaviour (Barnett et al., 2014). Understanding these positive experiences may help universities facilitate environments to have these needs met in ways that do not put students at risk of negative consequences of alcohol use.

4.4.6. Conclusion

We found evidence of the HIE in three measures of alcohol use (frequency, quantity, HED frequency) and alcohol-related problems in a diverse sample of Canada's emerging adult undergraduate population. This study adds to our understanding of the

potential nuances of the HIE specific to emerging adulthood. More research on mechanisms underlying the HIE will help immigrants maintain the protective aspects of their immigrant generation status while facilitating their healthy integration into Canadian culture.

Table 4.1. *Correlation Matrix of Immigrant Generation Status, Alcohol Indicators, Acculturation, and Enculturation*

Variable	n	*M*	SD	1	2	3	4	5	6	7
1. Immigrant Generation Status	1303			–						
2. Alcohol Frequency	1032	3.02	.87	.24***	–					
3. Alcohol Quantity	1017	2.21	1.12	.17***	.47***	–				
4. HED Frequency	1021	2.18	1.08	.24***	.68***	.72***	–			
5. Alcohol-related Problems	1027	3.07	4.10	.26***	.60***	.52***	.64***	–		
6. Acculturation	630	6.81	1.64	.23***	.04	.00	.03	.01	–	
7. Enculturation	632	6.88	1.73	-.15***	-.11**	-.11*	-.13**	-.06	.31***	–

Note. Pearson correlations. The acculturation and enculturation variables have lower n's due to missing data and fatigue effects. Please note the correlations here include all three immigrant generation status groups. HED = heavy episodic drinking. ***$p < .001$, **$p < .01$, *$p < .05$.

Table 4.2. *Raw Descriptive Statistics for Alcohol Indicators, Acculturation, and Enculturation by Immigrant Generation Status*

	Immigrant Generation Status	Mean	*SD*	Mdn	N	% of Total
Alcohol Frequency	1.5 Gen	2.67	.84	2	157	15.51
	2nd Gen	2.74	.82	3	180	17.79
	3+ Gen	3.17	.85	3	675	66.70
	Total	3.01	.87	3	1012	100
Alcohol Quantity	1.5 Gen	1.83	1.07	1	156	15.50
	2nd Gen	2.05	1.08	2	177	17.59
	3+ Gen	2.33	1.10	2	673	66.89
	Total	2.20	1.11	2	1006	100
HED Frequency	1.5 Gen	1.66	.82	1	157	15.53
	2nd Gen	1.96	1	2	179	17.71
	3+ Gen	2.35	1.11	2	675	66.77
	Total	2.18	1.08	2	1011	100
Alcohol-related Problems	1.5 Gen	1.65	2.89	0	158	15.55
	2nd Gen	2.68	4.37	0	180	17.72
	3+ Gen	3.48	4.17	2	678	66.73
	Total	3.05	4.09	1	1016	100
Acculturation	1.5 Gen	5.87	1.93	6	237	37.86
	2nd Gen	6.63	1.78	7	175	27.96
	3+ Gen	6.89	1.77	7.33	214	34.19
	Total	6.8	1.64	7.1	626	100
Enculturation	1.5 Gen	7.07	1.76	7.4	239	38.11
	2nd Gen	6.96	1.69	7.4	174	27.7
	3+ Gen	6.62	1.71	6.6	214	34.13
	Total	6.89	1.73	7.2	627	100

Note. Mdn = Median. The acculturation and enculturation variables have lower n's due to missing data and fatigue effects. HED = Heavy episodic drinking. Frequency ranged from "Never" (1) to "4 times a week or more" (4). Quantity ranged from "1 or 2" drinks per drinking occasion (1) to "10 or more" (4). HED frequency ranged from "Never" (1) to "Daily or almost daily" (4). Alcohol-related problems were scored "Yes" (1) or "No" (2).

Table 4.3. *Trimmed Means, Trimmed Standard Errors, and One-Way Analyses of Variance in Alcohol Frequency and Alcohol Quantity by Immigrant Generation Status*

Variable	Immigrant Generation Status						df	F	*p*
	1.5		2nd		3+				
	M	*SE*	*M*	*SE*	*M*	*SE*			
Alcohol Frequency	2.67[a]	0.07	2.74[a]	0.09	3.17[b]	0.05	2, 21.4	20.71	< .001***
Alcohol Quantity	1.83[a]	0.11	2.05[a]	0.10	2.33[b]	0.05	2, 183.8	10.11	< .001***

Note. Trimmed means and trimmed standard errors at 20%. ***$p < .001$, **$p < .01$, *$p < .05$. For each row, means that have a different superscript letter were statistically different from each other in post-hoc tests.

Table 4.4. *Heavy Episodic Drinking Frequency Hurdle Model*

Predictors	Incidence Rate Ratios [or Odds Ratios]	95%CI	*p*
Count Model			
(Intercept)	1.42	1.30 – 1.54	< .001***
Immigrant Generation Status [1.5]	0.47	0.33 – 0.68	< .001***
Immigrant Generation Status [2nd]	0.78	0.62 – 0.99	.044*
Zero-inflated Model			
(Intercept)	[2.63]	2.22 – 3.11	< .001***
Immigrant Generation Status [1.5]	[0.36]	0.25 – 0.51	< .001***
Immigrant Generation Status [2nd]	[0.53]	0.37 – 0.74	< .001***
Observations	1011		
R^2 / R^2 adjusted	0.073 / 0.071		

Note. CI = Confidence Interval. ***$p < .001$, **$p < .01$, *$p < .05$. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count.

Table 4.5. *Alcohol-related Problems Hurdle Model*

Predictors	Incidence Rate Ratios [or Odds Ratios]	95%CI	*p*
Count Model			
(Intercept)	4.50	4.05 – 4.99	<.001***
Immigrant Generation Status [1.5]	0.75	0.57 – 0.98	.036*
Immigrant Generation Status [2nd]	1.09	0.86 –1.37	.482
Zero-inflated Model			
(Intercept)	[1.99]	1.69 – 2.33	< .001***
Immigrant Generation Status [1.5]	[0.33]	0.23 – 0.48	< .001***
Immigrant Generation Status [2nd]	[0.46]	0.33 – 0.64	< .001***
Observations	1016		
R^2 / R^2 adjusted	0.324 / 0.322		

Note. CI = Confidence Interval. ***$p < .001$, **$p < .01$, *$p < .05$. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count.

Table 4.6. *Alcohol Frequency Linear Regression Results*

Predictors	*B*	95%CI	*p*
(Intercept)	2.66	2.52 – 2.81	< .001***
Immigrant Generation Status [2nd]	0.02	-0.19 – 0.23	.87
Acculturation	0.05	-0.03 –0.12	.21
Enculturation	0.01	-0.07 – 0.09	.76
Acculturation X Enculturation	0.00	-0.02 – 0.03	.84
Immigrant Generation Status X Acculturation	-0.06	-0.18 – 0.05	.26
Immigrant Generation Status X Enculturation	-0.13	-0.24 – -0.01	.03*
Observations	251		
R^2 / R^2 adjusted	0.039/ 0.015		

Note. CI = Confidence Interval. ***$p < .001$, **$p < .01$, *$p < .05$. Slopes are unstandardized.

Table 4.7. *Alcohol Quantity Robust Linear Regression Results*

Predictors	*B*	95%CI	*p*
(Intercept)	1.56	1.36 – 1.75	< .001***
Immigrant Generation Status [2nd]	0.28	0.02 – 0.55	.037*
Acculturation	0.02	-0.05 –0.10	.56
Enculturation	-0.04	-0.10 – 0.03	.26
Observations	247		
R^2 / R^2 adjusted	0.035 /0.023		

Note. CI = Confidence Interval. ***$p < .001$, **$p < .01$, *$p < .05$. Interaction terms were non-significant, and thus omitted from the final presented model here for ease of interpretation. Slopes are unstandardized.

Table 4.8. *Heavy Episodic Drinking Frequency Hurdle Model with Acculturation and Enculturation*

Predictors	Odds Ratios [or Incidence Rate Ratios]	95%CI	*p*
Zero-inflated Model			
(Intercept)	0.81	0.57 – 1.15	.23
Immigrant Generation Status [2nd]	1.48	0.89 – 2.48	.13
Acculturation	1.07	0.93 – 1.22	.36
Enculturation	0.97	0.84 – 1.11	.65
Count Model			
(Intercept)	[0.55]	0.35 – 0.87	.01**
Immigrant Generation Status [2nd]	[2.11]	1.23 – 3.61	.006**
Acculturation	[0.95]	0.84 – 1.08	.43
Enculturation	[0.96]	0.85 – 1.09	.55
Observations	250		
R^2 / R^2 adjusted	0.034 / 0.018		

Note. CI = Confidence Interval. ***$p < .001$, **$p < .01$, *$p < .05$. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count. Interaction terms were non-significant, and thus omitted from the final presented model here for ease of interpretation.

Table 4.9. *Alcohol-related Problems Hurdle Model with Acculturation and Enculturation*

Predictors	Odds Ratios [or Incidence Rate Ratios]	95%CI	*p*
Zero-inflated Model			
(Intercept)	0.67	0.46 – 0.97	.034*
Immigrant Generation Status [2nd]	1.16	0.68 – 1.96	.59
Acculturation	1.20	0.98 – 1.46	.075
Enculturation	1.24	1.00 – 1.54	.05
Acculturation X Enculturation	0.97	0.90 – 1.04	.42
Immigrant Generation Status X Acculturation	0.87	0.65 – 1.16	.36
Immigrant Generation Status X Enculturation	0.67	0.47 – 0.90	.008**
Count Model			
(Intercept)	[2.52]	1.72 – 3.68	< .001***
Immigrant Generation Status [2nd]	[2.12]	1.35 – 3.32	.001**
Acculturation	[1.03]	0.86 – 1.25	.72
Enculturation	[1.11]	0.92 – 1.33	.27
Acculturation X Enculturation	[1.00]	0.93 – 1.07	.99
Immigrant Generation Status X Acculturation	[.88]	0.67 – 1.15	.35
Immigrant Generation Status X Enculturation	[1.08]	0.84 – 1.38	.57
Observations	252		
R^2 / R^2 adjusted	0.382 / 0.365		

Note. CI = Confidence Interval. ***$p < .001$, **$p < .01$, *$p < .05$. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count.

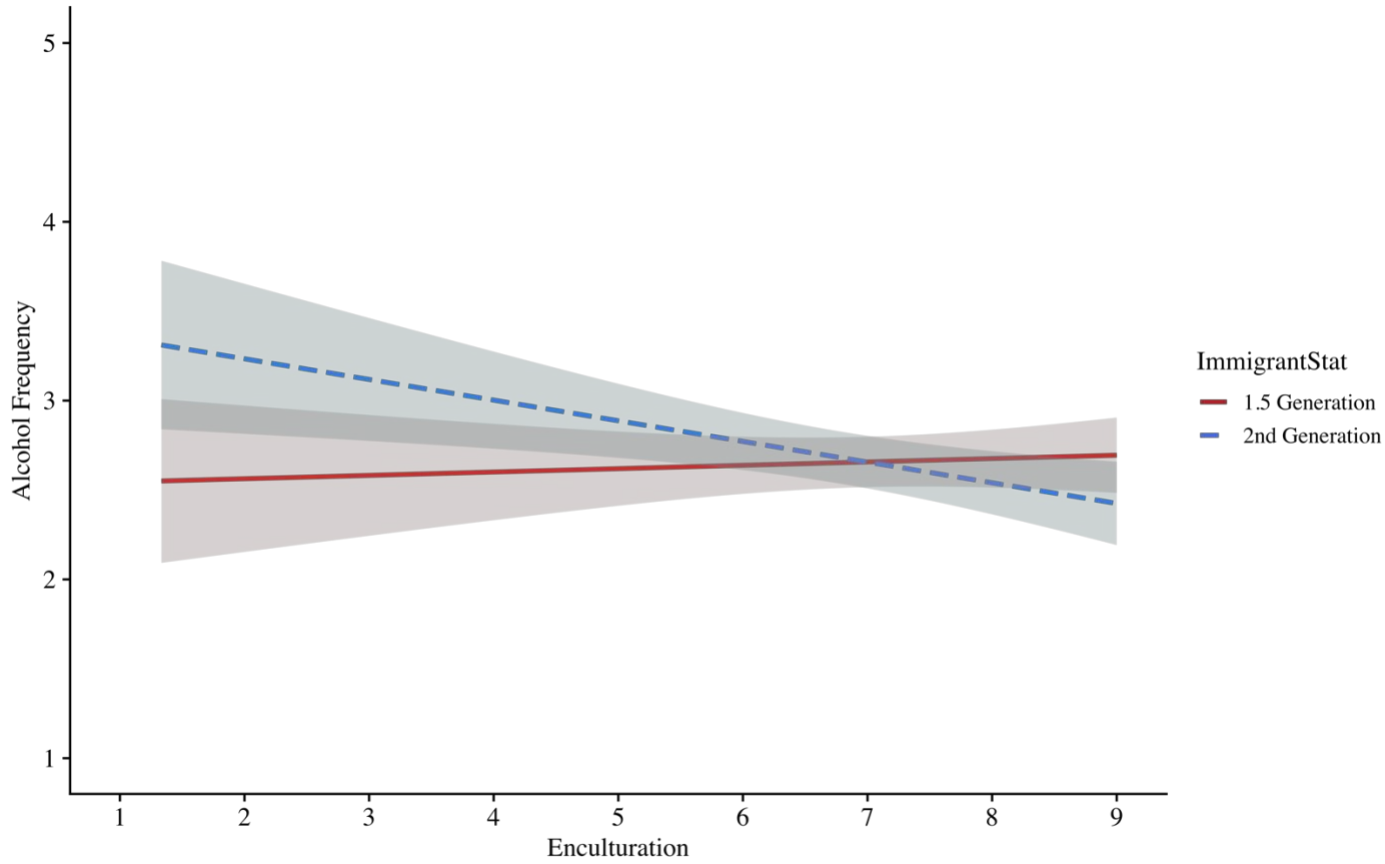

Figure 4.1. *Significant interation between Immigrant Generation Status and Enculturation Predicting Alcohol Frequency.*
Note: Model-predicted values.

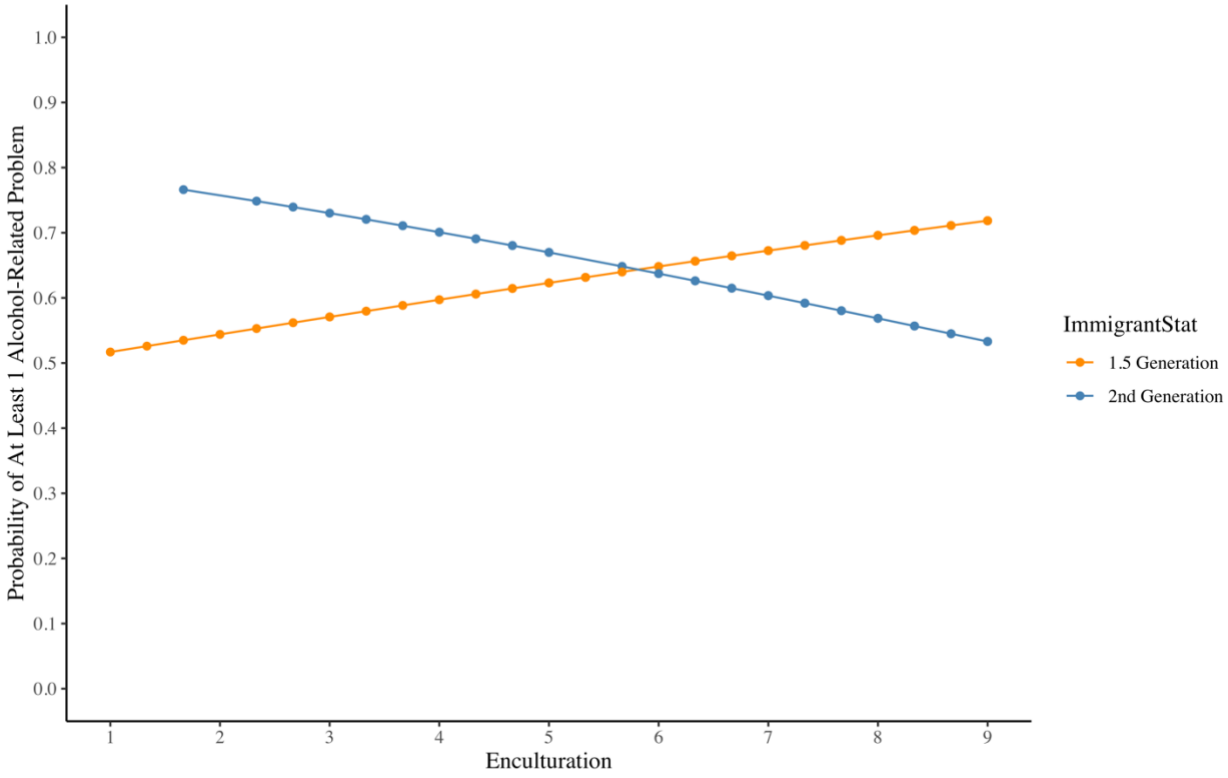

Figure 4.2. *Significant interation between Immigrant Generation Status and Enculturation Predicting the Probability of At Least One Alcohol-Related Problems.*
Note: Model-predicted values.

CHAPTER 5. GENERAL DISCUSSION

5.1. Summary of Results

A phenomenon observed in several developed countries in which recent immigrants report better health compared to the majority population is known as the healthy immigrant effect (HIE). The aims of this dissertation were to expand research on the HIE for alcohol use into the Canadian context; expand the breadth of research on HIE for alcohol use in youth and emerging adults by broadening the measures of alcohol use, accounting for other variables that could influence alcohol use, and employing a longitudinal design; and explore the role of acculturation and enculturation in this topic. Longitudinal Study 1 (Chapter 2) surveyed high school students in Montréal, Canada between grades 7-11 and measured the HIE for age of drinking onset and alcohol quantity. In supplementary analyses, we also controlled for socioeconomic status (SES) and alcohol attitudes – two potential mechanisms of the HIE. Study 2 (Chapter 4) was cross-sectional and measured the HIE across four alcohol indicators (quantity, frequency, HED, alcohol-related problems) among first- and second-year university students across Canada. We also analyzed the main effects and interactions of acculturation and enculturation with immigrant generation status on alcohol indicators and examined influences of COO. Both studies provided empirical evidence for the HIE in Canada. Alcohol involvement was highest among individuals of 3^{+} immigrant generation status, followed by individuals of 2^{nd} immigrant generation status, with individuals of 1.5 immigrant generation status reporting the least alcohol involvement. The HIE was generally not moderated by levels of acculturation or enculturation; however, we found significant interactions between immigrant generation status and enculturation on alcohol

frequency and the likelihood of reporting an alcohol-related problem. Enculturation showed the expected negative association with alcohol frequency and alcohol-related problems among students of 2nd immigrant generation status but was unexpectedly positively associated with both alcohol indices among students of 1.5 immigrant generation status. COO per capita alcohol consumption was positively associated with alcohol frequency and an increased likelihood of HED among students of 1.5 and 2nd immigrant generation status.

5.2. Novel Contributions

This dissertation contributes significantly to the HIE on alcohol use literature by expanding it to the Canadian context. The studies included in this dissertation are among the largest to be conducted in Canada with youth and emerging adults. This is significant as Canada is among the world's leading economies, being a strong member of the G7, the informal collective of the seven of the world's powerful economies (2015). Given Canada's unique demographic makeup and significant efforts to promote multiculturalism, it is not sound to defer to European or American research on the HIE when considering Canadian populations. As Canada continues to attract hundreds of thousands of immigrants every year (Government of Canada, 2022d), it is imperative that Canadian research on the HIE as it pertains to alcohol use continues to advance so that newcomers can have a healthy integration into Canadian society without adopting or exacerbating poor drinking habits. Moreover, across the two studies, we have supported the presence of the HIE across five different alcohol outcomes: grade of drinking onset, alcohol quantity, alcohol frequency, HED frequency, and alcohol-related problems. Study 1 was among the first studies to examine the HIE on alcohol use as it relates to grade of

onset in immigrant children and to also consider alcohol attitudes, and Study 2 is among the first studies with emerging adults to consider acculturation, enculturation, and country of origin (COO) alcohol rates. Therefore, the breadth of alcohol involvement covered by this dissertation is a significant strength. Moreover, both studies included large sample sizes and the diversity of the samples allowed for generalizability to the Canadian setting.

5.3. Implications

This dissertation has provided strong empirical support for the presence of the HIE in Canada. We have shown among immigrant adolescents and emerging adults, being of 1.5 immigrant generation status is associated with the least alcohol involvement. However, Study 1 showed that over time, rates of drinking among students of 1.5 immigrant generation status does increase and both studies reveal that being of 2^{nd} or 3^{+} immigrant generation status is associated with increased alcohol consumption. Therefore, this dissertation has demonstrated that immigrant youth in Canada follow the same general developmental trend in alcohol use as the majority population. A recent global meta-analysis of the change in alcohol consumption across adolescence and emerging adulthood revealed a steady increase in consumption across the ages of 10 to 25, with peak drinking around 22 years of age (Pinquart, 2024). Similarly, this dissertation has demonstrated that the emerging adult developmental stage of exploration and experimentation (Arnett, 2000) is relevant to the drinking behavior of the immigrant population as well.

With this knowledge comes the responsibility to equip students (with particular emphasis on students of 1.5 and 2^{nd} immigrant generation status) with the necessary information about the harms associated with alcohol use to encourage decisions that

promote overall health. The Canadian Post-Secondary Survey reported, across the 2019-2020 academic year, that only one in six students (16%) had heard of Canada's Low-risk Drinking Guidelines (LRDGs) which are now called Canada's Guidance on Alcohol and Health (Government of Canada, 2021). The most recent guidelines which were developed and published by the Canadian Centre on Substance Use and Addictions (2023) state that youth should delay drinking as late as possible and promote the overall message that increased number of weekly drinks is associated with increased health risks. To increase awareness of these guidelines, I recommend they be easily accessible on high school and university campuses in various languages. Unfortunately, the infographic currently available on the CCSA website is only available in English and French. Awareness of the guidelines will not be sufficient to promote meaningful decrease in alcohol consumption amongst frequent drinkers. Indeed, the guidelines' low-risk threshold of two drinks per week may seem too low to promote compliance in many, particularly among youth who have less future focus than adults (Lo-oh, 2021). Therefore, universities are also recommended to adopt a harm reduction stance that encourages students to adopt practices to reduce the harmful consequences of high-risk drinking such as HED. These include environmental and individual strategies such as limiting the number of licensed alcohol permits on campus and providing education regarding designated driving and increased hydration while consuming alcohol (Rosenberg et al., 2011). The results of Study 1 revealed that youth of 1.5 and 2nd immigrant generation status have a delayed drinking onset compared to youth of 3^{+} immigrant generation status. With this knowledge, a focus on preventive measures in early high school years and even junior high school (middle school) may be more fruitful than intervening after students have

already begun to engage in alcohol use. Next, 44% of 1.5 immigrant generation status students in the university-based Study 2 self-identified as international students. Universities have opportunity to provide psychoeducation and preventive alcohol use programs to international students prior to their arrival on campus.

High school and university alcohol use prevention programs that are culturally sensitive are essential. There are several school-based substance use/alcohol use initiates identified by the Canadian officials as successful programs such as Project SUCCESS (Schools Using Coordinated Community Efforts to Strengthen Students), Protect Toward No Drug Abuse and Project ALERT (Public Safety Canada, 2022) and the Ontario Grade 5 curriculum includes education on alcohol use and other substance use (Government of Ontario, 2024). In light of the results of my dissertation, it is recommended that these initiatives incorporate reflection on country of origin and immigrant generation status on beliefs, expectations and acceptability of alcohol use. Language of materials and family engagement are factors that may be particularly important for youth of 1.5 immigrant generations tatus. Evaluation of these initiatives should also assess the efficacy of interventions by immigrant generation status.

The importance of psychoeducation regarding alcohol consumption spans academic, social, and clinical contexts and is particularly important for youth from 1.5 and 2nd immigrant generation status families. This dissertation demonstrated that youth across all immigrant generation statuses engage in alcohol use however given the general pattern of results which revealed 3^{+} immigrant generation status youth engage in the greatest alcohol involvement, particular emphasis on 1.5 and 2nd immigrant generation status youth is warranted to preserve the protective nature of immigrant generation status.

Understanding the drinking prevalence, culture and common alcohol-related problems amongst Canadian adolescents and emerging adults in Canada may better equip immigrant parents with the tools and appropriate language to discuss this topic with their offspring. Parents originating from countries where alcohol use is stigmatized may especially benefit from explicit instruction on how to openly discuss alcohol use with their children, with the aim of delaying use as much as possible. Parents may hold beliefs or assume that because of their own strong stance on alcohol use, or because of the culture to which their child was originally exposed, their child will choose the same path as them. Overtime however and through exposure to Canadian drinking culture, their offspring may actually engage in alcohol use like the drinkers observed in this dissertation. By providing psychoeducation and direct support through workshops or webinars, families would hopefully become more prepared should their child be exposed to alcohol or opportunities to engage in drinking from peers. Programming specifically tailored to immigrant families can be facilitated in collaboration with organizations who already serve immigrant families such as the Ottawa Community Immigrant Services Organization (OCISO).

For clinicians working with families of 1.5 and 2nd immigrant generation status, I recommend that they incorporate inquiring about frequency and quantity of alcohol use into their practice even if problems related to alcohol use is not part of the presenting concern. When possible, assessing parents' and child's alcohol use and overall understanding of alcohol use in Canada separately may facilitate disclosure of any concerns. Clinicians can make use of the Cultural Formulation Interview (CFI) to gain

understanding of the cultural context. The American Psychiatric Association has made the CFI freely available online (Aggarwal & Lewis-Fernández, 2020).

There is a tendency in psychological literature to overvalue large statistical effects when trying to search for the underlying drivers of complex behaviours (Götz et al., 2022). In the context of Study 2, though we found country of origin (COO) alcohol use to have small positive effects on alcohol quantity and increased likelihood of HED among youth of 1.5 and 2nd immigrant generation status, these findings are not something to quickly overlook simply because the effect sizes were small. Indeed, it is the culmination of several small effects that lead to complex psychological phenomena such as the HIE (Götz et al., 2022). Therefore, COO alcohol use is an important additional factor to consider when trying to intervene with alcohol use among immigrants. Similarly, the unexpected finding of enculturation being positively associated with alcohol frequency and the likelihood of reporting any alcohol-related problem(s) among 1.5 immigrant generation status students should not be ignored despite its small magnitude. This is a finding of clinical significance and may point to unique treatment needs as it may reflect increased experiences of discrimination and emotional distress among 1.5 immigrant generation status students with higher enculturation levels.

5.4. Limitations

Overall, this dissertation provided a broad investigation to the HIE in alcohol use among Canadian adolescents and emerging adults. A primary limitation relevant across the two studies is that we had no measure of ethnic density which could be a moderator to the HIE. Ethnic density refers to the phenomenon in which the health of an ethnic minority is better when the individual is situated among people of the same ethnicity

(Shaw et al., 2012). For instance, the proportion of ethnic minority students in classrooms is negatively associated with externalizing behaviours and feelings of paranoia among ethnic students in the Netherlands (Eilbracht et al., 2015; Gieling et al., 2010). Furthermore, in the UK, non-Caucasian adults living in areas of greater co-ethnic density are less likely to be current drinkers compared to their counterparts (Bécares et al., 2011). There is currently little research on this phenomenon in Canadian adolescents' or emerging adults' alcohol use. Study 1 had no measures of ethnicity and due to limited sample size and missing data, we did not systematically consider the role of ethnicity in the HIE in Study 2. The distribution of the ethnicity data is found in Appendix AB. There were 12 different ethnic groups represented in the data, with White, South Asian, Arab/West Indian, and Chinese being the top four groups reported. Additionally, I acknowledge that my primary analyses have grouped all immigrants together without considering individual differences between the immigrant's home country and the subsequent impact on the strength of the HIE. Since my study data did not have targeted recruitment efforts to capture specific cultural groups, but instead was part of previously established general surveys of high school/university students, there was not sufficient data to draw sound conclusions based on home country. If such analyses were conducted, I would expect to find that HIE would be strongest amongst immigrants coming from predominantly Muslim countries in which alcohol consumption is either banned or deemed very unacceptable (e.g., Afghanistan, Iran, Kuwait). I would expect that the HIE be weakest among immigrants coming from countries with heavy drinking cultures such as England, Scotland, Ireland, and Australia. Relatedly, Study 2 did not systematically consider potential differences in the magnitude of the HIE across provinces. Canadian

survey data has revealed differences in risk of emotional problems among immigrant children across provinces (Pottie et al., 2015). Given differences that may arise between provinces in the percentage of immigrants, availability and quality of social infrastructure, and drinking culture, by grouping immigrants together in both studies, nuances of the HIE on alcohol youth were likely left undetected. Furthermore, neither study included age of migration as a potential moderator to the HIE. I would expect that immigrants who arrived in Canada at an earlier age (e.g., childhood) would have greater alcohol involvement compared to those who migrated at later ages (e.g., adolescence).

Next, my studies assessed the HIE on measures of alcohol use without also assessing polysubstance use. Data suggests many youth are mixing alcohol with other drugs or caffeinated energy drinks (Canadian Centre on Substance Use and Addiction, 2014; Government of Canada, 2019). Polysubstance use is associated with criminal behaviour and adolescents using multiple substances may be at increased risk of developing a substance use disorder among other adverse consequences (Tomczyk et al., 2016); therefore, extending research on the HIE to this area is important. If I were to have measured polysubstance use, I would have expected to find a similar pattern of results as Studies 1 and 2 in that youth of 1.5 immigrant generation status would report the least amount of polysubstance use compared to youth of 2^{nd} and 3^{+} immigrant generation status. Furthermore, we did not include measures of drinking location in our studies. I postulated in Study 1 that one reason why high school students of 1.5 immigrant generation status reported lower levels of drinking than other groups may be because they are more likely to be socially isolated and less likely to be present at social gatherings that involve alcohol. In Study 2, we considered the fact that less students of 1.5

immigrant generation status reported living in university residence, which may contribute to less exposure to pro-drinking environments. Having clear data on drinking location would help provide empirical support to these speculations. Merrill and colleagues (2023) found that over a 28-day period, American university students experienced more negative alcohol-related consequences when drinking at home/university dorm and large gathering settings than at bars or clubs. Moreover, across the 28 days, students reported experiencing more nausea/vomiting at home/dormitory than at large gatherings, suggesting that the accessibility of alcohol in the dorm context may lead to greater drunkenness, particularly for underage students living in dormitories (Merrill et al., 2023).

Our samples across the two studies are limited to students attending secondary and post-secondary education. Large scale prospective studies have shown that heavy drinking adolescents have the highest risk of dropping out of high school (Hjarnaa et al., 2023) and that high-level alcohol consumption predicts high school dropout even after controlling for externalizing and internalizing problems (Ove et al., 2024). Study 1 had overall low rates of drinking (i.e., approximately 20-74% abstainer rate across grades, average number of drinks below the heavy episodic drinking cutoff) and our study likely does not capture the unhealthiest subsection of adolescent drinkers since participants had to be present at school to take part in data collection. I would expect that, should that subsection of unhealthy adolescent drinkers been included in my study, they would primarily have been youth of 3^{+} immigrant generation status, increasing that group's drinking rates and therefore increasing the effect sizes (i.e., mean differences) between them and both youth of 1.5 and 2^{nd} immigrant generation status. Next, students of 1.5

immigrant generation status in our high school sample had the lowest socioeconomic status on average. By limiting our sample in Study 2 to students attending post-secondary institutions, we excluded students who do not have the financial means to attend university; this may have disproportionally affected students of1.5 immigrant generation status who are less likely to have access to government supports. I would expect that should this subsection of 1.5 immigrant generation status students have been included in my study, it would have decreased the drinking rates observed in that group and therefore increased effect sizes (mean differences) between them and both students of 2^{nd} and 3^{+} immigrant generation status.

A final limitation is that our study did not differentiate between participants born in Canada or U.S., thus treating Canadian citizens as equal to U.S. immigrants. However, U.S. immigrants are more similar to Canadians than are other international immigrants (Croucher, 2011). Originating from one of the most powerful nations, U.S. immigrants carry relative privilege over immigrants from other countries and often differ in their motivations for immigration. A large proportion of American immigrants are not escaping injustice or persecution nor are they desperately searching for a better life, but rather are immigrating to Canada by "happenstance… subtle nudges and flukes of circumstance" (Croucher, 2011). In a study of U.S. immigrants to Canada, Croucher (2011) found U.S. immigrants assumed little cultural differences in Canada prior to immigrating, considered Canada to be an extension of the U.S., and operated with an attitude of "nonchalance." Indeed, the mentioned cultural differences the U.S. immigrants experienced were mainly trivial, including differences in pronouncing "z", the use of the metric system, and Canadians negotiating more in the workplace. The author states,

> "Ultimately, however, the amount and type of adaptation required of Americans who migrate northward seems less a function of the actual degree of cultural difference between Canada and the USA and more the product of a generally carefree attitude on the part of these migrants about international border crossing" (Croucher, 2011).

Therefore, as most respondents who selected "Canada or US" are likely to be Canadians, and given the similarities between the cultures, we do not believe this to be a serious limitation to our study.

Future Directions

Future research should clarify the nuances behind alcohol use patterns among individuals of 2nd immigrant generation status. In Study 1 we found youth of 2nd immigrant generation status resembled youth of 3+ immigrant generation status regarding alcohol quantity but were similar to youth of 1.5 immigrant generation status regarding drinking onset. In a cross-sectional international study of lifetime alcohol frequency in adolescent immigrants to 23 predominantly European countries, Barsties and colleagues (2017) found that native adolescents reported the highest lifetime frequency, but no significant differences were observed between first- and 2nd immigrant generation status youth. Interestingly, first-generation immigrants reported the most frequent lifetime drunkenness, further illustrating the need for tailored interventions. The authors propose frequent drunkenness opposed to general alcohol use may be indicative of immigration-related adjustment difficulties such as rejection or a lack of belonging (Barsties et al., 2017). This article also demonstrates the importance of considering the drinking culture of the receiving country as the HIE may be nation specific. Several of the receiving

European countries included in the Barsties et al. (2017) article report per capita alcohol consumption rates larger than Canada's (e.g., Denmark, Finland) which may explain the differing pattern of results from my studies. Individuals of 2nd immigrant generation status have unique experiences in that they are growing up surrounded by a dominant culture but may be exposed to multiple cultures in their home environment. Therefore, those of 2nd immigrant generation status may share similar stressors or psychosocial needs as those of 1.5 immigrant generation status. To better understand alcohol patterns among youth of 2nd immigrant generation status in Canada, research that considers parental alcohol consumption, acculturation, and enculturation would be important. This would help understand how shared parental factors between youth of 1.5 and 2nd immigrant generation status can explain the drinking patterns of 2nd immigrant generation status youth.

Next, given the social and physical developmental changes that occur over adolescence, future research on the HIE in youth alcohol use should consider more frequent measurements to capture its trajectory and identify critical periods of intervention. As our study found differences in alcohol quantity emerging among immigrant groups later in high school, longitudinal studies that capture the transition from high school to post-secondary education would be beneficial to understanding the HIE. Notably, emerging and young adults 20-29 years old represent the highest percentage of problematic drinkers in Canada (Public Health Agency of Canada, 2016). Immigrants may thus be exposed to increased pressure to engage in heavy alcohol use and may benefit from tailored interventions before leaving high school. Similarly, given the dynamic process of adapting to Canadian culture while simultaneously honouring

heritage culture values, future research should include multiple measures of acculturation and enculturation over time instead of limiting to a single timeframe as I did. Acculturation and enculturation may have greater associations with alcohol indicators based on the individual's perception of cultural dissonance between their heritage culture and Canadian culture. Therefore, supplemental qualitative data that permits individuals to speak directly to the differences in alcohol cultures between their heritage culture and mainstream Canadian culture would be valuable.

Study 1 found that alcohol attitudes were significant predictors of alcohol use among immigrant youth and those of 1.5 immigrant generation status reported the least permissive attitudes around alcohol, pointing toward one potential mechanism for the HIE in youth. Future research should expand upon this and consider the role of injunctive norms on immigrant alcohol use. Injunctive norms refer to how a respondent perceives their peers' attitudes toward and acceptability of alcohol use (Lac & Donaldson, 2018). Injunctive norms have been found to be associated with alcohol outcomes among adolescents and emerging adults, but research including different immigrant generations is needed (Pedersen et al., 2017). Recent immigrant youth may be more likely to view drinking as unacceptable based on their COO's injunctive norms.

Immigrant youth's alcohol attitudes may also be influenced by parental socialization. Immigrant parents, out of fear of the dominant culture's influence on their children, may increase their monitoring behaviours (Ashbourne et al., 2012; Chan et al., 2016). Moreover, Iran is a predominantly Muslim country and consuming alcohol is a punishable crime. As such, there is great stigma associated with alcohol and its use is not deemed acceptable (Lankarani & Afshari, 2014).

Across both studies, immigrant generation status was determined based on place of birth, but we did not explicitly ask about refugee status. Youth and emerging adult refugees are often escaping traumatic situations in their home countries and therefore come to Canada with specific and high levels of need that span across multiple service domains (Walsh et al., 2011). I would expect that the magnitude of the HIE on alcohol use would be smaller among refugees than immigrants as it has been found with indicators of physical health (Lu & Ng, 2019) given differences in baseline health. My results therefore may be underrepresenting the HIE by not screening for refugee status. In sum, specific research on the HIE with an emphasis on refugee populations is needed to understand the trajectory of youth refugee alcohol use.

Lastly, it is an inevitable truth that current policy-level factors likely favour the selection of healthier immigrants to Canada. For instance, Canada's immigration process includes a medical exam in which potential immigrants could be refused admission if their health is believed to be likely to cause excessive demand on Canada's health and social services (Immigration, 2021). Therefore, future research on the HIE must include a robust examination of selection effects that includes consideration of which immigrant category the individual (or their family) is applying through. Such studies would require large samples to be able to compare the alcohol consumption levels of individuals who were allowed entry into Canada and those who were not. A longitudinal design would also be required to test the strength of such selection effects overtime. As with other multifaceted phenomena, it is likely the combination of selection effects and psychological processes such as acculturation, enculturation, and alcohol attitudes that contribute to differences in immigrant alcohol use.

5.5. Conclusion

This dissertation has provided empirical evidence of the HIE on alcohol use in Canadian adolescents and emerging adults. Across two studies, we found that youth of 1.5 immigrant generation status reported the least alcohol involvement across five outcomes: grade of drinking onset, alcohol quantity, alcohol frequency, HED frequency, and alcohol-related problems. This research calls for an increase in culturally sensitive alcohol use prevention programs that can support immigrant youth so that they can maintain the advantages associated with immigration of reduced alcohol use and alcohol-related problems associated while still having a healthy social integration into Canadian society.

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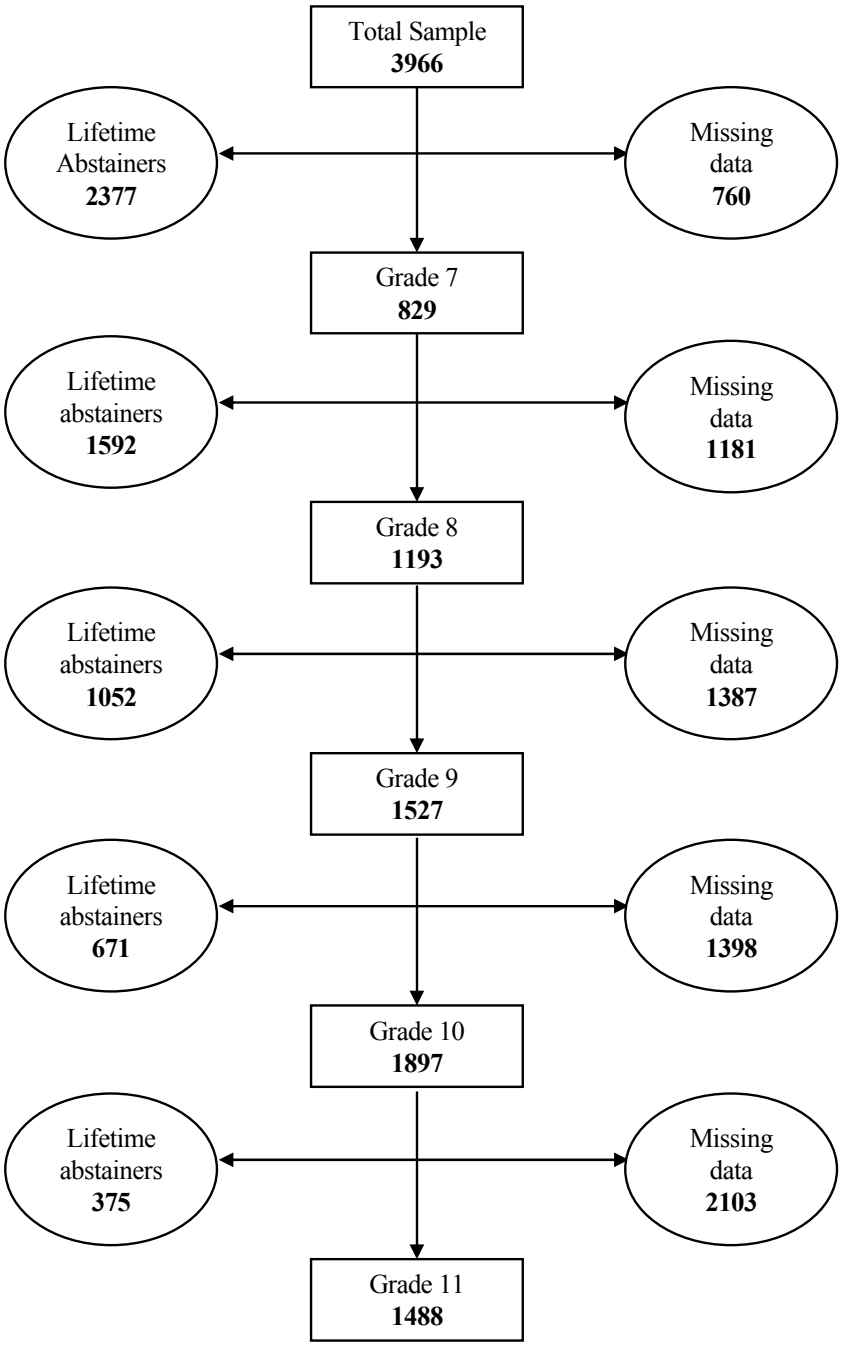
APPENDIX A. STUDY 1 ALCOHOL QUANTITY PARTICIPANT FLOWCHART



Note. Participant flow chart indicating the number of participants included in the alcohol quantity analyses, total number of lifetime abstainers, and missing data at each wave.

APPENDIX B. STUDY 1 BIC VALUES FOR MODEL COMPARISONS

Model Comparisons

Model	df	BIC
Poisson, random intercepts, grade coded numerically	8	33153.50
Negative binomial, random intercepts, grade coded numerically	8	27207.07
Negative binomial, random intercepts, grade coded numerically, school clustering	9	27053.93
Negative binomial, random intercepts, grade coded categorically, school clustering	18	27114.44
Negative binomial, random intercepts, random slopes, grade coded numerically, school clustering	11	26979.00*

Note. df = degrees of freedom, * = selected model.

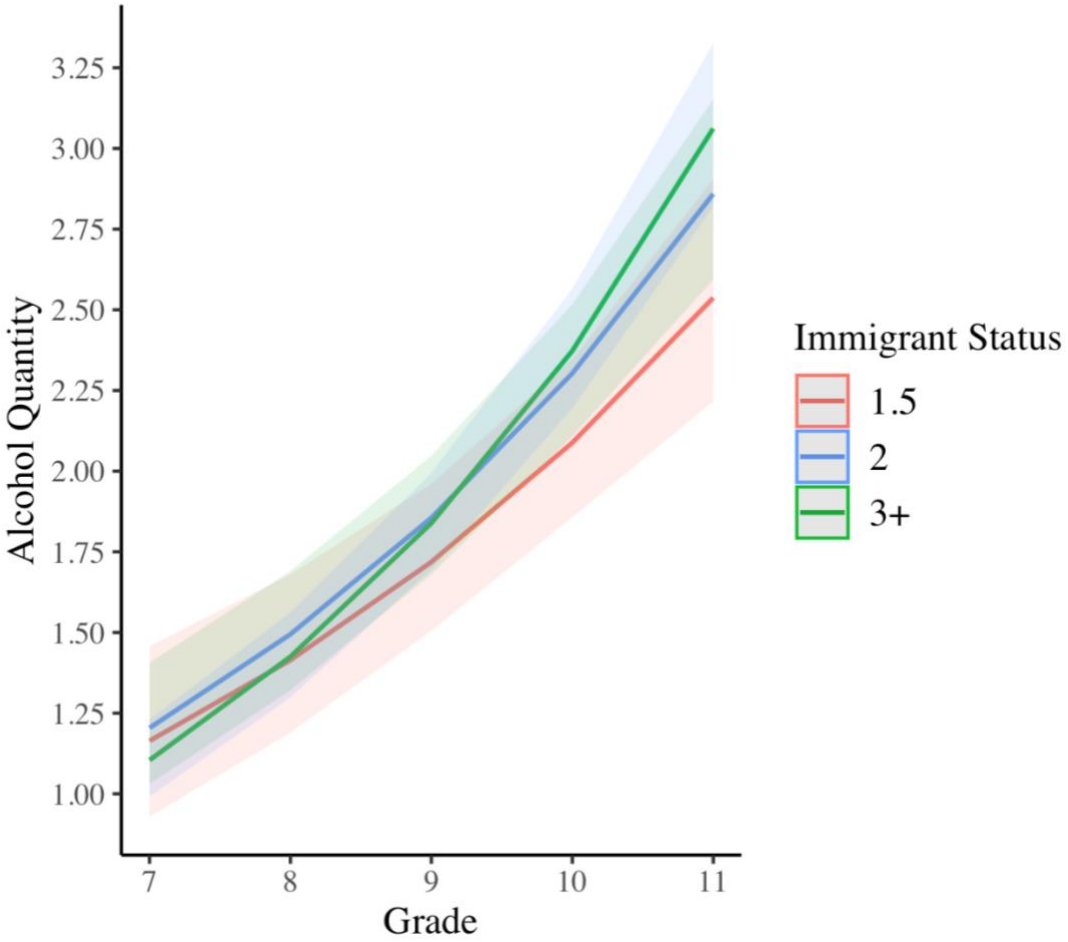
APPENDIX C. STUDY 1 DESCRIPTIVE STATISTICS FOR SES BY IMMIGRANT GENERATION STATUS AND GRADE

	Immigrant Generation Status	**Mean**	***SD***	**Mdn**	**N**	**% of Total**
Grade 7	1.5 Gen	4.84	1.82	5	419	11.29
	2nd Gen	5.27	1.76	5	1122	30.24
	3+ Gen	5.55	1.65	6	2169	58.46
	Total	5.39	1.72	5	3710	100
Grade 8	1.5 Gen	5.17	1.92	5	369	11.19
	2nd Gen	5.51	1.75	6	1006	30.49
	3+ Gen	5.81	1.62	6	1924	58.32
	Total	5.65	1.71	6	3299	100
Grade 9	1.5 Gen	5.23	1.78	5	332	11.08
	2nd Gen	5.65	1.76	6	916	30.57
	3+ Gen	5.98	1.66	6	1748	58.34
	Total	5.8	1.72	6	2996	100
Grade 10	1.5 Gen	5.50	1.79	6	313	11.00
	2nd Gen	5.83	1.75	6	864	30.36
	3+ Gen	6.15	1.58	6	1669	58.64
	Total	5.95	1.67	6	2846	100
Grade 11	1.5 Gen	5.46	1.77	6	257	12.77
	2nd Gen	5.90	1.71	6	722	35.88
	3+ Gen	6.32	1.59	6	1033	51.34
	Total	6.06	1.69	6	2012	100
Total	1.5 Gen	5.25	1.63	5.4	446	11.47
	2nd Gen	5.60	1.57	5.67	1175	30.21
	3+ Gen	5.86	1.46	6	2268	58.31
	Total	5.71	1.53	5.8	3889	100

APPENDIX D. STUDY 1 DESCRIPTIVE STATISTICS FOR ALCOHOL ATTITUDES BY IMMIGRANT GENERATION STATUS AND GRADE

	Immigrant Generation Status	Mean	*SD*	Mdn	N	% of Total
Grade 7	1.5 Gen	1.34	.51	1	233	10.93
	2nd Gen	1.31	.46	1	567	26.61
	3+ Gen	1.42	.51	1.25	1331	62.46
	Total	1.38	.5	1	2131	100
Grade 8	1.5 Gen	1.43	.57	1	298	11.18
	2nd Gen	1.41	.52	1.25	767	28.78
	3+ Gen	1.67	.59	1.5	1600	60.04
	Total	1.57	.58	1.5	2665	100
Grade 9	1.5 Gen	1.63	.65	1.5	317	11.27
	2nd Gen	1.61	.61	1.5	856	30.44
	3+ Gen	1.88	.63	2	1639	58.29
	Total	1.77	.64	1.75	2812	100
Grade 10	1.5 Gen	1.77	.65	1.75	313	11.07
	2nd Gen	1.78	.66	1.75	861	30.46
	3+ Gen	2.16	.60	2	1653	58.47
	Total	2.00	.65	2	2827	100
Grade 11	1.5 Gen	1.91	.63	2	255	12.76
	2nd Gen	1.94	.65	2	715	35.79
	3+ Gen	2.28	.59	2.5	1028	51.45
	Total	2.11	.64	2	1998	100
Total	1.5 Gen	1.61	.51	1.5	423	11.45
	2nd Gen	1.64	.50	1.58	1107	29.98
	3+ Gen	1.85	.48	1.83	2162	58.55
	Total	1.76	.50	1.75	3692	100

APPENDIX E. STUDY 1 EXPLORATORY MODEL FIGURE



Model-predicted alcohol quantity by immigrant generation status and grade, adjusted for SES and alcohol attitudes. Data has been backtransformed from the log scale to the original metric.

APPENDIX F. STUDY 1 PARTICIPATANTS' PLACE OF BIRTH BY IMMIGRANT GENERATION STATUS

	Immigrant Generation Status			
Participant Place of Birth	1.5	2	3^{+}	Total
Canada or the US	-	1175	2268	3443
Europe	100	-	-	100
Africa	70	-	-	70
Caribbean	39	-	-	39
East Asia (e.g. China, Japan, Korea, Philippines, Indonesia, etc.)	99	-	-	99
South Asia e.g. India, Pakistan, Sri Lanka, etc.)	24	-	-	24
Middle East e.g. Iran, Iraq, Syria, Saudi Arabia, Israel, Lebanon, etc.)	37	-	-	37
South or Central America e.g. Mexico, Brazil, Colombia, etc.)	59	-	-	59
Other	18	-	-	18

Note. Participants were categorized as 1.5 immigrant generation status if their place of birth was not "Canada or US", 2nd immigrant generation status if they answered, "Canada or US" for themselves but at least one parent was not "Canada or US", and 3^{+} immigrant generation status if their answers to all three items were "Canada or US".

APPENDIX G. STUDY 1 PARTICIPATANTS' MOTHERS' PLACE OF BIRTH BY IMMIGRANT GENERATION STATUS

	Immigrant Generation Status			
Participant's Mother's Place of Birth	1.5	2	3^{+}	Total
Canada or the US	34	284	2268	2586
Europe	84	176	-	260
Africa	76	110	-	186
Caribbean	34	107	-	141
East Asia (e.g. China, Japan, Korea, Philippines, Indonesia, etc.)	84	175	-	259
South Asia e.g. India, Pakistan, Sri Lanka, etc.)	26	124	-	150
Middle East e.g. Iran, Iraq, Syria, Saudi Arabia, Israel, Lebanon, etc.)	26	72	-	98
South or Central America e.g. Mexico, Brazil, Colombia, etc.)	56	95	-	151
Other	13	29	-	42

Note. Participants were categorized as 1.5 immigrant generation status if their place of birth was not "Canada or US", 2nd immigrant generation status if they answered, "Canada or US" for themselves but at least one parent was not "Canada or US", and 3^{+} immigrant generation status if their answers to all three items were "Canada or US".

APPENDIX H. STUDY 1 PARTICIPATANTS' FATHERS' PLACE OF BIRTH BY IMMIGRANT GENERATION STATUS

	Immigrant Generation Status			
Participant's Father's Place of Birth	1.5	2	3^{+}	Total
Canada or the US	32	180	2268	2480
Europe	81	200	-	281
Africa	83	110	-	193
Caribbean	31	135	-	166
East Asia (e.g. China, Japan, Korea, Philippines, Indonesia, etc.)	80	140	-	220
South Asia e.g. India, Pakistan, Sri Lanka, etc.)	29	133	-	162
Middle East e.g. Iran, Iraq, Syria, Saudi Arabia, Israel, Lebanon, etc.)	29	119	-	148
South or Central America e.g. Mexico, Brazil, Colombia, etc.)	51	98	-	149
Other	16	41	-	57

Note. Participants were categorized as 1.5 immigrant generation status if their place of birth was not "Canada or US", 2nd immigrant generation status if they answered, "Canada or US" for themselves but at least one parent was not "Canada or US", and 3^{+} immigrant generation status if their answers to all three items were "Canada or US".

APPENDIX I. STUDY 2 PARTICIPANT PLACE OF BIRTH

	Immigrant Generation Status			
Participant Place of Birth	1.5	2	3^+	Total
Canada or the US	-	252	759	1011
Europe	32	-	-	32
Africa	34	-	-	34
Caribbean	16	-	-	16
East Asia (e.g. China, Japan, Korea, Philippines, Indonesia, etc.)	70	-	-	70
South Asia e.g. India, Pakistan, Sri Lanka, etc.)	54	-	-	54
Middle East e.g. Iran, Iraq, Syria, Saudi Arabia, Israel, Lebanon, etc.)	48	-	-	48
South or Central America e.g. Mexico, Brazil, Colombia, etc.)	24	-	-	24
Other	14	-	-	14

Note. Participants were categorized as 1.5 immigrant generation status if their place of birth was not "Canada or US", 2nd immigrant generation status if they answered, "Canada or US" for themselves but at least one parent was not "Canada or US", and 3^+ immigrant generation status if their answers to all three items were "Canada or US".

APPENDIX J. STUDY 2 – MOTHER'S PLACE OF BIRTH

	Immigrant Generation Status			
Mother's Place of Birth	1.5	2	3^+	Total
Canada or the US	13	52	759	824
Europe	29	54	-	83
Africa	33	20	-	53
Caribbean	17	9	-	26
East Asia (e.g. China, Japan, Korea, Philippines, Indonesia, etc.)	64	34	-	98
South Asia e.g. India, Pakistan, Sri Lanka, etc.)	56	33	-	89
Middle East e.g. Iran, Iraq, Syria, Saudi Arabia, Israel, Lebanon, etc.)	42	24	-	66
South or Central America e.g. Mexico, Brazil, Colombia, etc.)	20	14	-	34
Other	10	12	-	22

Note. Participants were categorized as 1.5 immigrant generation status if their place of birth was not "Canada or US", 2nd immigrant generation status if they answered, "Canada or US" for themselves but at least one parent was not "Canada or US", and 3^+ immigrant generation status if their answers to all three items were "Canada or US".

APPENDIX K. STUDY 2 FATHER'S PLACE OF BIRTH

	Immigrant Generation Status			
Father's Place of Birth	1.5	2	3^+	Total
Canada or the US	8	49	759	816
Europe	34	43	-	77
Africa	32	20	-	52
Caribbean	14	12	-	26
East Asia (e.g. China, Japan, Korea, Philippines, Indonesia, etc.)	64	34	-	98
South Asia e.g. India, Pakistan, Sri Lanka, etc.)	56	34	-	90
Middle East e.g. Iran, Iraq, Syria, Saudi Arabia, Israel, Lebanon, etc.)	46	30	-	76
South or Central America e.g. Mexico, Brazil, Colombia, etc.)	20	16	-	36
Other	10	10	-	20

Note. Participants were categorized as 1.5 immigrant generation status if their place of birth was not "Canada or US", 2nd immigrant generation status if they answered, "Canada or US" for themselves but at least one parent was not "Canada or US", and 3^+ immigrant generation status if their answers to all three items were "Canada or US".

APPENDIX L. STUDY 2 VIA-B CONTEXTUAL EXPLANATION

The Vancouver Acculturation Index (VIA) is an established bidimensional measure of acculturation that includes an acculturation factor, and an enculturation factor. We started our development of our brief VIA (VIA-B) by keeping 10 of the original 20 items based on a published factor analysis with Canadian immigrants (Testa et al., 2019).. As seen in Appendix O, the ten-item measure revealed an unclear factor structure that suggested three factors instead of the validated and well-established two factor structure. One factor included most of the acculturation items, one factor pertained to all the enculturation items, but one other factor was ambiguous. Upon further observation, we decided to omit four items with similar wording that appeared to be similar in semantic meaning to the gregariousness facet of extraversion (i.e., talkativeness, sociability) regardless of being about Canadian culture (acculturation) or heritage culture (enculturation). That is, these 4 items are strongly intercorrelated with each other due to their conceptual overlap with extraversion, despite also being somewhat separable into enculturation and acculturation factors.

Four omitted items:

hc_social_canada: I enjoy social activities with typical Canadian people.

hc_interac_canada: I am comfortable interacting with typical Canadian people.

hc_social_same: I enjoy social activities with people from the same heritage culture as myself.

hc_interac_same: I am comfortable interacting with people of the same heritage culture as myself.

Of note, the item “hc_interac_same” had cross-loadings across two factors, the enculturation factor, and the other ambiguous “extraversion factor.” Items “hc_social_canada”

and “hc_interac_same” also loaded onto the ambiguous “extraversion factor.” Item “hc_social_same” was omitted because of similar wording to the items in the ambiguous “extraversion factor.

After omitting those four items, the remaining six items created a clearer two factor structure: three items pertaining to acculturation, and three items pertaining to enculturation (See Appendix P). The fit indices for this two-factor measure were acceptable (RMSEA = .086, TLI = 0.934) and thus analyses were all conducted with this revised measure.

APPENDIX M. STUDY 2 10 INITIAL ITEMS OF THE VIA-B

Variable name	Item description
1. hc_social_same	I enjoy social activities with people from the same *heritage culture* as myself
2. hc_social_canada	I enjoy social activities with typical Canadian people
3. hc_interac_same	I am comfortable interacting with people of the same *heritage culture* as myself
4. hc_interac_canada	I am comfortable interacting with typical Canadian people
5. hc_culture_same	It is important for me to maintain or develop the cultural practices of my *heritage culture*
6. hc_culture_canada	It is important for me to maintain or develop Canadian cultural practices
7. hc_entertain_same	I enjoy entertainment (e.g. movies, music) from my *heritage culture*
8. hc_friends_same	I am interested in having friends from my *heritage culture*
9. hc_behave_canada	I often behave in ways that are typically Canadian
10. hc_mainstream_canada	I believe in mainstream Canadian values

Note. Participants were freely asked to define their heritage culture.

APPENDIX N. STUDY 2 VIA TEN ITEM CORRELATION MATRIX

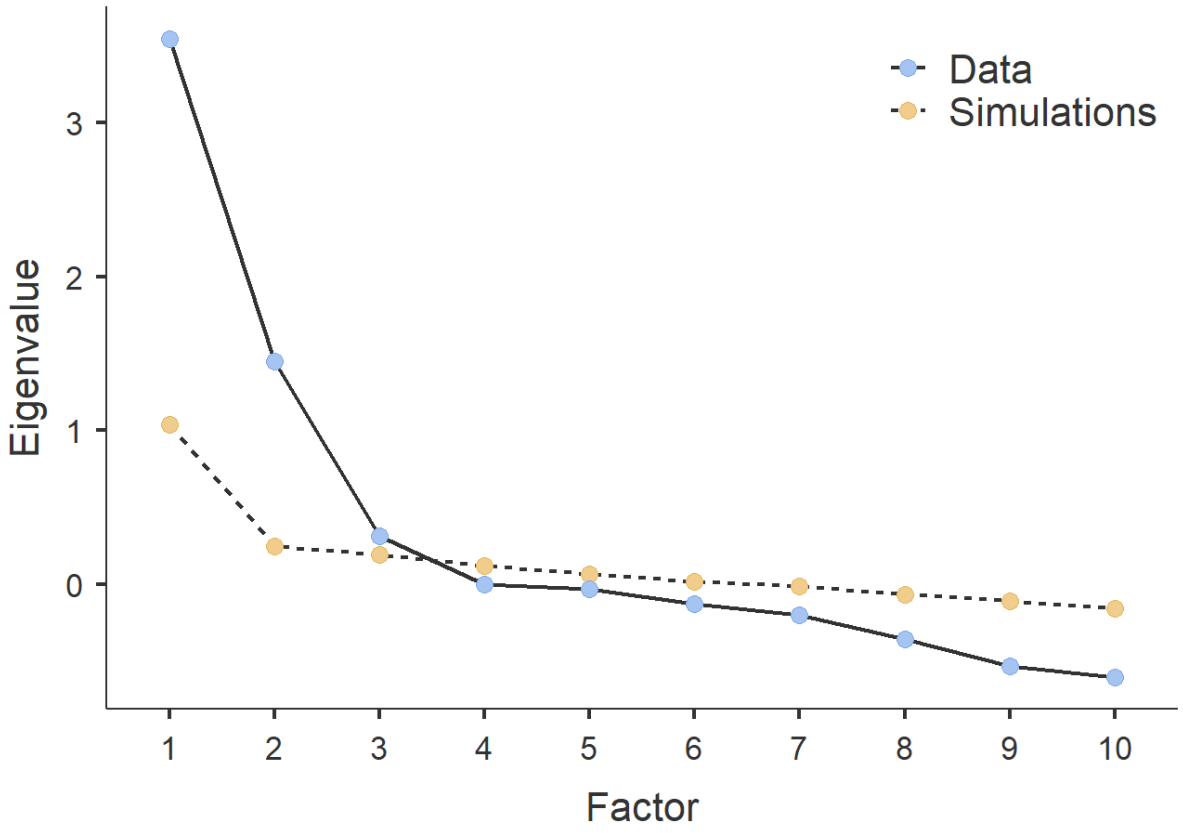
Variable	*n*	M	SD	1	2	3	4	5	6	7	8	9	10
1. hc_social_same	409	6.95	2.02	–									
2. hc_social_canada	403	6.9	2.02	.38***	–								
3. hc_interac_same	413	7.54	1.79	.71***	.37***	–							
4. hc_interac_canada	409	7.37	1.81	.33***	.76***	.49***	–						
5. hc_culture_same	412	6.67	2.31	.53***	.19***	.49***	.22***	–					
6. hc_culture_canada	411	5.82	2.36	.2***	.41***	.16**	.34***	.34***	–				
7. hc_entertain_same	409	6.77	2.35	.5***	.13*	.44***	.22***	.51***	.21***	–			
8. hc_friends_same	412	7.18	2.04	.68***	.27***	.57***	.29***	.54***	.26***	.58***	–		
9. hc_behave_canada	408	6.48	2.41	.05	.51***	.09	.46***	.05	.40***	.04	.13**	–	
10. hc_mainstream_canada	401	6.3	2.21	.07	.47***	.08	.35***	.09	.48***	.05	.09	.62***	–

Note. Pearson correlations, pairwise comparisons. ***p<.001, **p<.01, *p<.05.

APPENDIX O. STUDY 2 VIA TEN ITEM FACTOR LOADINGS AND SCREE PLOT

	Factor Loadings			
Variable	1 (Enculturation)	2 (Extraversion)	3 (Acculturation)	Uniqueness
hc_social_canada	0.01	**0.76**	0.21	0.24
hc_interac_canada	0.03	**0.85**	0.04	0.23
hc_culture_canada	0.24	0.02	**0.57**	0.58
hc_behave_canada	-0.06	0.25	**0.63**	0.42
hc_mainstream_canada	0.01	0.06	**0.76**	0.37
hc_social_same	**0.79**	0.15	-0.09	0.28
hc_interac_same	**0.64**	**0.36**	-0.20	0.33
hc_culture_same	**0.73**	-0.11	0.11	0.51
hc_entertain_same	**0.72**	-0.13	0.08	0.54
hc_friends_same	**0.81**	-0.05	0.09	0.35

Note. 'Maximum likelihood' extraction method was used in combination with an 'oblimin' rotation. Factor loadings greater than .30 are bolded.

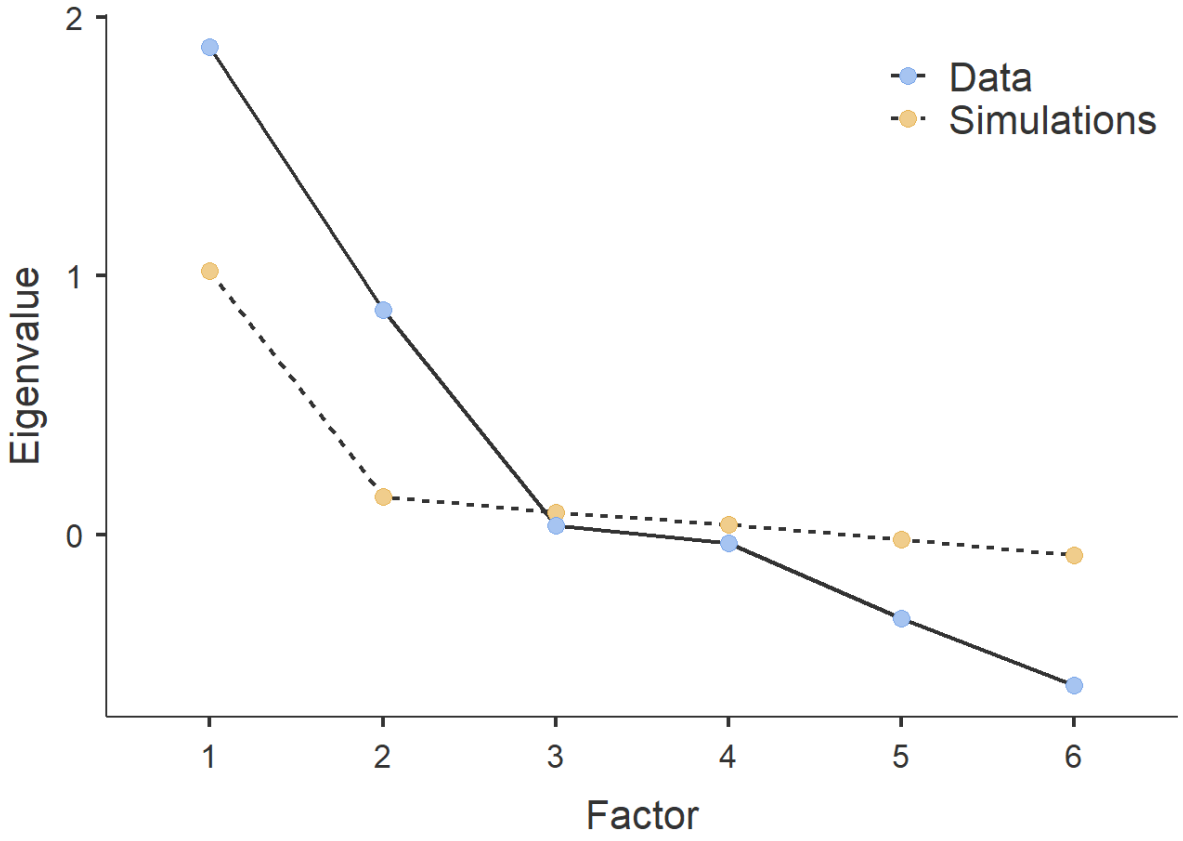


Scree Plot with ten initial VIA-B items including simulated comparison values from parallel analysis

APPENDIX P STUDY 2 VIA FACTOR LOADINGS WITH SIX RETAINED ITEMS AND SCREE PLOT

	Factor Loadings		
Variable	1 (Enculturation)	2 (Acculturation)	Uniqueness
hc_culture_canada	0.27	**0.52**	0.60
hc_behave_canada	-0.03	**0.72**	0.49
hc_mainstream_canada	-0.04	**0.86**	0.28
hc_culture_same	**0.72**	0.01	0.49
hc_entertain_same	**0.75**	-0.05	0.45
hc_friends_same	**0.77**	0.02	0.41

Note. 'Maximum likelihood' extraction method was used in combination with an 'oblimin' rotation. Factor loadings greater than 0.30 are bolded.



Scree Plot with six retained items including simulated comparison values from parallel analysis

APPENDIX Q. STUDY 2 WHO ALCOHOL PER CAPITA CONSUMPTION

STATISTICS

WHO Alcohol Per Capita Consumption in Liters over a calendar year (World Helath Organization, 2019)

Country	**Total**
Afghanistan	.013
Argentina	9.45
Armenia	4.67
Australia	10.36
Bahamas	4.8
Bangladesh	0
Belarus	10.96
Belize	6.37
Bosnia and Herzegovina	7.81
Brazil	7.32
Canada	8.81
Chile	8.95
China	6.04
Colombia	5.45
Cuba	6.26
Denmark	10.13
Dominican Republic	6.68
Ecuador	4.37
Egypt	.14
El Salvador	4.09
Eritrea	2.11
Ethiopia	2.2
Finland	10.65
France	12.23
Germany	12.79
Ghana	2.78
Greece	10.5
Guyana	5.33
Haiti	3.02
Iceland	9.21
India	5.61
Indonesia	.22
Iran (Islamic Republic of)	1.01

Iraq	.37
Ireland	12.75
Israel	4.38
Italy	8.01
Jamaica	4.16
Japan	10.09
Jordan	.52
Kazakhstan	5
Kenya	2.15
Kuwait	0
Lebanon	1.53
Malaysia	.93
Malta	8.27
Mexico	5.05
Netherlands	9.67
New Zealand	10.69
Nigeria	6.19
Norway	7.14
Pakistan	.31
Peru	6.78
Philippines	7.02
Portugal	12.09
Republic of Korea	8.45
Republic of Moldova	12.85
Romania	12.34
Russian Federation	10.5
Serbia	8.85
Singapore	2
Slovakia	11.06
Somalia	0
Sri Lanka	2.87
Sweden	9.04
Switzerland	11.23
Syrian Arab Republic	.19
Turkey	1.77
Thailand	8.5
The former Yugoslav Republic of Macedonia	6.43
Trinidad and Tobago	6.52
Tunisia	2.04
Ukraine	8.34

United Kingdom of Great Britain and Northern Ireland	11.45
United States of America	9.97
Vietnam	7.93

APPENDIX R. STUDY 2 ALCOHOL FREQUENCY DESCRIPTIVES BY IMMIGRANT GENERATION STATUS AND GENDER

Trimmed Means, Trimmed Standard Errors, and Robust Two-Way Analyses of Variance in Alcohol Frequency by Immigrant Generation Status and Gender

Immigrant Generation Status												Robust Two-Way ANOVA		
1.5				2nd				3+					Test Statistic	*p*
Women		Men/N-B		Women		Men/N-B		Women		Men/N-B		Immigrant Generation Status	63.95	.001**
M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	Gender	2.43	.124
2.6	0.08	2.86	0.22	2.75	0.11	2.72	0.24	3.12	0.06	3.39	0.07	Immigrant Generation Status X Gender	2.16	.351

Note. N-B = non-binary, ***p<.001, **p<.01, *p<.05. No degrees of freedom are reported since an adjusted critical value was used for the robust two-way ANOVA.

APPENDIX S. STUDY 2 ALCOHOL QUANTITY DESCRIPTIVES BY IMMIGRANT GENERATION STATUS AND GENDER

Trimmed Means, Trimmed Standard Errors, and Robust Two-Way Analyses of Variance in Alcohol Quantity by Immigrant Generation Status and Gender

Immigrant Generation Status												Robust Two-Way ANOVA		
1.5				2nd				3+					Estimate	*p*
Women		Men/N-B		Women		Men/N-B		Women		Men/N-B		Immigrant Generation Status	51.90	.001**
M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	Gender	2.43	.062
1.78	1.28	1.95	0.23	2.02	0.11	2.14	0.24	2.20	0.06	2.89	0.13	Immigrant Generation Status X Gender	2.16	0.014*

Note. N-B = non-binary, ***p<.001, **p<.01, *p<.05. No degrees of freedom are reported since an adjusted critical value was used for the robust two-way ANOVA.

APPENDIX T. STUDY 2 SUPPLEMENTAL HED MODEL WITH GENDER

Heavy Episodic Drinking Frequency Hurdle Model Accounting for Gender

Predictors	Incidence Rate Ratios [or Odds Ratios]	95% CI	*p*
Count Model			
(Intercept)	1.85	1.59 – 2.14	<.001***
Immigrant Generation Status [1.5]	0.46	0.32 – 0.66	<0.001***
Immigrant Generation Status [2nd]	0.79	0.63 – 1.01	.058
Gender [Women]	0.70	0.59 – 0.83	<.001***
Zero-inflated Model			
(Intercept)	[3.60]	2.58 – 5.02	<.001***
Immigrant Generation Status [1.5]	[0.34]	0.24 – 0.49	<.001***
Immigrant Generation Status [2nd]	[0.52]	0.37 – 0.73	<.001***
Gender [Women]	[0.68]	0.48 – 0.96	.028*
Observations	1010		
R^2 / R^2 adjusted	0.097 / 0.094		

Note. CI = Confidence Interval. ***p<.001, **p<.01, *p<.05. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count.

APPENDIX U. STUDY 2 SUPPLEMENTAL ALCOHOL-RELATED PROBLEMS MODEL WITH GENDER

Alcohol-Related Problems Hurdle Model Accounting for Gender

Predictors	Incidence Rate Ratios [or Odds Ratios]	95%CI	*p*
Count Model			
(Intercept)	4.56	3.78 – 5.51	<.001***
Immigrant Generation Status [1.5]	0.75	0.57 – 0.98	.036*
Immigrant Generation Status [2nd]	1.09	0.86 –1.37	.475
Gender [Women]	0.98	0.80 – 1.20	.851
Zero-inflated Model			
(Intercept)	[1.95]	1.45 – 2.63	<.001***
Immigrant Generation Status [1.5]	[0.33]	0.23 – 0.48	<.001***
Immigrant Generation Status [2nd]	[0.47]	0.33 – 0.65	<.001***
Gender [Women]	[1.02]	0.75 – 1.40	.883
Observations	1015		
R^2 / R^2 adjusted	0.323 / 0.320		

Note. CI = Confidence Interval. ***p<.001, **p<.01, *p<.05. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count.

APPENDIX V. STUDY 2 SUPPLEMENTAL ALCOHOL FREQUENCY LINEAR REGRESSION WITH GENDER AND COO

Alcohol Frequency Linear Regression Results Accounting for Gender and Country of Origin Per Capita Consumption

Predictors	*β*	95%CI	*p*
(Intercept)	2.70	2.32 – 3.07	<.001***
Immigrant Generation Status [2nd]	-0.04	-0.29 – 0.21	.740
Acculturation	0.03	-0.07 –0.12	.616
Enculturation	0.00	-0.08 – 0.09	.982
Gender [Women]	-0.18	-0.49 – 0.13	.264
Per Capita Consumption	0.06	0.02 – 0.10	.004**
Acculturation X Enculturation	-0.00	-0.04 – 0.03	.806
Immigrant Generation Status X Acculturation	-0.02	-0.15 – 0.12	.812
Immigrant Generation Status X Enculturation	-0.13	-0.26– -0.01	.034*
Observations	216		
R^2 / R^2 adjusted	0.120/ 0.086		

Note. CI = Confidence Interval. ***p<.001, **p<.01, *p<.05. Slopes are unstandardized.

APPENDIX W. STUDY 2 SUPPLEMENTAL ALCOHOL QUANTITY LINEAR REGRESSION WITH GENDER AND COO

Alcohol Quantity Linear Regression Results Accounting for Gender and Country of Origin Per Capita Consumption

Predictors	*β*	95%CI	*p*
(Intercept)	1.71	1.33 – 2.10	<.001***
Immigrant Generation Status [2nd]	0.26	-0.04 – 0.56	.087
Acculturation	0.02	-0.08 –0.11	.743
Enculturation	-0.05	-0.12 – 0.03	.217
Gender [Women]	-0.16	-0.53 – 0.20	.378
Per Capita Consumption	0.01	-0.03 – 0.04	.775
Observations	211		
R^2 / R^2 adjusted	0.038 /0.015		

Note. CI = Confidence Interval. ****p*<.001, ***p*<.01, **p*<.05. Interaction terms were non-significant, and thus omitted from the final presented model here for ease of interpretation. Slopes are unstandardized.

APPENDIX X. STUDY 2 SUPPLEMENTAL HED MODEL WITH GENDER AND COO

Heavy Episodic Drinking Frequency Hurdle Model with Acculturation and Enculturation While Accounting for Gender and Country of Origin Per Capita Consumption

Predictors	Incidence Rate Ratios [or Odds Ratios]	95%CI	*p*
Count Model			
(Intercept)	0.68	0.39 – 1.19	.178
Immigrant Generation Status [2nd]	2.02	1.10 – 3.72	.023*
Acculturation	0.89	0.78 – 1.03	.114
Enculturation	0.94	0.82 – 1.08	.377
Gender [Women]	0.71	0.40 – 1.24	.230
Per Capita Consumption	1.00	0.92 – 1.08	0.938
Zero-inflated Model			
(Intercept)	[0.91]	0.52 – 1.58	.738
Immigrant Generation Status [2nd]	[1.27]	0.72 – 2.25	.407
Acculturation	[1.10]	0.94 – 1.28	.244
Enculturation	[0.94]	0.80 – 1.10	.424
Gender [Women]	[0.76]	0.41 – 1.40	.386
Per Capita Consumption	[1.09]	1.00[a] – 1.19	.044*
Observations	214		
R^2 / R^2 adjusted	0.049 / 0.022		

Note. CI = Confidence Interval. ***p<.001, **p<.01, *p<.05. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count. Interaction terms were non-significant, and thus omitted from the final presented model here for ease of interpretation. [a]Odds ratio is 1.0025 without rounding to two digits.

APPENDIX Y. STUDY 2 SUPPLEMENTAL ALCOHOL-RELATED PROBLEMS MODEL WITH GENDER AND COO

Alcohol-related Problems Hurdle Model with Acculturation and Enculturation While Accounting for Gender and Country of Origin Per Capita Consumption

Predictors	Incidence Rate Ratios [or Odds Ratios]	95%CI	*p*
Count Model			
(Intercept)	1.77	0.99 – 3.15	.053
Immigrant Generation Status [2nd]	1.76	1.08 – 2.85	.023*
Acculturation	0.97	0.80 – 1.18	.789
Enculturation	1.14	0.95 – 1.37	.159
Gender [Women]	1.65	0.92 – 2.96	.095
Per Capita Consumption	1.06	0.95 – 1.13	.127
Acculturation X Enculturation	.99	0.92 – 1.06	.739
Immigrant Generation Status X Acculturation	.88	0.66 – 1.16	.360
Immigrant Generation Status X Enculturation	1.02	0.79 – 1.30	.894
Zero-inflated Model			
(Intercept)	[0.64]	0.36 – 1.14	.133
Immigrant Generation Status [2nd]	[1.05]	0.58 – 1.89	.880
Acculturation	[1.21]	0.98 – 1.51	.083
Enculturation	[1.22]	0.97 – 1.54	.086
Gender [Women]	[1.11]	0.59 – 2.09	.753
Per Capita Consumption	[1.01]	0.93 – 1.10	.799
Acculturation X Enculturation	[0.95]	0.87 – 1.03	.200
Immigrant Generation Status X Acculturation	[0.85]	0.61 – 1.18	.323
Immigrant Generation Status X Enculturation	[0.65]	0.47 – 0.90	.010*
Observations	216		
R^2 / R^2 adjusted	0.433 / 0.408		

Note. CI = Confidence Interval. ***p<.001, **p<.01, *p<.05. The outcome of the zero-inflated component of the model is the occurrence of a non-zero (positive) count.

APPENDIX Z. STUDY 2 VANCOUVER INDEX OF ACCULTURATION

*The following was retrieved from an open-source database.

Please circle *one* of the numbers below each question to indicate your degree of agreement or disagreement.
Many of these questions will refer to your h*eritage culture*, meaning the original culture of your family (other than Canadian). It may be the culture of your birth, the culture in which you have been raised, or any culture in your family background. If there are several, pick the one that has influenced you *most* (e.g. Irish, Chinese, Mexican, African). If you do not feel that you have been influenced by any other culture, please name a culture that influenced previous generations of your family.

Your *heritage* culture (other than Canadian) is: _____

I enjoy social activities with people from the same *heritage culture* as myself

Disagree								Agree
1	2	3	4	5	6	7	8	9

I enjoy social activities with typical Canadian people

Disagree								Agree
1	2	3	4	5	6	7	8	9

I am comfortable interacting with people of the same *heritage culture* as myself

Disagree								Agree
1	2	3	4	5	6	7	8	9

I am comfortable interacting with typical Canadian people

Disagree								Agree
1	2	3	4	5	6	7	8	9

It is important for me to maintain or develop the cultural practices of my *heritage culture*

Disagree								Agree
1	2	3	4	5	6	7	8	9

It is important for me to maintain or develop Canadian cultural practices

Disagree								Agree
1	2	3	4	5	6	7	8	9

I enjoy entertainment (e.g. movies, music) from my *heritage culture*

Disagree								Agree
1	2	3	4	5	6	7	8	9

I am interested in having friends from my *heritage culture*

Disagree								Agree
1	2	3	4	5	6	7	8	9

I often behave in ways that are typically Canadian

Disagree								Agree
1	2	3	4	5	6	7	8	9

I believe in mainstream Canadian values

Disagree								Agree
1	2	3	4	5	6	7	8	9

APPENDIX AA. STUDY 2 INTERNATIONAL STUDENT ROBUST T-TESTS

Alcohol Outcome	Test statistic	Trimmed mean difference	95%CI	*p*
Frequency	-0.78	-0.11	-0.43 – 0.22	.60
Quantity	1.06	0.20	-0.24 – 0.64	.37
Heavy Episodic Drinking	0.62	0.08	-0.17 – 0.34	.53
Alcohol-Related Problems	0.69	0.23	-0.44 – 0.90	.49

Note. Analyses compare alcohol outcomes among those who identified as international students versus not among students of 1.5 immigrant generation status. Degrees of freedom not available for robust t-tests.

APPENDIX AB. STUDY 2 PARTICIPANT'S ETHNICITY BY IMMIGRANT GENERATION STATUS

	Immigrant Generation Status			
Ethnicity	1.5	2	3^{+}	Total
Native Canadian/First Nations/Indigenous	1	2	44	47
White	50	105	716	871
Chinese	44	22	6	72
Filipino	11	7	1	19
Latin American	23	15	1	39
Japanese	4	2	2	8
Korean	12	6	-	18
Black (E.g., African, Haitian, Jamaican, Somali)	32	20	5	57
South Asian (e.g., East Indian, Pakistani, Punjabi, Sri Lankan)	58	43	2	103
Arab/West Indian (e.g., Armenia, Egyptian, Iranian, Lebanese, Moroccan)	52	35	1	88
Southeast Asian (e.g., Cambodian, Indonesia, Laotian, Vietnamese)	17	11	0	28
Other (e.g., Mixed race)	19	26	14	59

Note. Participants who responded "I prefer not to say" were coded as missing.