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William L. Wagner-Flynn April 22, 2016

Pre-migration persecution, socioeconomic factors, and trajectories of depression among new immigrants to the United States

By
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For the degree of Master of Public Health

Hubert Department of Global Health

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Abstract

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Objective:

The objective of this study was to characterize the effects of pre-migration persecution and socioeconomic factors on long-term trajectories of depression among new immigrants to the United States. It utilizes a nationally representative survey of new immigrants to the United States, assessing the effects of self-reported pre-migration persecution and four socioeconomic indicators on three depression outcomes, depression at baseline, depression at follow-up, and depression at both baseline and follow-up. Results presented are controlled for demographic factors and two potential confounders.

Background:

While studies have shown United States immigrants to be a generally healthy group relative to the native-born population, the literature has shown considerable variability in immigrant mental health outcomes after resettlement in the United States. Among the key factors influencing post-migration depression identified thus far have been pre-migration psychological trauma and socioeconomic status. However, previous studies have primarily relied upon cross-sectional data for describing the role of these factors. In addition, the accurate estimation of factors influencing long-term mental health trajectories for immigrants is complicated by several processes unique to migration, including selective migration and migration-related stress.

Methods:

Weighted odds ratios were calculated using logistic regression. Unadjusted odds ratios for all three depression outcomes were presented for each independent variable analyzed. Next, seven progressively adjusted models were presented separately for each depression outcome: depression at baseline, depression at follow-up, and depression at both baseline and follow-up.

Results:

Self-reported pre-migration persecution resulted in an increased odds of all three depression outcomes among refugees, but not other immigrants. Immigrants who were female, single, and from Latin America had greater odds of all depression outcomes. Associations for all of these variables were strongest among the group of immigrants reporting depression at both baseline and follow-up.

Conclusions:

Pre-migration persecution is an important predictor of depression among refugees, but not necessarily for other immigrants. Immigrants with a history of persistent, long-term depression show the strongest correlations with persecution and measures of socioeconomic status.

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Contents

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Chapter 1. Introduction

Context and Significance

International migration occurs when people cross international boundaries in the process of a permanent or semi-permanent change of residence (Lee 1966; United Nations Department of Economic and Social Affairs [UNDESA] 2013). There were 232 million international migrants living worldwide in 2013 according to the latest publication of the United Nation's World Migration Report, an increase in 77 million, or 50%, over the 155 million international migrants in 1990 (UNDESA 2013). While those 232 million international migrants constituted just over 3% of the global population in 2013, they comprise a much larger share of the population in certain parts of the world (UNDESA 2013).

Immigration is particularly important in the United States. The United States contains a larger share of the world's foreign-born population than any other country, with 46 million, nearly one-fifth of the global total (UNDESA 2013). Immigrants are a much more prominent sub-group in the United States than they are across the globe; as of the 2010 census, the foreign-born population accounted for nearly 13% of the total population in the United States, roughly four times higher than the global figure (Hirschman 2014). Immigrants have helped shape the United States throughout its history. From the earliest flows of European colonial settlers, to the period of mass immigration between 1880 and 1930 that coincided with the Industrial Revolution, to the renewed growth in immigration that followed the end of the Cold War, immigration booms have coincided with several periods of critical growth throughout United States history (Hirschman

2014; Massey 1995; Peri 2013; Schlesinger 1921; United States Department of Homeland Security [USDHS] 2014).

In recent years, annual immigration flows have reached unprecedented levels, outpacing the growth of the overall United States population (Hirschman 2014; USDHS 2014). After the Immigration and Nationality Act of 1965 repealed the restrictive, country-quota system enacted as part of the Immigration Act of 1924, immigrant flows increased gradually until the late 1980s (USDHS 2014). Since the late 1980s, the United States has seen record flows of immigrants; 13 of the 19 years in which the United States has admitted over 1 million Lawful Permanent Residents have occurred since 1989 (USDHS 2014). These recent flows have helped push the foreign born percentage of the United States population close to their peak of 14-15% from the late 1800s to the early 1900s (Hirschman 2014).

As a subpopulation that is historically and contemporarily prominent in the United States, immigrants are an important group to study. In the United States economy, immigrants contribute by filling holes in the labor pool, starting businesses, and investing personal savings domestically (Fairley 2012; Hirschman 2014). A steady proportion of immigrants enter the United States each year on employment visas; from 2004-2013, between 12% and 22% of Lawful Permanent Residency (LPR) admissions had employment visas, with an average of 15% over that time (USDHS 2014). According to data from the 2010 Current Population Survey, a higher proportion of the immigrant work force is a business owner (10.5%) than the non-immigrant workforce (9.3%) (Fairley 2012). In short, immigrants are important to the United

States economy because they expand labor supply in critical sectors and also increase economic production (Hirschman 2014).

Immigration policy is often a contentious issue in contemporary American politics. Earlier this year, the Supreme Court announced it would rule on a legal challenge a series of 2014 executive actions enacted by President Obama's in November 2014 (Liptak and Shear 2016; United States Citizenship and Immigration Services [USCIS] 2015). Obama's executive orders would expand, by millions, the number of illegal immigrants who would be eligible for Deferred Action for Parents of Americans or Lawful Permanent Residents (DAPA), a program that avoids deportation and provides work permits for parents of citizens or Lawful Permanent Residents (LPRs) (Liptak and Shear 2016). The contested legal and political battle surrounding Obama's executive actions exemplifies the contentiousness of domestic immigration policy.

International migration has increased in the last quarter century, and it continues to impact certain countries in particular (UNDESA 2013). As the predominant host country for international immigrants, the United States is uniquely affected by international migration (Hirschman 2014; Peri 2013; Schlesinger 1921). Research on recent immigrants has potentially broad implications on society, economics, and politics in the United States and beyond.

Immigrant Mental Health

Immigrants to the United States are, as a group, generally healthier than the US-born population (Abraido-Lanza et al 1999; Akresh and Frank 2008; Alegria et al 2007; Alegria et al 2008;

Antecol and Bedard 2006; Argeseanu Cunningham et al 2008; Singh and Siahpush 2002). Explanations for this phenomenon, discussed later, usually attribute immigrant health advantages to selective immigration (i.e., healthier people tend to be more likely than unhealthy people immigrate to the United States), selective emigration (i.e., immigrants whose health deteriorates after coming to the United States are more likely to move back to their native countries), or to environmental and cultural factors protecting health behaviors (Abraido-Lanza et al 1999; Akresh and Frank 2008; Alegria et al 2007; Alegria et al 2008; Antecol and Bedard 2006; Argeseanu Cunningham et al 2008; Breslau et al 2011; Mehta and Elo 2012; Riosmena et al 2013; Singh and Siahpush 2002; Thomson et al 2013; Turra and Elo 2008).

Despite the overall health advantage for the foreign-born in the United States, there are some exceptions with regard to mental health conditions, especially amongst certain subgroups of immigrants (Ahn and Kim 2015; Breslau et al 2011; Jamil et al 2007; Song et al 2015; Taylor et al 2014). In particular, immigrants experiencing pre-migration trauma, particularly refugees and asylum-seekers, are known to have elevated risk of mental health disorders (Fazel et al 2005; Lindert et al 2009; Montgomery et al 2014; Wong and Miles 2014; Yun et al 2015). In addition, a substantial degree of variability in immigrant mental health exists across age, sex, country of birth, socioeconomic status, and visa type (Ai et al 2015; Akresh and Frank 2008; Alegria et al 2007; Jasso et al 2005; Li and Anderson 2015; Tan 2014). Studies of non-immigrants have shown the potential implications of psychological stress and socioeconomic status on long-term mental health (Link and Phelan 1995; Kessler et al 1999), but the isolated effect of pre-migration psychological trauma and socioeconomic status in immigrants can be difficult to estimate owing to several processes inherent in international migration (Jasso et al 2004; Jasso et al 2005).

One such process is that of selective migration. Selection factors that differentiate international migrants from non-migrants have the potential to result in two populations that differ across demographic and socioeconomic characteristics and/or health status (Antecol and Bedard 2006; Jasso et al 2004; Jasso et al 2005; Rubalcava et al 2008; Thomson et al 2013). If factors that determine migration selection also influence the mental health effects of psychological trauma or socioeconomic status, they could confound the relationship between psychological trauma and socioeconomic status and mental health. The process of migration itself - and related stresses such as displacement, changes in residence, and visa waiting periods - further complicates the analysis of mental health trajectories of international migrants (Jasso et al 2004; Jasso et al 2005).

A further limitation of the present literature on the long-term effects of pre-migration conditions on immigrant mental health, most studies on immigrant mental health to date have relied upon cross-sectional data such as the National Latino and Asian American Study (NLAAS) and the National Comorbidity Survey - Replication (NCS-R) (Ai et al 2015; Alegria et al 2007; Alegria et al 2008; Cook et al 2009; Borges et al 2009; Breslau et al 2007; Breslau et al 2011; Li and Anderson 2015; Tan 2014). Others have used only baseline data from the New Immigrant Survey (NIS) (Montgomery et al 2014; Wong and Miles 2014; Yun et al 2014), a panel study of immigrants newly admitted to LPR status for which data from a follow-up survey was released in 2014 (Jasso et al 2014). Numerous studies have called for longitudinal research on long-term mental health trajectories of immigrants (Argeseanu Cunningham et al 2008; Jasso et al 2004;

Riosmena et al 2013), but thus far, the literature has primarily utilized cross-sectional data to measure the effects of pre-migration experiences and socioeconomic status on mental health.

Problem Statement

While studies have documented a correlation between pre-migration conditions and immigrant mental health, they have not been able to assess the long-term effects of psychological trauma and socioeconomic status on mental health. Aspects of the migration process, including selective migration and migration-related stress, complicate estimation of the effects of pre-migration conditions on post-migration mental health (Jasso et al 2004). There is a need for research on how pre-migration factors affect long-term mental health trajectories that accounts for aspects of the migration process.

Purpose Statement

The purpose of this study is to investigate the long-term consequences of pre-migration persecution and socioeconomic factors on depression trajectories while also accounting for the confounding effects of selective migration and migration-related stress.

Research Questions

1. How does pre-migration persecution affect long-term trajectories for depression among refugees and non-refugee immigrants to the United States?

2. How do socioeconomic factors, as measured by education, marital status, employment, and English proficiency, affect long-term trajectories for depression among immigrants to the United States?

3. Are relationships between persecution, socioeconomic factors and depression trajectories affected by potential sources of bias such as health selection and migration-related stress?

Study Objective

This study will utilize two rounds of data collection from the 2003 adult sample of the New Immigrant Survey, a nationally representative panel study of immigrants recently admitted to LPR status that will be explained in further detail later. It will analyze the effects of pre-migration persecution and various socioeconomic factors on three depression outcomes: depression at baseline, depression at follow-up, and depression at both waves (henceforth referred to as chronic depression) using a step-by-step approach to model building that will allow assessment of the effects of demographic variables, socioeconomic variables, refugee status, and persecution. It will then add the effects of health selection and depression related to the migration process to models, assessing the effect of both potential sources of bias on odds ratios for demographic variables, socioeconomic variables, refugee status, and persecution.

Significance Statement

Immigrants are a historically important, contemporarily prominent, and growing subpopulation of United States society. Immigration affects the population, economy, and politics of the United States. Understanding how immigrants' pre-migration experiences affect their long-term

mental health is a key part of the puzzle in disentangling the roles of pre-migration, migration, and post-migration predictors of immigrant health trajectories in the United States. Findings will inform health care practitioners, social workers, and policy-makers who serve immigrant populations in the United States.

Definition of Terms

Chronic depression: The condition affecting immigrants identified as having general depression, as assessed using the World Mental Health-Composite International Diagnostic Interview, both at baseline and at follow-up.

Persecution: Psychological harm experienced by immigrants or their families prior to migration on the basis of race, ethnicity, sex, socioeconomic factors, or personal beliefs.

Baseline, Follow-up; Wave 1, Wave 2: Rounds of data collection for the 2003 cohort of New Immigrant Survey participants. "Wave 1" and "Baseline" are used interchangeably, and "Wave 2" and "Follow-up" are also used interchangeably.

Selective Migration: The permanent or semi-permanent relocation of people across international borders that occurs as a result of rational choices made by individuals and families influenced by factors such as age, sex, socioeconomic status, social capital, and pre-migration experiences.

Health selection: The effect of migration selection on immigrant health

Migration-related depression: General depression whose proximate cause is best characterized by the stresses related to the process of migrating from one's place of origin to the United States.

Chapter 2: Background

Section 1: Measuring immigrant depression

This section will describe current research on general health and mental health among immigrants, and their overall health advantage compared to the native-born United States population. Before investigating competing explanations for this so-called "paradox," an explanation of a few basic theories of migration will introduce a theoretical foundation upon which many contemporary theories rely. Of these contemporary migration theories, three are most commonly invoked to explain the paradoxical health advantage among the foreign-born population in the United States: the Healthy Immigrant Effect, the Salmon Hypothesis, and Healthy Behaviors theories. Following a discussion of evidence behind each of these three theories, another potential source of bias is revealed with a description of various stresses related to the migration process. Finally, the section concludes with a brief historical overview of United States immigration policy.

The Immigrant Paradox

The direct relationship of socioeconomic status and health has long been understood as a "fundamental cause" of population health disparities in the United States (Link and Phelan

1995). A core paradigm of social epidemiology, this relationship appears to be contradicted by the superior health of immigrants relative to the native-born United States population (Akresh and Frank 2008; Argeseanu Cunningham et al 2008; Singh and Siahpush 2002). This "Immigrant Paradox" can be understood as the unexplained advantage across a wide range of health indicators experienced by immigrants compared to the native-born United States population, despite lower SES and higher prevalence of discrimination, displacement, separation from family and other traumatic experiences (Akresh and Frank 2008; Alegria et al 2008).

Numerous studies have documented lower prevalence of mental illness, disability, chronic illness, BMI, and mortality among immigrants compared to the native-born population (Alegria et al 2007; Alegria et al 2008; Antecol and Bedard 2006; Argeseanu Cunningham et al 2008; Singh and Siahpush 2002; Thomson et al 2013). These studies have compared first-generation immigrants to various sub-populations in the United States, including subsequent generations of immigrants (Abraido-Lanza et al 1999; Alegria et al 2007), native-born Non-Hispanic Whites (Alegria et al 2008; Mehta and Elo 2012), inter-state migrants within the United States (Hamilton 2015), and non-immigrants from the country of origin (Borges et al 2009; Breslau et al 2011; Mehta and Elo 2012) (for a review of studies of health of foreign-born people in the United States, see Argeseanu Cunningham et al 2008). Consistently, findings have held that immigrants are generally healthier than the group of comparison.

Two main types of theories have attempted to explain this paradox. The "Healthy Immigrant Effect" and the "Salmon Hypothesis" attribute health advantages among immigrants to selective migration into and out the United States, respectively (Akresh and Frank 2008; Jasso et al 2004;

Thomson et al 2013). Alternative theories argue that protective behavioral norms and social support from migrants' native culture protects migrant health (Abraido-Lanza et al 1999; Akresh and Frank 2008; Jasso et al 2004; Singh and Siahpush 2002; Thomson et al 2013). Before comparing arguments for competing explanations of the Immigrant Paradox, it is important to understand the theory upon which they rely.

Lee's "Theory of Migration"

In a 1966 article entitled "A Theory of Migration," Everett S. Lee laid out a series of observations and theories that underlie many current assumptions about migration. Among the theories advanced by Lee was that migration is selective (Lee 1966). Because migrating between two places involves overcoming certain barriers (or "intervening obstacles"), migrants must have a reason for migrating. According to Lee, migrants are positively selected if their primary reasons for migrating are "plus factors" in the destination country, while those who respond to "minus factors" in their origin are negatively selected (Lee 1966). Known as the Push-Pull Theory of Migration, Lee's Theory suggests that groups of migrants that enter a host country looking for better opportunities, family re-unification, better quality of living, or other positive factors will be healthier than most in their country of origin. On the other hand, groups of migrants entering a host country because of negative factors in their country of origin such as poor economic prospects, war and violence, or persecution, may have worse health than most in their country of origin.

Two other theories from Lee's paper are important in framing the debate surrounding health selection. First, Lee points out that the volume of global migration tends to increase over time

unless the migrant stream is limited (Lee 1966). This theory is supported by international migration statistics described above; between 1990 and 2013, the number of global migrants increased by 50% (UNDESA 2013). Second, as the difficulty associated with migration increases, the flow of migrants becomes increasingly positively selected (Lee 1966). Several research articles whose descriptions will follow have either relied upon Lee's theories or tested them in certain populations of immigrants.

The Healthy Immigrant Effect

The Healthy Immigrant Effect postulates that immigrants to the United States tend to be healthier than the average person in their home country because of selection due to structural factors (i.e., medical screening prior to entry) or self-selection (i.e., migrants only choose to migrate if they are healthy enough to do so) (Abraido-Lanza et al 1999; Palloni and Ewbank 2004; Jasso et al 2004; Thomson et al 2013). Numerous studies have tested the Healthy Immigrant Effect using various health outcomes, methods and comparison groups (Abraido-Lanza et al 1999; Akresh and Frank 2008; Argeseanu Cunningham et al 2008; Borges et al 2009; Breslau et al 2011; Hamilton 2015; Mehta and Elo 2012; Riosmena et al 2013). With some exceptions (Abraido-Lanza et al 1999; Rubalcava et al 2008), the studies generally find support for the existence of a Healthy Immigrant Effect.

Some studies have investigated factors that influence selective migration and the Healthy Immigrant Effect. Akresh and Frank, using data from the New Immigrant Survey, found that immigrants from Mexico were least likely among all countries of origin to have positive health selection, even after accounting for socioeconomic status (Akresh and Frank 2008). The authors

concluded that pre-established migratory networks and the physical proximity of the United States reduced barriers associated with emigrating from Mexico compared to other countries (Akresh and Frank 2008). Mehta and Elo's research added to this finding, showing that health selection of migrants from the former Soviet Union from 1970-2000 depended upon the difficulty of obtaining a visa to the United States (Mehta and Elo 2012). Both of these findings support Lee's theory that "the degree of positive selection increases with the difficulty of the intervening obstacles (Lee 1966)."

Akresh and Frank also observed that the extent of health selection for a given country of origin was predicted by the composition of socioeconomic indicators of the population (Akresh and Frank 2008), a result that supports Lee's theory that better socioeconomic status in the sending country leads to more positive selection (Lee 1966). Jasso et al, point out that older immigrants may be negatively selected because they are not of working age, making it unlikely that they are being "pulled" to the United States for economic opportunity (Jasso et al 2004). Breslau et al uncovered positive selection at the family-level that had been obscured at the individual level (Breslau et al 2011). While Breslau et al generally found evidence in support of a Healthy Immigrant Effect, they made an exception with mental health, concluding that healthier behaviors in Mexican culture were more likely to explain Mexican immigrant health advantages over the US-born population (Breslau et al 2011).

Overall, research on selective migration suggests that the Healthy Immigrant Effect may play a role in the Immigrant Paradox. The Healthy Immigrant Effect is consistent with theory on selective migration and has been demonstrated across numerous study populations. However,

some studies have yielded mixed (Breslau et al 2011), weak (Rubalcava et al 2008), or unconvincing findings (Abraido-Lanza et al 1999) or suggested alternative explanations (Alegria et al 2007; Alegria et al 2008; Brown et al 2015; Butler et al 2015; Cook et al 2009; Singh and Siahpush 2002). Finally, the Healthy Immigrant Effect and other theories are not mutually exclusive; if the Healthy Immigrant Effect explains part of the Immigrant Paradox, other theories could still be valid.

The "Salmon Hypothesis"

The "Salmon Hypothesis" postulates that immigrants who return to their home country in old age are generally less healthy than those who stay in the United States, resulting in a deceptively healthy sample of older immigrants (Abraido-Lanza et al 1999; Jasso et al 2004; Riosmena et al 2013; Thomson et al 2013; Turra and Elo 2008). When unhealthy immigrants move back to their countries of origin they are not captured in mortality estimates, rendering them "statistically immortal" (Abraido-Lanza et al 1999). In the Salmon paradigm, negative emigration from the United States is generally hypothesized to be caused by a desire to return home when one's health deteriorates (Thomson et al 2013; Turra and Elo 2008), but could also stem from retirement or loss of employment (Abraido-Lanza et al 1999).

Despite considerable methodological challenges associated with tracing inward and outward migration across a large sample (Abraido-Lanza et al 1999) there has been some success in demonstrating a Salmon Effect, although studies have stopped short of attributing the Immigrant Paradox solely to such effects (Riosmena et al 2013; Thomson et al 2013; Turra and Elo 2008). Using Social Security data, Turra and Elo found that mortality of older foreign-born Social

Security beneficiaries living outside the United States was higher compared to foreign-born beneficiaries living domestically for all ethnicities, especially Hispanic (Turra and Elo 2008). The same study also found that foreign-born beneficiaries who had recently emigrated had high mortality rates (Turra and Elo 2008). Their findings support the Salmon Hypothesis, suggesting that not only do older immigrants who return home have higher mortality, but they often die soon after returning home.

Similar results have been reported when examining health outcomes other than mortality. Thomson et al found evidence of a Salmon Effect when studying disability among older immigrant adults (Thomson et al 2013). Abraido-Lanza et al, on the other hand, found unconvincing evidence for the Salmon Hypothesis (Abraido-Lanza et al 1999). Overall, evidence exists supporting the Salmon Hypothesis, with possibly stronger evidence among Hispanics (Turra and Elo 2008). However, studies have stopped short of chalking up the Hispanic Paradox entirely to negative emigration associated with the Salmon Effect.

Healthy behavior theories

Alternative explanations for the Immigrant Paradox argue that cultural practices and socio-environmental factors within an immigrant's country of origin have protective effects on health (Abraido-Lanza et al 1999; Alegria et al 2007; Antecol and Bedard 2006; Borges et al 2009; Breslau et al 2007; Breslau et al 2011; Marmot et al 1984; Singh and Siahpush 2002; Thomson et al 2013; Vega et al 2009). These theories are often invoked when measures of selective migration fail to fully account for the apparent health advantage among immigrants (Abraido-Lanza et al 1999; Alegria et al 2007; Borges et al 2009; Breslau et al 2011) and/or when the

health outcome under study is highly influenced by modifiable factors such as diet, exercise, or substance abuse (Abraido-Lanza et al 1999; Alegria et al 2007; Borges et al 2009; Singh and Siahpush 2002).

For instance, Abraido-Lanza et al argued that it was unlikely that the Salmon Hypothesis or the Healthy Immigrant fully explained the Hispanic health advantage. The Salmon Hypothesis, the authors argued, was implausible because mortality among Cubans (who couldn't return to Cuba) and Puerto Ricans (whose deaths would be captured regardless of whether they returned to Puerto Rico) was still lower than native-born whites (Abraido-Lanza et al 1999). The authors pointed out that the Healthy Immigrant Effect could not explain the health advantage of Hispanic immigrants over non-Hispanic white immigrants (Abraido-Lanza et al 1999) and concluded that behavioral risk factors such as diet, smoking, and alcohol use protected Hispanics. Similarly, Singh and Siahpush compared all-cause and cause-specific mortality among immigrants to US-born Americans and found that many of the outcomes with the strongest immigrant health advantage were strongly tied to health behaviors, including lung cancer, heart disease, cardiovascular diseases, unintentional injuries, suicide, and firearm injuries (Singh and Siahpush 2002). The authors concluded that nativity differences in smoking, alcohol consumption, diet, obesity, and socio-familial support could explain much of the immigrant health advantage (Singh and Siahpush 2002).

Antecol and Bedard's 2006 study, which analyzed BMI across different cohorts and races of immigrants using data from the National Health Interview Survey from 1989-1996, investigated the relationship between BMI and length of residence in the United States across different sex

and race groups (Antecol and Bedard 2006). Their study revealed that BMI among immigrants tends to increase with increased time spent in the United States, but the extent of BMI convergence to native-born levels depends on race and gender. For instance, Hispanic immigrant women tend to enter with lower BMI than native-born women but eventually ascend to native BMI levels, while males of all races never fully ascended to native-born male BMI levels (Antecol and Bedard 2006). Overall, however, their results bolster the argument that modifiable health conditions such as obesity are highly sensitive to environmental factors.

Several studies have made the same argument with regard to mental health disorders. Alegria et al found that immigrant health advantages for past-year or life-time risk of psychiatric disorder dissipated across subsequent generations, and postulated that the increase across subsequent Latino generations could be related to environmental effects (Alegria et al 2007). Breslau et al combined data from two national surveys (NLAAS and NCS-R) in the United States and a national Mexican survey (M-NCS) and assessed evidence for selective migration of Mexicans between 2000 and 2003 using a wide range of indicators (Breslau et al 2011). While the study uncovered positive selection at the family level for height and education (i.e., families with migrants were more likely to be taller and better educated), it found evidence for negative selection for mental health indicators at both the individual and the family level (Breslau et al 2011). The authors concluded that, while Mexicans may be positively selected for physical and socioeconomic traits, they appear to be negatively selected for mental health indicators (Breslau et al 2011). The authors attributed advantages in Mexican immigrants' mental health relative to US-born whites to lower prevalence of mental health disorders in Mexico rather than selective migration (Breslau et al 2011).

In short, there is convincing evidence that the Immigrant Paradox is related to three distinct phenomena: positive selection of immigrants into the United States (i.e., the Healthy Immigrant Effect), negative selection of emigrants from the United States in their older years (i.e., the Salmon Hypothesis), and healthy behaviors of migrants attributable to their home environment. Because the competing theories are not mutually-exclusive, the true explanation for the Immigrant Paradox may be a combination of multiple explanations (Abraido-Lanza et al 1999; Alegria et al 2007; Breslau et al 2011; Thomson et al 2013). Evidence shows that the effect of these three phenomena on migrant health also varies depending on gender, country of origin, age, cohort, health outcome, and possibly other factors. Because selective immigration, selective emigration, and the effect of health behaviors developed in migrants' home countries may vary depending upon demographic and socioeconomic factors, these phenomena have the potential to bias relationships between mental health and socio-demographic factors.

Migration stress

Likewise, stress that immigrants experience during the migration process may have the potential to bias relationships between mental health and predictors of interest (Kasl and Berkman 1983). Jasso et al define migration stress as all the stressors related to the process of moving from one country to another besides those related to obtaining a visa (Jasso et al 2004; Jasso et al 2005). These stressors begin with entrance into the United States and fade over time with increased acquaintance and acclimation to a new language, new culture, and other stressors related to moving across physical and cultural borders (Jasso et al 2005). According to Jasso et al, migration stress is characterized by an initial decline in health, followed by a recovery (Jasso et

al 2005). If migration stress does follow such a trajectory, it is possible that migration stress could drive depression and other psychological conditions artificially high for new immigrants (Kirmayer et al 2011). Similarly, migration stress could dilute the perceived effect of selective migration for measurements of new immigrants.

Migration stress also could impact socio-demographic sub-groups differently, which could bias relationships between demographic and socioeconomic variables and depression. For instance, the process of immigration is markedly different for various visa categories such as employment preferences, family preferences, refugees, and asylum seekers (Jasso et al 2005; Prabhu and Baronoski 2012). Employment preferences often receive their visa much faster than family preferences, and refugee visas are unlimited, while there is an annual limit of 10,000 visas for asylees (Jasso et al 2004). Refugees and asylum seekers also go through many screenings for mental health and infectious diseases that may be more arduous than for other immigrants (Prabhu and Baranoski 2012). Asylum seekers may be exposed to violence and/or extremely long periods of stress and uncertainty about their migration status (Kirmayer et al 2011).

While Jasso et al are careful to distinguish between visa stress (stress related to obtaining a visa) and migration stress (stress related to moving across borders), both occur around the time of migration and both have the potential to affect different subgroups of immigrants differently (Jasso et al 2005). It is important to consider the effect of these stressors in order to limit bias in relationships of demographic and/or socioeconomic variables with depression trajectories. Looking at long-term trajectories of depression may illuminate potential bias due to migration stress.

History of United States immigration policy

Since early in United States history, immigration policy has helped shape the magnitude and composition of the immigrant population. The first major immigration policy in the United States, the 1790 Naturalization Act limited the eligibility for naturalization to white foreigners of "good moral character" (Cohn 2015). The policy of excluding non-white foreigners continued until 1870 (Cohn 2015). Apart from the exclusion of non-whites, however, immigration policy throughout most of the 1800s was relatively non-restrictive (Cohn 2015; Hirschman 2014).

By 1860, the foreign-born population of the United States had grown to higher than 13%, where it would stay until restrictive immigration legislation in the 1920s (Cohn 2015; Hirschman 2014; USDHS 2014). In the early part of the 1800s, the majority of immigrants came from Western European countries, particularly Ireland, Germany, and the present-day United Kingdom. In the latter half of the 19th century and into the early 20th century, the vast majority of immigrants were still European, but increasingly from Eastern European and Mediterranean countries such as Austria-Hungary, Russia, and Italy (USDHS 2014). This period from the late 1800s until the 1920s, when the foreign-born population comprised over 13% of the United States population, is known as the "Age of Mass Migration" (Hirschman 2014).

The 1920s concluded the period of mass migration with the passage of national origin quotas, which numerically limited the annual flow of immigrants from each country for the first time in United States history (U. S. Customs and Immigration Services [USCIS] 2012). From the 1920s until the late 1960s, annual immigrant flows dropped dramatically even while the total United

States population continued to rise (Hirschman 2014; USDHS 2014). By 1970, the foreign-born population had dropped below five percent of the total population of the United States (Hirschman 2014).

In 1965, amendments to the Immigration and Nationality Act reversed a four-decade trend of lower levels of immigration (Borjas 1993; Hirschman 2014). The 1965 amendment repealed country-specific quotas and made it easier for family members of United States citizens to immigrate (Borjas 1993; Hirschman 2014).

Aside from generating an unprecedented volume of immigration, the amendments also changed the composition of United States immigrants (Borjas 1993). While Europeans had historically comprised the bulk of annual immigrant flows, the changes made in 1965 to immigration policy opened the door for Asians and Latin Americans to enter in unprecedented volumes (Borjas 1993). The 1960s were the first decade in United States history in which Europeans did not comprise a majority of immigrants entering the United States in that period (USDHS 2014). By the 1980s, Asians and Latin Americans each constituted 42% of immigration over the decade, while Europeans accounted for only 11% of immigrants entering the United States in the 1980s (Borjas 1993).

Today, immigrants to the United States are still most likely to come from Asia or Latin America; from 2010-2013, 40% of immigrants who were admitted as LPRs were Asian, while another 38% were from Mexico, Central America, South America, or the Caribbean (USDHS 2014). Only 9% of LPR admissions were European immigrants over the same time period (USDHS

2014). Decades of increasing immigrant flows since the 1965 amendment to the Immigration and Nationality Act have restored the foreign-born population to over 13% of the total population as of the 2010 census, close to levels only previously sustained during the Age of Mass Migration (Hirschman 2014).

Section 2: Factors influencing variability of immigrant depression

Having established two processes related to migration that complicate research on immigrant mental health, this section addresses the evidence behind the contribution of various demographic characteristics, socioeconomic factors, and pre-migration conditions to immigrant mental health. A variety of factors are known to influence immigrant depression. This study is particularly interested in the effect of pre-migration persecution and socioeconomic variables on trajectories of depression over time. However, accounting for other known factors for depression will yield more accurate estimates for the effect of persecution. This section discusses demographic (age, sex, and country of origin) and socioeconomic (education, marital status, employment, and English proficiency) factors for depression, as well as the literature surrounding how refugee status and persecution can affect mental health.

Age at migration

Studies that have investigated the effect of age at migration on post-migration health have generally found that immigrants who enter the United States as children are more likely to experience poor mental health after migration than immigrants in general (Ahn and Kim 2015; Alegria et al 2007; Borges et al 2009; Breslau et al 2007). For instance, Borges et al found that Mexican immigrants who migrated to the United States prior to reaching age 13 were more

likely to have suicidal symptoms than those who migrated after reaching age 13. Breslau et al had similar findings; immigrants in the NCS-R who came to the United States as adolescents or adults had lower prevalence of mood and impulse control compared to the native-born population, but immigrants who entered as children had similar risk as the native-born population (Breslau et al 2007). Alegria et al found the same phenomenon using data from the NLAAS; immigrants who migrated as children were the only group with higher prevalence of psychiatric disorders than natives.

A review of the health of foreign-born people in the United States by Argeseanu Cunningham and colleagues also notes that some studies have found that older immigrants around retirement age may be at risk for worse mental health compared to native-born individuals of the same race (Argeseanu Cunningham et al 2008). These studies suggest that, while immigrants as a whole are positively selected and tend to be healthier than natives, immigrants who enter the United States as children or older adults may have comparable or greater risk of poor mental health compared to the native-born population.

As previously discussed, many immigrants to the United States are positively selected, embarking on a journey to the United States in search of better job prospects, family re-unification, or other opportunities. Those that immigrate for these "pull" factors can be assumed to be generally healthier than the population as a whole in their home country. However, the decision to migrate is often not an individual, but a family one (Mincer 1978). Thus, while a family may be positively selected and generally healthier in the aggregate than most where they are from, not all individuals within that family are necessarily healthy selections. With this in

mind, it makes sense that children (and possibly retired adults), who are more likely to be migrating due to the pursuit of opportunities by family members, would not be positively selected for health.

Sex

Numerous studies have demonstrated that female immigrants have greater risk for mental health disorders than males (Arevalo et al 2015; Bourque et al 2011; Song et al 2015; Tan 2014). This has been shown across different types of disorders as well as within different populations of immigrants. For instance, a 2011 meta-analysis of psychotic disorders among migrants all over the world by Bourque et al yielded higher incident rate ratios for women compared to men (Bourque et al 2011). Song et al analyzed a sample of torture survivors at a clinic in Northern California and found that women were more than three times more likely than men to have anxiety (Song et al 2015). Arevalo et al used data from the Boston Puerto Rican Health Study to look at depressive symptoms at two time-points separated by two years. In that study, depressive symptomology among Puerto Ricans was significantly associated with female gender at both baseline and at follow-up (Arevalo et al 2015)

Tan used data from two nationally representative surveys (NLAAS and NCS-R) with data on depression and nativity to study lifetime and past-year prevalence of major depressive disorder and major depressive episode among Chinese immigrants (Tan 2014). Tan's results showed higher lifetime and past-year prevalence for major depressive disorder and major depressive episode among women compared to men (Tan 2014). Tan's results are particularly relevant to this study because the outcomes were related to depression, utilized population-based surveys,

and were based on Chinese immigrants, a group that constitutes a relatively large proportion of American immigrants.

Country of origin

Much of the literature on mental health of US immigrants has focused on variation within Latin America (Alegria et al 2007; Lewis-Fernandez et al 2005) and/or has focused on mental health of immigrants from a particular country (Ahn and Kim 2015; Arevalo et al 2015; Borges et al 2009; Familiar et al 2011; Jamil et al 2007; Tan 2014; Taylor et al 2014). Using data from the NLAAS, Alegria et al noted the markedly increased prevalence of past-year and life-time psychiatric disorders among Puerto Ricans compared to other Hispanic immigrants. Mexicans, Cubans, and other Latino immigrants all had relatively similar prevalence of past-year and lifetime psychiatric disorders in the NLAAS. Lewis-Fernandez et al noted that data from the Hispanic HANES (data was from 1982-1984) showed a similar trend; past-year prevalence of depression among native Puerto-Ricans living in the United States was much higher than among native Mexicans or Cubans (Lewis-Fernandez et al 2005).

Apart from studies focusing on Hispanics, relatively few studies have assessed variation in immigrant mental health outcomes by country of origin. Using data from the New Immigrant Survey, Akresh and Frank demonstrated that Mexican immigrants are less likely than all others to be positively selected, although some of this can be explained by differences in socioeconomic status, and the outcome measure was not specific to mental health (Akresh and Frank 2008). Several studies have noted the markedly high prevalence of psychiatric disorders in particular sub-groups of immigrants, such as anxiety, PTSD, substance use, and depression among Iraqi

refugees (Jamil et al 2007; Song et al 2015; Taylor et al 2014) or depression among older Koreans (Ahn and Kim 2015).

Overall, research on variation of mental health by country of origin shows substantial variation by country of origin. However, it is unclear to what extent this variation may be influenced by factors such as socioeconomic status, employment, refugee status, torture, persecution, and other factors.

Education

While education is often considered a protective factor for health, the relationship of education and mental health in immigrants is less clear. On the one hand, higher levels of education may lead to greater social mobility and wealth for immigrants; on the other, it also may lead to greater exposure to discrimination and stress (Alegria et al 2007). Findings on the effect of education on immigrant mental health have been mixed. For instance, analyses by Lau et al of general depressive disorders and general anxiety disorders among Asian-American women yielded protective odds ratios for high school graduates and college graduates, but a hazardous odds ratio for post-college graduates (Lau et al 2015). None of the odds ratios in those models were statistically significant. In a study of mental health among Latino men, Ai and colleagues found that men with a high school education were significantly more likely to have general anxiety disorder. However, the same finding did not hold for college graduates (Ai et al 2015). Overall, evidence of a protective effect for education on mental health is mixed.

Marital status and socio-familial support

Marital status and social and/or family support have been shown to be associated with mental health outcomes and correlates, such as psychological distress, perceived discrimination, anxiety, and depression among immigrants and minorities (Ai et al 2015; Chou 2012; Kessler et al 1999; Kirmayer et al 2011; Li and Anderson 2015). In general, immigrants who are single, divorced, or widowed, who have experienced a loss of family support or cohesion, or who perceive a general lack of social support tend to be more likely to report psychological distress, perceived discrimination, anxiety, and depression (Ai et al 2015; Chou 2012; Kessler et al 1999; Kirmayer et al 2011; Li and Anderson 2015).

For example, Ai et al used NLAAS data to show that negative interactions with family members were associated with major depressive disorder and suicidal ideation among Latino-American men (Ai et al 2015). Li and Anderson used the same data source to investigate psychological distress and perceived discrimination among Asian immigrants, finding that single, never married immigrants were more likely to report both outcomes (Li and Anderson 2015). Kessler et al used data from the MacArthur Foundation Midlife Development in the United States (MIDUS) phone survey to show that adults in the United States who perceived frequent day-to-day discrimination and major lifetime discrimination were more likely to be single (Kessler et al 1999).

While many studies investigating these relationships have relied on cross-sectional data and thus cannot establish the causal directionality between marital status or social support and mental health, both directions seem plausible. In other words, it is conceivable that immigrants who are

single, experiencing family discord, or perceive a lack of social support would be at risk for poor mental health but it is also reasonable to assume that poor mental health could contribute to these conditions. Either way, the consistent findings that marital status and socio-familial support are tied to mental health indicate that some measure of these elements should be incorporated into studies of immigrant mental health.

Employment status

Employment is also related to mental health, with employed immigrants generally enjoying better mental health than unemployed immigrants. As George et al point out in their scoping review of Canadian immigrant mental health, employment is important both for its protection from the stresses related to poverty, financial insecurity, and economic hardship, as well as from isolation and social exclusion (George et al 2015). In the study by Ai et al using NLAAS data, Latino men who were employed were significantly protected from major depressive disorder (Ai et al 2015).

Employment may be particularly important for refugees who, unlike many immigrants, do not migrate for economic opportunities but for so-called "push" factors. In their meta-analysis of pre- and post-displacement factors and refugee mental health, Porter and Haslam documented a strong moderating role for economic opportunity in the relationship between pre-migration factors and refugee mental health after re-settlement (Porter and Haslam 2005). In their review of immigrant and refugee mental health in the United States and Canada, Kirmayer et al also note the importance of employment for both immigrants and refugees (Kirmayer et al 2011). While post-migration employment can also measure pre-migration social status and/or immigrant

visa category, it is widely accepted as an important factor for immigrant and refugee mental health.

English language proficiency

The effect of English language proficiency (sometimes called English language acculturation) on immigrant mental health is complex. English proficiency is necessary for acquiring many types of jobs in the United States, and may help immigrants acquire social ties and networks that protect mental health (Arevalo et al 2015; Butler et al 2015; Kirmayer et al 2011). Lack of English proficiency may result in feelings of social isolation and alienation, particularly among older immigrants (Miller et al 2013). Language barriers among immigrants can result directly in stress related to learning a new language and can inhibit utilization of health care services (Ornelas and Perreira 2011).

However, English proficiency is also a part of acculturation, a complex process that may negatively impact immigrant health due to acculturative stress and changing health-related behaviors (Cook et al 2009). English acculturation also may be associated with a loss of ethnic identity and intergenerational familial conflict may expose immigrants to situations in which they are more likely to face discrimination or persecution (Cook et al 2009). Language acculturation may also impact different groups of immigrants differently; Arevalo et al found that the effect of language acculturation on depressive symptomology was different depending on the immigrant's neighborhood ethnic density (Arevalo et al 2015). The literature on language acculturation seems to suggest that English proficiency predicts variation in immigrant mental health, but that the direction of the effect depends on numerous other factors.

Refugees and asylum seekers

Refugees and asylum seekers enter the United States under different circumstances, and with different health status, than other immigrants (Eckstein 2011; Lindert et al 2009; Prabhu and Baranoski 2012). Common health problems among refugees shortly after resettlement include musculoskeletal issues, pain in the lower back and neck, chronic headaches, asthma, diabetes mellitus, vitamin D deficiency, and hypertension (Eckstein 2011). While much attention is focused on infectious diseases among refugees, pre-migration and post-migration screening for "inadmissible conditions" such as tuberculosis, HIV and other STDs, malaria, and other infectious disease of public health concern limit the prevalence of infectious disease for incoming refugees (Eckstein 2011; Stauffer and Weinberg 2009).

Incoming refugees are also screened for mental health disorders, and can be rejected from entry into the United States if they do not pass mental health screens (Prabhu and Baranoski 2012; Stauffer and Weinberg 2009). Nonetheless, refugees have been documented as having substantially higher prevalence of psychiatric conditions such as anxiety, depression, and PTSD (Eckstein 2011; Fazel et al 2005; Lindert et al 2009), although substantial variation in prevalence estimates between studies of these conditions has been documented (Fazel et al 2005).

As a demonstration of the variability in prevalence estimates of anxiety and depressive disorders between studies, one meta-analysis concluded that prevalence of anxiety and depression disorders were roughly twice as high among refugees and asylees compared to labor migrants (Lindert et al 2009), while another found that prevalence of major depression among refugees

was likely no different than prevalence of major depression within host country populations (Fazel et al 2005). There seems to be a general consensus, however, that refugees are at higher risk of Post-Traumatic Stress Disorder, psychiatric comorbidity, and pain compared to the general population (Eckstein 2011; Fazel et al 2005; Lindert et al 2009).

Often grouped in the same category as refugees, asylum seekers face uniquely stressful migration journeys, as they often enter the United States with no guarantee of permanent residency (Prabhu and Baranoski 2012; Hocking et al 2015; Jasso et al 2004; Silove et al 1997; Silove et al 1998). As explained above, migration stress can have long-term effects on mental health, complicating the relationship between pre-migration factors, post-migration factors, and mental health. Factors such as long waiting times for Lawful Permanent Residency status and rejection of refugee status can modify the risk of mental health disorders among refugees and asylum-seekers (Hocking et al 2015; Jasso et al 2004).

The vast literature surrounding mental health among refugees is far too voluminous to be covered in detail here. In this brief discussion of refugee mental health, however, several things are apparent. First, refugees and asylees face a different selection process and migration journey than other immigrants (Jasso et al 2004; Prabhu and Baranoski 2012; Stauffer and Weinberg 2009). Second, they may be at higher risk for psychiatric disorders such as depression and anxiety, and are almost certainly at higher risk for psychiatric comorbidities, PTSD, and pain (Fazel et al 2005; Lindert et al 2009). Finally, considerable variation in mental health status exists within refugee populations (Fazel et al 2005; Jamil et al 2007; Lindert et al 2009), which

may be attributable to within-group differences in the migration journey (Jasso et al 2004; Jasso et al 2005), as well as pre-migration and post-migration factors (Porter and Haslam 2005).

If immigrants to the United States are generally assumed to be positively selected for health, migrating opportunistically for so-called "pull" factors, refugees and asylum seekers are an important sub-population of immigrants to the extent that they contradict this assumption. However, refugees and asylum-seekers may not be the only sub-groups of immigrants that migrate for "push" factors. Immigrants who have experienced political violence, persecution, or discrimination in their home country prior to migration should also be considered exceptions to the healthy migrant paradigm. In addition, considering the heterogeneity in refugee pre-migration experiences and mental health mentioned above, persecution and discrimination may act as an important moderator explaining differential mental health outcomes among refugees and asylum seekers.

While much of the literature on pre-migration discrimination and persecution focuses on refugees, some studies have analyzed the effect of these factors in immigrants of all types (Li and Anderson 2015; Montgomery et al 2014; Steel et al 2009; Wong and Miles 2014; Yun et al 2015). For example, in their meta-analysis of traumatic experiences and mental health outcomes, Steel et al incorporated findings from studies that focused not only on refugees, but on populations affected by war, genocide, holocaust, terrorism, persecution, or torture (Steel et al 2009). The meta-analysis adjusted for methodological differences in the studies, including sampling methods, methods for measurement of outcomes, and whether the study used a point estimate or period estimate for prevalence of mental health outcomes (Steel et al 2009). The

meta-analysis produced a weighted, adjusted prevalence of 30.8% for depression across 117 surveys going as far back as the 1980s. The study found that populations exposed to potentially traumatic experiences and torture were more likely to have higher rates of certain psychiatric disorders, particularly PTSD (Steel et al 2009).

Li and Anderson used data from the NLAAS to study the effect of pre-migration trauma on psychological distress in Asian American immigrants (Li and Anderson 2015). The authors utilized the Kessler-10 scale of nonspecific psychiatric distress to measure the outcome and the Posttraumatic Stress Diagnostic Scale (PDS) series of questions to measure the pre-migration independent variable (Li and Anderson 2015). Nearly half of Asian immigrants in the NLAAS had experienced some form of pre-migration trauma, as measured by the PDS questions (Li and Anderson 2015). The study found that pre-migration trauma was significantly associated with both post-migration perceived discrimination and with psychological distress (Li and Anderson 2015). Li and Anderson's findings highlight the importance of incorporating pre-migration psychological factors in studies of mental health post-migration.

Section 3: Pre-migration persecution and depression: findings from the New Immigrant Survey

This section now turns to findings from the data source for this study, the New Immigrant Survey. After a preliminary description of the data sources, three studies that have focused on pre-migration persecution and depression using the NIS are highlighted (Montgomery et al 2014; Wong and Miles 2014; Yun et al 2015). Finally, a discussion of the gaps in the literature that will be addressed by this study concludes the section.

The New Immigrant Survey (NIS) is a nationally-representative cohort study of immigrants to the United States, with baseline surveys conducted at the time of admission to Lawful Permanent Residency (Jasso et al 2006). The NIS consists of two cohorts, a 1996 pilot cohort with one wave of data collection and a 2003 cohort with two waves of available data. Methods of the New Immigrant Survey will be explored further below. Three studies have utilized baseline data from the 2003 adult cohort to estimate the effects of pre-migration persecution on immigrant depression (Montgomery et al 2014; Wong and Miles 2014; Yun et al 2015).

Wong and Miles estimated prevalence of past-year probable depression, finding prevalence of approximately 3%, although the exact method for determining probable depression was not described (Wong and Miles 2014). The study also calculated odds ratios for pre- and post-migration predictors of past-year depression, including pre-migration persecution (which the authors called political violence) (Wong and Miles 2014). In a model adjusting for socio-demographic and post-migration variables, the authors found a significant an odds ratio for the political violence variable with depression (OR=2.48).

In a similar study, Montgomery et al utilized the same study population to look pre-migration harm and two depression outcomes (Montgomery et al 2014). The pre-migration harm variable utilized the same question as Wong and Miles used for the variable they called "political violence." In a model for general depression adjusted for socio-demographic variables, pre-migration harm had an odds ratio of 1.33 (Montgomery et al 2014). However, when the authors used the same model but changed the depression outcome to major depression with dysphoria (defined as a count of 3 or more affirmative responses to questions regarding depressive

symptoms), the effect of pre-migration harm was magnified (OR=2.24) (Montgomery et al 2014).

Yun et al compared non-refugee immigrants who had reported persecution to refugees who had reported persecution, using the same measure of persecution as used by Wong and Miles and Montgomery et al to measure political violence and pre-migration harm, respectively (Yun et al 2015). Yun et al also made use of seven follow-up questions asked of all immigrants who had reported persecution. The questions assessed whether the participant had been incarcerated, punished by public officials, punished by others, had property confiscated, lost their job, had property damaged, or been threatened (Yun et al 2015). Four outcomes were assessed, major depression, physical impairment due to pain, general health, and changes in past-year general health (Yun et al 2015).

Several interesting differences between immigrants and refugees emerged from analyses. Persecuted refugees were in worse health compared to refugees who did not report persecution, with roughly twice the odds of major depression, physical impairment due to pain, and poor general health (Yun et al 2015). Second, persecuted refugees reported more types of persecution than persecuted immigrants and had higher odds ratios for all four outcomes compared to the non-persecuted refugee reference group (Yun et al 2015). In other words, refugees who were persecuted tended to have worse health compared to both persecuted non-refugees and non-persecuted refugees. These findings suggest a synergistic effect for refugee status and persecution on immigrant health.

Studies by Wong and Miles, Montgomery et al, and Yun et al provide insight into the effect of persecution on immigrant mental health. Pre-migration persecution appears to be positively associated with post-migration depression, and its effect may be more strongly associated with more severe forms of depression. This is evidenced by the increase in magnitude of the effect of pre-migration persecution on major depression compared to that on general depression, as shown by Montgomery et al. Finally, persecution may have a differential effect on refugees and non-refugee immigrants, as suggested by results from the Yun, et al study.

The three studies described above show the potential for new discoveries surrounding pre-migration persecution and depression among immigrants, using the first nationally-representative data source for United States immigrants. However, further questions remain unanswered, including several of interest in this study. No study thus far has made use of the second wave of data collection for the NIS 2003 cohort, which was released in April 2014 (Jasso et al 2014). Using this follow-up data, explorations into factors influencing long-term trajectories for depression, including the role of pre-migration persecution and socioeconomic factors, are now possible. Of particular interest in assessing factors influencing depression trajectories is the group of immigrants who report depression at both baseline and follow-up, a group that provides a measure of elevated severity of depression.

Finally, no study thus far has utilized available measures of health selection (described by Akresh and Frank 2008) or migration-related depression (described in Jasso et al 2005) to account for the potentially confounding effects of health selection and the migration process in the relationship between pre-migration persecution and depression. The literature on immigrant

mental health suggests that these two factors could potentially bias relationships between persecution, socioeconomic variables, and depression. This study will go beyond existing studies by analyzing the longitudinal effects of pre-migration persecution on general depression at two time points and by measuring potential biases related to selective migration and migration-related depression.

Chapter 3: Methodology

New Immigrant Survey

The New Immigrant Survey is a nationally representative prospective panel study of new legal immigrants to the United States and their children (Jasso et al 2006; Jasso et al 2014). The study consists of two cohorts, a 1996 pilot cohort with one completed wave and a 2003 full cohort with two completed waves (Jasso et al 2006; Jasso et al 2014). The sampling frame for the 2003 cohort consisted of 12,500 adults recently granted lawful permanent residency (LPR) status between May and November 2003 using electronic administrative records compiled by the United States Immigration and Naturalization Service (now known as the former INS; its duties were transferred to different entities within the Department of Homeland Security in 2003). Sampling was stratified by visa class of admission, with employment preferences and diversity immigrants over-sampled and spouses of immigrants under-sampled (Jasso et al 2004a) (see Appended Table 1).

The first wave of the survey was conducted between June 2003 and June 2004 among 8,753 adult participants, a response rate of 69%. Interviews were conducted in seven languages via phone (60%) or in-person (40%). Topics covered in survey questions included health, education,

religion, family dynamics, language skills, employment, life experiences, and utilization of healthcare and government services. In addition to responses to survey questions the NIS-2003-1 dataset contains sampling weights to account for over-sampling or under-sampling of different visa categories.

The second wave of the survey was conducted between June 2007 and December 2009 among 4,363 adult participants, a retention rate of 51% of all participants that completed the baseline survey. Interviews were conducted in the seven languages used in the first wave, plus three others. Over three-quarters of interviews were conducted over the phone at follow-up. Survey questions for Wave 2 capture changes since Wave 1 in family structure, housing, employment, income, current health, insurance, healthcare utilization, English language skills, political integration, and international and migration. In addition to responses to survey questions at each wave, datasets contain basic information on participants from administrative data, such as country of origin, and visa category.

This study utilizes data from the two available waves of the adult sample of the 2003 cohort (NIS-2003-1 and NIS-2003-2). NIS-2003-1 and NIS-2003-2 are available on Princeton University's website, at http://nis.princeton.edu. Data are available in two formats: Public Use data or Restricted Use data. In order to download Restricted Use data, users must obtain IRB approval from their home institution. In order to download Public Use data, users do not need to acquire IRB approval but are prompted to fill out an on-line user agreement. This study utilizes the Public Use data, so only an on-line user agreement was necessary.

The analytic sample for this study consists of all participants who responded to both waves of the survey. Despite the relatively loss to follow-up rate for Wave 2 (49%), a comparison of the analytic sample (n=4,363) and the group of participants who only completed the Wave 1 survey (n=4,210) revealed that the analytic sample did not differ substantially across variables of interest (for a complete comparison, see Appended Table 2).

Demographic Measures

Age

There are several different measures of age in the NIS. Participants in Wave 1 were asked "In what year were you born?" Data for that question was available for all but 15 participants. Thus, one measure of age would be to subtract the participant's year of birth from the year of interview at Wave 1. In Wave 2, interviewers were instructed to verify the participant's year of birth reported in Wave 1 and calculate the participant's age at last birthday. A total of 143 participants corrected their reported birth date from Wave 1. This measure of age was included in NIS-2003-2. The day, month, and year of the interview was available for both Wave 1 and wave two, allowing for a precise measure of time between waves. Time between interviews ranged from 3.07 years to 6.35 years, with a median of 3.99 years.

Because the Wave 2 measure of age was verified by the interviewer, it was assumed to be the most accurate measure of age. However, since the Wave 2 measure of age was reported as age at last birthday rather than as an exact age, it would be misleading to simply subtract the exact time between waves from the Wave 2 age at last birthday variable. Instead, each participant was

assumed to be half-way between their reported Wave 2 age at last birthday and the age at their next birthday (in other words, half a year was added to the Wave 2 age variable).

Age at Wave 1 was then calculated by subtracting the exact time between waves from the estimated exact age at Wave 2. The mean for this measure of age at Wave 1 was 39.5; the mean age as calculated using the year of birth originally reported in Wave 1 was 39.4. Because Wave 1 age is an imprecise estimate rather than an exact measure, age was analyzed as a categorical variable. Participants were grouped into the following categories: 18 to ≤ 30, 30 to ≤ 40, 40 to ≤ 50, 50 to ≤ 60, and 60 or older.

Sex

Sex was measured using participants' responses at Wave 1 to the following question "I need to ask these questions of everyone, are you male or female?" In Wave 2, interviewers were asked to verify the participant's reported sex if necessary. For each of the 29 participants asked to verify their sex, responses were consistent in the two waves. In other words, between verifications by the interviewer and self-reported verifications, each participant's sex reported at baseline was confirmed at follow-up.

Country of origin

Country of origin was provided in the pre-load section of the NIS-2003-1 dataset and was also asked as a survey question in the demographic section. In order to protect the identity of participants, the NIS aggregated certain countries of origin into regions. The same categorization scheme was used for the region variable in the pre-load section and the region

variable in the demographic section, with 99% agreement between the two variables. Because the pre-load section comes from administrative data, it was assumed to be more valid than the survey question. For individuals whose country of origin was "unknown" in the pre-load dataset (a total of seven participants), the country of origin variable from the demographic section was used instead.

For analysis, all countries of origin were grouped into the existing categories configured by the NIS (Latin America and the Caribbean, Europe and Central Asia, East Asia, South Asia, and the Pacific, Middle East and North Africa, and Sub-Saharan Africa). One participant whose country of origin was listed as the United States was coded as missing. After grouping the countries of origin from the pre-load section into the pre-defined regions, six participants (0.1%) were different from what their region of origin would have been if the variable from the demographic section had been used instead (see Appended Table 3).

Socioeconomic Measures

Education

Two questions were used to determine participants' years of education. Initially, the following question was used: "Now, I have a few questions about your education. How many years of schooling in total have you completed?" Participants with non-missing, non-outlier values for that question were grouped into two categories, less than 12 years of education, or 12 or more years of education. A histogram of years of education showed potential outliers on the right tail of the distribution. Outliers were identified using the outlier=Q3+1.5(IQR). The lower-bound

outlier formula was not used because values of 0 would still be plausible for participants. The outlier formula yielded a value of 22.

Individuals reporting greater than 22 years of education (n=76) were checked against a second question, "What is the highest degree, diploma or certificate that you have received?" If an individual reported greater than 22 years of education and a high school diploma or higher, the participant was categorized as having 12 or more years of education. The remaining three participants with a value of greater than 22 years of education and no information on highest degree attained were coded as missing for education.

For individuals with missing data for the question "How many years of schooling in total have you completed?" (n=10), the response to the second question, "What is the highest degree, diploma or certificate that you have received?" was used if it was available (which it was for four participants). Otherwise, for the other six participants with missing data for both education questions, education was coded as missing. Overall, nine participants had missing data for education.

English Proficiency scale

Four questions regarding participants' ability to communicate in English were asked at each wave, although not all questions were asked of all participants. Each participant was asked the following two questions at wave 1:

"How well would you say you understand English when someone is speaking to you?"

"How well would you say you speak English?"

The four response options were "very well," "well," "not well," and "not at all." A subset of participants was also asked how well he or she could read or write in English. In wave 2 the same four questions were asked, but none were asked of the entire sample.

In order to obtain a measure of ability to communicate in English for the entire sample, only the two wave 1 questions asked of each participant were used. Using the following scale, a variable was created from responses to each question: zero, for responses of "not at all"; one, for responses of "not well"; two, for responses of "well"; and three, for responses of "very well." The scores for each of the two English proficiency variable were added together, forming a single English proficiency variable. Level 1 on the English proficiency scale indicates that the immigrant responded with "not at all" to questions about whether he or she could understand or speak English. If the immigrant's English proficiency is Level 7, the participant reported he or she could understand and speak English "very well."

English proficiency scale was analyzed as a continuous independent variable, thus odds ratios for English proficiency scale can be interpreted as the odds of reporting a given depression outcome relative to those whose English proficiency was one level lower. This interpretation of the English proficiency variable assumes that there is a progressive, linear effect of English proficiency on depression outcomes. In order to test the plausibility of that assumption, crude

odds ratios for the effect of each level increase of English proficiency scale on baseline and follow-up depression were calculated.

The results demonstrated a negative linear relationship between level of English ability and odds of wave 1 depression (See Appended Table 4). Similarly, the relationship between level of English ability and wave 2 depression was negative and mostly linear (except between level three and level four, where odds of depression rose slightly before falling again at level five) (See Appended Table 4). This investigation provided confidence that it would be appropriate to treat English scale as a continuous predictor of depression in adjusted logistic regression models during the analysis stage.

Marital Status

At each wave participants were asked which of the following conditions applied to them: married, living with someone in a marriage-like situation but not married, separated, divorced, widowed, or never married and not living with someone in a marriage-like situation. This question was used to create a binary variable for "single" or "not single." Those who responded that they were separated, divorced, widowed, or never married were coded as "single," while those who were married or living with someone in a situation similar to marriage were coded as "not single."

Because it would be difficult to argue a causal effect for marital status at Wave 2 on depression trajectories (due to the uncertainty in their temporal ordering), only the wave 1 measure was incorporated into analysis. When a variable denoting change in marital status between waves

was included in fully adjusted models for chronic depression (not shown), marital status change from "not single" at Wave 1 to "single" at Wave 2 was significantly associated with depression (OR=3.71; 95% CI: 1.63-8.44) but there was very little change in the relationships of persecution and refugee status with chronic depression. The only two variables with a change-in-effect of greater than 10% after adding change in marital status to the full chronic depression model were "single" marital status (increase in effect of 20%) and "Latin America/Caribbean" region (increase in effect of 11%). While these changes are interesting, the marital change variable was not included due to uncertainty in the temporal ordering of marital change and depression status and because the variable did not alter the effect of persecution and refugee status.

Employment status

Employment status was also assessed at both waves, but similarly to marital status, only employment status at wave 1 was incorporated into analysis due to uncertainty in the temporal ordering of employment at wave 2 and depression trajectories. Participants were asked if they were working now, unemployed and looking for work, temporarily laid off or on sick or other leave, disabled, retired, a homemaker, or other. Those who reported that they were currently working were coded as "working," and all others were coded as "not working."

Visa Category and Refugee status

Data on visa category of admission, taken from administrative data by the INS, was included in the pre-load section of the wave 1 dataset. Ten total categories included spouses, parents, children, and other family preferences; diversity preferences; employment preferences; legalization immigrants (a group including immigrants who had originally entered illegally);

refugees, asylees, and parolees; and other immigrants. For the purposes of analysis, the category of refugees, asylees, and parolees were considered refugees while all others were considered non-refugee immigrants. This is the same way that refugees have been categorized in other studies using NIS data (Montgomery et al 2014; Wong and Miles 2014; Yun et al 2015).

Persecution

Persecution was assessed using responses to the following question: "Did you or your immediate family ever suffer any harm outside of the United States because of your political or religious beliefs, or your race, ethnicity or gender?" If participants answered yes, they were asked a series of seven follow-up questions including whether they had been incarcerated, physically punished, had property damaged or confiscated, received threats, or lost a job. For the purposes of analysis, only participant responses to the general question about harm outside the United States was used. For a more in-depth analysis of the types of persecution and effects on depression (using wave 1 data only), see Yun et al, 2015. The persecution variable used in analysis was coded 1 if participants responded "yes" to the question about harm outside the United States and 0 if participants responded "no."

Depression outcomes

The New Immigrant Survey adapted questions from the Composite International Diagnostic Interview-Short Form (CIDI-SF) to assess for depressive disorders. The core CIDI version, a structured diagnostic interview for psychiatric disorders designed for use in different cultures, was developed at the request of the World Health Organization (WHO) and first published in 1988 (Robins et al 1988). The CIDI-SF is a shortened version of the core CIDI. Other surveys,

such as the National Comorbidity Survey (NCS) and the National Comorbidity Survey-Replication (NCS-R) also adapted CIDI interview questions to assess for psychiatric disorders (Harvard Medical School 2005). Diagnoses from CIDI structured questions are compatible with DSM-III psychiatric diagnoses (Robins et al 1988).

The New Immigrant Survey adapted eight questions from the CIDI-SF. All participants were asked the following question: "During the past 12 months, was there ever a time when you felt sad, blue, or depressed for two weeks or more in a row?" The possible answers to this question were "yes," "no," or "did not feel depressed because on anti-depressant medication." Those who responded affirmatively or were taking anti-depressant medication were classified as having past-year general depression.

The New Immigrant Survey also asked seven follow-up questions to those who qualified as having general depression. Participants with affirmative responses to three or more follow-up questions can then be classified as having major depression with dysphoria. This study did not utilize these questions, and only assessed general depression (for a study that investigated both general depression and major depression with dysphoria using NIS data, see Montgomery et al 2014).

The general depression question (as well as the seven follow-up questions) were asked at both waves of the survey. This study assesses three outcomes based on general depression: depression at wave 1, depression at wave 2, and chronic depression. Chronic depression was defined as those who reported general depression at both waves.

Immigrants were also asked if they had ever felt sad, blue, or depressed because of the process of becoming a permanent resident. If they responded affirmatively, they were asked if those feelings had lasted two weeks or longer. Participants who responded that they had felt sad, blue, or depressed due to the process of becoming a permanent resident but who did not report symptoms lasting two weeks or more were classified as having short-term migration-related depression. If participants responded that they had felt sad, blue, or depressed for at least two weeks because of the LPR process were classified as having long-term migration-related depression. Migration-related depression was then used as a measure of the potentially confounding effects of migration stress in models of depression during the analysis stage.

Several questions included in NIS-2003-1 allow for assessment of health selection of immigrants (for an in-depth analysis of immigrant health selection using NIS data, see Akresh and Frank 2008). First, because immigrants' current health status could differ from their health at the time of migration, the following question was used: "Compared with your health right before you most recently came to the United States to live, would you say that your health is better now, about the same, or worse?" If immigrants reported that their health was the same as it had been at the time of migration (roughly two-thirds of immigrants reported no change in health), the following question was used to determine health selection: "If you compared your current health to people in your home country, how would you rate it—excellent, very good, good, fair, or poor?" Those who rated their health relative to people in their home country as "excellent" or "very good" were coded as having positive health selection. Those who responded with "good"

were coded as having neutral health selection. Those who responded with "fair" or "poor" were coded as having negative health selection.

Participants who reported that their health status had declined since migration but who still reported their health as "excellent" or "very good" compared to people in their home country were also categorized as having positive health selection. Likewise, those who reported that their health status had improved but was still only "fair" or "poor" compared to people in their home country were considered to have negative health selection.

For participants who reported that their health since migration had declined and who rated their health relative to their compatriots as "fair" or "poor", or for those who reported improved post-migration health and "excellent" or "very good" health relative to people from their home country, a different question had to be used. For these participants, the following question was used to measure health selection instead: "Consider your health while you were growing up, from birth to age 16. Would you say that your health during that time was excellent, very good, good, fair, or poor?" Participants who rated their childhood health as "excellent" or "very good" were considered to have been positively selected for health. Those who rated their childhood health as "good" were coded as "neutral" for health selection, while those who responded with "fair" or "poor" were coded as "negative" for health selection.

Analyses

All analysis was done using Stata SE Version 14.0. In order to account for the sampling weights and stratified sampling method, the svset command was used. The NIS-2003-1 dataset includes a variable with sample weights for each observation and the sample stratification variable. Both weighted and un-weighted descriptive statistics were generated with tabulations (Table 1). Stata uses Taylor series linearization to compute confidence estimates for its "svy" suite of commands. Taylor series linearization is considered a valid method for computing confidence estimates for survey data (Brogan 2005).

Weighted bivariate odds ratios of each independent variable with the three outcomes (depression at baseline, depression at follow-up, and chronic depression) were generated in order to ascertain the weighted, unadjusted odds ratios of all independent variables with all outcomes under study (Table 2). All observations with missing data on either the independent variable or the outcome were excluded.

Finally, odds ratios for each of the three outcomes were computed from a series of logistic regression models. Again, observations with missing data on any variable in the model were excluded from analysis. Models were built using the following process. Model A represented weighted odds ratios of demographic variables (baseline age, sex, and country of origin) with each outcome. The age variable was categorized, as previously described, with ages 18-29 the referent group.

In Model B, all socioeconomic variables (single, education less than 12 years, English scale, and not currently working) were added to Model A. The reference groups were "not single," "education > 12 years," English ability of seven (the highest possible level), and "currently working," respectively.

In Model C, refugee status was added to Model B, with non-refugee immigrants the referent group. In Model D, persecution (binary) and its interaction with refugee status were added to Model C. The reference group for the interaction term of refugees and persecution was non-refugee immigrants who did not report pre-migration persecution. Model D yielded the fully-adjusted odds ratios of all independent variables for each of the three outcomes, before accounting for the potential confounding effects of health selection and migration-related depression.

Model E added health selection to Model D, with "neutral" health selection the referent group. Confounding due to health selection was assessed by comparing odds ratios in Model D to those in Model E and calculating the change-in-effect between ORs from Model D and Model E. In a 2009 review of variable selection in epidemiologic studies published in four major journals, change-in-effect estimation was among the two predominant data-driven techniques for assessing confounding (the other being stepwise selection) (Walter and Tiemeier 2009). The a priori threshold chosen to identify confounding was a change-in-effect of 10% or more. The 10% change-in-effect threshold is commonly used to identify confounding in epidemiology (for a discussion of the suitability of 10% change-in-effect as a cutoff for confounding, refer to Lee 2014).

Model F added migration-related depression to Model D, with immigrants not reporting migration-related depression serving as the reference group. The same guidelines were used to assess confounding due to migration-related depression. Finally, Model G added both health selection and migration-related depression to Model D, representing the weighted, fully-adjusted model for each depression outcome, accounting for confounding due to both health selection and migration-related depression.

Chapter 4: Results

Descriptive Statistics

Table 1 shows weighted and un-weighted descriptive characteristics for the analytic sample (n=4,363). The mean weighted age was 39.1 and baseline and 42.9 at follow-up. Less than 20% of the weighted sample was 50 or older, despite the fact that this sample excludes children under the age of 18.

Roughly three-fifths of the sample was under age 40 at baseline. Females constituted 58% of the weighted sample. Approximately 47% of the weighted sample was born in Latin America or the Caribbean. The next most common country of birth was Asia and the Pacific, comprising 27% of the weighted sample. Europe and Central Asia, Sub-Saharan Africa, and North Africa and the Middle East, listed in order of descending weighted proportion, made up just over a quarter of the weighted sample combined.

Overall, the weighted sample represents a relatively well-educated group comprised primarily of couples and families. Just less than two-thirds of the weighted sample (64%) had at least 12 years of education, while over three-quarters were married or living together at baseline (78%). The proportion of the weighted sample that was married or living together at follow-up was slightly lower than at baseline (72%).

The sample varied greatly in employment status and English proficiency at baseline. The majority of the weighted sample was working now (56%), while roughly one-sixth each were unemployed and looking for work or considered themselves a homemaker. Similarly, 24% said they understood and spoke English "very well," while 16% said they understood and spoke English "not at all," demonstrating the variability of employment status and English proficiency. As the noticeable differences between weighted and un-weighted percentages demonstrate, both employment status and English proficiency depended upon visa category.

Overall, just under 8% of the weighted sample reported some form of pre-migration persecution. Depression was more prevalent at baseline than at follow-up. At baseline, 14% of the sample reported general depression, compared to 10% at follow-up. However, these numbers are slightly misleading, as depression was more likely to be missing at follow-up than at baseline (9% compared to 3%). Among those with available data for depression at baseline, prevalence of general depression was 14%. Among those with available data for depression at follow-up, prevalence of general depression was 11%.

Chronic depression was characterized as the presence of general depression at both baseline and follow-up. In this sample, just under 3% met the criteria for chronic depression. Due in large part to the high prevalence of missing data on depression at follow-up, approximately 12% of the sample could not be assessed for chronic depression.

Unadjusted odds ratios

Table 2 provides weighted, unadjusted odds ratios for each dependent variable with baseline depression, follow-up depression, and chronic depression. No clear pattern is evident with age group and baseline depression. The 18-29, 30-39, and 40-49 age groups had nearly identical odds of depression at baseline. The 50-59 age group appeared slightly more vulnerable to depression at baseline, while the group of adults aged 60 and older appeared slightly protected, although neither result was statistically significant.

At follow-up, all age groups had higher odds of depression than the 18-29 reference group, although only the odds ratio for the 50-59 age group was significant (OR=1.67; 95% CI: 1.14-2.44). The same finding was true for chronic depression, as no age group had significantly different odds of chronic depression than the 18-29 age group besides the 50-59 age group (OR=2.33; 95% CI: 1.19-4.57). Overall, the only clear pattern that emerged from the unadjusted odds ratios of age groups and depression outcomes was that participants between the ages of 50 and 59 had higher odds of depression than participants younger than 30, especially for chronic depression.

Sex had a much more distinct pattern with depression than age. Females were 50% more likely than males to have general depression at baseline, 66% more likely at follow-up, and nearly three times more likely to have chronic depression than males. All of these results were significant with 99.9% confidence.

Odds ratios for region of birth and depression were calculating using "Europe and Central Asia" as the referent group. While all regions include multiple countries consisting of a heterogeneous collection of races, ethnicities, and cultures, Europe and Central Asia (a group that included Canada and the UK, among others) was chosen as the reference group because participants from that group were thought to be more ethnically and culturally similar to Americans than any other region.

Unadjusted odds ratios for region of birth and depression showed no clear pattern in the "Middle East/North Africa" and "Sub-Saharan Africa" groups relative to the "Europe and Central Asia" group. For the "Asia/Pacific" group, odds ratios for depression at follow-up and for chronic depression are higher than the referent group, though not significantly so. For the "Latin America/Caribbean" group, odds of depression at baseline, at follow-up, and for chronic depression were more than double those of the reference group and significant with >99% confidence for each outcome.

For each of the three depression outcomes, having at least 12 years of education was significantly protective compared to having fewer than 12 years of education, before adjustment for any other factors. Participants with fewer than 12 years of education were 1.43 times more

likely to have depression at baseline than those with at least 12 years (95% CI: 1.17-1.75), 1.28 times more likely to have depression at follow-up (95% CI: 1.02-1.60), and 1.83 times more likely to have chronic depression (95% CI: 1.21-2.78).

Compared to participants who were married or living with a significant other, participants who were single were significantly more likely to have depression at baseline, at follow-up, and to have chronic depression before adjustment. The increase in odds of depression relative to the "married/living together" for single participants was 34% at baseline and 51% at follow-up. For chronic depression, the crude odds ratio of single immigrants compared to the reference group was 2.09 (95% CI: 1.38-3.17).

Unadjusted odds ratios of depression for refugees compared to all other immigrants were higher for each of the three depression outcomes, though only significant at baseline. At baseline, refugees had 1.46 time higher crude odds of general depression than non-refugee immigrants (95% CI: 1.05-2.01). At follow-up, the extent of increase in unadjusted odds of depression for refugees fell to 31% and was no longer significant. For chronic depression, refugees had 1.65 times higher crude odds compared to all other immigrants but this result was not statistically significant (95% CI: 0.87-3.13).

The unadjusted odds ratios for persecution and depression outcomes were positive but relatively weak and non-significant. At baseline, immigrants reporting persecution were 1.17 times more likely than those reporting no persecution (95% CI: 0.84-1.64). At follow-up, the odds ratio of persecuted compared to non-persecuted immigrants rose modestly to 1.21 and were still non-

significant (95% CI: 0.82-1.78). Odds of chronic depression among immigrants reporting pre-migration persecution were 1.45 times those of non-persecuted immigrants but still not significant (95% CI: 0.72-2.72).

Models for general depression at baseline

Table 3 shows models for general depression at baseline. Each model, starting with only demographic factors in Model A and ending with the fully-adjusted Model G, adds to or replaces independent variables from the previous model. In Model A, odds ratios for demographic variables (age group, sex, and region of birth) and depression at baseline are reported. Model B adds socioeconomic variables (education, marital status, employment, and English proficiency scale) to Model A. Model C adds refugee status to Model B. In Model D, refugee status is replaced with the interaction of refugee status and persecution. Model E adds health selection to Model D. Model F adds migration-related depression, rather than health selection, to Model D. Model G adds both health selection and migration-related depression to Model D.

Odds ratios for age categories and depression at baseline were all relatively similar except for the "60+" age group, which had substantially lower odds ratios across all models. In Model A, no age group was significantly different from the referent category of 18-29, but participants 60 and older had a non-significant OR of 0.72, after adjusting for differences in sex and region of origin (95% CI: 0.48-1.09). All other age groups in Model A were relatively similar to the 18-29 group, with the 50-59 group showing slightly higher adjusted odds of baseline depression.

In Model B, all age groups besides the "60+" group were very similar to the 18-29 group after adjusting for differences in age, sex, region, education, marital status, employment, and English proficiency. For immigrants aged 60 and older, odds of baseline depression were 0.56 compared to immigrants younger than 30 (95% CI: 0.36-0.87), after adjusting for demographic and socioeconomic variables. In Models C, D, E, and F, additions of refugee status, its interaction with persecution, health selection, and migration-related depression, respectively, did little to change odds ratios for baseline depression of any age category. The fully-adjusted Model G yielded similar odds ratios for age groups 30-39, 40-49, and 50-59, none of which were significantly different from immigrants between ages 18 and 29. Immigrants aged 60 and above had an odds ratio of 0.50 for baseline depression relative to immigrants aged 18-29 (95% CI: 0.31-0.79), after adjusting for demographic factors, socioeconomic factors, refugee and persecution status, health selection, and migration-related depression.

Female immigrants had a statistically significant increased odds of baseline depression compared to males in all models. In Model A, females had an odds ratio of 1.50 for baseline depression after accounting for differences in age and region (95% CI: 1.21-1.85). In Model B, the addition of socioeconomic variables attenuated the magnitude of the female odds ratio for baseline depression to 1.42 (95% CI: 1.13-1.78). Adding the measured effects of migration-related depression in Model F further reduced the odds ratio for females to 1.35 (95% CI: 1.06-1.70). In Model G, the fully-adjust odds ratio for baseline depression among females is 1.34 (95% CI: 1.06-1.70).

Immigrants born in Latin America and the Caribbean had a statistically significant difference in odds ratios for baseline depression relative to the "Europe and Central Asia" reference group in all models, while no other region of birth differed significantly. In Model A, immigrants born in Latin America and the Caribbean had an odds ratio of 2.15, adjusted for age and sex (95% CI: 1.55-2.97). Adding socioeconomic variables in Model B attenuated the odds ratio for Latin America and the Caribbean to 1.88 (95% CI: 1.35-2.64), but accounting for refugee status in Model C raised it to 2.06 (95% CI: 1.46-2.89). Accounting for migration-related depression in Model F reduced the odds ratio for Latin America and the Caribbean to 1.97 (95% CI: 1.38-2.80). The fully-adjusted odds ratio for depression among immigrants from Latin America and the Caribbean compared to those from Europe and Central Asia was 1.96 (95% CI: 1.38-2.80).

Odds of baseline depression among immigrants with fewer than 12 years of education did not differ significantly from those with at least 12 years in any adjusted model. In Models B-G, the odds ratio for immigrants with fewer than 12 years of education stayed between 1.09 (95% CI: 0.85-1.40) and 1.15 (95% CI: 0.89-1.48). In Model G, the adjusted odds ratio for immigrants with fewer than 12 years of education compared to those with 12 or more years was 1.13 (95% CI: 0.87-1.46).

To assess the effects of baseline marital status on baseline depression, single immigrants were compared to the reference group of immigrants who were married or living together. The odds ratio for baseline depression among single immigrants was not affected by the addition of refugee status, refugee status' interaction with persecution, health selection, or migration-related depression. In both Model B and Model G, the odds ratio for single immigrants compared to

those who were married or living with a significant other was statistically significant at 1.29 (95% CI: 1.02-1.62 for Model G).

Immigrants who were not working at baseline did not have a statistically significant difference in odds of baseline depression in any model. In Model B, immigrants who were not currently working had an odds ratio slightly above the null, at 1.06 times the odds of immigrants who were currently working (95% CI: 0.84-1.33). In subsequent models, adjustments for refugee status, refugee status and persecution, health selection, and migration-related depression raised the odds of depression among non-working immigrants relative to working only slightly. The fully-adjusted odds ratio in Model G for baseline depression among non-working immigrants was 1.15 (95% CI: 0.90-1.47).

The seven-level linear scale of English proficiency increases as immigrants' self-rated English proficiency increases. Across all models for depression at baseline, scaled English proficiency was significant or borderline-significant. In Model B, the odds ratio for a one-level increase in English proficiency was statistically significant at 0.94, after adjusting for demographic and socioeconomic variables (95% CI: 0.89-1.00). Thus, an increase from the lowest level to the highest level of English proficiency would result in an odds ratio of 0.69. In subsequent models the addition of refugee status and persecution raised the p-value for English proficiency scale so that it was no longer significant. However, adding migration-related depression to the model enhanced the effect of English proficiency scale on baseline depression. In the fully-adjusted Model G, the odds ratio for a one-level increase in English proficiency was 0.93 and statistically

significant (95% CI: 0.88-0.99). An increase from the lowest level to the highest level of English proficiency, according to Model G, would result in an odds ratio of 0.65.

In Model C, refugee status was added to the demographic and socioeconomic variables for which Model B had adjusted. Compared to non-refugee immigrants, refugees were at 1.82 times higher odds of reporting baseline depression (95% CI: 1.29-2.55), after adjusting for demographic and socioeconomic variables. However, breaking down refugees into groups by persecution status showed evidence of interaction between refugee status and persecution.

Model D replaces the refugee term from Model C with an interaction term between refugee status and persecution. Three groups, persecuted non-refugee immigrants, non-persecuted refugees, and persecuted refugees, were compared to the reference group of non-persecuted non-refugee immigrants. Persecuted non-refugee immigrants in Model D had a non-significant modest increase in odds of baseline depression compared to non-refugees who were not persecuted. After adjusting for migration-related depression, the odds ratio for persecuted non-refugees dipped slightly below the null and was still non-significant. The fully-adjusted odds ratio for baseline depression among non-refugee immigrants who had reported pre-migration persecution was 0.95 compared to non-refugees who hadn't reported persecution (95% CI: 0.57-1.57).

Refugees who had not reported persecution had a statistically significant odds ratio of 1.69 in Model D (95% CI: 1.09-2.64), which increased after adjusting for migration-related depression.

In Model G, refugees who had not been persecuted had an adjusted odds ratio of 1.83 compared to non-persecuted non-refugees (95% CI: 1.15-2.90).

Refugees who had reported persecution showed the highest odds of baseline depression of all groups. In Model D, persecuted refugees have an odds ratio of 2.03 compared to non-persecuted non-refugees for baseline depression (95% CI: 1.25-3.30). Adjustments for health selection in Model E and migration-related depression had virtually no effect, and the adjusted odds ratio for baseline depression among persecuted refugees in Model G remained at 2.03 (95% CI: 1.24-3.31). Health selection and migration-related depression were included in Models E, F, and G strictly for the purposes of assessing their influence on the above variables of interest, and their odds ratios were not interpreted.

Models for general Depression at follow-up

The relationship between age category and depression at follow-up was relatively similar to baseline for the 30-39 and 40-49 age groups, but differed among the 50-59 and 60 and older groups (at follow-up, the referent age group was 21 to 30 because no participants were younger than 21). As observed at baseline, participants aged 30-39 and 40-49 showed no significant difference compared to the reference group, even after accounting for socioeconomic variables, refugee and persecution interaction, health selection, and migration-related depression.

For immigrants ages 50-59, the non-significant increase in odds of depression compared to the referent group that had been observed at baseline became significant and increased in magnitude at follow-up. In Model A, 50-59 year-olds show an odds ratio of 1.74 for depression relative to

21-29 year-olds (95% CI: 1.18-2.55). Adjustments made in Models B, C, D, E, and F did little to change the magnitude of the odds ratio for the 50-59 year-olds, and their fully adjusted odds ratio shown in Model G was 1.70 (95% CI: 1.13-2.55).

While immigrants ages 60 and above had shown a lower odds of depression compared to 18-29 year-olds at baseline, models at follow-up showed an increase in odds of depression for that group. While higher odds of follow-up depression among participants ages 60 and older compared to the reference group were not significant and were attenuated after adjusting for socioeconomic factors and health selection, the change in effect of older age between baseline and follow-up stands out.

The effect of female sex on general depression at follow-up was remarkably similar, albeit slightly higher, compared to its effect at baseline. In Model A, female odds of depression compared to males was 1.64 (95% CI: 1.29-2.08). As observed at baseline, this effect fell slightly after adjusting for socioeconomic variables but remained significant with a high degree of confidence. Model G shows a fully adjusted odds ratio of 1.57 for depression among females at follow-up (95% CI: 1.21-2.03).

The effects of region of birth on general depression at follow-up also mirrored effects observed at baseline. Once again, odds of depression among immigrants from Asia, North Africa and the Middle East, and Sub-Saharan Africa did not differ significantly from the Europe and Central Asia reference group. The only minor difference among those groups was that Asians were at

slightly increased odds relative to Europeans at follow-up, while at baseline the groups had had nearly identical odds of depression.

Immigrants from Latin America and the Caribbean continued to have the highest odds of depression at follow-up. Similar to baseline, odds of depression at follow-up among immigrants from Latin America and the Caribbean was reduced after adjustment for socioeconomic variables, raised after adjustment for refugee status, and lowered after adjustment for migration-related depression. The fully adjusted odds ratio for depression at follow-up among Latin Americans compared to Europeans was statistically significant at 1.86 (95% CI: 1.27-2.73).

The effect of education on general depression at follow-up was almost non-existent. While baseline models showed a very slight, non-significant increase in odds of depression for immigrants with fewer than 12 years of education, models at follow-up yielded odds ratios that fluctuated within a few percentage points of the null for immigrants with fewer than 12 years of education compared to those with 12 or more years.

The effect of marital status on general depression, on the other hand, increased at follow-up compared to baseline. While baseline odds ratios for single participants hovered between 1.26 and 1.29 depending on the model, odds ratios for depression at follow-up among single immigrants ranged between 1.42 (95% CI: 1.10-1.84) and 1.44 (95% CI: 1.11-1.87). It is worth noting that, at both baseline and follow-up, the effect of marital status was virtually unaffected by variables added in increasingly adjusted models. This finding for marital status stands in stark contrast to education, which had roughly similar unadjusted odds ratios for baseline

depression, follow-up depression, and chronic depression (1.43, 1.28, 1.83, respectively) compared to marital status (1.34, 1.51, 2.09, respectively). While fully adjusted odds ratios for marital status are fairly similar to unadjusted odds ratios, adjusted odds ratios for education are much closer to the null than unadjusted odds ratios. Most of the attenuation in the odds ratios for depression appears to be due to adjustment for demographic factors.

Odds ratios for depression at follow-up among immigrants who had reported not working at baseline were remarkably similar to odds ratios seen at baseline for non-working immigrants. In the fully adjusted model, immigrants who had reported not working at baseline had 16% higher odds of depression at follow-up than immigrants who had reported working at baseline. The odds ratio for follow-up depression among immigrants not working at baseline increased slightly in from Model B to Model G, as more and more variables were adjusted for. However, the odds ratio for immigrants not working at baseline were not significant in any model.

While higher English proficiency at baseline was shown to have a moderate protective effect of borderline statistical significance on baseline depression, virtually no effect of baseline English proficiency is evident for depression at follow-up. Odds ratios for baseline English proficiency on follow-up depression ranged from 0.98 to 0.99 (not statistically significant) for each level increase in English proficiency.

The effect of refugee status, added in Model C, on follow-up depression was slightly less than observed for depression at baseline, though still statistically significant. The odds ratio for

depression at follow-up among refugees was 1.57 (95% CI: 1.04-2.37) compared to all non-refugee immigrants (compared to 1.82 at baseline).

As seen at baseline, refugees who reported pre-migration persecution reported higher odds of depression at follow-up than refugees who had not reported persecution. However, the difference between refugees who had been persecuted and those who hadn't was less severe than it had been at baseline. Persecuted refugees had an odds ratio of 1.65 relative to the non-persecuted, non-refugee reference group in Model D (95% CI: 0.89-3.04), while refugees who were not persecuted had an odds ratio of 1.49 compared to the reference group (95% CI: 0.88-2.54). Adding in health selection and migration-related depression to the model slightly attenuated the odds ratio for persecuted refugees, such that the fully adjusted odds ratio for that group was 1.59 (95% CI: 0.87-2.91). In contrast to baseline models, interaction terms for refugee and persecution were not significant in any model for depression at follow-up.

Models for chronic depression

Results shown in Table 5 demonstrate that many of the relationships observed from depression models at baseline and follow-up were substantially stronger among immigrants who reported depression at both waves. New relationships also present themselves in models of chronic depression, even though relatively few immigrants were depressed at both waves (n=113), thus limiting the statistical power for detecting relationships with chronic depression.

Models for baseline depression only showed a significant odds ratio for immigrants ages 60 and older compared to immigrants under 30, a protective relationship only seen after accounting for

socioeconomic variables. Models for depression at follow-up did not find that immigrants 60 or older were protected, but showed that immigrants in their 50s were at risk compared to immigrants under 30. Models for chronic depression showed both of these findings; immigrants in their 50s were at risk compared to the 18-29 age group but immigrants 60 and older were protected from depression (although p-values for the 60 and older group were not significant, likely because there were too few older immigrants to detect the difference). In addition, chronic depression models showed that immigrants in their 40s may have higher odds of depression compared to immigrants under 30.

Odds of depression at both baseline and follow-up were substantially higher among women compared to men. Model A for chronic depression shows that women were nearly three times as likely to have reported depression at baseline and follow-up compared to men. Adjustments for socioeconomic factors reduced the odds ratio for women slightly, but further adjustments for refugee status and persecution, health selection, and migration-related depression raised the odds ratio for women to 2.78 in the fully adjusted Model G. While women were moderately more likely than men to report depression at baseline (OR=1.34; 95% CI: 1.06-1.70 in Model G) and (OR=1.57; 95% CI: 1.21-2.03 in Model G), results from chronic depression models show that women were considerably more likely than men to report depression at both waves of the survey. Results for women compared to men were all significant with a high degree of confidence at baseline, follow-up, and for chronic depression.

Models of depression at baseline and follow-up showed that all regions of birth had relatively similar odds of depression as the Europe and Central Asia reference group besides Latin America

and the Caribbean. Table 5 shows that only immigrants from Latin America and the Caribbean were significantly differed significantly in odds of chronic depression compared to the reference group, with a fully adjusted odds ratio of 2.50 for chronic depression (95% CI: 1.11-5.62). Table 5 also shows that other groups had non-significant odds ratios that differed considerably in magnitude from models at baseline and follow-up. For instance, Asians had an odds ratio of 1.94 in Model G (95% CI: 0.81-4.66), while immigrants from Sub-Saharan Africa had an odds ratio of 0.45 in Model G (95% CI: 0.07-2.79). These results should be interpreted cautiously, as they are not statistically significant and are based on fairly small numbers, especially for Sub-Saharan Africa. The odds ratio of chronic depression in the Latin America and the Caribbean group, on the other hand, follow trends seen in previous models and are significant with 95% confidence.

Education continued to be a non-significant predictor in models for chronic depression. The fully adjusted odds ratio for immigrants with fewer than 12 years of education, compared to those with at least 12 years, was 1.22 (95% CI: 0.72-2.04). Taken in the context of the results for that group seen in Table 3 (OR=1.13; 95% CI: 0.87-1.46) and Table 4, (OR=0.97; 95% CI: 0.73-1.29), the results from Table 5 continue to demonstrate that education was not a meaningful predictor for depression within this sample after adjusting for other factors, particularly demographic factors. A glance at Table 2 shows that unadjusted odds ratios for immigrants with fewer than 12 years of education can be a misleading characterization of the effect of education on depression for this sample.

As described above, marital status appeared to have a similar effect on depression at baseline and follow-up as education in unadjusted models, but unlike education, the effect of marital status persisted in increasingly adjusted models. This was also true for chronic depression. Once again, the odds ratio for chronic depression among single immigrants was significant in all models and did not change much as more and more variables were added to the model. Model A for chronic depression yielded an odds ratio of 2.13 (95% CI: 1.35-3.35) for immigrants who were single at baseline; Model G yielded an odds ratio of 2.14 (95% CI: 1.34-3.41). In contrast to education, marital status continued to be an important factor for all depression outcomes even after adjustment for demographic and socioeconomic factors, persecution and refugee status, and potential sources of bias.

Models of depression at baseline and follow-up did not show a significant difference in odds of depression between immigrants who were not working at baseline compared to those who were, a finding which held true in chronic depression models. Model A shows that immigrants not working at baseline had an odds ratio of 1.19 (95% CI: 0.74-1.91) compared to immigrants working at baseline; after adjustments were made in Models C, D, E, and F, odds of chronic depression for this group increased modestly but remained non-significant. In the fully adjusted Model G, odds of chronic depression for immigrants not working at baseline was 1.29 (95% CI: 0.78-2.12) compared to immigrants working at baseline.

Baseline English proficiency had been shown to be moderately protective with borderline statistical significance at baseline, but did not have an effect on depression at follow-up. As shown in Table 5, baseline English proficiency may be moderately protective for chronic

depression as it was for baseline depression, though small numbers of immigrants reporting depression at both waves preclude a high degree of confidence in this interpretation. The odds ratio for every one-level increase in English proficiency was 0.94 (95% CI: 0.81-1.08) in the fully adjusted model, though not statistically significant.

Refugee status was significantly associated with depression at baseline (OR=1.82; 95% CI: 1.29-2.55) and follow-up (OR=1.57; 95% CI: 1.04-2.37) before including the interaction term with persecution, although the effect was diminished slightly at follow-up. Table 5 shows that refugee status was more strongly associated with chronic depression than it was for depression at either wave (OR=2.57; 95% CI: 1.34-4.92).

In models of depression at baseline, the addition of an interaction term with refugee status and persecution showed that refugees who were persecuted had moderately higher odds of depression compared to refugees who were not persecuted. At follow-up the same pattern held, although results were no longer statistically significant. Models for chronic depression present a much clearer demonstration of this finding, as shown in Table 5. Refugees who reported pre-migration persecution had 4.84 times higher odds of chronic depression compared to non-refugees who were not persecuted in the fully adjusted model (95% CI: 2.08-11.26). On the other hand, non-refugees reporting pre-migration persecution (OR=1.10; 95% CI: 0.42-2.85) and refugees who did not report persecution (OR=1.61; 95% CI: 0.56-4.58) did not have significantly different odds of chronic depression compared to non-refugee immigrants who were not persecuted. In conclusion, refugees who reported pre-migration persecution were nearly five time more likely than non-persecuted non-refugee immigrants to have general depression at baseline and at

follow-up, after accounting for demographic and socioeconomic differences and the potential confounding effects of health selection and depression related to the migration process.

Chapter 5: Discussion

Pre-migration persecution and refugee status

The primary purpose of this study was to obtain unbiased, adjusted estimates for the effect of pre-migration persecution on long-term trajectories for depression among immigrants to the United States. Informed by the literature, it analyzed the effect of persecution among refugees separately from that among other immigrants, finding several illuminating differences in the effect of pre-migration persecution on depression outcomes between the two groups.

At both baseline and at follow-up, persecuted refugees had slightly higher odds of depression than non-persecuted refugees. For chronic depression, however, persecuted refugees had substantially higher odds compared to any other group. Persecuted non-refugee immigrants, on the other hand, did not show much difference in odds of any of the three outcomes compared to non-persecuted non-refugees.

These results provide an answer to this study's first research question, regarding the effect of pre-migration persecution on mental health trajectories among immigrants and refugees: "it depends." Among refugees, pre-migration persecution appears to have had only a small effect on odds of depression at either baseline or follow-up. However, the dramatically elevated odds ratio for persecuted refugees in chronic depression models indicates that pre-migration

persecution places refugees at a markedly increased risk for more persistent, long-term depression.

Among non-refugee immigrants, on the other hand, there was very little difference between persecuted and non-persecuted immigrants for odds of any depression outcome. According to these results, it can be concluded that the effect of pre-migration persecution on long-term mental health seems to depend on refugee status. For refugees, pre-migration persecution may have serious long-term mental health implications; for non-refugees, this study finds no effect of pre-migration persecution.

This finding builds on other studies that have concluded that refugee mental health warrants separate consideration from the mental health of other types of immigrants (Lindert et al 2009; Yun et al 2015). For instance, a meta-analysis by Lindert et al revealed that refugees not only have higher rates of depression than labor migrants, but they do not experience the same protection from depression as labor migrants when resettling to a relatively wealthy country (Lindert et al 2009). The authors warned that studies of mental health in refugee populations may require different considerations than other types of immigrants (Lindert et al 2009).

One possible explanation for the difference in effect of pre-migration persecution between refugees and non-refugees can be taken from the study by Yun et al. In that study the authors showed that persecuted refugees were more likely to report multiple, more severe forms of persecution than persecuted non-refugees (Yun et al 2015). In other words, one possible explanation for the difference in effect of pre-migration persecution between refugees and non-

refugees is that refugees who reported persecution experienced higher doses of persecution – perhaps high enough doses to affect a noticeable change in their odds of depression.

Other explanations are also plausible, however. A return to Lee's theories of migration reminds us that there may be important differences between the type of people who migrate for "push" factors, and people who migrate for "pull" factors (Lee 1966). While most immigrants enter the United States for better opportunities, refugees and asylum seekers are usually pushed out of their home country. This difference may also explain the uneven effect of pre-migration persecution between refugees and immigrants.

Socioeconomic and demographic factors for depression

The second research question of this study concerned the effect of socioeconomic factors on long-term depression. Overall, this analysis showed mixed results for the four socioeconomic variables considered: education, marital status, employment, and English proficiency. Education seemed a promising predictor of depression in unadjusted models, but after controlling for other demographic and socioeconomic variables, education had no noticeable effect on depression for immigrants. Other studies have proposed that, while education is thought of as a protective health factor, it could also be detrimental to health if it promotes unhealthy assimilation or exposes immigrants to discrimination (Alegria 2007). It is possible that education could be protective for some people's mental health but not others, thus explaining the null finding.

Single immigrants had higher odds ratios across all outcomes compared to immigrants who were married or living together. This result supports existing research, which has generally found that

single immigrants are more likely to have worse mental health than immigrants that are married or living in a serious partnership (Kessler 1999; Li and Anderson 2015).

Employment was not significantly associated with any measure of depression after adjusting for demographic and social characteristics. English proficiency at baseline was protective for depression at baseline, but not for depression at follow-up. Overall, the strongest social predictor was marital status, especially for chronic depression.

In addition to the socioeconomic variables considered in this analysis, a glance at a few of demographic variables provides a few interesting comparisons to findings from other studies. In this study, immigrants from Latin America and the Caribbean had significantly higher odds of all three depression outcomes compared to the Europe/Central Asia reference group. While much of the literature has made note of the "Hispanic Health Paradox," (the same phenomenon as the immigrant paradox except only used to describe Hispanic immigrants) (Abraido-Lanza et al 1999; Alegria et al 2007; Vega et al 2009), this sample of immigrants revealed that immigrants from Mexico, Central and South America, and the Caribbean were at an increased risk for all depression outcomes compared to any other region. This could suggest that observed health advantages for Hispanic immigrants in previous studies were really due to factors related to being an immigrant (i.e., selective migration), not due to factors related to being Hispanic.

Building on evidence from previous studies, females had significantly higher odds of all three measures of depression compared to men (Arevalo et al 2015; Bourque et al 2011; Song et al 2015; Tan 2014). At baseline, women's odds were increased by 34% compared to men, while at

follow-up their odds were increased by 57%. However, while previous studies have used cross-sectional data to observe this phenomenon, this study adds a new finding: females had nearly three times the odds of reporting depression at both waves compared to men. This suggests that cross-sectional estimates of female risk of depression may under-represent the difference in their increase in depression risk compared to men.

Similarly, single immigrants had moderately higher odds of depression at baseline (29% higher) and at follow-up (43% higher) than immigrants who were married or living with a significant other. However, single immigrants were more than twice as likely to report depression at both waves. In separate analyses (not shown), an interaction term with female and single yielded an adjusted odds ratio for chronic depression of 6.00 for single women compared to married men. The striking increase in risk of depression at both waves among both single women and persecuted refugees suggests that the cross-sections of two vulnerable groups may yield exponentially higher risk of depression than the risk of either group alone. This hypothesis was not explored comprehensively, and remains merely a theory for future investigation.

This study accounted for two potential sources of bias, selection bias related to selective migration and the potential confounding effects of migration-related depression. Health selection was included in analysis because the literature indicated that there was a possibility that its effect would not be constant across all sub-populations of immigrants. However, the addition of health selection did little to change odds estimates for any independent variable with any depression outcome.

A likely explanation for this is that the models already contained variables that served as better proxies for health selection than the variable itself, which was created using a combination of two survey questions that may have been difficult for participants to answer accurately. For example, it may be difficult for participants to accurately compare their own health to the health of an average person in their home country. On the other hand, refugee status may be an excellent proxy for health selection. Another possible explanation is that the health selection variable did accurately measure some form of health selection, but not for mental health.

Depression related to migration also did not have a strong confounding effect. For all significant odds ratios in Model D (which was the fully adjusted model before adding health selection and migration-related depression) across all three outcome, none changed in magnitude by more than 10% and none changed to statistically non-significant.

This study made use of relatively recently-available data to study depression at two time points in a nationally representative cohort of new immigrants. Utilizing both waves allowed for the analysis of a unique group of immigrants – those who reported depression at both baseline and follow-up. This group represents a different way of measuring depression severity, frequency rather than by count of symptoms at any one time. A previous study of NIS data that analyzed major depression reported stronger correlations with key variables (including persecution) compared to analyses of general depression (Montgomery et al, 2014). Similarly, this study finds considerably stronger effects for several variables in models for chronic depression compared to models of general depression at baseline or follow-up.

Limitations

Three important limitations should be incorporated into interpretation of results from this analysis. First, there was significant loss to follow-up (49% in the adult sample) between waves of data collection. A comparison of participants who completed only baseline survey to those who completed baseline and follow-up (this study's analytic sample) yielded no remarkable differences in demographic and socioeconomic characteristics between the two groups (see Appended Table 2). Females and Latinos were more slightly likely to respond to the follow-up survey, as were immigrants who reported pre-migration persecution. These differences were not extreme, but it is possible that differential response to follow-up affects the generalizability of this study's analytic sample.

Similarly, the literature suggested that older, less healthy immigrants may be more likely to leave the United States in favor of their home country after developing an illness. This study was unable to measure the effect of this so-called "Salmon Hypothesis." It is possible that older, sicker immigrants were not represented as well in follow-up data.

Finally, this study relied upon self-report among a group of new immigrants. While the study design accounted for this to some degree by providing interpreters in seven different languages at baseline and ten at follow-up, reporting bias due to cultural factors could influence data quality. In particular, data for depression, which may be perceived differently by immigrants of different cultures, could be affected differential reporting. However, this study used a measure of depression developed by the WHO, and similar measures have been used in previous surveys such as the NCS-R.

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Tables

Table 1. Characteristics of analytic sample (N=4,363) at baseline and follow-up

	Baseline (2003-2004)			Follow-up (2006-2008)		
Variables	Unweighted		Weighted	Unweighted		Weighted
Age	**Mean**	**SD**	**Mean**	**Mean**	**SD**	**Mean**
	39.4	12.9	39.1	43.2	12.9	42.9
Age at baseline	**N**	**%**	**%**	**N**	**%**	**%**
18-29	1,042	23.9	26.3	485	11.1	12.4
30-39	1,569	36.0	34.9	1,551	35.6	35.7
40-49	906	20.8	19.7	1,175	26.9	26.1
50-59	466	10.7	10.2	631	14.5	14.0
60+	379	8.7	8.9	520	11.9	11.9
Missing	1	0.0	0.0	1	0.0	0.0
Sex	**N**	**%**	**%**			
Female	2313	53.0	57.9			
Male	2050	47.0	42.1			
Region of Birth	**N**	**%**	**%**			
Asia/Pacific	1,318	30.2	27.0			
Europe/Cent Asia	778	17.8	15.4			
Latin America/Carib	1,709	39.2	47.1			
Middle East/N Africa	264	6.1	5.0			
Sub-Saharan Africa	294	6.7	5.5			
Education at baseline	**N**	**%**	**%**			
<12 years	1,378	31.6	35.6			
12 years or more	2,976	68.2	64.3			
Missing	9	0.2	0.1			
Marital Status	**N**	**%**	**%**	**N**	**%**	**%**
Married/Living together	3,180	72.9	77.9	3,038	69.6	71.5
Single	1,181	27.1	22.1	953	21.8	19.3
Missing	2	0.1	0.0	372	8.5	9.2
Employment						
Not Working now	1,753	40.2	44.3	1,098	25.2	28.3
Working now	2,604	59.7	55.6	2,981	68.3	64.6
Missing	6	0.1	0.1	284	6.5	7.1
English Proficiency Scale	**N**	**%**	**%**			
1	629	14.4	15.6			
2	191	4.4	4.8			
3	970	22.2	22.7			
4	347	8.0	8.2			
5	824	18.9	18.5			

6	298	6.8	6.6			
7	1,104	25.3	23.7			
Refugee Status						
Non-refugee	4,084	93.6	93.6			
Refugee	279	6.4	6.4			
Persecution	**N**	**%**	**%**			
No	4,009	91.9	91.9			
Yes	336	7.7	7.6			
Missing	18	0.4	0.4			
Health Selection						
Positive	3,056	70.0	69.2			
Neutral	900	20.6	21.2			
Negative	259	5.9	6.3			
Missing	148	3.4	3.3			
Migration-related Depression						
None	3,414	78.3	78.2			
Lasted < two weeks	466	10.7	10.9			
Lasted at least two weeks	332	7.6	7.5			
Missing	151	3.5	3.4			
General Depression	**N**	**%**	**%**	**N**	**%**	**%**
No	3,635	83.3	82.4	3,562	81.6	80.9
Yes	578	13.3	14.2	441	10.1	10.3
Missing	150	3.4	3.4	360	8.3	8.8
Chronic Depression	**N**	**%**	**%**	**N**	**%**	**%**
No				3,754	86.0	85.2
Yes				113	2.6	2.9
Missing				496	11.4	11.9

Table 2. Weighted, unadjusted odds ratios with depression at baseline, depression at follow-up, and chronic depression

Variable	Baseline		Follow-up		Chronic	
Age Category	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
[18-30)	1	Ref	1	Ref	1	Ref
[30-40)	1.0	0.8-1.3	1.0	0.8-1.4	1.1	0.6-2.0
[40-50)	1.0	0.7-1.3	1.2	0.8-1.6	1.8	1.0-3.3
[50-60)	1.2	0.8-1.7	1.7	1.1-2.4	2.3	1.2-4.6
[60+)	0.7	0.5-1.1	1.4	0.9-2.1	1.0	0.4-2.4
Sex						
Male	1	Ref	1	Ref	1	Ref
Female	1.5	1.2-1.8	1.7	1.3-2.1	3.0	1.8-4.9
Region of Birth						
Europe/Cent Asia	1	Ref	1	Ref	1	Ref
Asia/Pacific	1.0	0.7-1.5	1.4	1.0-2.1	1.8	0.8-4.0
Latin-America/Carib	2.2	1.6-3.0	2.1	1.5-2.9	2.9	1.4-6.1
Middle East/N Africa	1.3	0.8-2.3	1.4	0.7-2.5	1.0	0.3-3.4
Sub-Saharan Africa	1.2	0.7-2.0	1.3	0.7-2.4	0.5	0.1-3.1
Education						
Less than HS education	1.4	1.2-1.8	1.3	1.0-1.6	1.8	1.2-2.8
HS education or greater	1	Ref	1	Ref	1	Ref
Marital Status						
Single	1.3	1.1-1.7	1.5	1.2-1.9	2.1	1.4-3.2
Married/Living together	1	Ref	1	Ref	1	Ref
Employment						
Working Now	1	Ref	1	Ref	1	Ref
Not Working Now	1.1	0.9-1.4	1.3	1.0-1.6	1.4	0.9-2.1
English Comp Scale						
(Linear)	0.9	0.9-1.0	1.1	0.9-1.0	0.8	0.8-1.0
Refugee						
Refugee/Parolee/Asylee	1.5	1.1-2.0	1.3	0.9-1.9	1.6	0.9-3.1
All Other Immigrants	1	Ref	1	Ref	1	Ref
Persecution						
Yes	1.2	0.8-1.6	1.2	0.8-1.8	1.5	0.8-2.7
No	1	Ref	1	Ref	1	Ref

Table 3. Weighted models of general depression at baseline

Variable	Model A		Model B		Model C		Model D		Model E		Model F		Model G	
Obs.	4,212		4,197		4,197		4,183		4,181		4,181		4,179	
Age Cat.	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
[18-30)	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
[30-40)	1.0	0.8-1.3	1.0	0.8-1.3	1.0	0.8-1.3	1.0	0.8-1.3	1.0	0.8-1.3	0.9	0.7-1.2	0.9	0.7-1.2
[40-50)	1.0	0.8-1.4	1.0	0.7-1.4	1.0	0.7-1.3	1.0	0.7-1.3	1.0	0.7-1.3	0.9	0.7-1.3	0.9	0.7-1.2
[50-60)	1.2	0.9-1.8	1.1	0.8-1.6	1.1	0.7-1.5	1.1	0.7-1.5	1.0	0.7-1.5	1.0	0.7-1.5	1.0	0.7-1.4
[60+)	0.7	0.5-1.1	0.6	0.4-0.9	0.5	0.4-0.8	0.5	0.3-0.8	0.5	0.3-0.8	0.5	0.3-0.8	0.5	0.3-0.8
Sex	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Male	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Female	1.5	1.2-1.9	1.4	1.1-1.8	1.4	1.1-1.8	1.4	1.1-1.8	1.4	1.1-1.8	1.3	1.1-1.7	1.3	1.1-1.7
Region	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Europe	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Asia/Pacific	1.0	0.7-1.5	1.0	0.7-1.4	1.1	0.7-1.6	1.1	0.7-1.6	1.1	0.7-1.6	1.1	0.7-1.6	1.1	0.7-1.6
Latin-Amer	2.1	1.6-3.0	1.9	1.4-2.6	2.1	1.5-2.9	2.1	1.5-2.9	2.1	1.5-2.9	2.0	1.4-2.8	2.0	1.4-2.8
Middle East	1.3	0.8-2.3	1.2	0.7-2.2	1.3	0.7-2.2	1.3	0.8-2.2	1.3	0.8-2.2	1.1	0.6-2.0	1.1	0.6-2.0
Africa	1.2	0.7-2.1	1.2	0.7-2.1	1.2	0.7-2.1	1.2	0.7-2.1	1.2	0.7-2.1	1.1	0.6-2.0	1.1	0.6-2.0
Education			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
< 12 years			1.1	0.9-1.4	1.1	0.9-1.4	1.1	0.9-1.4	1.1	0.9-1.4	1.1	0.9-1.5	1.1	0.9-1.5
12+ years			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Marital			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Single			1.3	1.0-1.6	1.3	1.0-1.6	1.3	1.0-1.6	1.3	1.0-1.6	1.3	1.0-1.6	1.3	1.0-1.6
Married			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Employ.			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Working			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Not Working			1.1	0.8-1.3	1.1	0.9-1.4	1.1	0.9-1.4	1.1	0.9-1.4	1.2	0.9-1.5	1.2	0.9-1.5
English			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
(Linear)			0.9	0.9-1.0	0.9	0.9-1.0	0.9	0.9-1.0	0.9	0.9, 1.0	0.9	0.9-1.0	0.9	0.9-1.0
Refugee					**OR**	**95% CI**								
Yes					1.8	1.3-2.6								
No					1	Ref								
Pers*Ref							**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
0 0							1	Ref	1	Ref	1	Ref	1	Ref
1 0							1.1	0.7-1.8	1.1	0.7-1.8	0.9	0.6-1.6	0.9	0.6-1.6
0 1							1.7	1.1-2.6	1.7	1.1-2.7	1.8	1.2-2.9	1.8	1.2-2.9
1 1							2.0	1.3-3.3	2.0	1.2-3.3	2.0	1.3-3.3	2.0	1.2-3.3

Table 4. Weighted models of general depression at follow-up

Variable	Model A		Model B		Model C		Model D		Model E		Model F		Model G	
Obs.	4,003		3,987		3,987		3,972		3,841		3,839		3,838	
Age Cat.	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
[18-30)	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
[30-40)	1.0	0.8-1.4	1.1	0.81.5	1.1	0.8-1.5	1.1	0.8-1.5	1.1	0.8-1.5	1.0	0.7-1.4	1.0	0.7-1.4
[40-50)	1.2	0.8-1.7	1.2	0.9-1.8	1.2	0.8-1.7	1.2	0.8-1.7	1.2	0.8-1.7	1.2	0.8-1.7	1.2	0.8-1.7
[50-60)	1.7	1.2-2.6	1.7	1.2-2.6	1.7	1.1-2.5	1.7	1.1-2.5	1.7	1.2-2.6	1.7	1.2-2.6	1.7	1.1-2.6
[60+)	1.4	0.9-2.1	1.2	0.8-1.9	1.2	0.8-1.9	1.2	0.8-1.9	1.1	0.7-1.8	1.1	0.7-1.8	1.1	0.7-1.8
Sex	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Male	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Female	1.6	1.3-2.1	1.6	1.2-2.0	1.6	1.2-2.0	1.6	1.2-2.0	1.6	1.2-2.1	1.6	1.2-2.0	1.6	1.2-2.0
Region	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Europe	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Asia/Pacific	1.3	0.9-2.0	1.3	0.9-1.9	1.4	0.9-2.0	1.4	0.9-2.1	1.4	0.9-2.1	1.4	0.9-2.1	1.4	0.9-2.1
Latin-Amer	2.0	1.4-2.8	1.9	1.3-2.7	2.0	1.4-2.9	2.0	1.4-2.9	1.9	1.3-2.9	1.9	1.3-2.7	1.9	1.3-2.7
Middle East	1.4	0.8-2.7	1.4	0.7-2.5	1.4	0.8-2.6	1.4	0.8-2.6	1.4	0.8-2.6	1.3	0.7-2.5	1.3	0.7-2.5
Africa	1.3	0.7-2.5	1.3	0.7-2.5	1.3	0.7-2.5	1.3	0.7-2.5	1.3	0.7-2.5	1.3	0.7-2.5	1.3	0.7-2.5
Education			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
< 12 years			1.0	0.8-1.3	1.0	0.8-1.3	1.0	0.8-1.3	1.0	0.7-1.3	1.0	0.7-1.3	1.0	0.7-1.3
12+ years			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Marital			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Single			1.4	1.1-1.8	1.4	1.1-1.8	1.4	1.1-1.9	1.4	1.1-1.8	1.4	1.1-1.9	1.4	1.1-1.9
Married			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Employ.			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Working			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Not Working			1.1	0.9-1.4	1.1	0.9-1.5	1.1	0.9-1.5	1.1	0.9-1.5	1.2	0.9-1.5	1.2	0.9-1.5
English			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
(Linear)			1.0	0.9-1.1	1.0	0.9-1.1	1.0	0.9-1.1	1.0	0.9-1.1	1.0	0.9-1.1	1.0	0.9-1.1
Refugee					**OR**									
Yes					1.6	1.0-2.4								
No					1	**95% CI**								
Pers*Ref							**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
0 0							1	Ref	1	Ref	1	Ref	1	Ref
1 0							1.3	0.8-2.2	1.3	0.8-2.2	1.2	0.7-2.0	1.2	0.7-2.0
0 1							1.5	0.9-2.5	1.5	0.9-2.5	1.5	0.9-2.6	1.5	0.9-2.6
1 1							1.6	0.9-3.0	1.6	0.9-3.0	1.6	0.9-2.9	1.59	0.9-2.9

Table 5. Weighted modes for chronic depression

Variable	Model A		Model B		Model C		Model D		Model E		Model F		Model G	
Obs.	3,867		3,852		3,852		3,840		3,839		3,838		3,837	
Age Cat.	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
[18-30)	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
[30-40)	1.1	0.6-2.0	1.1	0.6-2.1	1.1	0.6-2.1	1.1	0.6-2.1	1.1	0.6-2.1	1.1	0.6-2.0	1.0	0.6-2.0
[40-50)	1.8	1.0-3.4	1.8	1.0-3.5	1.8	0.9-3.4	1.8	0.9-3.4	1.8	0.9-3.4	1.7	0.9-3.3	1.7	0.9-3.3
[50-60)	2.4	1.2-4.9	2.0	1.0-4.1	2.0	1.0-4.0	1.9	1.0-3.9	1.8	0.9-3.6	2.0	1.0-3.9	1.9	0.9-3.7
[60+)	0.9	0.4-2.3	0.6	0.2-1.5	0.5	0.2-1.4	0.5	0.2-1.4	0.5	0.2-1.4	0.5	0.2-1.4	0.6	0.2-1.4
Sex	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Male	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Female	2.9	1.8-4.8	2.6	1.5-4.5	2.7	1.5-4.6	2.7	1.6-4.7	2.7	1.6-4.7	2.8	1.6-4.7	2.8	1.6-4.8
Region	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Europe	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Asia/Pacific	1.5	0.7-3.5	1.4	0.6-3.2	1.7	0.7-3.9	1.9	0.8-4.6	1.9	0.8-4.6	1.9	0.8-4.7	1.9	0.8-4.7
Latin-Amer	2.7	1.3-5.6	2.0	0.9-4.3	2.4	1.1-5.2	2.8	1.2-6.3	2.8	1.2-6.3	2.4	1.1-5.5	2.5	1.1-5.6
Middle East	1.1	0.3-3.8	1.0	0.3-3.3	1.0	0.3-3.4	1.1	0.3-3.7	1.1	0.3-3.6	0.8	0.2-3.2	0.8	0.2-3.2
Africa	0.5	0.1-3.2	0.5	0.1-2.9	0.5	0.1-2.9	0.5	0.1-3.4	0.5	0.1-3.4	0.4	0.1-2.7	0.5	0.1-2.8
Education			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
< 12 years			1.3	0.8-2.1	1.3	0.8-2.2	1.3	0.8-2.2	1.3	0.8-2.1	1.2	0.7-2.1	1.2	0.7-2.0
12+ years			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Marital			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Single			2.1	1.4-3.4	2.1	1.4-3.4	2.1	1.4-3.4	2.1	1.3-3.2	2.2	1.4-3.5	2.1	1.3-3.4
Married			1	Ref	1	Ref	1	Ref	1	Ref	1	Ref	1	Ref
Employ.			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Working			1	Ref	1	Ref	1	Ref	1	Ref	1.0	Ref	1	Ref
Not Working			1.2	0.7-1.9	1.2	0.8-2.0	1.2	0.8-2.0	1.2	0.8-2.0	1.3	0.8-2.2	1.3	0.8-2.1
English			**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
(Linear)			1.0	0.8-1.1	1.0	0.8-1.1	1.0	0.8-1.1	0.9	0.8-1.1	0.9	0.8-1.1	0.9	0.8-1.1
Refugee					**OR**	**95% CI**								
Yes					2.6	1.3-4.9								
No					1	Ref								
Pers*Ref							**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
0 0							1	Ref	1	Ref	1	Ref	1	Ref
1 0							1.4	0.5-3.4	1.4	0.5-3.4	1.1	0.4-2.8	1.1	0.4-2.9
0 1							1.6	0.6-4.4	1.6	0.6-4.4	1.6	0.6-4.6	1.6	0.6-4.6
1 1							4.4	1.8-11.1	4.5	1.8-11.1	4.8	2.1-11.1	4.8	2.1-11.3

Appendix

Appended Table 1: Frequency, Percent, and Mean Sample Weight of Observations, By Sample Stratum

Sampling Stratum	Observations	Percent	Mean Sample Wgt	Weighted Obs
1: Spouse of Citizen	724	16.59	2.04	1476
2. Employment Principle	709	16.25	0.38	267
3. Diversity Principle	616	14.12	0.38	235
4. Other	2,314	53.04	1.02	2365

Appended Table 2: Characteristics of analytic sample compared to participants not analyzed

Variable	Analytic Sample		Not Analyzed*	
Age	**Mean** 39.4		**Mean** 39.4	
Sex	**N**	**%**	**N**	**%**
Male	2,050	42.1	2076	45.4
Female	2,313	57.9	2134	54.6
Region of Birth	**N**	**%**	**N**	**%**
Europe/Cent Asia	778	15.4	715	17.0
Latin-America/Carib	1,709	47.1	1,461	41.7
Asia/Pacific	1,318	27.0	1,435	34.1
Middle East/N Africa	264	5.0	327	7.8
Sub-Saharan Africa	294	5.5	271	6.4
Missing	0	0.0	1	0.0
Education at baseline	**N**	**%**	**N**	**%**
Less than 12 years	1,378	35.6	1,367	36.2
12 years or more	2,976	64.3	2,827	63.3
Missing	9	0.1	13	0.5
Marital Status	**N**	**%**	**N**	**%**
Single	1,181	22.1	1,317	24.9
Not Single	3,180	77.9	2,889	75.0
Missing	2	0.0	4	0.1
Employment	**N**	**%**	**N**	**%**
Working now	2,604	55.6	2,389	54.4
Not Working now	1,753	44.3	1,815	45.5
Missing	6	0.1	6	0.1
English Proficiency	**Mean**		**Mean**	
Ascending Scale from 1-7	4.2		4.1	
Refugee Status	**N**	**%**	**N**	**%**
Refugee	279	6.4	275	6.7
Non-refugee	4,084	93.6	3,935	93.3
Persecution	**N**	**%**	**N**	**%**
No	4,009	91.9	3,931`	93.2
Yes	336	7.6	241	5.9
Missing	18	0.4	38	0.9
Health Selection	**N**	**%**	**N**	**%**
Positive	3,056	69.2	2,970	70.6
Neutral	900	21.2	843	20.0
Negative	259	6.3	218	5.2
Missing	148	3.3	179	4.3
Migration-related Depression	**N**	**%**	**N**	**%**
None	3,414	78.2	3,403	80.9
Lasted < two weeks	466	10.9	353	8.8
Lasted at least two weeks	332	7.5	263	6.0
Missing	151	3.4	191	4.2
General Depression	**N**	**%**	**N**	**%**
Yes	578	14.2	450	10.3
No	3,635	82.4	3,573	80.9
Missing	150	3.4	187	8.8

*Participants who completed the baseline survey but did not complete the follow-up survey were not analyzed

Appended Table 3: Countries of origin categorized into regions

Latin America/Caribbean	Europe/Central Asia	East Asia/South Asia/Pacific	Middle East/North Africa	Sub-Saharan Africa
Colombia	Arctic	China	Ethiopia	Nigeria
Cuba	Canada	India	*Other ME/NA	*Other S-SA
Dominican Republic	Poland	Korea		
El Salvador	Russia	Oceania		
Guatemala	Ukraine	Philippines		
Haiti	United Kingdom	Vietnam		
Jamaica	*Other E/CA	*Other EA/SA/P		
Mexico				
Peru				
*Other LA/C				

*"Other" categories include countries of origin that were aggregated by the NIS in order to protect the identity of participants from countries with relatively few immigrants

Appended Table 4: Crude odds ratios of increasing level of English proficiency on general depression at baseline and at follow-up

Depression at Baseline

Increase in English level	Unadjusted OR	95% CI (lower)	95% CI (upper)
From 1 To 2	1.1	0.7	1.6
From 2 to 3	0.9	0.6	1.1
From 3 to 4	0.7	0.5	1.0
From 4 to 5	0.7	0.5	0.9
From 5 to 6	0.7	0.5	1.0
From 6 to 7	0.5	0.4	0.7

Depression at Follow-up

Increase in English level	Unadjusted OR	95% CI (lower)	95% CI (upper)
From 1 To 2	0.7	0.4	1.1
From 2 to 3	0.6	0.5	0.8
From 3 to 4	0.7	0.4	1.0
From 4 to 5	0.6	0.4	0.8
From 5 to 6	0.5	0.3	0.8
From 6 to 7	0.4	0.3	0.6