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Marie Sugihara Date

Pre-migration experiences of victimization and chronic disease among foreign-born people

By

Marie Sugihara

Master of Public Health

Hubert Department of Global Health

_____

Dr. Solveig Argeseanu Cunningham

Committee Chair

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Marie Sugihara

Doctor of Medicine

Yokohama City University

2009

Thesis Committee Chair: Solveig Argeseanu Cunningham, PhD

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Abstract

Pre-migration experiences of victimization and chronic disease among foreign-born people

By Marie Sugihara

Background: Stressful events may have long-term implications for health and may be particularly common among immigrants. However, victimization as pre-migration stressor has rarely been studied as a risk factor for the development of chronic diseases except for mental illnesses among immigrants.

Objective: This study examines whether pre-migration victimization is associated with post-migration chronic diseases, specifically cardiovascular disease, respiratory disease, metabolic-related disease, arthritis, and cancer.

Methods: We used the New Immigrant Survey, a nationally representative longitudinal study of adult immigrants who obtained lawful permanent residence in the U.S. from June 2003 to June 2004. The adult sample consisted of 8573 respondents. First, correlation analysis between experiences of pre-migration victimization and each chronic disease was conducted using two-sample t-tests and χ^2 tests. The victimizations analyzed were harm due to political beliefs, race, ethnicity or gender; incarceration; physical punishment; confiscation or damage of property; loss of a job; and threats. A bivariate regression model was made to assess the odds ratios for each chronic disease and experience of victimization. Multivariate logistic regression models were used to assess and adjust for potential confounders.

Results: 6.7% of immigrants reported that they had experienced some victimization event. People from Europe/Central Asia, Sub Saharan Africa, and the Middle East/North Africa most often reported such experiences. Significant associations were observed in the bivariate model of cardiovascular disease (OR 1.38 [95%CI 1.05-1.81]), metabolic-related disease (OR 1.42 [95%CI 1.17-1.73]), arthritis (OR 2.06 [95%CI 1.45-2.92]), and cancer (OR 2.67 [95%CI 1.13-6.32]). Victimization was significantly associated with having cardiovascular disease, arthritis, and cancer, controlling for age, age-squared, gender, country of origin, employment, education, marital status, and years of residence in the U.S. (cardiovascular disease: OR 1.41 [95%CI 1.04-1.92], arthritis: OR 2.10 [95%CI 1.43-3.07], cancer: OR 3.32 [95%CI 1.36-8.10]), but not with respiratory disease and metabolic-related disease.

Conclusion: Pre-migration victimization was associated with developing cardiovascular disease, arthritis, and cancer but not with respiratory disease and metabolic-related disease. The result may have a significant implication as it points to the need to understand the health conditions of immigrants looking at both pre-and post-migration characteristics as a part of their life course.

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Chapter 1: Introduction

Chronic diseases have been leading causes of mortalities and morbidities in the U.S., and they account for most of the healthcare spending (Bauer et al. 2014). The U.S. healthcare expenditure has risen dramatically, and it accounts for 17.6 % of GDP in 2010 (Thorpe & Philyaw 2012). One of the reasons for the rising healthcare cost is known to be the increase of chronic diseases (Thorpe & Philyaw 2012), so preventive health measures and early detection of such disease are important for the reduction of the healthcare cost.

Immigrants consist of about 13.5 % of the total U.S. population in 2015 (Zong 2017), and they have often been considered to be healthier than the U.S. born population (Afable et al. 2016; Hao & Kim 2009). However, this appears to be less often the case with respect to chronic diseases, such as obesity and diabetes, which have been shown to be high on arrival or increase with time in the U.S. Thus, examining the factors associated with the development of chronic diseases among immigrants has the public health significance in understanding chronic diseases.

The etiology of chronic diseases is complex and is often linked to environmental conditions and exposures (Vineis et al. 2014). Post-migration characteristics that are associated with the development of chronic diseases have been studied elsewhere. For example, the length of time the immigrants have stayed in the U.S. is known to have a positive association with the development of obesity (Commodore-Mensah et al. 2016). The region of origin is associated with the prevalence of diabetes (Oza-Frank & Narayan 2010). However, events that immigrants experienced before the migration have rarely been examined in the context of chronic diseases among immigrants.

Many immigrants experience stresses often from experiences of victimization before and during stages of migration (Infante et al. 2012). Victimization is a term that is used in a wide context to describe an event of treating someone unfairly either by physically or emotionally. Pre-migration victimization is known to exist worldwide. For example, asylum seekers face insecurity and trauma events such as brainwashing and murder of family members (Silove et al. 1997). Some undocumented immigrants experience verbal and written threats when they cross the border (DeLuca et al. 2010). Children are also victims of victimization due to separation from their parents (Perreira & Ornelas 2013). These experiences may have implications for health. For example, undocumented immigrants and asylum seekers who experienced insecurity before migration are reported to have an increased risk of getting post-traumatic stress disorder (Rasmussen et al. 2007; Silove et al. 1997). Saarela et al. studied the effect of forced migration among Finns who had to migrate to the Soviet Union after the World War II and reported that the risk of mortality among displaced male increased by 20 % (Saarela & Finnas 2009).

In general population, good amount of studies have revealed that traumatic events such as abuse or violence are associated with some of the chronic diseases such as cardiovascular diseases (Cohen et al. 2007; May-Ling et al. 2015), diabetes, arthritis (Afifi et al. 2016; Von Korff et al. 2009), pulmonary disease (Afifi et al. 2016) and mental illnesses (Cohen et al. 2007). However, although immigrants decide to immigrate for a various reason and some of their pre-migration events cause stress, victimization as pre-immigration acute stressor has rarely been studied as a risk factor for the development of chronic diseases except for mental illnesses among the immigrant population. We hypothesized that the experiences of victimization are associated with other chronic diseases along with mental illness among immigrants.

In this study, we described the prevalence of exposure to victimization before migration among immigrants using the New Immigrant Survey, a nationally representative longitudinal study of adult immigrants who obtained lawful permanent resident status in the U.S. from June 2003 to June 2004. We aimed to assess whether the pre-migration experiences of victimization are associated with post-migration chronic diseases, specifically cardiovascular disease, respiratory disease, metabolic-related disease, arthritis, and cancer. The dataset we used is unique because it has detailed data about pre-migration and migration pathways of immigrants in the U.S.

Early screening can decrease long-term morbidity, and patients with chronic diseases require continuous disease management. Thus, this study will enable us to take an early measure to protect the lives of immigrants by understanding about prevalence and risk factors associated with chronic diseases among them. Also, the importance of life course health care in understanding chronic diseases has been discussed in the previous literature (Imura 2013; Parekh & Zizza 2013; Sivasankaran & Thankappan 2013). The pre-migration experiences and exposures of immigrants consist as a part of their life courses among immigrants and considering the pre-migration factors would be meaningful in expanding the existing etiologies of chronic diseases.

Chapter 2: Literature review/Background

1. Immigrants in the United States

1-1. Population characteristics

International migration occurs due to several drivers. One driver is the situation in the country of origin, such as economic situation, political status, wars, and natural disasters which force people to move to other countries (Marc R. Rosenblum 2011). Another driver is the attractive factors in the country of destination, such as job opportunity and safety (Marc R. Rosenblum 2011). The other factor is a social network that allows families to integrate into the destination by migrating to the country (Marc R. Rosenblum 2011). The Office of the United Nations High Commissioner for Refugees (UNHCR) reported that the number of people who were displaced worldwide has almost doubled since the 1990s, and that 65.6 million people were displaced at the end of 2016 because of persecution, conflict, and violations of human rights (Adrian Edwards 2017; United Nations High Commissioner for Refugees 2017). Among them, 10.3 million people were newly displaced in the year 2016 (Adrian Edwards 2017; United Nations High Commissioner for Refugees 2017).

There has also been a dynamic movement of people who enter the U.S. 69,920 people came to the U.S. as refugees, 26,124 people were granted asylum status, and about one million people newly obtained lawful permanent residence status in 2015 (Office of Immigration Statistics - The Department of Homeland Security 2016). About 30 % of these refugees came from Africa, 60 % came from Asia, and rest came from other regions (Office of Immigration Statistics - The Department of Homeland Security 2016). There are also people who come to stay in the U.S. for a short time. 181 million people stayed in the U.S. with nonimmigrant admission status in 2015 to

travel, work, or study for a limited time (Office of Immigration Statistics - The Department of Homeland Security 2016).

Lawful permanent residents are non-citizens who are issued a green card and are authorized to live and stay in the U.S. permanently under the Immigration and Nationality Act. There are several kinds of people who become lawful permanent residents. The large proportion of new lawful permanent residents consists of immediate relatives of U.S citizens and constitutes more than 40 % of new lawful permanent residents every year (Baugh 2017). In 2015, the proportion of new family-sponsored immigrants including immediate relatives of U.S. citizens among all lawful permanent residents was 64.6 %, refugees and asylums were 14.5 %, and immigrants who became lawful permanent residents under employment-based preferences were 13.7 % (Baugh 2017).

1-2. Victimization

Immigrants have a wide variety of backgrounds including positive and negative experiences in the country of origin, family circumstances, cultures, and ethnicity. One reason why immigrants have to migrate is victimization in the country of origin. The word "victimization" is used in several ways such as peer victimization, crime victimization, or political victimization. Crime victimization is defined as "the idea that the moral status of a wrongful act turns in part on the degree to which the wrong's victim is vulnerable or innocent, and the wrongdoer preys upon that vulnerability or innocence (Kleinfeld 2013)". In National Crime Victimization Survey, it is explained as "nonfatal personal crimes (rape or sexual assault, robbery, aggravated and simple assault, and personal larceny) and household property crimes (burglary, motor vehicle theft, and other theft) (Bureau of Justice statistics 2016)". Peer victimization is often studied in school settings where it is defined as the personal or emotional

experience of bullying (Hutson 2017). In this study, we use the word “victimization” as a wider context, treating someone unfairly to the extent that he or she is affected physically or emotionally and focus especially on pre-immigration victimization.

A wide variety of cases about pre-immigration victimization, which can be considered to have a huge impact on immigrants’ health, have been reported worldwide. Saarela et al. showed how forced migration affected the mortality of immigrants among Finns who had to migrate to the Soviet Union after the World War II and reported that the risk of mortality among displaced male increased by 20 % (Saarela & Finnas 2009). Mollica et al. studied the mental impact on Cambodians of trauma by displacement in Thailand-Cambodia border camps (Mollica et al. 1993). Undocumented immigrants who migrate through the US-Mexican border also experienced violence, such as verbal and physical threats and assaults (Infante et al. 2012). They perceived that they were putting themselves and their families at risk by crossing the border (DeLuca et al. 2010), and some undocumented immigrants face posttraumatic stress disorder (Rasmussen et al. 2007). Children also experience pre-migration victimization due to separation from their parents and family separation (Perreira & Ornelas 2013). Asylum seekers face insecurity and trauma before immigration. Silove reports that among the trauma events which were experienced by asylum seekers, 57.9 % was were seeing murder of family member or friend, 47.4 % were seeing unnatural death of family member or friend, 44.7 % were being close to death, 42.1 % were forced separation from family members, 36.8 % were brainwashing, 31.6 % were sickness without access to health care, and 31.6 % were serious injury (Silove et al. 1997). The high exposure to that pre-migration trauma was associated with a diagnosis of posttraumatic stress disorder (Silove et al. 1997).

1-3. Migration stress

Migration is a tremendous life event for immigrants. As mentioned before, immigrants decide to immigrate or are forced to leave their home countries for various reasons, and they are affected physically as well as psychologically by the migration, especially those who have experienced victimization. Some effects of victimization could be explained by stress. Stress that immigrants experience due to migration has been discussed elsewhere. Stress is a broad term, and there is no consensus on its definition. Monroe defines stress as "an organism's adaptation to challenging environmental conditions over time" (Monroe 2008). Stress due to migration has been studied in previous literature and has been perceived in several ways. Gallo et al. defined stress of people with a Hispanic/Latino background in three categories: chronic stress, perceived stress, and traumatic stress when she studied the association between stress and cardiovascular disease (Gallo et al. 2014). Chronic stress was defined as stress due to prolonged stressors because of life domains such as financial problems, employment, health problems of the person or someone close to them and drug or alcohol problems (Gallo et al. 2014). Perceived stress was defined as stress from the person's perspective, and traumatic stress was stress due to traumatic events such as physical or sexual assault, natural disaster, or combat exposure (Gallo et al. 2014).

Acculturative stress is another term that has been used (Caplan 2007; K. H. Lee & Woo 2013; S. Singh et al. 2015). It is stress due to acculturation processes that immigrants face when they encounter a new environment in the host country such as culture, lifestyle, norms, or diet. It was defined in three categories: instrumental such as financial, language barrier, lack of access to health care, unemployment, and lack of education; social stress such as loss of social network or social status and changing gender roles; and societal such as stigma, legal status, and political forces (Caplan 2007).

Jasso, who is a principal investigator of the New Immigrant Survey explained two kinds of stress in her article: visa stress and migration stress (Jasso 2011). Visa stress is a stress that immigrants experience during the process of acquiring a legal permanent residence status and migration stress is stress while immigrants encounter adjusting to a new country (Jasso 2011). Both can be experienced simultaneously depends on immigrants' situations and the extent of the stress which they experience differ. Migration stress is used similarly to the acculturative stress, and visa stress may be considered as one of the pre-immigration stresses. Jasso explains that refugees or asylees may experience a little visa stress because the more difficult part in their migration process is to obtain the initial refugee or asylees status than getting legal permanent residence statuses afterward (Jasso 2011).

Of these categories of stress, victimization may be considered as traumatic or acute stress compared to other acculturative or chronic stress although immigrants may suffer by continuous stress after the experience of victimization. Also, immigrants may suffer from visa stress or some kinds of stress during the pre-migration process because of victimization depends on their situations.

2. Immigrants' Health

2-1. How we consider immigrants' health and what has been discussed

Immigrants have been observed to be healthier in general compared to the U.S. born population (Afable et al. 2016; Argeseanu Cunningham et al. 2008; Barger & Gallo 2008; Barrington et al. 2010; Bennett et al. 2007; Elo & Culhane 2010; Hao & Kim 2009; Mehta et al. 2015). It is often called "Immigrant Health Advantage" (Afable et al. 2016) or "Healthy Immigrant Effect" (Hao & Kim 2009). One reason why immigrants are considered as a healthier population compared to the

U.S. born population are that immigrants may be a healthier group of people in the home country compared to those who did not migrate and are left in the home country (Marmot et al. 1984). Another good explanation is that the culture or healthy habits that immigrants bring from their home country make them healthier than the U.S. born population (Afable et al. 2016).

However, "Immigrant Health Advantage" appears to be less often the case with respect to some aspects of immigrants' health. Heterogeneity in health among immigrants was discussed as one of the notable characteristics in immigrants' health (Argeseanu Cunningham et al. 2008; Choi 2012). Heterogeneity in the prevalence of overweight and obesity was reported among immigrants in the U.S. within and across the countries of origin due to nutrition transition (Choi 2012). The health status of immigrants changes rapidly after migration due to acculturation and becomes similar to that of the U.S. born population (Delavari et al. 2013; Olson et al. 2017). On the other hand, opposed to the discussion of diminished "Immigrant Health Advantage" by acculturation, Beker et al. reported that children of less-acculturated mothers who have low English proficiency were more likely to be obese (Baker et al. 2015), which suggests that acculturation could impact obesity both in a positive and negative way, and that it may not be the only factor that puts immigrants' health in danger.

Social determinants of health among immigrants have also been discussed. Access to health care, insurance issues, and frequent use of the emergency rooms were reported as some of the problems that immigrants encounter when they seek health care in the U.S. (Derose et al. 2009). Language barriers and lack of access to preventive medicine were considered as risk factors for cardiovascular disease among low-income Latino women (Koniak-Griffin & Brecht 2015).

Most of the discussion of immigrants' health and its risk factors are related to post-migration characteristics or events, and few focus on pre-immigration ones. However, considering life course approach, it would be reasonable to think about pre-immigration characteristics or events as well.

2-2. Prevalence and discussion about chronic health condition among immigrants

Chronic diseases are complex and are linked to many environmental conditions and exposures such as age, sex, ethnicity, pre-existing health conditions, environmental factors, and cultures (Vineis et al. 2014). Early detection or preventive screening often decrease long-term morbidity, and patients with chronic diseases require continuous follow-ups. Thus, understanding about prevalence and risk factors associated with chronic diseases among immigrants will enable us to take early measures to protect their lives.

The prevalence of diabetes among immigrants in the U.S was studied using the National Health Interview Survey (1997-2005) (Oza-Frank & Narayan 2010). It has been reported that the prevalence of diabetes adjusted by gender and age among European immigrants was 3.1 % whereas the prevalence among the Indian subcontinent was the highest percentage of 10.0 %, followed by Africa, Mexico, Central America, and Caribbean (Oza-Frank & Narayan 2010). It has also been reported that the prevalence of diabetes among immigrants increases by the length of stay in the U.S. after migration (Oza-Frank et al. 2011). Another study from the Hispanic Community Health Study/Study of Latinos, which is a large cohort study targeted to more than 16,000 Hispanics in the U.S., revealed that the prevalence of diabetes among Hispanic/Latinos, including immigrants and non-immigrants in the U.S., was 16.9 % (McCurley et al. 2015). In the US, the prevalence of diagnosed diabetes was reported to be 8.3 % in 2012 among adults who

answered the National Health Interview Survey (Geiss et al. 2014). It is hard to compare each study because the way they asked and conducted interviews is different. However, we may be able to say that health status regards to diabetes among immigrant population is not any better than the U.S. born population especially among those from certain countries of origin.

Several characteristics have been investigated in relation to obesity among immigrants in the U.S. The length of time that immigrants have stayed in the U.S. has been observed in many literatures and is known to have a positive association with the development of obesity. Some studies had cut-off points of 10 years (Commodore-Mensah et al. 2016; Goel et al. 2004) whereas others had 15 years (Bharmal et al. 2015; Kaplan et al. 2004). Frank et al. analyzed the New Immigrant Survey and showed that both men and women from low socio-economic countries increase their BMI with US tenure, and the BMI increases as they stay in the US longer, which suggested the homogeneity of the change of BMI after migration by the country of origin (Frank & Akresh 2013). The generation of immigrants was another popular characteristic that was associated with obesity among immigrants (Popkin & Udry 1998; G. K. Singh et al. 2009). Also, ethnicity (Wen et al. 2013) and socioeconomic status (Cook et al. 2017; Van Hook & Balistreri 2007), region of birth (Oza-Frank & Narayan 2010), age at arrival (Roshania et al. 2008), legal status (Yeh et al. 2016), educational status (Albrecht et al. 2013), and food hardship experiences (Caspi et al. 2017) were linked to obesity among immigrants. Neighborhood environment after migration was also studied but had both a positive (Wen & Maloney 2011) and a negative (Nobari et al. 2013) association with becoming obese. Lack of social support and post-immigration stress have been an emerging theme in the context of studying obesity as well (Tovar et al. 2013).

Regarding cardiovascular disease among immigrants, it is difficult to understand the actual prevalence of hypertension among immigrants. The National Health and Nutrition

Examination Survey from 1998-2008 revealed that people who were born outside of the U.S. are more likely to have undiagnosed hypertension or uncontrolled hypertension compared to the U.S. born population (Zallman et al. 2013). 27.7 % of foreign-born adults had undiagnosed hypertension, and 61.6 % of them had uncontrolled hypertension (Zallman et al. 2013). This implies the importance of social determinants of health when we think about immigrants' health, such as access to health care or insurance issues.

The occurrence of stroke among immigrants has rarely been studied in the U.S., but one cohort study in Ontario, Canada revealed that the incident rate of acute stroke among new immigrants was 1.69 per 10,000 person-years, which was lower than long-term residents (Saposnik et al. 2010). In not only strokes but also other chronic diseases in general, there is a concern that non-communicable diseases have been poorly studied among African immigrants in the U.S. by comparison to communicable diseases such as tuberculosis and HIV/AIDS (Venters & Gany 2011).

In addition to cardiovascular disease and metabolic-related diseases, arthritis is a chronic disease that is also considered as an important chronic disease in assessing immigrants' health. A study of 200 adult Filipino Americans in Philadelphia revealed that 28.9% had diagnosed arthritis, where arthritis was considered as a condition including rheumatoid, gout, lupus and fibromyalgia (Bhimla et al. 2017). A study of 1,430 patients on rheumatoid arthritis in Sweden including 139 immigrants showed that the subjective scores of perceived pain and function were worse in immigrants compared to the Swedish-born population (Andersson et al. 2013). However, the objective test score of the inflammation did not have a significant difference (Andersson et al. 2013). This result may be explained by a consequence of the different perception of pain and

stress due to immigration, which may cause a limitation in conducting a self-reporting survey comparing immigrants and U.S. born population.

Regarding respiratory diseases, chronic obstructive pulmonary disease is known to have a strong association with smoking statuses in the general population. In the Hispanic population, the Hispanic Community Health Study/Study of Latinos revealed that Puerto Ricans and Cubans had a higher prevalence of chronic obstructive pulmonary disease compared to other Hispanics due to prior asthma diagnosis and smoking status (Puerto Ricans 14.1 % v. Cubans 9.8 % v. Other <6 %) (Barr et al. 2016). It has also been reported that there is a difference by race controlling for smoking status (Gilkes et al. 2016). A cross-sectional study of 358,614 people in London revealed that black and Asian people were less likely to develop chronic obstructive pulmonary disease compared to white people, controlling for smoking (Gilkes et al. 2016). For asthma, a study of the Hispanic Community Health Study/Study of Latinos showed that the prevalence of asthma is higher among the US-born population and those Hispanics who immigrated as children compared to those who immigrated as adults (19.6 % v. 19.4 % v. 14.1 %) (Barr et al. 2016).

The Swedish immigrant's study showed that the incidence rate of cancer is known to be lower among immigrants compared to the native population because of the Westernized lifestyle is known to be one of the causes to develop cancer (Hemminki et al. 2014). Another study looking at cancer moralities among immigrants in Canada showed that the immigration status has a favorable effect on cancer mortalities (Cheung et al. 2017). However, the incidence of cancer among immigrants in the U.S. is not well understood. There are a few studies which have shown disparities of cancer outcomes and cancer screening rates among non-Hispanic White populations in the U.S. (Hurtado-de-Mendoza et al. 2014; H. Y. Lee et al. 2017).

3. How traumatic stressful events can affect health condition in general population

Not only immigrant populations but also other populations, in general, have experienced some kind of traumatic violence or trauma in their lives which may cause a huge impact on their health. The Australian Longitudinal Study on Women's Health showed that mid-aged women who experienced some kind of abuse, either physically, mentally, or sexually, are more likely to develop coronary heart disease by 50 % (May-Ling et al. 2015). The Canadian Community Health Survey-Mental Health also showed that children who have experienced abuse either physically or mentally are more likely to develop arthritis, high blood pressure, chronic lung disease, stroke, and cancer, controlling for obesity, smoking status and socioeconomic background (Afifi et al. 2016). The mechanism of the relationship between childhood abuse and health status in adulthood is not well understood, but a study in laboratory suggests that childhood abuse is related to a C-reactive protein in adulthood, which can lead to elevated health risks (Schrepf et al. 2014). The World Mental Health Surveys also showed that childhood psychosocial stressful events such as physical and sexual abuse and neglect increase the risk of development of arthritis in adulthood by 20-40 % (Von Korff et al. 2009).

When we consider these traumatic experience as stress, the positive association between stress and chronic diseases, especially cardiovascular diseases, diabetes, and mental illness, has been studied elsewhere in the general population, while there have been controversial discussions about the association between stress and chronic disease especially for cancer. Chronic lung diseases have not been studied in a way that psychological stress may develop the disease but in a way that the chronic lung disease may impair psychological state (Connolly & Yohannes 2016; Zawada et al. 2015).

The association between stress and cardiovascular disease has been discussed by looking at some social factors that may cause some stress (Albus 2010). In regards to acute stress, stressful events such as the death of immediate family, disasters, and war are known to increase the risk of getting cardiovascular diseases (Cohen et al. 2007). Chronic stress, such as lack of social support and social isolation, has a strong association with coronary heart disease and stroke (Bunker et al. 2003; Stuller et al. 2012). In regards to work-related stress, a dose-response relationship between the amount of work and the risk of getting cardiovascular diseases has been shown in some studies (Steptoe & Kivimaki 2012). Laboratory experiments have revealed that stress is associated with some pathogenic pathways that lead to increases in coronary artery diseases (Cohen et al. 2007).

The association between traumatic events and mental illnesses has been revealed, specifically for posttraumatic stress disorder, depression, anxiety disorders, and cognitive impairment (Cohen et al. 2007; Schneiderman et al. 2005).

The association between diabetes and stress has been observed as well. Hyperglycemia caused by acute stress has a negative effect on the maintenance of glucose level in diabetes patients. However, the effect of the hyperglycemia on the development of type 2 diabetes among healthy people is still controversial (Marcovecchio & Chiarelli 2012; Surwit et al. 1992). Stress may promote the development of type 2 diabetes indirectly by because there is a relationship between stress and obesity (Marcovecchio & Chiarelli 2012). A prospective cohort study targeting 10,308 adults in London has shown an association between stress at work and the development of the metabolic syndrome (Chandola et al. 2006).

Regarding cancer, it has been discussed elsewhere that stress can be one of the complex causes of developing cancer, but the mechanism is unclear (Butow et al. 2000). Some previous

literature showed a significant association between psychological stress due to severe life events and cancer especially for breast cancer (Kruk 2012; Lillberg et al. 2003) However, it is still controversial whether psychological factors can be one of the causes to develop cancer (Butow et al. 2000; Schraub et al. 2009) . One of the reasons for little evidence regarding the relationship between stress and cancer is a non-theoretical approach to examine stress or stressful events and insufficient power in most of the previous studies (Butow et al. 2000).

4. Victimization and health condition in immigrant populations

The relationship between mental illness and stress among immigrants have been studied in several literatures (Bas-Sarmiento et al. 2017; Hollifield et al. 2002). Some of the characteristics have been considered as a risk factor for the development of mental illness among immigrants, such as being female, low social and economic status, involuntary migration, time of residence in the migrated country, poor physical status, and difficulties of acculturation (Bas-Sarmiento et al. 2017). Although post-migration stressors have been focused on when assessing immigrants' health (Shishehgar et al. 2015), victimization as pre-immigration acute stressor has rarely been studied except for one cross-sectional study conducted using the New Immigrant Survey in 2003, which showed a significant association between preimmigration harm and depression among immigrants (Montgomery et al. 2014).

The Hispanic Community Health Study focusing on health of Latinos, a prospective cohort study conducted in 2010/2011 targeting 5,313 adults of Hispanic/Latino background showed that chronic stress increases a prevalence of coronary heart disease, diabetes, and hypertension, and on the other hand, traumatic events decrease a prevalence of diabetes (Gallo et al. 2014; McCurley et al. 2015). An oral glucose tolerance test targeting 3,923 adults from the same cohort showed that the association between chronic stress and prevalence of type 2 diabetes

is due to poor glucose regulation before the diagnose of diabetes (McCurley et al. 2015). A cross-sectional study conducted in Pennsylvania from 2005 to 2008 targeting 423 Chinese immigrant women has shown a significant positive association between negative life events, using a Life Experiences Survey, and insulin resistance (Fang et al. 2015).

A cross-sectional study using the national database of the Dutch Community Health Services for Asylum seekers targeting 105,180 adults has shown a significant association between posttraumatic stress disorder and a higher prevalence of type 2 diabetes among those who are not diagnosed as repression (Agyemang et al. 2012).

The evidence is not enough about the association between stressful events and cancer among immigrants. Previous studies have studied the relationship between stigma and development of cancer especially among Asian immigrants in the U.S., but the findings are still controversial (Lebel et al. 2016).

There are also a few studies of African immigrants. A cross-sectional survey conducted targeting 129 African immigrants in 2008/2009 showed no association between migration stress measured by the Acculturative Stress Scale for International Students and blood pressure levels (Daramola & Scisney-Matlock 2014). The stress measured in this study was perceived discrimination/hate/rejection, homesickness, culture shock, and stress due to change and guilt (Daramola & Scisney-Matlock 2014). Another study targeting 238 African immigrants conducted by the National Institutes of Health revealed that the allosteric load score, which demonstrates the physiological effect of stress on cardiovascular, metabolic, and immune systems, was negatively associated with family reunification (Bingham et al. 2016).

5. Aim of this study

The fig. 1 shows the conceptual framework describing what is suggested from previous literature about the factors that contribute to the development of chronic diseases in the immigrant population. Several literatures suggest that post-migration factors that are sometimes discussed in relation to acculturation contribute to the development of chronic disease, especially metabolic-related disease, cardiovascular disease, respiratory disease, and mental illness among immigrants (Barr et al. 2016; Hale et al. 2014; Oza-Frank & Narayan 2010; Zallman et al. 2013). Although few studies were available about arthritis and cancer among immigrants regarding post-migration factors including migration/acculturation stress, general psychological stress have been discussed as one of the promoters in developing such diseases in general population (Kruk 2012; Von Korff et al. 2009). Regarding pre-migration factors, previous literature suggested that pre-migration victimization is related to the development of mental illness (Montgomery et al. 2014).

In Fig. 1, individual and environmental factors are classified into three categories: pre-migration, post-migration and other personal characteristics. For the pre-migration factor, we focused on the pre-migration victimization for our study. As much previous literatures argue that a multi-social ecological approach shows how several levels of individual and social environment factors are embedded in development of a disease throughout the life course, these multi-level factors in the Fig. 1 should affect the development of disease as a distal determinants of chronic diseases (Gary-Webb et al. 2013). Pre-migration victimization leads to pre-migration stress as the pathway from traumatic events to stress has been discussed (Roth & Cohen 1986). Also, a cognitive activation theory of stress shows that a load of some stressor leads to stress response through the brain (Ursin & Eriksen 2004). The characteristics shown in the post-

migration situation are known to be the factors that contribute to acculturation which in some situations lead to the development of chronic disease (Alidu & Grunfeld 2017; Gary-Webb et al. 2013). They also lead to migration and acculturation stress (Caplan 2007; Jasso 2011). The outcomes in Fig. 1 is classified into two categories; mental illness, and chronic diseases other than mental illness because the latter diseases are the ones we will use for this study. A dotted line is an association that we are trying to test in our study.

People decide to migrate for various reasons, and some of them are due to victimization in the country of origin. Also, there are a good amount of studies that revealed that traumatic, stressful events such as abuse or violence are associated with some of the chronic health conditions specifically cardiovascular diseases, diabetes, arthritis, respiratory diseases, mental illness, and cancer. However, victimization as pre-immigration acute stressor has rarely been studied as a risk factor for the development of these diseases except for mental illness among the immigrant population. A few studies have focused on chronic stress and other diseases. However, most of them focus on a certain ethnicity or a certain community. Risk factors of immigrant health have often focused on post-migration characteristics and less on pre-migration factors. Pre-migration factors should be considered as well as other post-migration experiences when we observe immigrants' health as a part of their life course.

In this study, we aimed to assess whether the pre-migration experiences of victimization are associated with post-migration chronic diseases, specifically cardiovascular disease, respiratory disease, metabolic-related disease, arthritis, and cancer. This study will contribute to the existing knowledge on the etiology of chronic diseases among the immigrant population.

Chapter 3: Methods

1. Study Population and Data Source

1-1. Study Population

The main research purpose for the analysis was to understand whether there is an association between pre-migration experiences of victimization and chronic health condition after migration to the U.S. The study population to answer this was all adult immigrants who are 18 and older and obtained lawful permanent resident status in the U.S. from June 2003 to June 2004.

1-2. The New Immigrant Survey

The dataset used for this analysis was the New Immigrant Survey, a nationally representative longitudinal study of immigrants, sampled at the point of receiving permanent resident status. It is a public data-use database jointly organized by four institutions: RAND, Princeton University, New York University, and Yale University. It is also supported by the National Institute of Health, the National Institute of Child Health and Human Development, the National Institute on Aging, the Office of Behavioral and Social Science Research, the National Science Foundation, the U.S. Immigration and Naturalization Service, the Office of the Assistant Secretary for Planning and Evaluation and the Pew Charitable Trusts. The New Immigrant Survey was developed to address scientific and policy questions regarding the impact of migration and migration behavior and to understand the fundamental characteristics of immigrants, such as the assimilation of immigrants and their families, achievements and burden

of immigrants, and the pathways of migrations. There is no such other publicly available dataset that has detailed information about migration in the U.S.

The New Immigrant Survey has conducted this survey three times. A pilot survey (NIS-P) was carried out from October of 1996 to February 1998 to design and shape the full NIS. The first full cohort (NIS-2003-1) was sampled, and the baseline survey was conducted from June 2003 to June 2004. They were followed up from June 2007 to December 2009 for the second survey (NIS-2003-2). For this analysis, NIS-2003-1 was used.

The sampling frame for each survey was based on the electronic administrative records about new immigrants organized by the U.S. government. It included all adult immigrants who had obtained legal permanent residence and two kinds of children who were not with the adult immigrants: adopted orphans under five years and minor children of U.S. citizens. Thus, the sampling frame represents both immigrants who have newly arrived in the U.S. with immigrant documents and those who have already stayed in the U.S. with a temporary nonimmigrant visa or have stayed illegally and obtained a legally permanent visa.

1-3. The sampling method and data collection for NIS-2003-1

The adult sample from NIS-2003-1 was used for this analysis. The adult samples are those who are 18 and older and obtained lawful permanent resident status from June 2003 to June 2004. The number of sampled cases was 12,500 in the Adult Sample, and they were stratified into four strata: spouses of U.S. citizens (2,064, 16.5 %), employment principals (2,064, 16.5 %), diversity principals (1,688, 13.5 %), and other immigrants (6,635, 53.5 %). Immigrants who became legal permanent residents with an employment-based visa as a principal

were oversampled. Then, a random-number statistical method was used to select the first x cases in each stratum to generate eight replicates for eight sampling periods. The duplicates of samples, such as two selected individuals married to each other, were identified at the time of sampling and in the field. The latter individual was replaced with another individual in the subsequent replicate, which resulted in a final sample size of 12,488. The surveys were mailed to the address to which the selected immigrant requested the green card be sent as soon as the lawful permanent resident status was admitted. Then, 60 % of the adult sample interviews were conducted by phone-survey, and the rest were conducted by the in-person survey. In result, the adult sample consisted of 8,573 respondents with a response rate of 68.6 %.

To calculate sampling weights, 32 stratum-replicate-specific sampling fractions were created from eight replicates and four stratums that divided the size of the sample by the number in the sampling frame. Each stratum-replicate-specific fraction was multiplied by the entire sampling frame over all replicates and strata and divided by the number sampled over all replicates to generate stratum-replicate-specific sampling ratio. The reciprocal of each ratio was the design weights.

The survey was conducted in the preferred language of the respondent to maximize response rate and data quality. Survey instruments were drafted in English and were translated into seven languages: Chinese, Korean, Polish, Russian, Spanish, Tagalog, and Vietnamese. Also, key concepts and consent forms were translated into an additional seven languages: Arabic, Farsi, French, Gujarati, Hindi/Urdu, Serbo-Croatian, and Ukrainian. For the interviews in Chinese, Korean, Polish, Russian, Spanish, Tagalog, Vietnamese, Amharic, French, and Haitian

Creole, the interviews were conducted by bilingual interviewers. For all the other languages, interviews were conducted by a team of an interviewer and an interpreter.

The NIS-2003-1 survey included questions separated into several modules: demographics, pre-immigration experiences, employment, health, health and life insurance, health care utilization and daily activities, income, assets, transfers, social variables, and migration history. The adults were also asked parent/guardian related questions and completed a home-SF assessment if they had a child.

2. Data work

2-1. Obtaining NIS-2003-1 dataset

The New Immigrant Survey was available in two forms depending on the nature of the variables: public use dataset and restricted use contractual dataset. For this analysis, only the public use dataset was used. To obtain access to the dataset, users need to register in an online registration form maintained by the Office of Population Research Data Archive. The data are available in SAS, STATA, and SPSS. The NIS-2003-1 dataset contains 27 files available to download. For this analysis, demographics (NIS03-A_sas), employment (NIS03-C_sas), health (NIS03-D_sas), migration history (NIS03-K_sas), and appendum (NIS03-N_sas) were downloaded.

2-2. Variables used

2-2-1. Outcome variables

For this analysis, the outcome variables that were used to examine were self-reported chronic diseases, specifically: perceived health condition, cardiovascular disease, respiratory disease, metabolic-related disease, cancer, and arthritis. All the questions asking about the respondent's past or current health status except for any acute illnesses and mental illness in the health (NIS03-D_sas) dataset were included in this analysis.

1) Perceived health condition

Indication of a perceived health condition was determined through the question, "Would you say your health is excellent, very good, good, fair, or poor?" coded in five categories: excellent, very good, good, fair, or poor. For this analysis, it was recoded in two categories: excellent, very good and good; and fair and poor. Those who did not answer, answered "do not know," or refused to answer all the questions were coded as missing.

2) Cardiovascular disease

For this analysis, a new binary variable to describe the history of cardiovascular disease was created including those who answered yes to the questions of the history of high blood pressure, heart problem, myocardial Infarction, angina, congestive heart failure, or stroke at least once.

Indication of high blood pressure was determined through the question, "Has a doctor ever told you that you have high blood pressure or hypertension?" coded by yes or no. Indication

of heart problems was determined through the question, “Has a doctor ever told you that you had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems?” coded by yes or no. Indication of myocardial infarction was determined through the question, “Have you ever had a heart attack or myocardial infarction?” coded by yes or no. Indication of angina was determined through the question, “During the last year have you had any angina or chest pains due to your heart?” coded by yes or no. Indication of congestive heart failure was determined through the question, “In the last year has a doctor told you that you have congestive heart failure?” coded by yes or no. Indication of stroke was determined through the question, “Has a doctor ever told you that you had a stroke?” coded by yes or no.

3) Respiratory disease

For this analysis, a new binary variable to describe the history of respiratory disease was created including those who answered yes to the questions of the history of chronic lung disease and asthma at least once.

Indication of chronic lung disease was determined through the question, “Has a doctor ever told you that you have chronic lung disease such as chronic bronchitis or emphysema?” coded by yes or no. Indication of asthma was determined through a question, “Have you ever had, or has a doctor ever told you that you have asthma?” coded by yes or no.

4) Metabolic-related disease

For this analysis, a new binary variable to describe the history of metabolic-related disease was created, including those who answered yes to the questions of diabetes or whose BMI falls into categories or either overweight, obese, or class3obese.

Indication of diabetes was determined through the question, “Has a doctor ever told you that you have diabetes or high blood sugar?” coded by yes or no. BMI was calculated by using self-reported height and weight, and categorized in five categories: underweight, healthy weight, overweight, obese, and class3obese. BMI of less than 10 and more than 65 was considered as extreme and changed to missing.

5) Arthritis

Indication of arthritis was determined through the question, “Have you ever had, or has a doctor ever told you that you have arthritis or rheumatism?” coded by yes or no. Those who did not answer, answered “do not know,” or refused to answer this question were recoded as missing.

6) Cancer

Indication of cancer was determined through the question, “Has a doctor ever told you that you have cancer or a malignant tumor, excluding minor skin cancers?” coded by yes or no. Those who did not answer, answered as “do not know” or refused to answer this question were recoded as missing.

2-2-2. Main exposure variables of interest

The main exposure of interest was whether the respondent reported that he, she, or their immediate family had experienced acts of victimization in their home country, specifically harm due to political beliefs, race, ethnicity or gender; incarceration; physical punishment by public officials or others; confiscation of property; property damage; loss of job; and verbal or written

threats. All the questions regard to victimization in the home country were obtained from the migration history (NIS03-K_sas) dataset.

1) Any harm due to political beliefs, race, ethnicity or gender

Indication of any harm due to political beliefs, race, ethnicity or gender was determined through the 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?” coded by yes or no. This question was asked to all the sampled adults. Those who did not answer answered as “do not know,” or refused to answer this question were recoded as missing. This variable was the primary exposure variable of interest that was used for regression models.

2) Other variables in regards to victimization

Questions of specific kinds of victimization were asked to all the respondents who did not say no to the first 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?” The question started by asking, “Did any of the following happen to you or your immediate family outside of the United States because of your political or religious beliefs, or your race, ethnicity or gender?”, and asked about several kinds of victimization, specifically: incarceration, physical punishment by public officials, physical punishment by others, confiscation of property, loss of job, property damage, and verbal or written threats. The answer for each question was coded by yes or no. Also, those who were not asked about these questions because they answered no to the first 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?" were recoded from missing to no.

2-2-3. Other exposure variables of interest

Other exposure variables that may be relevant to health, specifically: age, gender, race/ethnicity, country of origin, years of residence in the U.S., year of the first arrival in the U.S., employment status, educational status, marital status, and smoking status were accounted for in the analysis.

1) Age

Age was calculated by subtracting year of birth from the year of the interview, determined through the question "In what year were you born?" Both the year of birth and the year of the interview were obtained from the demographics (NIS03-A_sas) dataset. Those who did not answer, answered as "do not know," or refused to answer the year of birth were recoded as missing.

2) Age squared

Age squared was calculated by squaring the age variable to identify an inflection point where the rate of the effect by age changes either from negative to positive or positive to negative. This second derivative was added to the age variable because the effect of age on the health outcome was not considered constant.

3) Gender

Indication of gender was determined in the demographics (NIS03-A_sas) section through the question, “I need to ask these questions of everyone, are you male or female?” coded by male, female, refused, or do not know.

4) Race

Indication of the race was determined in an appendum (NIS03-N_sas) section through the question, “What race do you consider yourself to be? Select one or more of the following,” coded by five categories, specifically: American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White. For analysis, they were recoded in three categories: white, black and other. American Indian or Alaska Native, Asian and Native Hawaiian or Other Pacific Islander were included in the category “other.” Those who did not answer, answered “do not know”, or refused to answer this question were recoded as “other”.

This variable was used for descriptive analysis to understand the characteristics of the target population for this study. However, it was not used for logistic regression models because it was too correlated with the country of origin variable.

5) Ethnicity

Indication of ethnicity was determined in an appendum (NIS03-N_sas) section through the question, “Surveys of American citizens typically ask questions on ethnicity and race. How would you answer these questions? Do you consider yourself to be Hispanic or Latino?” coded

by yes and no. Those who did not answer, answered “do not know,” or refused to answer this question were recoded as missing.

In the same way as the race variable, this variable was used for descriptive analysis to understand the characteristics of the target population for this study. However, it was not used for logistic regression models because it was too correlated with the country of origin variable.

6) Country of origin

Indication of the country of origin was determined in a demographics (NIS03-A_sas) section through the question, “In what country were you born?” Those who did not answer, answered “do not know,” or refused to answer this question were recoded as missing. All the countries were recoded in seven categories, specifically: North America, Latin America and the Caribbean, East and South Asia/Pacific/Oceania, Sub Saharan Africa, Europe/Central Asia, and Middle East/North Africa.

7) Years of residence in the U.S.

Instead of calculating the years of residence in the U.S. by using only one variable about the year of the first arrival in the U.S., we decided to calculate the total duration of trips in the U.S. This is because Redstone et al. analyzed the New Immigrant Survey and the U.S. census to compare how the question about year of arrival in the US in the U.S. census is different from the total duration of trips in the U.S. which was asked in the New Immigrant Survey (Redstone & Massey 2004).

We calculated indication of years of residence in the U.S. by adding all the years over and above the first 60 days that an immigrant stayed in the U.S. for this analysis through the questions: “In what country were you born?”, “About what age were you when you left that country? To what country did you move at that time?” and “Did you subsequently leave that country to live in another country for at least 60 days?’’. The third question was asked multiple times in the New Immigrant Survey until the respondent finished moving to other countries for more than 60 days. We added all the stays in the U.S. that was more than 60 days-duration. The stays that were less than 60 days were not captured in this analysis because of the way the question was asked. All the data were obtained from the migration history (NIS03-K_sas) dataset.

8) Year of the first arrival in the U.S.

Indication of the year of the first arrival in the U.S. was defined as the year that an immigrant stayed in the U.S. for more than sixty days for the first time. The data were obtained from the migration history (NIS03-K_sas) dataset. Those who did not answer, answered “do not know,” or refused to answer the questions were recoded as missing. The years were recoded in four categories: before 1980, before 1990, before 2000, and after 2000.

This variable was used for descriptive analysis to understand the characteristics of the target population for this study. However, it was not used for logistic regression models because it was too correlated with the years of residence in the U.S. variable.

9) Employment

Indication of employment status was determined in employment (NIS03-C_sas) section, through the question, “Now I am going to ask you some questions about your current employment situation. Are you working now, temporarily laid off, unemployed and looking for work, disabled and unable to work, retired, a homemaker, or what?” coded by seven categories: working now; unemployed and looking for work; temporarily laid off, on sick or other leave; disabled; retired; homemaker; or other. They were recoded in a binary variable, employed and not employed. Those who answered “working now” were recoded as employed and the rest were recoded as not employed. Those who did not answer, answered “do not know,” or refused to answer this question were recoded as missing.

10) Education

Indication of education completed was asked in a demographics (NIS03-A_sas) section, through the question, “Now, I have a few questions about your education. How many years of schooling in total have you completed?” Those who did not answer, answered as “do not know,” or refused to answer this question were recoded as missing. The years of education completed were recoded as a binary variable: more than twelve years and less than twelve years.

11) Marital status

Indication of marital status was determined in a demographics (NIS03-A_sas) section, through the question, “Are you now **?” with six categories to answer: married; living together in a marriage-like relationship but not married; separated; divorced; widowed; or never married, not living with someone in a marriage-like relationship. Those who answered either married or

living together in a marriage-like relationship but not married were recoded as married, and others were recoded as unmarried. Those who did not answer, answered as “do not know,” or refused to answer this question were recoded as missing.

12) Smoking status

Indication of smoking status was determined in health (NIS03-D_sas) section, through the question, “Do you smoke cigarettes now?” coded by yes or no. Those who did not answer, answered as “do not know,” or refused to answer this question were recoded as missing.

This variable was used for descriptive analysis to understand the characteristics of the target population for this study. However, it was not used for logistic regression models because it was not the purpose of this study to identify the effect of behavioral factors on a health outcome.

3. Data analysis

All downloaded datasets of adult samples, specifically: demographics (NIS03-A_sas), employment (NIS03-C_sas), health (NIS03-D_sas), migration history (NIS03-K_sas), and appendum (NIS03-N_sas), were merged by respondent ID, and variables were recoded as needed before analysis. Sampling weights were used for all the analysis and data were analyzed using SAS 9.4. As the sampling weights were calculated for each combination of four strata and eight replicates already, and the inclusion of the strata variable made no difference in the significance level and standard errors in the outputs, the strata variable was not included in the final analysis.

Subpopulation was used for all the analysis. For the subpopulation, those who had missing data in any of the variables that were used in the logistic regressions; primary

victimization of interest, age, gender, employment, education, marital status, years of residence in the U.S. and country of origin, were dropped from the entire analysis. There were 597 data that were dropped.

First, descriptive analysis was conducted to assess and describe the prevalence of each kind of victimization among total adult samples and correlations between experiences of victimization and each health condition. Correlation analysis was conducted to examine statistical significance in the association of victimization and each health condition using a χ^2 test. Among the several kinds of victimization variables, a variable asking about any harm due to political beliefs, race, ethnicity, or gender was used as a primary victimization of interest for the rest of the analysis as the largest number of adult samples answered yes to the question.

Another descriptive analysis was conducted to assess correlations between experiences of primary victimization and each health condition, and the primary victimization and other exposure variables of interest. Correlation analysis was conducted to examine statistical significance in each association using two-sample t-tests and χ^2 tests.

Multivariate logistic regression models were used to assess and adjust for potential confounders. In these models, the outcome was each self-reported chronic disease which was statistically significant in the correlation analysis. The primary exposure of interest was the primary victimization of interest. First, the bivariate regression model for each disease was made. Next, three multivariate logistic regression models were made for each disease: a model controlling for age, age-squared, and gender; a model controlling for age, age-squared, gender and country of origin; and a model controlling for age, age-squared, gender, country of origin, employment, education, marital status, and years of residence in the U.S. Subpopulation was used and R-square was calculated for all logistic regression models.

Finally, the interaction was assessed for two variables: years of residence in the U.S., and gender for the association of each health condition and a primary victimization of interest.

We assessed the interaction by years of residence in the U.S. because we hypothesized that if the stress from pre-migration victimization exposure may diminish as people stay longer in the U.S. which may have a favorable effect on the development of chronic disease. Thus, although we saw a significant association between victimization and cardiovascular disease, and victimization and arthritis, and we did not see any outstanding coefficient in the years of residence variable in the regression model, we hypothesized that the association might differ if we stratify the population by years of residence in the U.S. by setting a cut-off point of the years.

Gender was also assessed as an interaction because some literature suggests a gender difference in a way people react by traumatic events saying that women are more sensitive to traumatic events (Modena et al. 2017), and a high prevalence of the post-traumatic disorder in women (Silove et al. 2017). Thus, we hypothesized that women might be more vulnerable to getting the illness from the exposure of victimization and gender may describe the significant heterogeneity in the association between victimization and chronic diseases.

We set the alpha level of interaction to 0.1 to identify interaction better as some literature have previously suggested (Kaestle et al. 2005; Kirrane et al. 2005) although to raise the alpha level in assessing interaction is still controversial (Marshall 2007).

4. Ethical considerations

Since all the variables that were used for this analysis were downloaded from public use dataset, IRB submission before this study was not required.

Chapter 4: Results

1. Description of Study Population Participants

Table 1 displays the prevalence among adult immigrants 18 and older who obtained legal residence in the U.S. between June 2003 and June 2004 of victimization in their home country experienced by themselves or members of their immediate family. 6.69 % of the population experienced any type of harm due to political beliefs, race, ethnicity, or gender; 1.79 % experienced incarceration; 2.45 % experienced physical punishment by public officials; 2.34 % experienced physical punishment by others; 1.95 % experienced confiscation of property; 2.95 % experienced property damage; 3.01 % experienced loss of job; and 5.12 % experienced verbal or written threats. More than half people reported experience of more than one type of victimization, and average number of the reported victimization was 3.38.

Table 2 demonstrates the correlations between the prevalence of chronic diseases and experiences of primary victimization of interest which is any type of harm due to political beliefs, race, ethnicity, or gender experienced by participants or their immediate family. Those who had experienced victimization more frequently reported cardiovascular disease (13.24 % v. 9.98 %, p=0.0212), metabolic-related disease (51.44 % v. 42.65 %, p=0.0004), arthritis (8.33 % v. 4.23 %, p<0.0001), and cancer (1.35 % v. 0.51 %, p=0.0198) than those who had not experienced victimization.

Appendix 1 shows the correlations between the prevalence of more detailed chronic diseases and the experiences of all victimizations of interest. A significant positive correlation was observed between reporting a poor or fair health condition and having experienced some kinds of victimization; any type of harm due to political beliefs, race, ethnicity, or gender;

physical punishment by others; loss of job; property damage; or verbal or written threats. Among those who had experienced any type of harm due to political beliefs, race, ethnicity, or gender, 15.47 % reported a poor or fair health condition, whereas 9.35 % of those who had not experienced victimization reported the same condition (p<0.0001). Another significant positive correlation was observed between those who were overweight, obese, or class 3 obese and those who had experienced some kinds of victimizations; any type of harm due to political beliefs, race, ethnicity, or gender; incarceration; physical punishment by public officials; physical punishment by others; loss of job; verbal or written threats. The prevalence of overweight, obese, or class 3 obese individuals was 50.32 % among those who had experienced any type of harm due to political beliefs, race, ethnicity or gender, and 41.33 % among those who had not experienced victimization (p<0.0001). 6.92% among those who had experienced the victimization reported more than one type of disease. Appendix 2 shows a detailed finding on the number of chronic disease people reported. Although the majority reported only one type of chronic disease, people reported up to six types of chronic diseases.

Table 3 shows the socio-economic and demographic characteristics of immigrants who reported that they had or had not experienced any type of harm due to political beliefs, race, ethnicity, or gender by themselves or members of their immediate family. The mean age of those who had experienced the victimization was 40.2 years old, and that of those who had not was 39.0 years old. Men more often reported having experienced victimization (8.0 % for men v. 5.7 % for women). White and black participants reported having experienced victimization more than did other races (8.6 % for white v. 8.6 % for black v. 3.7 % for other). Those who were employed often reported having experienced victimization (8.6 % for employed v. 4.3 % for unemployed) and those who had completed more than 12 years of education often reported

having experienced victimization (5.2 % for less than 12 years of education v. 7.6 % for more than 12 years). Those who had immigrated from Europe/Central Asia, Sub-Saharan Africa, and the Middle East/North Africa more frequently reported having experienced victimization (14.2 % for Europe/Central Asia, 12.8 % for Sub-Saharan Africa, and 11.4 % for Middle East/North Africa), while those from North America, East, and South Asia/Pacific/Oceania, and Latin America and the Caribbean less frequently reported victimization (1.9 % for North America, 3.4 % for East and South Asia/Pacific/Oceania, and 5.1 % for Latin America and the Caribbean). Those who experienced victimization had lived in the U.S. longer, with the mean year of those who had experienced victimization being 7.2 years, and the mean year of those who had not being 5.2 years. Those who had arrived in the U.S. for the first time in the 1980s and 1990s more often reported experiencing harm than those who arrived later (9.9 % in the 1980s, 9.3 % in the 1990s, and 4.8 % in the 2000s).

2. Bivariate logistic regression models for cardiovascular disease, respiratory disease, metabolic-related disease, arthritis, and cancer

Table 4 shows the bivariate odds ratios for each chronic disease and having experienced any type of harm due to political beliefs, race, ethnicity, or gender. In the bivariate model, those who reported having experienced victimization had odds of a cardiovascular disease that was 1.38 times that of those who had not experienced victimization (95% CI 1.05-1.81). Those who reported having experienced victimization had odds of metabolic-related disease that was 1.42 times that of those who had not experienced victimization (95% CI 1.17-1.73). Those who reported having experienced victimization had odds of arthritis that was 2.06 times that of those who had not experienced victimization (95% CI 1.45-2.92). Additionally, those who reported having experienced victimization had odds of cancer that was 2.67 times that of those who had

not experienced victimization (95% CI 1.13-6.32). No significant association was observed in the bivariate model between respiratory disease and victimization.

3. Multivariate logistic regression models for cardiovascular disease, respiratory disease, metabolic-related disease, arthritis, and cancer controlling for selected characteristics

Table 5 shows three kinds of regression models demonstrating the correlation between each chronic disease and having experienced any type of harm due to political beliefs, race, ethnicity, or gender by themselves or members of their immediate family controlling for selected characteristics: a model controlling for age, age-squared, and gender (Model 1); a model controlling for age, age-squared, gender, and country of origin (Model 2); and a model controlling for age, age-squared, gender, country of origin, employment, education, marital status, and years of residence in the U.S. (Model 3).

For all the models of cardiovascular disease, victimization was significantly associated with having cardiovascular disease, controlling for other variables (model3: OR 1.41 [95%CI 1.04-1.92]). Older immigrants were more likely to have cardiovascular disease controlling for other variables in Model 3 (OR for age 1.13 [95%CI 1.09-1.18]), and age squared showed that the effect of age is linear for all ages. Employed immigrants were less likely to have cardiovascular disease than unemployed immigrants, controlling for other variables, in Model 3 (OR for employment 0.69 [95%CI 0.56-0.85]). The proportion of variance explained by Model 3 was 21.18 %.

For all the models of respiratory disease, victimization was not significantly associated with respiratory disease, and none adequately explained the proportion of variance.

For Model 1 and Model 2 of metabolic-related disease, victimization was significantly associated with metabolic-related disease, controlling for other variables (Model 1: OR 1.28 [95%CI 1.05-1.57], Model 2: OR 1.28 [95%CI 1.04-1.58]). Older immigrants and male immigrants were more likely to have metabolic-related disease (OR for age 1.12-1.14, OR for male 2.00). Those from East and South Asia/Pacific/Oceania, Sub Saharan Africa, and Europe/Central Asia were less likely to have metabolic-related disease compared to those from Latin America and the Caribbean. The proportion of variance explained by Model 1 was 7.15 %, and that by Model 2 was 13.97 %. For Model 3, victimization was not significantly associated with metabolic-related disease, controlling for other variables.

In all models, victimization was significantly associated with arthritis, controlling for other variables (Model 3: OR 2.10 [95%CI 1.43-3.07]). Older immigrants, female immigrants, and unmarried immigrants were more likely to have arthritis, controlling for other variables (OR for age 1.16-1.17, OR for male 0.50-0.55, and OR for married 0.70). Age squared showed that the effect of age is linear for all ages. The proportion of variance explained by Model 3 was 22.26 %.

In all models, victimization was significantly associated with cancer, controlling for other variables (Model 3: OR 3.32 [95%CI 1.36-8.10]). Due to the relatively small sample size, the confidence intervals were large for all the Models.

4. Assessing interaction

The interaction was assessed for two variables: years of residence in the U.S., and gender for the association between victimization and each chronic disease.

Table 6 shows the association between victimization and each chronic disease stratified by years of residence in the U.S. by considering those who have stayed in the U.S. more than ten years and less than ten years, controlling for the same variables as Model 3. Significant relationships between victimization and each chronic disease were observed, especially among those who have stayed in the U.S. fewer than ten years for cardiovascular disease, metabolic-related disease, and arthritis (cardiovascular disease: OR 1.52 [95%CI 1.06-2.17], metabolic-related disease: OR 2.49 [95%CI 1.05-5.94], arthritis: OR 1.77 [95%CI 1.11-2.83]). However, Breslow-Day test for homogeneity showed that years of residence in the U.S. was an interaction of the association only for respiratory disease but not for other chronic diseases (p=0.0724).

Table 7 shows the association between victimization and each chronic disease by gender, controlling for the same variables as Model 3. Significant relationships between victimization and both cardiovascular disease and cancer were observed among males (cardiovascular disease: OR 1.66 [95%CI 1.09-2.52], cancer: OR 9.29 [95%CI 2.54-33.91]). Breslow-Day test for homogeneity showed that the association was significantly different stratified by gender in cardiovascular disease and cancer but not in other diseases.

Chapter 5: Discussion/Conclusion/Recommendation

This study examined whether there is an association between pre-migration experiences of victimization and chronic health conditions after migration to the U.S. While the prior research shows how the experiences of victimization affect mental health, research and information relevant to the effect of victimization on chronic health conditions among immigrants are lacking. This study added the existing literature by examining the effect of victimization on other diseases such as cardiovascular diseases, respiratory diseases, metabolic-related diseases, arthritis, and cancer to test the hypothesis that victimization experience before migration is associated with chronic health conditions after migration and to learn that the factors before migration are not negligible, when we look at chronic health condition among immigrants.

1. Main findings

Bivariate analysis using logistic regression revealed that there is a significant relationship between pre-migration experience of victimization due to political beliefs, race, ethnicity, or gender by themselves or members of their immediate family and having a diagnosis of cardiovascular disease, metabolic-related disease, arthritis, and cancer. However, closer examination using multivariate analysis revealed that the relationship between the experience of victimization and chronic health condition was only significant in cardiovascular disease, arthritis and cancer, but not in respiratory disease and metabolic-related diseases, controlling for age, age-squared, gender, country of origin, employment, education, marital status, and years of

residence in the U.S. To the best of our knowledge, since there has been no study that looks at pre-migration victimization and health conditions except for mental illness among the immigrant population in the U.S. of all races and ethnicity, it is difficult to assess the consistency with previous research. However, when victimization is considered as a wider term such as "previous traumatic events", or "stressful events" and is not limited to pre-migration victimization, there are some similarities that are found in previous research. Our findings are consistent with previous research among the general population that showed the association between the previous experience of traumatic events and the development of cardiovascular disease and arthritis (Afifi et al. 2016; May-Ling et al. 2015; Von Korff et al. 2009). Our findings are also consistent with previous research among the immigrant population that showed the association between chronic stress and cardiovascular disease among the Hispanic population, although it was not the association with acute traumatic stress but chronic stress (Gallo et al. 2014). Whether the stress from pre-migration victimization as acute stress or chronic stress is not clear, and it is not something we were able to test in this study. Cancer among immigrants has rarely been studied in the context of its association with stressful events. However, our finding was consistent with some of the previous literature that showed the relationship between psychological stress and development of cancer in the general population, although the discussion is still controversial (Kruk 2012; Lillberg et al. 2003). We found a significant relationship between victimization and cancer. However, due to the small sample size, the confidence intervals were relatively large for all the models we analyzed, which made our findings less precise.

The relationship between metabolic-related disease and experience of victimization was not significant in multivariate analysis, although some previous research shows a positive

association: negative life events are associated with insulin resistance among Chinese immigrants (Fang et al. 2015), and chronic stress is associated with diabetes among the Hispanic population (Gallo et al. 2014). One potential explanation about our study's finding on metabolic-related disease is the effect of country of origin on the association between victimization and chronic disease. People from Latin America and the Caribbean are more likely to develop metabolic-related diseases compared to other regions, such as East and South Asia/Pacific Oceania and Europe/Central Asia, so those differences may have neutralized the association. Our finding that showed the difference in an odds ratio of metabolic-related disease by country of origin was consistent with previous research that showed the difference of prevalence of diabetes by country of origin (Oza-Frank & Narayan 2010). Although our study did not stratify the model by country or region of origin, such analysis may have revealed that people from certain countries or regions show a stronger association between pre-migration victimization and the development of metabolic-related disease than people from other countries or regions.

Both of our bivariate and multivariate analyses did not find a significant relationship between respiratory disease and victimization. This finding was inconsistent with previous research that looked at the significant association between previous experience of traumatic violence and chronic lung disease in the general population (Afifi et al. 2016), although few studies have been done in the past about the association between the development of respiratory disease and previous traumatic or stressful experiences. One possible explanation for our finding is that two questions asking about asthma and chronic lung diseases, such as chronic bronchitis and emphysema, were included together in the variable of respiratory disease. The reason we conducted our analysis in this way is that both chronic bronchitis and emphysema are classified as chronic lower respiratory diseases in ICD10-CM (Centers for Disease Control and Prevention

2017). Our decision to perform analysis in this way may not have been appropriate regarding the association between victimization and the development of chronic diseases, because known mechanisms of developing the diseases are different (Abramson et al. 2014; Hekking & Bel 2014; Ohara et al. 2016). However, Appendix 1 shows that, even though we analyzed chronic lung disease and asthma separately by looking at the correlation with each victimization by χ^2 test, neither of the associations were significant for chronic lung disease and asthma. This may be because of the sample size issue, so the result from Appendix 1 does not necessarily mean that stratification by the kinds of respiratory disease would be meaningless. Another thing we may need to consider is that the self-reporting of the health condition may have misclassified the variable of respiratory disease, especially because the diagnosis of asthma is complex and often based on clinical information (Busse 2011). Further research in which asthma and chronic lung disease are analyzed separately and the severity of the disease is accounted for may be necessary in order to consider the effect of victimization on respiratory diseases more closely.

We analyzed three models for each disease using three different sets of variables to control the association between victimization and each disease. The proportion of variance explained improved more in Model 1 in all the diseases analyzed. However, the proportion of variance explained did not improve further in cardiovascular disease and arthritis in Model 2 and Model 3, and the OR did not change dramatically in the models. This means that additional information on country of origin, employment, years of education, marital status, and years of residence in the U.S., which we included as control variables in Model 2 and Model 3 in cardiovascular disease and arthritis, did not confound the relationship between victimization and each disease. We did not expect this result when we designed the models because those controlling variables were correlated with the experience of victimization in Table 3 and are also

known to be associated with cardiovascular disease and arthritis (Bell et al. 2017; Bjornnes et al. 2018; Brennan-Olsen et al. 2017; Jiang et al. 2015; Kakinami et al. 2017).

On the other hand, the presence of the controlling variables, such as country of origin, employment, education, marital status, and years of residence, explained more in Model 2 and Model 3 in metabolic-related disease and cancer. This suggests that the presence of those variables, some of which are considered as post-migration environmental factors, confound the association between pre-migration and both metabolic-related disease and cancer. This result for metabolic-related disease was consistent with what we expected because the variables were correlated with the experience of victimization, which Table 3 shows, and they are also known to be associated with metabolic-related disease (Ng & Su 2017; Strauss et al. 2016).

The detailed study on various kinds of victimizations shown in Appendix 1 revealed that individuals reporting poor or fair health conditions are more likely to have experienced some kinds of victimizations: any type of harm due to political beliefs, race, ethnicity, or gender; physical punishment by others; loss of job; property damage; or verbal or written threats. The self-rated health is known to be a useful measure in capturing overall health status (Lu et al. 2017). The prevalence of poor or fair health status was 15.47% among those who experienced victimization, which was higher compared to 9.35% of those who did not experience victimization. A longitudinal study using the Survey of Income and Program Participation from 1996 to 2008 showed that the prevalence of those who reported poor, fair health status was 9% among immigrants in the U.S., which was consistent with our result (Lu et al. 2017).

A previous research study looking at the association between self-rated health and social capital especially on interpersonal networks among Korean woman immigrants showed that the immigrants who have more inter-ethnic networks with native-born neighbors have better self-

rated health than those who rely on co-ethnic networks (Kim 2018). Our result that victimization has a negative effect on self-reported health may be because the immigrants who have experienced victimization may tend to seek more co-ethnic networks, which leads to a worse perceived health status. For example, the countries that have more victimizations than other countries may have a certain custom that forms co-ethnic networks.

2. Other relevant findings

Analysis on socio-economic and demographic characteristics of those who experienced victimization and those who did not reveal that those who experienced victimization were older; male; currently employed; having completed more than 12 years of education; born in either Europe/central Asia, sub Saharan Africa, or middle east/north Africa; lived in the U.S. longer; and first arrived in the U.S. in either the 1980s or the 1990s. There were not existing literatures available that support this result. However, the fact that education and current employment status were correlated with the experience of victimization may suggest that, among those who have experienced victimization in home countries, those who are more educated and have more abilities to get jobs were able to migrate to the U.S. and others had to remain in their home country as internally displaced persons. The regions of origin that have more people who experienced victimization include countries that recently experienced war or conflict, including but not limited to the Bosnia War, the Rwandan Genocide, and the Gulf War. Further analysis of these countries instead of regions of origin would be necessary to see the detailed events that caused victimization.

A significant difference was found in the association between the experience of victimization and the development of cardiovascular diseases stratified by gender. This finding suggested that men are more vulnerable to exposure to victimization. The reason for this is

unclear, and few studies have explored the importance of gender difference in the association between victimization and cardiovascular disease. However, the result is inconsistent with some similar previous research. One study looking at post-traumatic stress after the earthquake in Italy in 2012 showed that more women than men reported having strokes, transient ischemic attacks, atrial fibrillation, deep venous thrombosis, pulmonary embolism, panic attacks, aspecific chest pain, and Tako Tsubo cardiomyopathy and DVE/PE, which suggests that women are more sensitive to traumatic events (Modena et al. 2017). Another study shows that the prevalence of post-traumatic stress disorder is twice as high among women as men (Silove et al. 2017). The reason our result was inconsistent with previous literature may be due to the strength or kinds of the victimization that people faced, which we did not include in our study for this time. In addition, the victimization variable included the experience of victimization by themselves or members of their immediate family in the New Immigrant Survey. So, if we were able to limit the victimization as the only direct experience of victimization, there may have been other gender proportions.

The variable of years of residence in the U.S. was not interaction in the association between the experience of victimization and a diagnosis of chronic diseases except for respiratory disease. This result suggests that the stressful effects of pre-migration victimization do not diminish over time. This pre-migration stress is different from post-migration stress which is known to be related to years of residence in the U.S. (Commodore-Mensah et al. 2016; Goel et al. 2004).

Appendix 1 shows the correlations between the prevalence of more detailed chronic diseases and the experiences of all categories of victimization. The correlation between arthritis and victimization was significant in all types of victimization. It is notable to see that the

significant relationship is not limited to the victimization by physical punishment, which may obviously lead to physical damage to the skeletal system. The result is consistent with previous literature that shows that psychosocial stress leads to the development of arthritis (Afifi et al. 2016; Von Korff et al. 2009). Another finding we learned from Appendix 1 is that there were more people who were overweight, obese or class 3 obese among those who experienced victimization compared to those who did not for all the types of victimizations except for the victimization related to the property. No other consistent pattern was found regarding the types of victimization and the relationship between victimization and health conditions. Analysis on comorbidity in Appendix 2 showed that about 7% of those who experienced victimization reported having more than one type of disease. Having multiple chronic diseases is also an issue in the general population in the U.S., and it is a significant impact on both economically and functional status of patients (Buttorff et al. 2017; Cortaredona & Ventelou 2017).

3. Limitations and future directions

This study has several important limitations. Due to the nature of the variables available, the victimizations that were analyzed were experienced either by the immigrants themselves or by their immediate family, which we were unable to separate in our analyses. It is possible that immigrants themselves experienced victimization directly or indirectly through their immediate family, which may have affected the health outcomes of the immigrants differently, but we were unable to distinguish the difference in our study.

Another limitation is that outcome variables on health conditions were about a current health condition or a history of the health condition but did not include the severity of diseases, which may have caused misclassification of diseases. Also, although the health conditions are

based on a diagnosis previously made by a doctor, it is self-reported by a respondent who may have introduced recall bias.

The other limitation is that since this is a cross-sectional study, it is difficult to determine the causal relationship between exposure to victimization and current health outcomes. Additionally, the timing that immigrants experienced victimization and developed each health condition was not considered in any of the variables. Thus, temporality is not clear, and the duration from the time of victimization to the development of adverse health condition was not considered in this study, which would be a potential future study to consider.

Lastly, the main exposure variable of victimization was about any harm due to political beliefs, race, ethnicity, or gender, which includes multiple contexts, and the wording may have been understood differently by immigrants. It would be desirable to ask questions about political beliefs, race, ethnicity, or gender separately to understand the more nuanced context of victimization, and any qualitative study on the experiences of victimization may supplement this study in future.

4. Strengths

The strengths of this study include its large sample size and inclusion of the whole population of recent immigrants in the U.S. as a study population, regardless of countries of origin and races. Additionally, to the best of our knowledge, this is the first study that assesses pre-migration experiences of victimization and chronic health conditions after migration to the U.S., targeting the whole population of immigrants in the U.S. except for mental illnesses. The nature and uniqueness of the New Immigrant Survey enabled us to examine the relationship between pre-immigration experiences and current health conditions.

5. Conclusion

This study provides the first report on pre-migration experiences of victimization and chronic health conditions after migration to the U.S. among adult immigrants who have recently obtained lawful permanent resident status. Bivariate analysis using logistic regression revealed that there is a significant relationship between pre-migration experience of victimization due to political beliefs, race, ethnicity, or gender by themselves or members of immediate family and diagnosis of cardiovascular disease, metabolic-related disease, arthritis, and cancer. Additionally, multivariate analysis revealed that the relationship between victimization and chronic health conditions was only significant in cardiovascular disease, arthritis, and cancer, controlling for age, age-squared, gender, country of origin, employment, education, marital status, and years of residence in the U.S. These results point to the need to understand the health conditions of immigrants in the U.S., looking at both pre-and post-migration characteristics as a part of their life course.

Appendices

Appendix 1. The difference of prevalence of diseases between those who experienced victimization and those who did not experience victimization.

Any harm due to political beliefs, race, ethnicity or gender

	Any harm due to political beliefs, race, ethnicity or gender (%)		p[a]
	Victimization		
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	15.47	9.35	<.0001
High Blood Pressure	11.50	9.36	0.1221
Heart Problem	3.26	1.65	0.0084
Myocardial Infarction	0.92	0.39	0.0777
Angina	1.30	0.57	0.0506
Congestive Heart Failure	0.81	0.31	0.0743
Stroke	0.42	0.43	0.9734
Chronic Lung Disease	1.45	0.70	0.0553
Asthma	3.65	2.83	0.3419
Diabetes	4.13	3.81	0.7224
Cancer	1.35	0.51	0.0198
Arthritis	8.33	4.23	<.0001
Underweight[b]	7.02	12.09	
Normal BMI[b]	42.66	46.58	<.0001
Overweight, Obese, Class 3 Obese[b]	50.32	41.33	
Reporting more than one type of diseases[c]	6.92	5.36	0.1538

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.
[c] Types of disease include heart problem, high blood pressure, myocardial infarction, angina, congestive heart failure, stroke, chronic lung disease, asthma, diabetes, cancer, arthritis, obesity and underweight.

Incarceration

	Incarceration (%)		p[a]
	Victimization		
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	14.52	9.66	0.0568
High Blood Pressure	9.08	9.51	0.8678
Heart Problem	2.77	1.75	0.3631
Myocardial Infarction	2.05	0.40	0.0032
Angina	0.82	0.62	0.7695

Congestive Heart Failure	0.49	0.34	0.7125
Stroke	0.00	0.44	N/A
Chronic Lung Disease	1.36	0.74	0.3859
Asthma	1.44	2.91	0.2379
Diabetes	7.48	3.77	0.0235
Cancer	1.99	0.54	0.0292
Arthritis	8.87	4.44	0.0143
Underweight[b]	10.41	11.78	
Normal BMI[b]	35.22	46.49	0.0199
Overweight, Obese, Class 3 Obese[b]	54.37	41.73	

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.

Physical punishment, by public officials

	Physical punishment, by public officials (%)		p[a]
	Victimization		
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	13.50	9.65	0.0816
High Blood Pressure	10.01	9.50	0.8173
Heart Problem	1.26	1.78	0.5922
Myocardial Infarction	1.12	0.41	0.1513
Angina	0.60	0.62	0.9698
Congestive Heart Failure	0.00	0.35	N/A
Stroke	0.00	0.44	N/A
Chronic Lung Disease	1.51	0.73	0.2108
Asthma	5.44	2.82	0.0901
Diabetes	4.45	3.83	0.6555
Cancer	2.16	0.53	0.006
Arthritis	9.24	4.40	0.0035
Underweight[b]	7.52	11.87	
Normal BMI[b]	41.15	46.40	0.0304
Overweight, Obese, Class 3 obese[b]	51.33	41.73	

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.

Physical punishment, by others

	Physical punishment, by others (%)		p[a]
	Victimization		
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	17.09	9.57	0.0012
High Blood Pressure	13.90	9.39	0.0545
Heart Problem	2.97	1.74	0.2175
Myocardial Infarction	1.18	0.41	0.1301
Angina	1.86	0.59	0.033
Congestive Heart Failure	0.00	0.35	N/A
Stroke	0.00	0.44	N/A
Chronic Lung Disease	1.41	0.72	0.2594
Asthma	3.63	2.86	0.625
Diabetes	4.10	3.84	0.8541
Cancer	1.28	0.53	0.22
Arthritis	9.63	4.40	0.0014
Underweight[b]	7.82	11.86	
Normal BMI[b]	39.61	46.47	0.0243
Overweight, Obese, Class 3 Obese[b]	52.57	41.67	

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.

Confiscation of property

	Confiscation of property (%)		p[a]
	Victimization		
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	9.86	9.75	0.9638
High Blood Pressure	8.96	9.53	0.8165
Heart Problem	2.54	1.75	0.4688
Myocardial Infarction	2.54	0.38	<.0001
Angina	1.42	0.60	0.2249
Congestive Heart Failure	1.11	0.32	0.083
Stroke	0.00	0.44	N/A
Chronic Lung Disease	0.45	0.75	0.6121
Asthma	3.75	2.86	0.6111
Diabetes	4.02	3.84	0.9094
Cancer	1.99	0.54	0.0255
Arthritis	9.56	4.42	0.0036
Underweight[b]	9.27	11.81	0.6856

Normal BMI[b]	47.25	46.24	
Overweight, Obese, Class 3 Obese[b]	43.48	41.95	

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.

Loss of job

	Loss of job (%)		
	Victimization		p[a]
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	14.10	9.61	0.0258
High Blood Pressure	11.70	9.44	0.2641
Heart Problem	3.39	1.72	0.0637
Myocardial Infarction	1.55	0.39	0.0062
Angina	1.13	0.60	0.3489
Congestive Heart Failure	1.32	0.31	0.0141
Stroke	0.45	0.43	0.972
Chronic Lung Disease	1.53	0.71	0.1365
Asthma	2.79	2.88	0.9366
Diabetes	2.69	3.88	0.3602
Cancer	0.58	0.57	0.968
Arthritis	8.25	4.40	0.0065
Underweight[b]	7.37	11.90	
Normal BMI[b]	43.97	46.33	0.0453
Overweight, Obese, Class 3 obese[b]	48.66	41.77	

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.

Property damage

	Property damage (%)		
	Victimization		p[a]
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	14.71	9.59	0.0141
High Blood Pressure	10.62	9.48	0.5754
Heart Problem	3.59	1.71	0.0406
Myocardial Infarction	2.08	0.38	0.0001
Angina	1.65	0.59	0.0609
Congestive Heart Failure	1.34	0.31	0.0127

Stroke	0.46	0.43	0.953
Chronic Lung Disease	0.71	0.74	0.9539
Asthma	4.49	2.83	0.237
Diabetes	4.69	3.82	0.5204
Cancer	1.77	0.53	0.019
Arthritis	10.00	4.35	0.0002
Underweight[b]	7.65	11.88	
Normal BMI[b]	44.60	46.33	0.1022
Overweight, Obese, Class 3 obese[b]	47.75	41.79	

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.

Verbal or written threats

	Verbal or written threats (%)		
	Victimization		p[a]
	Experienced	Not experienced	
Perceived Health Condition (Poor / Fair)	16.28	9.38	<.0001
High Blood Pressure	11.64	9.40	0.1499
Heart Problem	3.64	1.66	0.0043
Myocardial Infarction	1.20	0.38	0.0161
Angina	1.20	0.59	0.1546
Congestive Heart Failure	1.06	0.30	0.018
Stroke	0.55	0.42	0.721
Chronic Lung Disease	1.47	0.70	0.0834
Asthma	3.59	2.84	0.4629
Diabetes	4.18	3.82	0.7263
Cancer	1.77	0.50	0.002
Arthritis	9.74	4.23	<.0001
Underweight[b]	7.21	12.01	
Normal BMI[b]	41.42	46.53	0.0005
Overweight, Obese, Class 3 obese[b]	51.37	41.46	

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976);
[a] χ^2 test of proportions was used to assess the significance.
[b] Three categories are categorized based on BMI. χ^2 test of proportions for BMI was assessed to identify whether the proportion of BMI status was different depends on the presence of victimization.

Appendix 2. Percentages of immigrants reporting diseases by number of types of diseases and experience of victimization

Number of types of diseases[a]	Experienced victimization[b] (%)	Did not experience victimization[b] (%)	Total (%)
0	70.76 (2.14)	74.91 (0.59)	74.62 (0.57)
1	22.22 (1.96)	19.51 (0.54)	19.70 (0.52)
2	4.91 (1.00)	4.32 (0.26)	4.36 (0.26)
3	1.46 (0.50)	0.92 (0.12)	0.96 (0.12)
4	0.46 (0.33)	0.25 (0.07)	0.27 (0.07)
5	0.19 (0.20)	0.06 (0.03)	0.07 (0.03)
6	-[c]	0.03 (0.02)	0.03 (0.02)

Data sources: The New Immigrant Survey (2003-2004)

Note: Weighted to sample design (N=7976); Standard errors are shown in parentheses.

[a] Types of disease include high blood pressure, myocardial infarction, angina, congestive heart failure, stroke, chronic lung disease, asthma, diabetes, cancer, arthritis, obesity and underweight.

[b] Victimization indicates any harm due to political beliefs, race, ethnicity or gender.

[c] No data.

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Table 1. Percentage of immigrants having experienced victimization in their home country

	Experienced Victimization (%)
Type of victimization*	
Incarceration	1.79
Physical punishment by public officials	2.45
Physical punishment by others	2.34
Confiscation of property	1.95
Property damage	2.95
Loss of job	3.01
Verbal or written threats	5.12
Harm due to political beliefs, race, ethnicity, or gender[a]	6.69
Average number of types of victimizations reported: 3.38 (0.10)[b]	

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sampling design (N=7976).
[a] Harm due to political beliefs, race, ethnicity or gender is the sum of the total of different types of victimization.
b Standard errors is shown in parentheses.

Table 2. The prevalence of diseases by category among those who had vs. had not experienced victimization

Victimization[a]	**Experienced (%)**	**Not experienced (%)**	***p***
Cardiovascular disease[b]	13.24	9.98	0.0212*
Respiratory disease[c]	4.38	3.20	0.1914
Metabolic-related disease[d]	51.44	42.65	0.0004*
Arthritis	8.33	4.23	<.0001*
Cancer	1.35	0.51	0.0198*

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sample design (N=7976); * $p < .05$

[a] victimization indicates any harm due to political beliefs, race, ethnicity, or gender.

[b] Cardiovascular disease includes those who answered yes to high blood pressure, heart problems, myocardial infarction, angina, congestive heart failure, or stroke.

[c] Respiratory disease includes those who answered yes to chronic lung disease or asthma.

[d] Metabolic-related disease includes those who answered yes to diabetes or who are categorized as overweight, obese or class 3 obese.

Table 3. Characteristics of immigrants who reported that they had or had not experienced any type of victimization by themselves or members of their immediate family

Characteristics	Experienced	Not experienced	*p*
Age at interview, mean (SD)	40.2 (12.9)	39.0 (13.8)	0.0636
Gender (%)			0.0003*
Male	51.9	43.0	
Female	48.1	57.0	
Hispanic or Latino (%)			0.0002*
Yes	30.6	39.7	
No	69.4	60.3	
Race by category (%)			<.0001*
White	63.9	48.5	
Black	14.3	10.9	
Other	21.8	40.6	
Country of origin (%)			<.0001*
North America	0.4	1.5	
Latin America, Caribbean	34.1	45.8	
East and South Asia, Pacific, Oceania	14.3	29.0	
Sub-Saharan Africa	12.0	5.8	
Europe, Central Asia	31.9	13.8	
Middle East, North Africa	7.4	4.1	
Current employment (%)			<.0001*
Yes	71.0	53.8	
No	29.0	46.2	
Year of education by category (%)			0.0001*
<12	28.2	37.1	
≥12	71.8	62.9	
Current marital status (%)			0.1743
Married or marriage-like relationship	73.7	76.4	
Other	26.3	23.6	
Current smoking (%)			0.2105
Yes	12.3	10.4	
No	87.7	89.6	
Cumulative years of residence in the US, mean (SD)	7.2 (5.9)	5.2 (6.4)	<.0001*
Year of first arrival at the US (%)			<.0001*
<1980	0.1	2.2	
<1990	18.4	12.2	
<2000	44.3	31.7	
≥2000	37.2	53.9	

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sampling design (N=7976); Two sample t-test was used to calculate p-value for age at interview, years of education and cumulative years of residence in the US.; χ^2 test of proportions was used to calculate p-value for rest of the variables; ** Column percent is listed for categorical variables; ***** $p < .05$

Table 4. Bivariate logistic regression models for predicting cardiovascular disease, respiratory disease, metabolic-related disease, arthritis, and cancer with exposure to victimization

Outcomes	Intercept	OR (95%CI)	Max-rescaled R^2
Cardiovascular Disease	-2.1993	1.38 (1.05, 1.81)	0.0014
Respiratory Disease	-3.4099	1.39 (0.85, 2.27)	0.001
Metabolic-Related Disease	-0.296	1.42 (1.17, 1.73)	0.0026
Arthritis	-3.1191	2.06 (1.45, 2.92)	0.0066
Cancer	-5.2747	2.67 (1.13, 6.32)	0.0088

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sample design (N=7976); Victimization indicates any harm due to political beliefs, race, ethnicity or gender.

Table 5. Multivariate logistic regression models for predicting cardiovascular disease, respiratory disease, metabolic-related disease, arthritis, and cancer controlling for selected characteristics with the exposure of victimization

Cardiovascular Disease

Variable	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 OR (95%CI)
Victimization[a]	1.40 (1.04, 1.87)	1.35 (1.00, 1.82)	1.41 (1.04, 1.92)
Age			
Age	1.12 (1.08, 1.17)	1.13 (1.08, 1.17)	1.13 (1.09, 1.18)
Age-squared	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Gender			
Female	(reference)	(reference)	(reference)
Male	0.91 (0.76, 1.08)	0.91 (0.76, 1.08)	0.98 (0.82, 1.18)
Country of Origin			
North America		1.21 (0.56, 2.59)	1.20 (0.56, 2.59)
Latin America, Caribbean		(reference)	(reference)
East and South Asia, Pacific, Oceania		0.77 (0.63, 0.95)	0.77 (0.61, 0.97)
Sub-Saharan Africa		0.84 (0.57, 1.23)	0.83 (0.56, 1.25)
Europe, Central Asia		1.07 (0.83, 1.38)	1.10 (0.83, 1.46)
Middle East, North Africa		0.77 (0.63, 0.95)	0.76 (0.46, 1.23)
Employment			
Not employed			(reference)
Employed			0.69 (0.56, 0.85)
Years of Education			
Less than 11 years			(reference)
More than 12 years			0.98 (0.80, 1.19)
Marital Status			
Not married			(reference)
Married or marriage-like relationship			1.06 (0.87, 1.29)
Years in the US			1.01 (1.00, 1.02)
Intercept	-6.3956	-6.2075	-6.1109
Max-rescaled R-Square	0.2054	0.2081	0.2118

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sample design (N=7976).
[a] Victimization indicates any harm due to political beliefs, race, ethnicity or gender.

Respiratory Disease

Variable	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 OR (95%CI)

Victimization[a]	1.47 (0.90, 2.40)	1.45 (0.88, 2.40)	1.28 (0.78, 2.11)
Age			
Age	0.94 (0.90, 0.98)	0.94 (0.90, 0.99)	0.94 (0.90, 0.99)
Age-squared	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Gender			
Female	(reference)	(reference)	(reference)
Male	0.75 (0.56, 0.99)	0.75 (0.56, 1.00)	0.70 (0.52, 0.94)
Country of Origin			
North America		1.48 (0.53, 4.15)	1.53 (0.55, 4.26)
Latin America, Caribbean		(reference)	(reference)
East and South Asia, Pacific, Oceania		0.90 (0.64, 1.26)	1.14 (0.77, 1.67)
Sub-Saharan Africa		0.93 (0.51, 1.71)	1.09 (0.58, 2.06)
Europe, Central Asia		1.08 (0.70, 1.66)	1.31 (0.82, 2.08)
Middle East, North Africa		0.66 (0.27, 1.58)	0.81 (0.34, 1.97)
Employment			
Not employed			(reference)
Employed			1.13 (0.82, 1.56)
Years of Education			
Less than 11 years			(reference)
More than 12 years			1.13 (0.82, 1.56)
Marital Status			
Not married			(reference)
Married or marriage-like relationship			0.70 (0.52, 0.95)
Years in the US			1.04 (1.02, 1.06)
Intercept	-1.9495	-1.5334	-1.7526
Max-rescaled R-Square	0.0074	0.0089	0.022

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sample design (N=7976).
[a] Victimization indicates any harm due to political beliefs, race, ethnicity or gender.

Metabolic-related Disease

Variable	**Model 1** OR (95%CI)	**Model 2** OR (95%CI)	**Model 3** OR (95%CI)
Victimization[a]	1.28 (1.05, 1.57)	1.28 (1.04, 1.58)	1.19 (0.96, 1.48)
Age			
Age	1.12 (1.10, 1.15)	1.14 (1.12, 1.17)	1.13 (1.10, 1.15)
Age-squared	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Gender			
Female	(reference)	(reference)	(reference)
Male	2.00 (1.80, 2.23)	2.00 (1.80, 2.24)	1.97 (1.76, 2.20)
Country of Origin			
North America		0.57 (0.35, 0.92)	0.60 (0.36, 1.02)

Latin America, Caribbean		(reference)	(reference)
East and South Asia, Pacific, Oceania		0.31 (0.27, 0.35)	0.37 (0.32, 0.42)
Sub-Saharan Africa		0.60 (0.48, 0.75)	0.72 (0.57, 0.91)
Europe, Central Asia		0.48 (0.41, 0.57)	0.57 (0.48, 0.68)
Middle East, North Africa		0.87 (0.67, 1.14)	1.04 (0.79, 1.37)
Employment			
Not employed			(reference)
Employed			0.98 (0.87, 1.12)
Years of Education			
Less than 11 years			(reference)
More than 12 years			0.94 (0.83, 1.07)
Marital Status			
Not married			(reference)
Married or marriage-like relationship			1.08 (0.96, 1.22)
Years in the US			1.04 (1.03, 1.05)
Intercept	-3.2041	-3.7513	-3.6895
Max-rescaled R-Square	0.0715	0.1397	0.1525

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sample design (N=7976).
[a] Victimization indicates any harm due to political beliefs, race, ethnicity or gender.

Arthritis

Variable	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 OR (95%CI)
Victimization[a]	2.30 (1.56, 3.38)	2.12 (1.44, 3.11)	2.10 (1.43, 3.07)
Age			
Age	1.16 (1.10, 1.23)	1.17 (1.10, 1.24)	1.17 (1.10, 1.24)
Age-squared	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Gender			
Female	(reference)	(reference)	(reference)
Male	0.50 (0.38, 0.66)	0.50 (0.38, 0.66)	0.55 (0.41, 0.73)
Country of Origin			
North America		2.95 (0.93, 9.35)	3.46 (0.93, 12.81)
Latin America, Caribbean		(reference)	(reference)
East and South Asia, Pacific, Oceania		0.89 (0.66, 1.21)	1.11 (0.79, 1.55)
Sub-Saharan Africa		1.06 (0.59, 1.92)	1.20 (0.65, 2.19)
Europe, Central Asia		1.30 (0.91, 1.87)	1.64 (1.09, 2.47)
Middle East, North Africa		1.28 (0.71, 2.29)	1.50 (0.82, 2.75)
Employment			
Not employed			(reference)
Employed			0.91 (0.65, 1.26)

Years of Education			
Less than 11 years			(reference)
More than 12 years			0.76 (0.56, 1.03)
Marital Status			
Not married			(reference)
Married or marriage-like relationship			0.70 (0.53, 0.92)
Years in the US			1.02 (1.00, 1.04)
Intercept	-8.2103	-7.2545	-6.8316
Max-rescaled R-Square	0.2114	0.2157	0.2226

Data sources: The New Immigrant Survey (2003-2004)
Notes: Weighted to sample design (N=7976).
[a] Victimization indicates any harm due to political beliefs, race, ethnicity or gender.

Cancer

Variable	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 OR (95%CI)
Victimization[a]	2.93 (1.25, 6.86)	3.08 (1.27, 7.45)	3.32 (1.36, 8.10)
Age			
Age	1.08 (0.93, 1.26)	1.09 (0.93, 1.26)	1.11 (0.96, 1.27)
Age-squared	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)
Gender			
Female	(reference)	(reference)	(reference)
Male	0.34 (0.16, 0.71)	0.34 (0.16, 0.72)	0.34 (0.16, 0.72)
Country of Origin			
North America		4.07 (0.50, 33.03)	1.68 (0.08, 37.01)
Latin America, Caribbean		(reference)	(reference)
East and South Asia, Pacific, Oceania		1.06 (0.47, 2.42)	1.28 (0.53, 3.11)
Sub-Saharan Africa		—[b]	—[b]
Europe, Central Asia		1.28 (0.53, 3.06)	1.47 (0.54, 3.99)
Middle East, North Africa		0.45 (0.06, 3.62)	0.42 (0.05, 3.83)
Employment			
Not employed			(reference)
Employed			0.33 (0.15, 0.74)
Years of Education			
Less than 11 years			(reference)
More than 12 years			1.74 (0.76, 4.02)
Marital Status			
Not married			(reference)
Married or marriage-like relationship			1.31 (0.57, 3.02)
Years in the US			1.07 (1.04, 1.11)

Intercept	0.8018	-8.0799	-9.0728
Max-rescaled R-Square	0.0970	0.1125	0.1613

Data sources: The New Immigrant Survey (2003-2004)
Note: Weighted to sample design (N=7976).
[a] Victimization indicates any harm due to political beliefs, race, ethnicity or gender.
[b] No data in this category was found in the sample.

Table 6. The association between victimization and each chronic disease by years of residence in the U.S. controlling for age, age squared, country of origin, employment, education, marital status, and gender

Variable	OR[a] (95% CI)		Homogeneity (*p*-value)[b]
	Years in the U.S.		
	10 or More	Less than 10	
Cardiovascular disease	1.24 (0.71, 2.17)	1.52 (1.06, 2.17)	0.1497
Respiratory disease	1.95 (0.99, 3.81)	0.92 (0.42, 2.01)	0.0724†
Metabolic-related disease	1.00 (0.70, 1.44)	2.49 (1.05, 5.94)	0.1596
Arthritis	2.75 (1.42, 5.29)	1.77 (1.11, 2.83)	0.9135
Cancer	3.06 (0.79, 11.77)	2.98 (0.80, 11.06)	0.5279

Data sources: The New Immigrant Survey (2003-2004)

Notes: Weighted to sample design (N=7976); Victimization indicates any harm due to political beliefs, race, ethnicity or gender; † indicates $p < .10$.

[a] Odds ratio of the variable by the presence of victimization experience, controlling for age, age-squared, gender, country of origin, employment, education, marital status, and years of residence in the U.S.

[b] Breslow-Day test was used to assess accuracy of homogeneity of the OR.

Table 7. The association between victimization and each chronic disease by gender controlling for age, age squared, country of origin, employment, education, marital status, and years of residence in the U.S.

Variable	OR[a] (95% CI)		Homogeneity (*p*-value)[b]
	Male	Female	
Cardiovascular disease	1.66 (1.09, 2.52)	1.16 (0.76, 1.79)	0.0581†
Respiratory disease	1.86 (0.96, 3.62)	0.88 (0.42, 1.87)	0.1539
Metabolic-related disease	1.15 (0.85, 1.55)	1.24 (0.92, 1.67)	0.8372
Arthritis	2.25 (1.29, 3.94)	1.99 (1.18, 3.35)	0.3250
Cancer	9.29 (2.54, 33.91)	1.83 (0.46, 7.25)	0.0654†

Data sources: The New Immigrant Survey (2003-2004)

Notes: Weighted to sample design (N=7976); Victimization indicates any harm due to political beliefs, race, ethnicity or gender; † indicates $p < .10$.

[a] Odds ratio of the variable by the presence of victimization experience, controlling for age, age-squared, gender, country of origin, employment, education, marital status, and years of residence in the U.S.

[b] Breslow-Day test was used to assess accuracy of homogeneity of the OR.

Fig. 1. The conceptual framework for chronic disease among immigrant population