Disentangling Mental Health, Immigrant Adaptation, and Selection: A Natural Experiment Approach

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Abstract

International migration is associated with a wide range of negative mental health outcomes among Southeast Asian immigrants to the U.S. The inherent stress of adapting to an especially foreign environment appears implicated; and it is widely held that successful adaptation (or acculturation) to the new setting will moderate these links between stress and poor mental health outcomes. A central problem with this paradigm is that the data employed to evaluate it often come from clinic populations; and nearly always consist of post-migration measures of outcomes and predictors. Our approach to this dilemma is to employ a "natural experiment" research design, which involves comparisons of a wide range of mental health outcomes for three population-based samples of Vietnamese immigrants, never-leavers, and returnees. A central focus is the role of selection factors on several key dimensions of immigrant mental health.

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INTRODUCTION

International migration appears to have a wide range of health impacts on migrants. One major set of health outcomes of interest is mental health. While the existing literature on immigrant's mental health is extensive, there are several major gaps, both substantive and methodological. One major substantive gap is that we know less about the Vietnamese, one of the principal immigrant groups to the U.S. over the past two decades, than about immigrants from other countries. A second major substantive gap is that while a fairly wide range of mental health problems among immigrants have been identified; much less work has focused on the potential causal or mediating mechanisms. One major methodological problem in this general literature involves the potentially confounding effects of selection bias, i.e., outcomes related to the fact that immigrants are not a random sample of those in the countries of origin. A second major methodological problem related to mental health issues among Vietnamese-American immigrants is that most work has been conducted on clinic samples, rather than population-based samples.

This study explores potential longer-term impacts of international migration on Vietnamese mental health. It addresses the key problems above by using a "natural experiment" research design, involving the comparison of three population-based samples: Vietnamese immigrants in the United States; Vietnamese who have never left Vietnam (hereafter referred to as never migrants); and Vietnamese returnees in Vietnam. Before June 1989 essentially all Vietnamese who made it to a country of first asylum were successfully settled in the West (most in the United States) – this constitutes the Vietnamese immigrant group. For those arriving in the transition countries after June

1989, only those able to prove a bona fide risk of persecution in Vietnam were accepted for resettlement; most (about ¾) were repatriated to Vietnam – those repatriated constitute the returnee group. Those who never attempted to emigrate constitute the never migrant group.

By comparing the immigrants to both the never-leavers and the returnees, one can estimate the effects of migration *per se* on health outcomes net of selection effects – this is because while both immigrants and returnees share the set of factors that predispose them to emigrate, only the immigrants have the experience of moving to and adjusting to life in America. Disadvantages in mental health outcomes found among immigrants relative to the never-leavers may be due to either adaptation or selection factors. But if the returnees show no similar disadvantage (relative to the never-leavers), this would provide evidence that the immigrant disadvantage is due to adaptation issues rather than to selection issues; if it were the latter, the returnees should demonstrate similar disadvantages relative to the never-leavers.

BACKGROUND

Migration and health

A large literature rich in both theory and data has addressed connections between migration and health. The general underlying idea is that the disruptions of moving to a new environment can take a toll on health (Kuo and Tsai 1986; Massey 1987). Loneliness and unfamiliarity with the new language and culture can lead to stress and a decline in psychological well-being. Health care services may be less familiar, more expensive, and more difficult to access, which can have its own negative consequences (Findley 1988);

behavior patterns that were automatic in the sending country are no longer applicable in the migrant's new home (Cassel 1974; Shuval 1993). Unfamiliarity can lead to stress, which can have its own negative consequences (Cassel 1974; Findley 1988; Shuval 1993). More recent studies showed that new immigrants, those of non-western origin (e.g. Southeast Asia), face additional obstacles for assimilation and have fewer opportunities for economic advancement, and therefore become especially disadvantaged (Massey 1995; Zhou and Bankston 1998).

On the other hand, Hull (1979), among others, pointed out that the effects of health on migration likely occur through a selection process by which migrants who are more healthy or otherwise more robust are the ones who undertake the often arduous journey to a new country. Furthermore, migrants (especially those moving from a poor country to a rich country such as the United States) could find better access to health care services in the new home country, could benefit from better diets, and/or a cleaner environment. Finally, new migrants, even if poor, may experience advantages that arise from their continued patterns of beliefs, practices, and social contacts that protect them from dangers that the new environment holds, resulting in an "epidemiological paradox". Thus, the causal link between migration and health, as observed, can occur in either direction.

Migration can take a toll on the mental health of immigrants due to both the stressful migration process (the trip) and as well as additional risk factors experienced upon or soon after arrival (Hull 1979; Anderson 1987; Massey 1987; Bhugra 2004). Difficulties related to immigrant adjustment has been a major subject of investigation in the past decades (Kuo and Tsai 1986; Beiser 1993; Pernice and Brook 1996; Bankston

1997; Landale et al. 1999; Ho 2004). Such difficulties can include separation from families and communities; loneliness and unfamiliarity with the new language and culture; and employment (Findley 1988; Newbold and Danforth 2003; Newbold 2005). Such difficulties can result in problems such as depression and anxiety (Beiser et al. 1989; Cerhan 1990; Scott and Scott, 1989; Mouanoutoua et al. 1991).

We know less about the factors that mediate the connections between migration and mental health outcomes. Some studies highlight the importance of social networks and their supportive function (Kuo and Tsai 1986; Walsh and Walsh 1987; Landale and Oropesa 2001). Walsh and Walsh (1987) report an independent effect of social support on blood pressure levels within their sample of immigrants. Social networks and support can encourage healthy behaviors and discourage unhealthy ones (Umberson 1987; House et al. 1992; Landale and Oropesa 2001). Social networks might also influence health more subtly, e.g., by putting an individual in a more healthy environment than they would be in if alone. Cultural factors related to patterns of family authority and cohesion might also explain some of the variability in mental health outcomes among immigrants, and between immigrants and other groups (Guendelman 1995; Rumbaut and Weeks 1996).

To summarize, there is a wide range of evidence suggesting a strong connection between migration and mental health; and social networks and cultural features are strong candidates for mediating factors. One major problem with this literature, however, is that it is difficult to separate the effects of migration from selection, i.e., it is very difficult to compare the mental health of migrants to those who were similarly disposed to leave, but did not (Stillman et al. 2006). The "healthy immigrants paradox" and mixed findings in literature comparing immigrants and natives highlights the importance of addressing the

selection issues and calls for further research on migration and health linkage with more new approaches.

Vietnamese immigrants and health

In Southeast Asia, the upheaval during the war in the 1970s displaced thousands of families from Cambodia, Laos, and Vietnam. A number of waves of Vietnamese emigrated to the United States (Davis 2000). By 2000, the United States Census has documented over one million Vietnamese immigrants, constituting one of the largest influxes of immigrants to the U.S in the latest two decades (US Census Bureau 2002).

The initial wave of former South Vietnamese military and civilian officials and their families was followed by a massive exodus of clandestine emigrants by both land and sea. In part to stem this outflow, Vietnam, the Asian countries of first refuge, and the West formulated with the UNHCR in 1979 an orderly departure program (ODP) to facilitate legal and safe departure of eligible Vietnamese. But until the mid-1980s, Vietnamese departing by this route were far outnumbered by clandestine departures. To encourage the countries of first asylum to continue accepting refugees, a policy of "asylum for resettlement," was established, where the countries of first refuge accepted all comers on the understanding that all would be accepted for resettlement in the West. This understanding collapsed in May 1988, when the countries of ultimate destination implemented more selective criteria.

The Comprehensive Plan of Action (CPA) established in June 1989 recommended that "mechanisms should be developed to determine the claims of new arrivals to refugee status on a regional basis." This was a dramatic departure as all refugees successful in

arriving at a country of first asylum prior to this time (and including refugees already in the camps at this time) were accepted for resettlement without any need to establish bona fide refugee credentials. After the implementation of the new policy, which required a need to establish a credible fear of persecution if they returned to Vietnam, only about a quarter of newly arriving refugees passed this test and were accepted for resettlement. A fairly small number, e.g., about 20,000 from 1978 through 1994, have been accepted for resettlement under the goal of family reunification with relatives already in the United States (calculated from data in Zhou and Bankston 1998).

Asian immigrants are considered by many to be a model minority in many respects, including better health outcomes (Lee 1998; Frisbee et al. 2000). Many studies conducted in Canada and in the United States have established the existence of an epidemiological paradox -- "healthy immigrant effect" (Abraido-Lanza et al. 1999; Newbold 2006). However, this does not seem to hold for Vietnamese immigrants, which are primarily refugees and are significantly different from the more frequently studied English-speaking European immigrants (Gold et al. 1989; Frisbee et al. 2000). Studies in literature showed that the Vietnamese-Americans typically arrive poor, and live in marginal urban areas (Bankston 1997; Zhou and Bankston 1996; 1998). They generally have worse outcomes than either the other Asian immigrants or native-born U.S. whites. Almost a quarter of the Vietnamese-Americans report their overall health status as being only fair or poor, compared to only 13% of whites (Frisbie et al. 2001). The Census Bureau (1993) reports a 1989 poverty rate of 26% for Vietnamese-Americans, compared to only 14% among those of Asian descent overall. Massey and Denton (1992) using 1980 census data confirm the Vietnamese to be the most segregated among all Asian

immigrant groups in the United States. According to the U.S. Census Bureau (2000), 93% of the Vietnamese speak Vietnamese at home; 65% do not speak English very well; and 44% are classified as linguistically isolated.

In terms of mental health and well being, a sizable literature has documented significant problems among Vietnamese immigrants, including depression, stress, anxiety, psychiatric symptoms and PTSD both on samples of either clinical or more representative non-clinical community population (Lin et al. 1979, 1985; Kroll et al. 1989; Kinzie et al. 1990; Beiser et al. 1993; Buchwald et al. 1993, 1995; Hinton 1997; Nelson et al. 1997; Hinton et al. 1998; Dong 2003). Recent studies suggest poor physical and mental health profiles among Vietnamese immigrants (e.g., Frisbie et al. 2001). However, despite the strong evidence of mental health needs, Vietnamese immigrants have been found to under-utilize mental health services due to lack of access to care and other barriers including language, traditional culture, health beliefs and practices (Uba 1992; Gellert 1995; Ngo-Metzger et al. 2003).[1] Systematic population-based research on the impact of international migration on the mental health of Vietnamese immigrants remains sparse, in spite of the fact that this group has been a major source of immigrants into the United States over the past two decades.

CONCEPTUAL FRAMEWORK

Our conceptualization of how migration might affect the mental health status of Vietnamese immigrants is outlined in the figure. The principal relationships of interest involve how migrant status, as categorized in the lower box from the left, affects the potentially mediating factors in the middle oval, and through them the mental health

[1] But see also Jenkins et al. 1996.

outcomes of interest in the box at the far right. Potential mediating influences include features of the new physical and social environments the migrants find themselves in, e.g., changing economic and social opportunities (or lack thereof), changing norms and expectations, and acculturation. Predisposing factors, such as those noted in the upper left box, will of course help determine who becomes a migrant in the first place. These predisposing factors will also affect the mental health outcomes in their own right, either directly or through their own interaction with the mediating factors. It is important to emphasize that a new and stimulating environment can foster positive mental health outcomes as well as negative outcomes.

(Insert Figure 1 here)

DATA AND METHODS

Data

Our underlying model proposes that features of the migration experience will influence the mental well-being of Vietnamese immigrants. Although the returnee group is included primarily as a reference group to help distinguish selection from migration effects *per se*, effects of their attempted emigration and subsequent return upon mental health outcomes will also be of interest. The never-migrant group will provide a baseline measure of the mental health outcomes net of any selection or migration effects, successful or otherwise.

Data were collected between 2003 and 2005. In total, they comprise three population-based sub-samples totaling 736 working age adults (23-53 years old). These sub-samples include 128 Vietnamese immigrants currently residing in New Orleans; 141

returnees to Ho Chi Minh City; and 467 Vietnamese nationals who never left Ho Chi Minh City. Returnees and never-migrants were selected using multi-stage cluster sampling, as follows. HCMC has 19 urban districts containing 259 urban wards. Three of these urban districts known to contain large numbers of returnees were selected for study. In each of the three selected districts, 1 ward was randomly selected. In the selected ward, 3 neighborhoods were randomly selected. For each neighborhood, four clusters (To Dan Pho) were randomly selected, and a complete listing of all adults was made. Among the households that included an eligible respondent – had lived in HCMC for at least 20 years, and was between 25-49 years of age - 12 households were randomly selected from each cluster. Within the household, if there was more than one eligible respondent, a procedure to randomly select a respondent was implemented; there were two refusals. A random sample of returnees living in these same urban wards constitutes the returnee sample. Data collection was completed in 2004. No refusals were reported.

For the immigrant sample, eligible individuals must have been between the ages of 25-49 during the time of the initial survey (summer of 2005); have been born in Vietnam; have arrived in the U.S. between 1980 and 1990; and have been between the ages of 15-30 when they arrived. We employed a recently-updated population register of Vietnamese-American households in the greater New Orleans area to draw our original sample during the summer of 2005. This register is maintained by the main NGO and Catholic church serving the area; it includes both Catholic and non-Catholic Vietnamese families, and lists household members by name. Upon arrival at the household thought to have an eligible respondent (the original registers had a list of residents, with their ages), the interviewer followed a procedure to first list and then randomly select an eligible

respondent. The entire set of questions and measurements took about 45 – 90 minutes to complete. The respondents were given a small honorarium ($25) for their time and trouble. Data collection was completed in August 2005. Of the eligible households contacted by our NGO collaborators, 125 completed the interviews and 46 refused, yielding a response rate of 73%.

Measurement and instruments

Our outcome measures include a range of widely used health scales, including the four SF-36 mental health subscales; and the Vietnamese Depression Scale. We also utilize two physical biomarker measures of mental health status, i.e., blood pressure and waist-hip ratio; and one behavioral measure (binge drinking). A wide range of indicators for the social, economic, and physical environment, and the level of acculturation (for the immigrant sample) are also available from the survey.

SF-36 health assessment instrument, developed by RAND Corporation and JE Ware (Ware and Sherbourne 1992) has been widely used and highly regarded as a reliable general health assessment tool (McDowell and Newell 1996). SF-36 subscales are computed in such a way that higher scores indicate better health outcomes (Range 0-100). Four subscales on general mental health, social functioning, role limitations due to emotional problems, vitality, energy, fatigue are utilized in this study to catch a wide range of mental well-being among our respondents.

A culturally grounded 18-item Depression Scale (VDS), developed by Kinzie at al (1982) is used to measure the symptoms of depression. VDS employed contains six culture-specific items associated with depression among the Vietnamese, as well as six

questions each about physical and psychological symptoms (Buchwald et al. 1993). With a cutoff of 13 points (Range 3-28), the VDS has in previous studies consistently shown a high level of sensitivity and specificity among Vietnamese residents, refugees and immigrants (Buchwald et al. 1993, Mckelvey et al. 1993; Buchwald et al. 1995).

Blood pressure readings were taking during the interview using a standard process using mercury sphygmomanometer. Considering the difficulties in the use of dual measures on both systolic and diastolic blood pressures, a combined effects – "biologic effect blood pressure" (Pe) was calculated by: Pe=0.45Ps+0.55Pd (Svensson and Lundstrom 1984) to get a more meaningful and parsimonious measurement on risk for high blood pressure.

Data analyses

Using the pooled three samples, three set of regression models, with linear OLS regression for continuous outcomes and logistic regression for binary outcomes, will be used to examine the relationship between migration and mental health outcomes, first with no controls, and then with controls for SES, marital status, age, and sex. A final set of regression models examine differentials in our mental health outcomes among the immigrants.

RESULTS

Table 1 presents the characteristics of the samples; some differences are apparent. The immigrant population is on average over 3 years older than returnees and never-leavers. Never-leavers are skewed towards females, while returnees and immigrants sample skewed towards males. The educational attainment of immigrant population is

higher on average (over half received 10 years education or above) than never-leavers and returnees. Returnees have less education than the other groups, with around 63 percent having only primary school education or even less. Furthermore, never-leavers on average are less agricultural, less unskilled, and more entrepreneur than returnees and immigrants.

(Insert Table I here)

Differences on mental health outcomes across migration status, as measured with SF 36 sub-scales, Vietnamese Depression Scale, affect balance, BMI, waist-hip ratio (WHR) and binge drinking are tabulated in Table 2. Five of our six standard mental health scales show differences among our sub-samples; as do all three of our biomarkers.

(Insert Table 2 here)

Multivariate level analysis (Table 3) reveals a consistent disadvantage on SF-36 mental health, social functioning, vitality, energy and fatigue among Vietnamese immigrants as compared to never-leavers. Vietnamese immigrants on average have higher BMI and waist-hip ratio, compared to both the other two groups. However, immigrants seem to fare better on role limitation due to emotional problems, affect balance, have lower likelihood of being depressed (compared to the returnees) and lower blood pressure. Returnees fare worse on social functioning, affect balance, have higher blood pressure and higher likelihood of being depressed than never-leavers.

(Insert Table 3 here)

Table 4 presents the results from multivariate level analysis on mental health among immigrants sample only. It revealed that higher English proficiency is related to better health outcome on social functioning at a marginally significant level ($p < 0.1$).

However, immigrant's native language skill seems more important. Higher proficiency in Vietnamese is associated with a better health outcome on depression; and is positively associated with a better a better outcome on vitality at a statistically marginal level ($p < 0.1$) . Regarding social networks, those having helpful social relations fare better on mental health and have lower depression score. However, bigger relations size and higher relations reciprocity do not seem to be protective for immigrant's mental health.

Males have better outcomes on vitality, energy and fatigue, however, fare worse on blood pressure, than females. Compared to those who perform agricultural, unskilled, service types of jobs, those having higher occupational status (i.e. having professional career) fare better on mental health, role limitation due to emotional problems and have lower depression score. Those who have never married or who are currently married/living together fare better on vitality energy and fatigue, mental health and have lower depression score as compared to the formerly married (including divorced, widowed and separated).

(Insert Table 4 here)

DISCUSSION

Our results suggest both mental health advantages and disadvantages for our sample of Vietnamese immigrants relative to our two samples of Vietnamese nationals. Immigrants are disadvantaged (worse-off) relative to never-leavers at a statistically significant levels for WHR and for vitality, energy and fatigue. The fact that returnees are not similarly disadvantaged relative to never-leavers on these two measures suggests that these disadvantages are due to the migration and adaptation experience *per se*, and not to

selection factors. The logic for ruling out selection is that returnees and immigrants should both share the set of "selection" factors that predispose one to leave. But since only the immigrants have the disadvantage (not the returnees), we conclude that the disadvantage is due to the factor that only the immigrants possess (the migration experience). By the logic of our research design, this migration effect should be free of the confounding effects of selection that plague studies comparing only immigrants and never-leavers. However, it should be emphasized again that the research approach has features of a natural experiment; it is not a randomized controlled trial, which would for obvious reasons be impossible for a study of migration and health. There is the potential for problems such as stigma and harassment that returnees might face upon their return home. Such potential appears to be minimized by careful monitoring by the UNHCR for several years after the returnees came back to Vietnam, and by a number of re-entry benefits to help these individuals and families re-establish themselves in Vietnam. Still, the fact that returnees appear to be at elevated risks for depression, social functioning, and mental health (see below) suggests that not all of these returns go well.

From a substantive point of view, the disadvantage that immigrants face on the vitality, energy, and fatigue dimension may be a form of "John Henryism," exhaustion resulting from the huge outlays of effort required to thrive in America, relative to Vietnam. The problems associated with WHR are surely associated with the high-fat American diet, but stress is implicated here, too, since the difference holds up on models controlling for BMI as well as out standard controls.

Immigrants are also disadvantaged, relative to never-leavers, on social functioning and general mental health. However, we're not able to attribute these

disadvantages to migration *per se*, since the immigrants are not significantly different from the returnees. Since returnees and immigrants share similar "selection" factors, these two mental health disadvantages for immigrants and returnees may have some similar grounding in *a priori* pre-migration characteristics of those who attempt to leave their homeland. On the other hand, the living environments of returnees and immigrants are very distinct, i.e., stressful in very different ways. Thus, the disadvantages may well have very different causes related to the two living environments.

This same set of models suggests that immigrants are advantaged (better-off) relative to never-leavers for role limitations due to emotional problems and blood pressure. Per the logic of our research design, the fact that returnees are not similarly advantaged relative to never-leavers suggests that these disadvantages are due to the migration and adaptation experience *per se*, and not to selection factors. Regarding role limitations due to emotional problems, it seems that in spite of living in a foreign and stressful environment, Vietnamese Americans meet (even exceed) the challenge of fulfilling their social obligations. Perhaps social connections are especially important - and are thus well-nurtured - in a new and foreign environment. Regarding blood pressure, the advantage seems likely due to more widespread screening and medication in the U.S. compared to the situation in Vietnam.

Immigrants fare better than returnees (but not different from never-leavers) on depression. This seems likely due to problems returnees face upon their return back to Vietnam.

Regarding differentials among the immigrants, divorce or separation, low occupational status, lack of Vietnamese proficiency, and lack of helpful social relations

all appear to have negative impacts on at least some of our key dimensions of mental health in our multivariate models.

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Figure and tables

Figure: Conceptual framework on migratory experience, social network, acculturation and mental Health outcomes

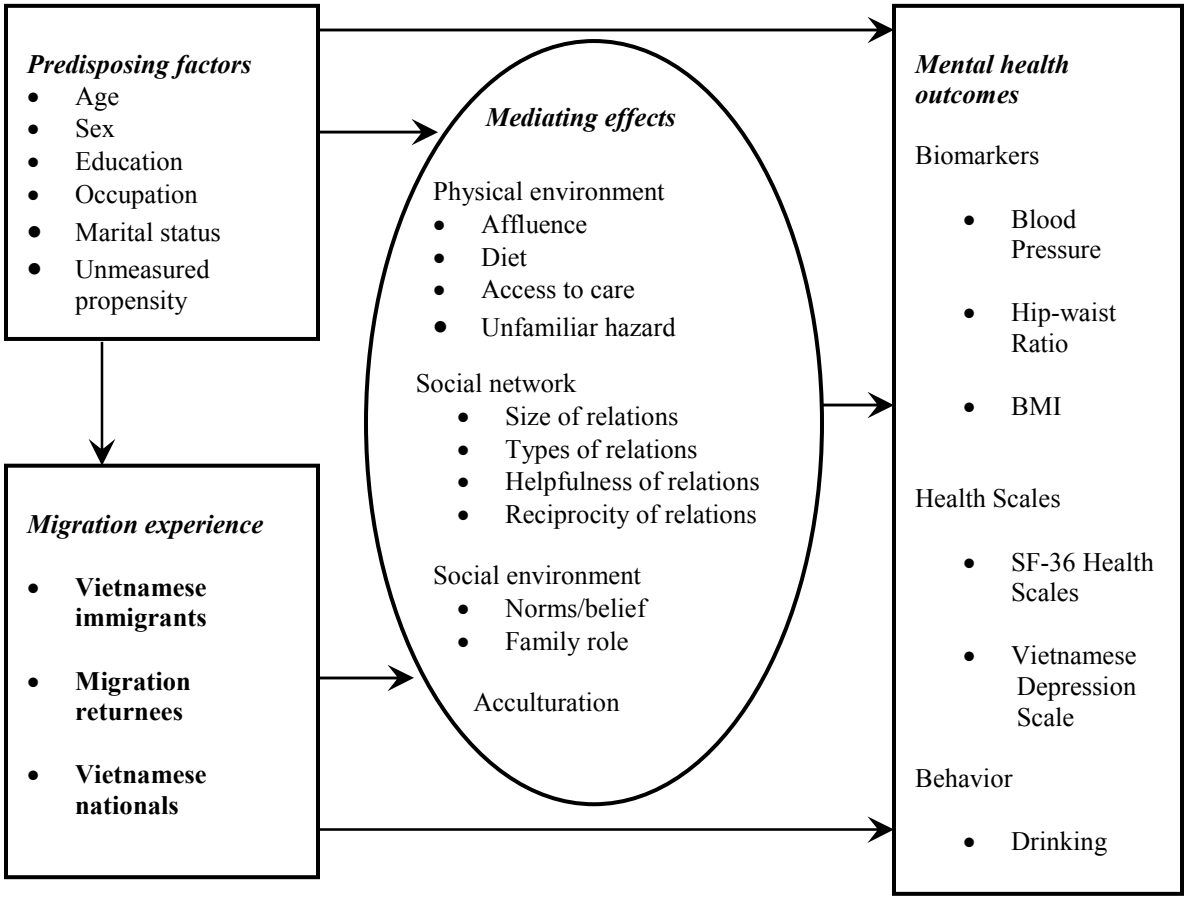

Table 1. Demographic Characteristics of Study Participants (N=736).

Items	Never leavers (n=467)	Returnees (n=142)	Immigrants (n=127)
Age			
Median age	39.00***	38.50	41.95
Range (23-53)			
Sex			
Male	43.0%***	59.9%	65.4%
Female	57.0%	40.1%	34.6%
Marital Status			
Never married	23.6%	21.8%	14.2%
Currently Married living with spouse	65.3%	69.7%	77.2%
Separated or formerly married	11.1%	8.5%	8.7%
Education			
0-6 years	34.7%***	62.7%	32.3%
7-9 years	26.3%	20.4%	13.4%
10 years or above	39.0%	16.9%	54.3%
Occupation			
Agriculture, unskilled, service	7.9%***	19.0%	17.5%
Clerical, factory, skilled, sales	12.2%	11.3%	27.0%
Professional, entrepreneur	56.1%	41.5%	33.3%
Unemployed, other	23.8%	28.2%	22.2%

^Significant at P<0.1; *Significant at p <0.05; ** Significant at p <0.01 *** significant at p < 0.001.

Note: The combined data has a sample of 738 respondents. 2 cases (1 with age=84 and 1 with age missing) were excluded from the analysis.

Table 2: Health Dimensions from the SF-36, Vietnamese depression scales and blood pressure biomarker (N=736)

Health scales	Never leavers (n=467)	Returnees (n=142)	Immigrants (n=127)
VT	64.98 (α= 68.66%)	65.88 (α= 73.40%)	61.34 (α= 36.41%)
SF* **	89.16 (α= 76.56%)	83.98 (α= 79.24%)	82.64 (α= 33.70%)
RE**	80.51 (α= 84.13%)	77.00 (α= 81.37%)	91.60 (α= 83.40%)
MH*	72.61 (α= 73.80%)	70.59 (α= 69.98%)	69.20 (α= 48.53%)
#VDS * **	8.43 (α= 79.63%)	9.43 (α= 70.18%)	6.35 (α= 91.28%)
#Blood pressure** **	98.00	102.66	97.94
Affect Balance* **	10.79	9.78	11.10
BMI* **	22.08	22.11	23.98
Waist-Hip ratio * **	0.833	0.841	0.921
Binge drinking (n=368, male only)	16.4%	17.6%	15.9%

^ significant at the $p < 0.1$ level. * significant at the $p < 0.05$ level. ** significant at the $p < 0.01$ level.
*** significant at the $p < 0.001$ level.

Notes: Larger scores indicate better health outcomes.

VT = Vitality, energy, and fatigue, SF = Social functioning,
RE = Role limitations due to emotional problems, MH = General mental health
# scores for General US population is from SF-36 Health Survey Manual and Interpretation Guide (Ware et al. 1993)
#VDS: (N=713 with 25 missing cases on depression scale items) Vietnamese Depression Scale (Range: 3-28) The higher value indicated being more depressed.
#Blood pressure: N=727 with 11 missing cases.

Table 3: Multivariate regression analysis on migration and health outcome (N=736)

Outcome measure	Never-leavers Beta	Returnees Beta	Immigrants Beta	R^2
MH: general mental health				
Model 1: Never-migrants as reference group		-1.95	-3.12*	0.06
Model 2: Returnees as reference group	1.95		-1.16	0.06
SF: social functioning				
Model 1: Never-migrants as reference group		-5.00**	-6.38***	0.03
Model 2: Returnees as reference group	5.00**		-1.38	0.03
VT: vitality, energy, and fatigue				
Model 1: Never-migrants as reference group		0.47	-3.46*	0.08
Model 2: Returnees as reference group	-0.47		-3.92*	0.07
RE: Role limitations due to emotional problems				
Model 1: Never-migrants as reference group		-4.05	11.10**	0.03
Model 2: Returnees as reference group	4.05		15.15***	0.03
Depression (Yes/no)				
Model 1: Never-migrants as reference group		1.75*	0.58	0.05
Model 2: Returnees as reference group	0.57*		0.33**	0.08
Affect Balance				
Model 1: Never-migrants as reference group		-1.02***	0.28	0.065
Model 2: Returnees as reference group	1.02***		1.31***	0.065
Blood Pressure				
Model 1: Never-migrants as reference group		2.85*	-3.40*	0.14
Model 2: Returnees as reference group	-2.85*		-6.25***	0.14
BMI				
Model 1: Never-migrants as reference group		-0.10	1.51***	0.08
Model 2: Returnees as reference group	0.10		1.61***	0.08
High waist-hip ratio A (Yes/no)				
Model 1: Never-migrants as reference group		0.91	5.41***	0.13
Model 2: Returnees as reference group	1.10		5.95***	0.13
#High waist-hip ratio B (Yes/no)				
Model 1: Never-migrants as reference group		0.94	4.26***	0.25
Model 2: Returnees as reference group	1.06		4.54***	0.25
Binge drinking				
Model 1: Never-migrants as reference group		1.26	1.10	0.031
Model 2: Returnees as reference group	0.87		0.87	0.031

Notes: ^ Significant at P<0.1; *Significant at p <0.05; **Significant at p <0.01; *** Significant at p <0.001.
Control variables include age, sex, marital status and occupation. #Logistic regression is performed with depression, WHR, and the reported statistics are Odds Ratio. #High waist-hip ratio model B further controls for BMI.

Table 4: Multivariate linear regression on mental health outcomes among Vietnamese immigrants (N=126).

	Mental Health Outcomes					
Predictors	**VT**	**SF**	**RE**	**MH**	**Depression**	**Blood Pressure**
Age	0.06	-0.21	0.43	0.33	0.038	-0.009
Sex						
Female (reference)						
Male	5.95**	0.56	3.09	2.94	0.15	4.39*
Occupational Status						
Agriculture, unskilled, service (Reference)						
Clerical, factory, skilled, sales	0.44	6.34	7.80	-3.72	-3.38*	3.60
Professional	6.40	7.25	17.15^	9.39*	-3.31*	2.84
Entrepreneur	-0.14	3.69	11.07	-0.99	-3.37*	3.57
Unemployed or others	3.51	0.42	0.83	-2.66	-3.63*	6.10^
Marital status						
Separated, formerly married (reference)						
Never married	7.32^	3.64	6.43	9.50*	-3.59*	-0.67
Currently married and living with spouse	7.45*	-2.07	10.83	5.57^	-2.55^	1.05
English proficiency	0.29	1.43^	-1.30	-0.14	0.04	0.92^
Vietnamese proficiency	1.25^	3.07*	0.79	-0.45	-0.90**	-0.91
Social relations size	-0.51	-0.31	5.83	-1.36	1.12	1.12
Having helpful relations	2.12	3.80	4.32	4.59*	-2.73**	6.15**
Relations reciprocity	-1.96	3.15	-6.86^	1.36	-0.69	-1.24
Length of Stay in the U.S.	0.019	-0.34	-0.32	-0.01	-0.07	-0.32
Constant	35.40*	45.93 *	62.21 *	51.83 ***	22.26 ***	98.09 ***
$\mathbf{R^2}$	0.15	0.21	0.10	0.22	0.16	0.16

^ significant at the p < 0.1 level. * significant at the p < 0.05 level. ** significant at the p < 0.01 level.
*** significant at the p < 0.001 level.

Notes: Larger scores indicate better health outcomes.
VT = Vitality, energy, and fatigue, SF = Social functioning,
RE = Role limitations due to emotional problems, MH = General mental health
#VDS: Vietnamese Depression Scale: (range: 3-28) the higher value indicated being more depressed.
#Blood pressure: biologic effect blood pressure (Pe) =0.45Ps+0.55Pd
English proficiency (range: 3-12), larger scores indicate better English language skill.
Vietnamese proficiency (range: 6-12), larger scores indicate better Vietnamese language skill.