ABSTRACT

While extant studies have generally linked immigrant acculturation with negative health behaviors, consistent with the widely documented "healthy immigrant effect," little is known about the extent to which the effects of acculturation vary across time and context. How and why the effects of acculturation vary across immigrant groups, in particular, is poorly understood. Using Panel data from the New Immigrant Survey (2003, 2007), this study examines the relationship between language acculturation (English-language proficiency and use) and four immigrant health behaviors: smoking frequency, drinking frequency, dietary change and physical activity. Results indicate that the link between language acculturation and health behaviors is contingent upon time, the measure of acculturation, the immigrant group, and the specific health behavior examined. Overall, language acculturation is positively associated with drinking frequency, but not associated with smoking frequency. While both English-language use and proficiency have implications for certain health behaviors in the short-term, proficiency appears to be associated with more health behaviors and have long-term effects. More specifically, in the short-run, language proficiency was positively associated with dietary change and physical activity, but not associated with smoking and drinking behavior. Over time, however, it positively influences both drinking frequency and physical activity. English-language use, on the other hand, was only associated with short-term change in diet. Language proficiency was, therefore, a stronger predictor of changes in health behaviors. Moreover, these effects vary across immigrant groups, especially the effects for drinking behavior. The effect of language proficiency on drinking frequency is significantly lower for Asian, black and Hispanic immigrants, compared to their white counterparts. Similar, but fewer, interactions were observed for the association between language use and drinking behavior. Overall, these results indicate that not only is acculturation a mixed bag which influences both positive and negative health behaviors, but its effects also vary across immigrant groups.

INTRODUCTION

Migration scholars have devoted a lot of attention to the social process of adjustment in host nations and the impacts that migration and adaptation processes have on immigrants' well-being. Given the widely-documented effects of migration on the physical and emotional well-being of immigrants (e.g. Cunningham, Ruben, and Narayan 2008; Hendriks 2015; McDonald and Kennedy 2004), immigrant health and health behaviors have been a focus of much prior research. In particular, the so-called "healthy immigrant thesis" suggests that while new immigrants are often healthier, on average, than their native-born counterparts, their health advantage dissipates over time (Antecol and Bedard 2006; Jasso et al. 2004). Recent literature suggests that this "healthy immigrant effect" also extends to health behaviors (Allen et al. 2007, 2008; Bacio, Mays, and Lau 2013; Prado et al. 2009; Singh and Siahpush 2002), primarily smoking and alcohol consumption (Abraído-Lanza, Chao, and Flórez 2005; O'Loughlin et al. 2010), which are the most widely studied health behaviors among immigrant populations, but also to other health behaviors, such as dietary choices (e.g. Akresh 2007).

While various explanations have been proposed for the "healthy immigrant effect," including selective migration, discrimination, and underreporting of health conditions (McDonald and Kennedy 2004), the primary explanation has focused on negative acculturation (Amaro et al. 1990; Escarce, Morales, and Rumbaut 2006; Lara, Gamboa, M Iya Kahramanian, et al. 2005; Salinas and Sheffield 2011; Shelley et al. 2004; Trinidad et al. 2006). That is, the decline in health, and the adoption of negative health behaviors, among immigrant populations has been attributed to the process of cultural change – the changes in lifestyle associated with the process of acculturation. On balance, and given the focus on negative health behaviors, the extant literature suggests that acculturation has a detrimental effect on immigrant health behaviors. Particularly, language

acculturation, which is the most widely used measure of acculturation (Lopez-Class, Castro, and Ramirez 2011), has been linked in some studies with higher rates of smoking, alcohol consumption and dietary change among certain immigrant groups (Abraído-Lanza et al. 2005; Bethel and Schenker 2005; Bryant and Kim 2013).

Findings, however, are often inconclusive because the effect of acculturation may vary across immigrant groups, health behaviors and the time period under study. First, acculturation may not have a uniform effect across various health behaviors. For instance, while some research suggests that immigration to the U.S. encourages smoking and alcohol consumption (Galvan and Caetano 2003), it has a positive influence on levels of physical activity (Gerber, Barker, and Pühse 2012). Second, the effects on health and health behaviors of acculturation is cumulative/longitudinal, which is to say that studies that rely on cross-sectional data may be missing or underestimating the long-term impacts of language acculturation on health behaviors (Kimbro 2009). Third, given that the immigrant population is heterogeneous, the effects of language acculturation may also be non-uniform across immigrant groups. It is important, therefore, to study these contingencies in the link between language acculturation and immigrant health, as enhancing healthful behaviors among immigrants requires not only our understanding of the long-term implications of the immigration experience on health behaviors, but also our ability to identify which immigrant groups are at risk for which negative health behaviors. And since health behaviors are associated with a variety of health outcomes, understanding the complex factors that influence immigrants' health behaviors is an essential component of understanding the healthy immigrant effect and immigrant adaptation.

In order to address these gaps in the research, this study will examine the contingent effects of language acculturation on various health behaviors. First, using national data from two waves (2003, 2007) of the New Immigrant Survey (NIS), it will examine the cross-sectional and longitudinal associations between English language proficiency and four health behaviors: smoking frequency, drinking frequency, frequency of physical activity, and dietary change. These health behaviors are important to study because they are believed to be important risk factors that account for more than 50% of premature deaths in the United States (Abraido-Lanza et. Al 2005). Second, it will examine the extent to which the associations between language acculturation and health behaviors vary across ethnic groups. The results highlight the extent to which the effect of linguistic acculturation varies across time, group and health behaviors. In doing so, this study sheds light on the complex relationship between language acculturation and immigrant health behavior and contributes to our understanding of why findings in the extant literature are sometimes inconsistent or contradictory (Salant and Lauderdale 2003).

BACKGROUND

Acculturation, which is commonly defined as "the adoption of norms and values of the host society" (Abraído-Lanza et al. 2005), is conventionally measured by proxy measures such as English-language proficiency, English-language use, and the length of stay in the host country. Language, in particular, is considered to be "the strongest single predictor of acculturation" (Alegria 2009; Arcia et al. 2001) because a shift in language proficiency and use is often an important element of cultural change and adaptation to life in the host society. Therefore, migration scholars have widely studied language acculturation and its implications for various outcomes of immigrants, including health behaviors. This literature, largely focusing on Hispanic and Asian

immigrants, seems to suggest that acculturation overall has a detrimental effect on health behaviors (Lara, Gamboa, M Iya Kahramanian, et al. 2005). Studies have linked acculturation with higher rates of smoking (Bethel and Schenker 2005; Unger et al. 2000), alcohol consumption (Bryant and Kim 2013; Hahm, Lahiff, and Guterman 2003, 2004; Thai, Connell, and Tebes 2010) and unhealthy dietary change among both Hispanic immigrants (Abraído-Lanza et al. 2005; Bethel and Schenker 2005; Marin, Perez-Stable, and Vanoss Marin 1989; Neuhouser et al. 2004) and Asians (Gomez et al. 2004; Lee, Sobal, and Frongillo 2000). That is, immigrant health behaviors are often negatively impacted with greater adaptation to the United States (Abraído-Lanza et al. 2005; Lopez-gonzalez et al. 2005; Zhang and Wang 2008), and this observation is used as one account for why immigrant health declines over time and/or converges with levels commensurate with the native-born population.

The empirical link between acculturation and health behaviors, however, is complex and, as others have noted (Abraído-Lanza et al. 2005; Lara, Gamboa, M. Iya Kahramanian, et al. 2005; Salant and Lauderdale 2003), the evidence is largely mixed. While the "negative acculturation thesis" certainly dominates the immigrant health literature, the empirical evidence with regard to the effects of acculturation on immigrant health behaviors is largely inconclusive because the effect of acculturation appears to be contingent upon various factors, including the specific health behavior examined, the focal immigrant group and the measure of health acculturation used in the study. And while there is relatively limited research on positive health behaviors, migration research on physical activity, contrary to the negative acculturation thesis, generally shows positive effects of acculturation. For instance, a recent review of the literature (Gerber et al. 2012) found that 57% of studies examined show a positive association between acculturation and levels of physical activity. This suggests that the narrow focus on negative health behaviors, in the extant

literature, is an important limitation because acculturation could lead to the adoption of both healthy and unhealthy behaviors, and its cumulative effect on immigrant health will depend on its net effect on health behaviors.

Another factor that contributes to mixed findings in the literature is variability in the effects of acculturation across immigrant groups. For example, it is well-known from prior research that health behaviors and the effects of acculturation on health behaviors vary by gender (Black and Markides 1993; Choi et al. 2008; Markides et al. 1990; Pérez-Stable et al. 2001; Zhang and Wang 2008). Studies seem to indicate that acculturation either has no effect or may actually be protective for men against negative health behaviors, such as smoking and alcohol drinking, whereas it is positively associated with negative health behaviors for women. For instance, studies have found that acculturation reduces the likelihood of smoking for Asian men and increases it for Asian women (Chen et al. 1999; Unger et al. 2000; Zhang and Wang 2008). Part of this gender difference in the behavioral effects of acculturation to the U.S. may be because immigrant women are acculturating to a society where female drinking or smoking is more tolerated (Cheng and McBride 2013), indicating that cultural background may be key in how acculturation influences long-term changes in health behaviors for immigrants.

What remains unclear, however, is how the effects of acculturation vary systematically across immigrant groups by race and ethnicity, which is an important gap to address in the literature. Given the heterogeneity of the immigrant population, migration researchers have long suspected important differences in acculturation effects across groups. Prior research has highlighted that "the process of acculturation is not identical for all immigrants and does not affect all areas of life equally and with the same time frame" (Chun, Organista, and Marin 2003). However, most prior

research has focused on the two major immigrant groups, Hispanics and Asians, and the empirical literature does not shed much light on how acculturation's effects vary across groups and is far from conclusive. For instance, while some recent studies have found similar effects, for Hispanic and Asian immigrants, of acculturation on some health behaviors (e.g. Unger et al. 2000), others note important differences in acculturation effects across pan-ethnic groups (e.g. Gorman, Read, and Krueger 2010). Similar acculturation outcomes may result, they argue, from exposure to the same host country environment (e.g. norms surrounding health behaviors and widespread marketing) and also be indicative of the fact that migration often occurs from collectivist cultures to the individualistic culture of the U.S. (Unger et al. 2000).

However, there are various factors that may contribute to differential effects of acculturation on health behaviors. For instance, there are different norms and attitudes towards various health behaviors in immigrant origin countries (Gorman et al. 2010), and these norms and attitudes have implications for immigrants' health and the behavioral changes as they acculturate to the host nation. In addition, there are differences across immigrant groups in context of reception (Portes and Rumbaut 2001), which is associated with varying levels of acculturative stress, which in turn is often associated with negative outcomes of acculturation. There may also be differences across immigrant groups in the social environment they are exposed to, as different immigrant groups settle or concentrate in different areas of the country. Moreover, the implications of acculturation for the network integration of immigrants may vary across ethnicity. In other words, the degree to which language acculturation reflects changes in network characteristics and social integration with the native-born population may be different across ethnic groups. Given ethnic differences in health behaviors and norms and the social implications of acculturation, it is therefore crucial for

acculturation research to examine and document the degree to which the health behavioral effects of acculturation vary across ethnic groups.

Inconsistent measures of acculturation across studies is also another factor that contributes to the incomparability of studies. Different measures of language acculturation have been used in the literature, with language proficiency and use being the most widely used. However, the literature is often unclear about mechanisms and, depending on the measure, there may be different mechanisms linking language acculturation and health behaviors. While a combined language acculturation index has been used in the literature, others have warned about the risk of conflating the different mechanisms at play (Gee, Walsemann, and Takeuchi 2010). For instance, the components of language acculturation could indicate social capital, cultural adoption, and could also represent human capital investment related to long-term commitment to the host nation. Prior studies suggest that language use is more likely to be an indicator of social network processes (Akresh 2007; Tegegne 2018), whereas language proficiency is related more to culture (Gee et al. 2010). Understanding the underlying mechanisms is important not only in identifying a valid measure of acculturation, but it will also shed light on why the impacts of acculturation may vary across immigrant groups.

Finally, an important consideration in immigrant health research ought to be the temporal aspects of the link between acculturation and health behaviors. Prior research predominantly relies on cross-sectional data, which does not allow us to control for self-selection and infer evidence of a causal relationship between language acculturation and health behaviors. Longitudinal approaches are needed to establish temporal order and adjust for potentially spurious associations between pre-migration characteristics and health behaviors. In addition, given that the effects on health and

health behaviors of acculturation are more likely to be cumulative, studies that examine short-term and long-term effects are needed. In other words, it is important to distinguish the effects of short-term adjustment to changes in the social environment from that of long-term acculturation. Indeed, existing studies hint that the effects of acculturation on health behavior are time-dependent. For instance, Akresh (2007) uses cross-sectional data to show that the effects of time spent in the U.S. on the dietary change wanes over time. The effects of acculturation on health and health behaviors are likely gradual and cumulative and examining both the short-term and long-term effects of acculturation is, therefore, crucial.

In sum, due to differences across studies in the health behavior and immigrant groups examined, and the measure of acculturation used, the link between immigrant acculturation and health behaviors is not fully and clearly understood. There is limited research on positive health behaviors, such as levels of physical activity, and the narrow focus on negative health behaviors is an important limitation of the literature because acculturation could lead to the adoption of both healthy and unhealthy behaviors, and its cumulative effect on immigrant health will depend on its overall effect on health behaviors. That is, immigration and acculturation may be enabling of certain health behaviors and constraining of others. Further, the behavioral effects of acculturation also may vary across groups depending on U.S. norms and how they compare to the norms surrounding certain health behaviors in immigrants' origin countries or local communities in the U.S.

Therefore, for the reasons aforementioned, comparisons of findings across studies are often a challenge since the measure of acculturation, the focal ethnic group, and the health behavior outcome examined vary across studies. It remains unclear to what extent findings can be

generalized to the overall immigrant population in the U.S. and whether the effects of acculturation are uniform across immigrant groups. Since important differences exist among immigrant groups by race and ethnicity in their health behaviors (Singh and Siahpush 2002), studying the differential risks associated with acculturation will be essential. To address these gaps, using data from the two waves of the New Immigrant Survey, this study examines the relationship between language acculturation and four health behaviors: smoking frequency, drinking frequency, dietary change and frequency of physical activity. First, I examine both the cross-sectional and lagged associations between language acculturation and these health behaviors. Then, I assess whether the observed effects of acculturation vary by race/ethnic group.

DATA AND METHODS

Data source

The data for this study come from the two waves of New Immigrant Survey (2003, 2007), a nationally representative dataset on immigrants who recently obtained legal permanent residency. The sample includes new arrivals and adjustees (i.e. immigrants who changed their visa status after some time of presence in the U.S.). The sampling frame consists of 12,500 new adult immigrants who were granted permanent residency between May and November 2003. The response rate for the first wave was 69%, providing a total of 8,573 respondents who completed the survey. Follow up interviews were conducted with 8,456 respondents between 2007 and 2009 and resulted in 3,902 fully completed and 461 partially completed (i.e. a total of 4, 363) interviews. The response rate and attrition rates for the second round of interviews was 46.1% and 48.4%, respectively. Respondents with missing data on the health behavior variables were excluded from the analysis and multiple imputation by chained equations (M=40) was used to impute missing data on covariates. The size of the analytical sample was 3,402.

Dependent variables: health behaviors

The dependent variables are four major health behaviors: smoking frequency, drinking frequency, dietary change and the level of physical activity. *Smoking frequency* is measured by the number of cigarettes the respondent smoked per day. *Drinking frequency* is measured by the number of days the respondent consumed alcohol in the last three months. Nonsmokers and nondrinkers are coded as 0. *Dietary change* in 2003 measures the degree of dietary change since arrival in the U.S. Respondents were asked to rate the degree (on a scale of 1 to 10) to which their current diet was different from their diet in their home country. In the follow up survey, however, dietary change (in 2007) was measured as the degree of dietary change since last interview. Finally, a measure of *physical activity* was constructed to indicate how many times per week respondents engaged in light and vigorous physical activities.

Independent variables: Language acculturation

English-language proficiency: Respondents self-rated their proficiency on a scale of 1 to 4 by responding to the question "How well would you say you speak English?" (1="not at all," 2="not well," 3="well," and 4="very well").

Covariates

Following previous research on immigrant health and health behaviors, the analyses adjust for a number of covariates when estimating the relationship between English-language proficiency and health behaviors, including English-language use. Questions about language use with friends, with spouse, at home and at work were used to construct an index of English-language use. Respondents were asked to provide a list of languages they use in each these social domains. For each of these domains (i.e. variables), responses were coded as "no English" (0), "Some English" (1), or "English only" (2). The language use index is, which is a row total of English-language use across

these four domains, rages from 0 to 8. The models include controls for human capital and socioeconomic status, including years of education, years in the United States, employment status (1=employed, 0=not employed) and household income (<25,000, 25,000-49,000, $50,000-$75,000 and >$75,000). Sociodemographic controls include age, household size, gender (female = 1), race (Asian, Black, Hispanic, White and Other), and marital status (married = 1, unmarried=0). English-language proficiency and use may also depend on intermarriage; therefore, the models control for whether or not married respondents have a native-born spouse. Finally, Since English is the lingua franca in some immigrants' home countries, I also adjust for whether or not respondents are from an English-speaking country of origin.

Methods

I estimate both cross-sectional (Table 3) and longitudinal (Table 4) regression models for each health behavior: smoking frequency (Model 1), drinking frequency (Model 2), dietary change (Model 3) and physical activity (Model 4). First, using data from 2003, I estimate the cross-sectional association between language acculturation and health behaviors in 2003. Second, I use data on health behaviors from 2007 to estimate the lagged effects of language acculturation on each health behavior (controlling for baseline health behaviors in 2003)[1]. To examine differences in the effects of language acculturation on health behaviors, I include interaction terms (interaction between race and language proficiency) in each model (Table 5).

 RESULTS

Descriptive statistics

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[1] English-language proficiency and use were asked only at time 1, which does not allow the estimation of fixed effects.

Tables 1 and 2 show descriptive statistics on the outcome variables and covariates respectively. The data in Table 1 are means and standard deviations for the whole sample in 2003 and 2007. Among immigrants overall, smoking frequency remains virtually unchanged, whereas drinking frequency increases significantly. However, the degree of dietary change and levels of physical activity decline overtime.

The data also show differences in health behaviors across race categories. The data from 2003 show that smoking and drinking frequency are highest among white immigrants and lowest among black immigrants and Asians respectively. The degree of dietary change is highest for Hispanic immigrants and lowest for Asians. Frequency of physical activity, on the other hand, is highest for white immigrants and lowest for Hispanic. For the most part, similar patterns are observed in the data from 2007. In 2007, however, dietary change is highest for black immigrants and lowest for whites, whereas physical activity levels are lowest among Asians. Differences across race after including important controls, such as socioeconomic status, are shown in Tables 3 and 4 and are discussed below.

Regression analyses

Table 3 presents Ordinary Least Squares (OLS) regression models of health behaviors using the cross-sectional data from 2003. The results show no relationship between language acculturation and smoking and drinking frequency (Models 1 and 2, respectively) in 2003. However, English-language proficiency is positively associated with both the degree of dietary change and the frequency of physical activity, whereas English-language use is positively linked to the degree of dietary change.

These models also highlight some group differences in health behaviors, after controlling for key confounders, such as socioeconomic status. For instance, relative to white immigrants, all other racial groups report lower levels of smoking and drinking behavior (and these differences are highly significant, p<.0001). Although the differences are marginally significant (P<.1), Asian and Hispanic immigrants report lower levels of physical activity. With regard to dietary change, black and Hispanic immigrants report higher degrees of dietary change relative to their diets in their home countries compared to white immigrants (this difference is highly significant for Hispanic immigrants, whereas it is marginally significant for black immigrants). With regard to gender, there were no differences in the degree of dietary change, but women report lower levels of smoking frequency, drinking frequency and physical activity.

Table 4 presents lagged regression models of health behaviors using the panel data (2003-2007). These models examine the relationship between linguistic acculturation and health behaviors in 2007, controlling for baseline (i.e. 2003) differences in health behaviors. In other words, these models examine change in health behaviors over time. The results show that English-language proficiency is positively associated with both drinking frequency (Model 2) and frequency of exercise (Model 4), but there was no association with smoking frequency (Model 1) and the degree of dietary change (Model 3). There was also no association between English-language use and any of the health behaviors examined.

With regard to group differences, black and Hispanic immigrants showed a lower degree of change over time (i.e. lower degree of increase) in smoking behavior relative to white immigrants, whereas all other racial groups showed a lower degree of change in drinking behavior and a higher degree dietary change (although the coefficient for Hispanic in the dietary change model is only

marginally significant). Moreover, Asian and black immigrants showed a lower degree of change in levels of physical activity relative to white immigrants. With regard to gender, there were differences in the models for smoking and drinking only, with women reporting lower levels of change (i.e. increase) relative to men.

Interactions between Race and Language Acculturation

Tables 5 and 6 examine whether there is an interaction effect between race and language acculturation in any of the 8 models presented above (with white as the reference group). Table 5 shows that there were highly significant interactions between race and language proficiency in the models for drinking frequency. That is, while English-language proficiency has a positive main effect on drinking frequency in 2003 and 2007, its effect is much smaller for all other groups. While English-language proficiency has a positive effect on levels of physical activity in 2003 (Table 3), this seems to be less so for Asian immigrants (i.e. this relationship is weaker for Asian immigrants compared to white immigrants). In addition, the effect of proficiency on changes in the frequency of smoking and physical activity (Models 5 and 8 respectively) was higher for black immigrants compared to whites. As shown in Table 6, there were fewer interactions between English-language use and race. In fact, it was only in the drinking frequency models (Models 2 and 7) where there were such interaction effects. The basic finding here is that, relative to white immigrants, the effect of language use on drinking frequency in 2003 was smaller for Asian and black immigrants, and smaller for black immigrants only in 2007.

Discussion

Migration is often accompanied by subsequent changes in lifestyle and health behaviors, which have long-term consequences for immigrant health. The extant literature, and the widely

documented "healthy immigrant effect" in particular, suggests that immigrants, on average, experience an increase in both negative health conditions and negative health behaviors. This negative effect of the immigrant experience on health behaviors has mainly been attributed to acculturation (Amaro et al. 1990; Salinas and Sheffield 2011; Trinidad et al. 2006), which is often measured by language proficiency and use. Since prior research has focused on Hispanic and Asian immigrants, however, the extent to which this effect of language acculturation is universal, which is to say the extent to which its effects vary across immigrant groups, is not well understood. Because prior research also has extensively relied on cross-sectional data, little is known about the long-term effects of language acculturation on health behaviors. That is, the literature is not clear whether the negative effects of language acculturation result from short-term adjustments to life in the host nation or whether they are reflective of long-term changes in health behaviors. Moreover, the extant literature focuses primarily on negative health behaviors (primarily smoking and alcohol consumption), which not only provides a partial and limited view of the link between acculturation and health behaviors, but may also lead to biased conclusions about the overall or "net" effects of language acculturation.

This study, therefore, examined the link between language acculturation and immigrant health behaviors, focusing on the contingent effects of English language proficiency. Particularly, the study investigated the short-term and long-term associations between language acculturation and health behaviors, examining four different health behaviors: smoking, drinking, dietary change and levels of physical activity. To assess whether language acculturation has different implications for health behaviors in the short-term and long-term, the analysis estimated both cross-sectional and longitudinal models using panel data from the NIS (2003, 2007). Moreover, interaction effects were estimated to study if the implications of language acculturation vary by race/ethnicity. The

results indicate that the link between language acculturation and health behaviors may be contingent upon time, the immigrant group and the specific health behavior examined.

More specifically, while language proficiency does not appear to be associated with smoking and drinking behavior in the short-run, it encourages both dietary change and frequency of physical activity. In the long-run, it is positively associated with both drinking frequency and physical activity. This suggests that the effect of language acculturation is generally positive when it comes to immigrants' levels of physical activity, but its effects on dietary change and drinking behavior is time-dependent. That is, immigrants who are more acculturated, perhaps unsurprisingly, adopt a diet that is more different relative to their diet in their home country in the short-run, but acculturation does not predict further change in diet in the long-term. This is consistent with Akresh's (2007) finding for Hispanic immigrants that the effect of time in the U.S. (another measure of acculturation in the literature) holds only up to a certain threshold. On the other hand, even though immigrants with higher language proficiency did not report higher levels of drinking frequency at time 1, they reported higher drinking frequency, on average, at time 2, suggesting a long-term or cumulative increase in drinking behavior among immigrants with higher language acculturation.

These results have important implications for how we understand the link between acculturation and immigrant health behaviors. First, acculturation is a mixed bag; and this is to say that while it encourages certain negative health behaviors, such as drinking more frequently and adopting a more western diet, it may also influence positive health behaviors, in this case physical activity, whose long-term health benefits have long been established (Warburton 2006). Second, while longitudinal data is not always available, acculturation studies that rely on cross-sectional data

may be overlooking the time-dependent relationship between language acculturation and certain health behaviors. As this study finds, for instance, while cross-sectional data shows no relationship between language acculturation and alcohol consumption, language acculturation is strongly associated with alcohol consumption in the lagged model, suggesting that non-findings in the literature may sometimes be an artifact of data limitations. Therefore, researchers should pay more attention to the implications of the time-frame under investigation.

Second, while the results suggest that language acculturation increases certain health behaviors in the short-run and in the long-run, consistent with the predictions of the healthy immigrant effect, it highlights that there may be different processes that contribute to this negative health assimilation. If we understand English-language proficiency to represent the cultural dimension of acculturation and English-language use to be associated with social network processes, the findings of this study suggest that the effects on drinking behavior and physical activity may be related cultural change, whereas the effects on smoking behavior and dietary change may be related to changes in social networks associated with acculturation.

Finally, the study has some limitations worth noting and that future studies could address. For instance, only newly admitted legal immigrants were included in the NIS sampling frame; therefore, findings from this study may not necessarily reflect the health behavioral effects of language proficiency and use for undocumented and other legal immigrants, who may experience different acculturative processes or paths. Therefore, group differences in acculturation effects may also be different for these groups of immigrants who are not captured in the present dataset. Moreover, while the focus of this study is on language acculturation, future studies could also benefit from examining other measures or correlates of acculturation, such as generational status,

length of residency, age at migration, and direct measures of social network integration. Despite these limitations, to the best of the author's knowledge, this is the first study to investigate group differences in acculturation effects using a nationally representative longitudinal data set, and makes an important contribution towards a fuller understanding of systematic differences in acculturation effects across immigrant groups.

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Table 1. Descriptive Statistics for Outcome Variables by Race/Ethnicity, New Immigrant Survey (NIS)
Panel (2003-2007)

Variable	NIS (2003)				
	Pooled	Asian	Black	Hispanic	White
Variable	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Smoking Frequency	.55 (2.30)	.43 (1.97)	.22 (1.20)	.33 (1.51)	1.32 (3.80)
Drinking Frequency	.49 (1.12)	.29 (.88)	.41 (.98)	.45 (1.00)	.89 (1.51)
Dietary Change	5.48 (3.21)	4.58 (2.75)	5.63 (3.02)	6.22 (3.42)	5.07 (3.02)
Physical Activity	4.39 (3.79)	4.43 (3.81)	4.83 (3.83)	4.01 (3.70)	4.96 (3.27)
	NIS (2007)				
	Pooled	Asian	Black	Hispanic	White
Variable	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Smoking Frequency	.54 (2.28)	.53 (2.20)	.25 (1.61)	.36 (1.78)	1.05 (3.27)
Drinking Frequency	.60 (1.23)	.40 (1.06)	.41 (.91)	.59 (1.15)	.99 (1.54)
Dietary Change	5.09 (3.20)	4.92 (3.04)	5.41 (3.26)	5.34 (3.40)	4.68 (2.89)
Physical Activity	4.32 (3.85)	3.97 (3.53)	4.13 (3.32)	4.39 (3.04)	4.72 (4.04)
N	3402	1000	378	1170	763

Table 2. Descriptive Statistics for Predictor Variables, New Immigrant Survey (2003), N =3402

Variable	M (SD) or %
Independent variables	
English-language proficiency	2.57 (1.02)
English-language use index	2.48 (2.16)
Covariates	
Years of education	13.05 (4.91)
Years in the United States	5.31 (6.12)
Household size	3.69%
Employed	62.00%
Household income	
<$25,000	55.00%
$25,000-$49,000	21.38%
$50,000-$75,000	9.81%
>$75,000	13.82%
Female	53.53%
Marital Status	70.95%
Native-born spouse	7.29%
English-speaking country of origin	20.00%
Race	
Asian	29.93%
Black	11.39%
Hispanic	34.82%
White	22.80%
Other	1.06%

Table 3: Cross-sectional Models of Immigrant Health Behaviors, New Immigrant Survey (2003)

Variable	Model 1 (smoking)	Model 2 (drinking)	Model 3 (diet)	Model 4 (exercise)
English-language proficiency	-0.03	0.04	0.24*	0.31*
	(0.07)	(0.04)	(0.10)	(0.13)
English-language use	0.05	0.01	0.11*	0.03
	(0.03)	(0.02)	(0.05)	(0.06)
Years of education	-0.00	0.00	-0.05**	0.03
	(0.01)	(0.01)	(0.02)	(0.02)
Employed	0.10	0.07	-0.05	-0.61***
	(0.09)	(0.05)	(0.15)	(0.17)
Household income				
$25,000-$49,000	-0.12	0.15*	0.03	-0.00
	(0.12)	(0.07)	(0.20)	(0.23)
$50,000-$75,000	-0.38**	0.20*	0.10	-0.04
	(0.14)	(0.10)	(0.27)	(0.32)
>$75,000	-0.22	0.40***	-0.41	0.52
	(0.21)	(0.11)	(0.26)	(0.35)
Years in the U.S.	-0.01	-0.01	0.07**	-0.05
	(0.02)	(0.01)	(0.03)	(0.03)
Years in the U.S. squared	0.00	0.00	-0.00+	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Age	0.00	0.00	-0.02***	0.02***
	(0.00)	(0.00)	(0.01)	(0.01)
Household size	-0.02	-0.03**	0.00	-0.00
	(0.02)	(0.01)	(0.03)	(0.04)
Female	-0.54***	-0.43***	0.08	-0.73***
	(0.10)	(0.05)	(0.13)	(0.16)
Race				
Asian	-0.76***	-0.53***	-0.17	-0.45+
	(0.19)	(0.08)	(0.18)	(0.25)
Black	-1.14***	-0.42***	0.46+	-0.20
	(0.19)	(0.09)	(0.24)	(0.30)
Hispanic	-0.97***	-0.29***	0.92***	-0.44+
	(0.17)	(0.07)	(0.20)	(0.26)
Other	-0.61	-0.51	0.02	-1.17+
	(0.51)	(0.33)	(0.63)	(0.65)
Married	-0.16	-0.01	-0.12	-0.42*
	(0.10)	(0.04)	(0.15)	(0.18)
Native-born spouse	0.08	0.19+	0.42+	0.04
	(0.20)	(0.10)	(0.24)	(0.30)
English-speaking country of origin	-0.21	0.14+	-0.60**	-0.24
	(0.16)	(0.07)	(0.18)	(0.26)
Constant	1.87***	0.82***	5.54***	3.94***
	(0.35)	(0.15)	(0.46)	(0.59)
Observations	3402	3402	3402	3402
R-squared				

Note: standard errors in parentheses; + p<.1, *p<0.05, **p<0.01, ***p<.0001

Table 4. Longitudinal Models of Immigrant Health Behaviors, New Immigrant Survey (2003-2007)

Variable	Model 1 (smoking)	Model 2 (drinking)	Model 3 (diet)	Model 4 (exercise)
English-language proficiency	-0.04	0.09*	0.00	0.29*
	(0.06)	(0.04)	(0.11)	(0.14)
English-language use	0.01	-0.00	-0.01	0.03
	(0.03)	(0.02)	(0.05)	(0.05)
Years of education	-0.01	0.00	0.03+	0.01
	(0.01)	(0.01)	(0.02)	(0.02)
Employed	-0.13	-0.02	-0.26+	-0.25
	(0.09)	(0.05)	(0.15)	(0.16)
Household income				
$25,000-$49,000	-0.02	0.05	0.12	-0.07
	(0.12)	(0.06)	(0.19)	(0.23)
$50,000-$75,000	-0.17	0.05	0.18	0.11
	(0.14)	(0.11)	(0.26)	(0.30)
>$75,000	-0.11	0.21*	-0.10	0.24
	(0.17)	(0.09)	(0.24)	(0.29)
Years in the U.S.	-0.01	0.00	0.02	0.02
	(0.02)	(0.01)	(0.02)	(0.03)
Years in the U.S. squared	0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Age	-0.00	-0.00	-0.02***	0.02*
	(0.00)	(0.00)	(0.01)	(0.01)
Household size	0.02	0.02+	0.05	-0.01
	(0.02)	(0.01)	(0.03)	(0.04)
Female	-0.49***	-0.43***	-0.03	-0.25
	(0.09)	(0.05)	(0.13)	(0.16)
Race				
Asian	-0.05	-0.33***	0.66***	-0.63**
	(0.15)	(0.07)	(0.18)	(0.22)
Black	-0.36*	-0.44***	0.67**	-0.62*
	(0.15)	(0.08)	(0.24)	(0.27)
Hispanic	-0.33*	-0.15*	0.39+	0.28
	(0.16)	(0.08)	(0.20)	(0.25)
Other	0.04	-0.27	-0.15	-0.15
	(0.30)	(0.24)	(0.56)	(0.72)
Married	-0.07	-0.13**	-0.22	-0.23
	(0.10)	(0.05)	(0.15)	(0.18)
Native-born spouse	-0.03	0.20*	0.23	0.03
	(0.13)	(0.10)	(0.24)	(0.27)

Table 3, continued

English-speaking country of origin	-0.29**	0.08	-0.88***	0.24
	(0.11)	(0.07)	(0.18)	(0.22)
Smoking frequency in 2003	0.49***			
	(0.07)			
Drinking frequency in 2003		0.37***		
		(0.04)		
Dietary change in 2003			0.17***	
			(0.02)	
Physical activity in 2003				0.25***
				(0.02)
Constant	1.27***	0.66***	4.42***	2.20***
	(0.36)	(0.15)	(0.47)	(0.54)
Observations	3402	3402	3402	3402
R-squared				

Note: standard errors in parentheses; + p<.1, *p<0.05, **p<0.01, ***p<.0001

Table 5. Interaction Models of Race and English Language Proficiency, New Immigrant Survey (2003-2007)

	Model 1 (smoking)	Model 2 (drinking)	Model 3 (diet)	Model 4 (exercise)	Model 5 (smoking)	Model 6 (drinking)	Model 7 (diet)	Model 8 (exercise)
English-language proficiency	-0.15	0.27***	0.13	0.34	-0.26	0.30***	-0.03	0.11
	(0.19)	(0.08)	(0.17)	(0.22)	(0.17)	(0.07)	(0.16)	(0.23)
Race								
Asian	-1.41**	0.39+	-0.30	0.77	-0.70	0.40*	0.66	-1.15+
	(0.50)	(0.20)	(0.49)	(0.70)	(0.53)	(0.19)	(0.51)	(0.67)
Black	-1.49**	0.24	-0.48	-0.05	-1.21*	0.39+	1.07	-1.99*
	(0.51)	(0.24)	(0.76)	(0.93)	(0.55)	(0.23)	(0.84)	(0.84)
Hispanic	-1.22*	0.43*	0.57	-0.81	-1.05*	0.51**	0.17	-0.27
	(0.48)	(0.20)	(0.51)	(0.66)	(0.52)	(0.18)	(0.50)	(0.68)
Other	-4.59+	-1.90	-0.19	0.17	-3.46*	0.52	-3.80	-1.46
	(2.72)	(1.93)	(2.82)	(4.02)	(1.59)	(1.70)	(2.63)	(4.37)
RaceXenglish-language proficiency								
AsianXenglish-language proficiency	0.24	-0.34***	0.04	-0.48+	0.23	-0.27***	-0.01	0.19
	(0.19)	(0.08)	(0.17)	(0.25)	(0.17)	(0.07)	(0.17)	(0.23)
BlackXenglish-language proficiency	0.12	-0.24*	0.33	-0.05	0.30+	-0.30***	-0.13	0.48+
	(0.19)	(0.09)	(0.26)	(0.33)	(0.17)	(0.09)	(0.28)	(0.28)
HispanicXenglish-language proficiency	0.08	-0.27***	0.13	0.20	0.27	-0.25***	0.09	0.20
	(0.18)	(0.08)	(0.19)	(0.25)	(0.17)	(0.07)	(0.18)	(0.26)
OtherXenglish-language proficiency	1.25	0.40	0.08	-0.44	1.11*	-0.27	1.13	0.43
	(0.96)	(0.69)	(0.83)	(1.26)	(0.54)	(0.55)	(0.77)	(1.45)
Constant	2.20***	0.17	5.85***	3.81***	1.88**	0.06	4.49***	2.76***
	(0.55)	(0.23)	(0.60)	(0.80)	(0.62)	(0.21)	(0.59)	(0.78)
Observations	3402	3402	3402	3402	3402	3402	3402	3402

Note: standard errors in parentheses.
+ p<.1, *p<0.05, **p<0.01, ***p<.0001

Table 6. Interaction between Race and English-Language Use, New Immigrant Survey (2003-2007)

	Model 1 (smoking)	Model 2 (drinking)	Model 3 (diet)	Model 4 (exercise)	Model 5 (smoking)	Model 6 (drinking)	Model 7 (diet)	Model 8 (exercise)
English-language use	0.04	0.05+	0.09	-0.00	-0.04	0.02	-0.05	-0.02
	(0.07)	(0.03)	(0.06)	(0.09)	(0.06)	(0.03)	(0.06)	(0.08)
Race								
Asian	-0.91***	-0.30**	-0.26	-0.36	-0.28	-0.27**	0.56*	-0.85*
	(0.25)	(0.11)	(0.26)	(0.37)	(0.28)	(0.10)	(0.27)	(0.35)
Black	-1.05***	-0.15	0.18	-0.57	-0.58*	-0.22+	0.21	-1.16**
	(0.26)	(0.14)	(0.38)	(0.49)	(0.27)	(0.12)	(0.43)	(0.44)
Hispanic	-0.96***	-0.13	0.91**	-0.68+	-0.56*	-0.08	0.26	0.17
	(0.24)	(0.10)	(0.28)	(0.36)	(0.26)	(0.09)	(0.27)	(0.34)
Other	-0.60	-0.53+	0.03	-1.18+	0.06	-0.27	-0.14	-0.13
	(0.51)	(0.32)	(0.63)	(0.66)	(0.31)	(0.24)	(0.56)	(0.72)
RaceXEnglish-language use								
AsianXEnglish-language use	0.06	-0.08*	0.03	-0.05	0.08	-0.02	0.03	0.08
	(0.08)	(0.03)	(0.08)	(0.11)	(0.07)	(0.03)	(0.07)	(0.09)
BlackXEnglish-language use	-0.03	-0.09*	0.09	0.12	0.07	-0.07*	0.14	0.17
	(0.07)	(0.04)	(0.10)	(0.13)	(0.07)	(0.03)	(0.11)	(0.11)
HispanicXEnglish-language use	-0.01	-0.05	-0.01	0.11	0.08	-0.03	0.04	0.02
	(0.07)	(0.03)	(0.08)	(0.11)	(0.06)	(0.03)	(0.08)	(0.10)
Constant	1.88***	0.64***	5.59***	4.12***	1.48***	0.57***	4.58***	2.38***
	(0.38)	(0.17)	(0.49)	(0.65)	(0.43)	(0.17)	(0.49)	(0.60)
Observations	3402	3402	3402	3402	3402	3402	3402	3402
R-squared								

Standard errors in parentheses; + p<.1, *p<0.05, **p<0.01, ***p<.0001