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Article

Pre-acculturation as a risk factor for obesity: Findings from the Health of Philippine Emigrants Study (HoPES)

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ABSTRACT

Immigrants to the United States may have an advantage in terms of healthier weight, but tend to gain excessive weight after arrival, and may suffer from obesity and related health conditions. Acculturation theory suggests that this increase in obesity risk is due to adoption of unhealthy western dietary behaviors, and assumes that "eastern/traditional" dietary behaviors prior to migration are healthier. While this assumption is supported by studies conducted several decades ago, the phenomenon of globalization that has risen since the 1990s has increased exposure to western ideas and behaviors in communities worldwide. Hence, today's immigrants are more likely to have already adopted less healthy behaviors that increase obesity risk prior to their arrival in the U.S., a phenomenon we term "pre-acculturation." The present study investigates the role of pre-acculturation in obesity development among immigrants from the Philippines.

Data come from the Health of Philippine Emigrants Study, fielded in 2017 (n = 1632). Pre-acculturation was measured with English proficiency, preparation to migrate, receiving care packages, texting, telephone, or internet contact with friends/family in the U.S. Outcomes included the body mass index (BMI, kg/m^2), waist circumference (WC, cm), waist-to-height ratio (WHtR) and waist-to-hip-ratio (WHR). Covariates included age, gender, education, financial strain, physical activity, and diet.

Migrants reported greater English proficiency, preparation, and a slightly lower WHtR than non-migrants, but did not differ on BMI, WC, or WHR. Preparation was associated with greater BMI, WC, and WHtR, and the effects of preparation status differed by migration status. Among migrants, more preparation was associated with greater BMI, WC, and WtHR. Further, among non-migrants, texting and telephone communications was related to lower BMI, WC, and WHR.

In summary, pre-acculturation may be a risk factor for obesity in the Philippines, suggesting that binary notions of "Western" versus "eastern/traditional" cultures may be too simplistic.

Introduction

Many studies indicate that immigrants to the United States (U.S.) are healthier than their U.S.-born counterparts (Alidu & Grunfeld, 2018). Yet the health of immigrants often erodes over time. This erosion is typically attributed to acculturation, the adoption of "Western" (often U.S.) ideas and behaviors (Oakkar et al., 2015; Serafica & D Angosta, 2016; Vargas & Jurado, 2016). However, there is good reason to interrogate this concept further, particularly the assumption that acculturation occurs after migration. Recent scholars have emphasized that the world is interconnected due to globalization, and have called for more studies using a cross-national perspective (Acevedo-Garcia, Sanchez-Vaznaugh, Viruell-Fuentes, & Almeida, 2012; Goryakin, Tim Lobstein, James, & Suhrcke, 2015; Hawkes, 2006; Popkin, Adair and Ng 2012; Ro & Bostean, 2015; Viruell-Fuentes, 2007). U.S. products and ideas are exported to other countries in many ways. Accordingly, we suspect that acculturation does not happen only after migration, as implied by much of the literature. We advance the idea of "pre-acculturation," referring to the process through which individuals become familiar with U.S. ideas and products in their home countries before migration (Berry & Sam, 1997; Jasinskaja-Lahti & Yijälä, 2011). The present study examines how pre-acculturation may be related to obesity risk in the Philippines.

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Conceptual background

Globalization has several definitions, but for our purposes refers to the economic, political and social interconnectedness between countries and residents of these countries. Globalization has been linked to worldwide changes in health problems, such as obesity (Goryakin et al., 2015; Popkin, Adair and Ng 2012). The rationale is that the transfer of practices, preferences, products, and ideas across countries contributes to common global trends in health behaviors and health outcomes. Indeed, although the United States has led much of the world in the rise of obesity, many other countries have followed suit (Lin, Teymourian, & Tursini, 2018; Popkin, Adair and Ng 2012). The rise in obesity worldwide is often attributed to the increased consumption of high calorie, processed foods and adoption of energy-saving devices (e.g. washing machines) in countries across the globe (Swinburn et al., 2011). Greater access to energy dense foods, and the simultaneous reduction of energy expenditure, contributes to the storage of energy in the body, and thus, higher rates of obesity.

A parallel literature has highlighted the growth in obesity among immigrants to countries such as the U.S. This literature has often noted that immigrants are less obese than their U.S. born peers, but that immigrants often rapidly become obese with time in the new country (Goel, McCarthy, Phillips, & Wee, 2004; Murillo, Albrecht, Daviglus, & Kershaw, 2015). This change in obesity is often attributed to acculturation, with the predominant assumption that acculturation occurs after arrival. For example, a recent systematic review noted, that "acculturation following immigration is associated with both chosen and imposed life changes …" (Alidu & Grunfeld, 2018, p. 725). Similar ideas are expressed elsewhere, such as in the following, "Among Hispanic adults [in the U.S.], the burden of obesity has been shown to differ by level of acculturation, i.e. the process of adaptation to a new culture by adoption of new attitudes, behaviors, and beliefs" (Murillo et al., 2015, p. 50). The word "new" implies little to no familiarity with the U.S., yet, this argument feels incomplete in the context of globalization. For example, Ortiga (2014) has noted that some nursing schools in the Philippines explicitly train their students to become "'global' Filipino nurses." Thus, globalization requires that we rethink traditional models of acculturation to more fully consider what occurs to migrants before they exit their countries.

Globalization may begin the process of adaption to a new society among migrants before they leave for their destination, a phenomenon we term "pre-acculturation." Globalization facilitates the transfer of ideas across distant countries, which can include knowledge and preferences for consumer goods (e.g. food) and behaviors (e.g. use of appliances), that reflect pre-acculturation (Jasinskaja-Lahti & Yijälä, 2011). It may also include broader ideas about health, beauty, fitness, and other attitudes and norms (Berry & Sam, 1997). This information is disseminated through multiple channels, including transnational corporations, colonialization and military occupation, mass media, and through immigrant networks (Acevedo-Garcia et al., 2012; Alegría, Álvarez, & DiMarzio, 2017).

Globalization may foster English proficiency. Due to historic occupation by the U.S. and transnational trade, English is widely used in many countries such as the Philippines (Gee, Walsemann, & Takeuchi, 2010). English proficiency is often used as a proxy for acculturation to U.S. society and has been related to obesity risk (Himmelgreen et al., 2004). However, language proficiency may have a slightly different meaning in the current context. Many migrants may want to improve their language skills to ensure a smoother transition in the destination country; thus, we consider it an aspect of pre-acculturation.

Pre-acculturation may involve other activities that help prepare one for life in a new country. This preparation can take the form of actions such as saving money and contacting relatives overseas. These actions may foster greater wealth and social support, which may reduce obesity and improve health (Bennett, Wolin and Duncan 2008). Gong and colleagues has argued that pre-migration preparation helps alleviate stress, which then can reduce the risk of health problems (Gong, Xu, Fujishiro, David, & Takeuchi, 2011). Indeed, stress can contribute to obesity through changes in the metabolism and storage of energy (Dallman, 2010).

In addition to stress, pre-acculturation may influence obesity risk through information and behavior change. Immigrants also exchange ideas with their kinfolk through telephone, texting, e-mail, and social media (Keshishian, 2000). For example, text messages might transmit inspiring messages (e.g. "I just ran a half-marathon"). Telephone calls might be particularly useful in facilitating communication about sensitive topics (e.g. "your uncle has diabetes"), whereas E-mail may provide particularly easy access to websites with health relevant information (e.g. low calorie recipes). Additionally, people in the Philippines may receive care packages from the U.S., which may contain products such as snack foods (Hof, 2018).

We explore pre-acculturation in the Philippines. This country provides a useful case for our research because it is a former U.S. territory, and continues to have ties with the U.S. The U.S. is the top receiving country for Filipino immigrants (Commission on Filipinos Overseas, 2010). In 2016, approximately 1.9 million Filipino immigrants resided in the U.S., making them the fourth largest immigrant population (behind those from Mexico, India, and China) (Gee et al., 2018).

We investigate whether persons in the Philippines experience pre-acculturation, whether pre-acculturation is more prevalent among migrants compared to non-migrants, and whether pre-acculturation is related to obesity risk factors. We also explore whether this relationship is explained by diet, physical activity or socioeconomic factors. The specific hypotheses are:

H1. Filipinos will demonstrate some level of pre-acculturation, as indicated by English proficiency, preparation to emigrate, and exchanges with friends/family members in the U.S.

H2. Filipinos who are planning to emigrate to the U.S. will demonstrate more pre-acculturation than those who are not planning to emigrate.

H3. Pre-acculturation will be associated with increased risk of obesity.

H4. The association between pre-acculturation and obesity will differ between Filipino migrants to the U.S. compared to non-migrants.

Body mass index (BMI) is one of the most widely used indicators of obesity. Some have argued that measures of abdominal fat mass are a more relevant indicator for health risks. Consistent with that argument, a recent review concluded that waist circumference (WC) might be a stronger risk factor for overall mortality than BMI (Seidell, 2010). Similarly, research from the Obesity in Asia Collaboration, involving over 263,000 participants, suggested that central obesity indicators, especially WC, are a more robust indicator of diabetes prevalence than BMI (Huxley et al., 2008). However, a study of 382 Filipina American women suggested that BMI, WC, and the waist-to-height ratio (WHtR) were equivalent in their ability to predict hypertension and diabetes (Battie et al., 2016). Similarly, a review of prospective studies indicated that BMI, WC, WHtR and the waist-to-hip ratio (WHR) were all equivalent in predicting type II diabetes (Qiao & Nyamdorj, 2010). Because there is currently no consensus as to the "best" indicator of obesity, we study these four interrelated measures that correlate with morbidity among Filipino populations (Battie et al., 2016; Serafica & D Angosta, 2016).

Methods

Sample

Data come from the Health of Philippine Emigrants Study (HoPES). We briefly describe the study below; additional details are available (Gee et al., 2018). HoPES has 2 cohorts, a migrant sample (n = 832) that

planned to emigrate to the U.S. and a non-migrant sample (n = 805) that remained in the Philippines. Baseline data for both cohorts was collected in the Philippines in 2017.

The non-migrant sample was obtained via a stratified random sampling of households near the cities of Manila and Cebu. The sampling design began with 3 strata (Metropolitan Manila, Metropolitan Cebu, and Rural Cebu). Within each stratum, HoPES sampled administrative units called *barangays* (akin to U.S. census tracts) with probabilities proportional to population. Within barangays, HoPES obtained a cluster sample of households and randomly selected individuals within households (response rate 69%). A criterion for joining the non-migrant cohort was no plans to move from the residence for the next 3 years.

The migrant sample consisted of Filipino emigrants destined for permanent residence in the U.S. HoPES collaborates with the Commission on Filipinos Overseas, a national government agency of the Philippines that regulates emigration. After a Filipino person has obtained legal clearances and secured their visa from both the Philippines and U.S. governments, before leaving the Philippines, they must attend a mandatory Pre-Departure Orientation Seminar (PDOS) in Manila or Cebu (and with rare exceptions, elsewhere in the country) (Gee et al., 2015). HoPES recruited participants attending PDOS sessions (response rate 37%), allowing for a unique opportunity to sample from the universe of all legal permanent migrants from the Philippines. Approximately 64% of migrants planned to leave for the U.S. within 2 weeks of attending the PDOS, and 34% planned to leave between 2 weeks and 2 months. Only 1.4% would depart more than 2 months from baseline. HoPES participants are representative of the recent Filipino immigrant population in the U.S. (Gee et al., 2018).

Measures

Dependent variables

Trained staff measured participants' height, weight, waist circumference, and hip circumference using a standardized protocol (Gee et al., 2018). All measures were taken thrice, and a fourth measure was taken if discrepancies among measurements exceeded pre-established thresholds; the three closest measures were averaged. Height was measured with a stadiometer (Chander brand, Model HM200P). Weight was measured with a digital scale (Tanita Corporation, Model BC-541N). These measures were used to derive the following outcomes:

Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared.

Waist circumference (WC) was measured at the midpoint between the iliac crest and the lower rib margin after expiration with a standardized measuring tape (Weight and Measure brand, Model CAN150). Hip circumference was measured as the maximum circumference over the buttocks.

Waist–to-Height-Ratio (WHtR) was calculated as WC divided by height.

Waist-to-Hip-Ratio (WHR) was calculated as the WC divided by the hip circumference.

Pre-acculturation

Migrants and non-migrants were asked about English proficiency and preparation for moving to the U.S.

Self-reported *English proficiency* assessed whether participants spoke English 0 = "not at all," to 4 = "very well."

Pre-migration preparation was a 9-item index that asked participants what they had done to prepare to move to the U.S. Sample items included, "took English classes," "saved money," "contacted relatives in the destination country." Affirmations were summed, with higher scores indicating more preparation.

Non-migrants were further asked about contact with friends and family in the U.S. with one question about texting or telephone calls and a second question about use of e-mail or other internet services. Responses were 0 = never, 1 = less than once a month, 2 = 1–3 times a month, 3 = at least once a week, 4 = every day. A third question asked about receiving care packages (balikbayan boxes); responses were 0 = never, 1 = less than once a year, 2 = once a year, 3 = twice a year, and 4 = three or more times per year. These indicators were used as independent measures instead of as a scale because preliminary analyses indicated they were associated with obesity indicators in different directions.

Covariates

Gender and *age* were included given well-established differences in adiposity by these characteristics.

Persons with greater education and economic resources may generally be healthier and adopt new ideas more quickly (Negy & Woods, 1992). Accordingly, we controlled for *education* and *financial strain*. The latter was a question asking, "when you think about the money that you have and all of your expenses, would you say that there is: (1) considerable difficulty in meeting expenses; (2) some difficulty in meeting expenses; (3) just enough to pay expenses, with no difficulty; (4) there is enough, with money left over" (Kahn & Pearlin, 2006).

We considered including employment and income as additional economic indicators, but did not include them because immigrants often terminate employment prior to moving.

Diet and physical activity potentially explain the relationship between pre-acculturation and obesity risk. *Diet* was assessed with 4 questions indicating the frequency of consumption of healthy and unhealthy foods, specifically soda, fast food, green leafy vegetables, and fresh fruit (Gee et al., 2018). Responses ranged from 0 = never to 5 = six or more times a week.

Physical activity was self-reported based on an established scale that asked 8 questions about the nature of the participant's employment and the hours in a typical week that the participant spent in physical activities (e.g. walking, housework, swimming) and the degree of vigor in performing them (Wareham et al., 2003). Per the protocol by Wareham et al. (2003), the activities are then grouped as a follows: "inactive" which indicates that the participant has a sedentary job (e.g. accountant) and no recreational activity; "moderately inactive" referring to a sedentary job with less than 30 min of recreational activity a day or a standing job (e.g. hairdresser) with no recreational activity; "moderately active" indicating a sedentary job with 30–60 min of daily recreational activity or a standing job with 30 min of recreational activity or a physical job (e.g. plumber) with no recreational activities; "active" which indicates a sedentary job with more than 60 min of recreational activity, a standing job with at least 30 min of recreational activity, or a physical job with some recreational activity or a heavy manual job (e.g. construction worker).

Analyses

Analyses began with univariate and bivariate explorations, then proceed to use linear regression to model the relationship between obesity indicators (BMI, WC, WHtR, WHR) and pre-acculturation indicators (English proficiency, preparation). The linear regression models began with demographic controls (age, gender), then included socioeconomic factors (financial strain, education). Final models included physical activity and diet. Interactions were tested to evaluate if the effect of pre-acculturation varied by migration status. Analyses are also stratified by migrants versus non-immigrants to probe the interactions further, and also because non-migrants were asked additional questions related to receiving care packages, texting/telephone and e-mail communications to the U.S. Data were missing for less than 5% of the variables (accounting for skip patterns), so we used complete case analysis on the analytical sample of n = 1632. Analyses employed sampling weights and the *svy* command in Stata version 14. The sampling weights are post-stratification weights that align the migrant and nonmigrant

samples in HoPES with the age, sex and education distribution of recent migrants from the Filipinos to the U.S. (2 years or less of U.S. residency) based on the American Community Survey 2011–2013.

Results

Table 1 summarizes the sample characteristics. Migrants and non-migrants showed similar levels of obesity risk. The mean BMI was 24.4 kg/m^2 and 24.7 kg/m^2, the mean waist circumference was 86.3 cm and 86.4 cm, and the WHtR was 0.386 and 0.386, for migrants, and non-migrants, respectively. None of these differences were statistically different. The difference in WHR was statistically significant, but the estimates were similar, 0.896 and 0.912, respectively. Migrants tended to report consuming more fruits and vegetables and less soda, but also less physical activity than non-migrants. The two groups did not differ statistically in their consumption of fast food, however.

Migrants reported greater English proficiency, with 60.6% reporting speaking English very well or well, compared to only 24.7% of non-migrants. Further, 83.7% of migrants did some preparation for moving to the U.S., compared to only 4.5% of non-migrants. Many non-migrants, however, did have contact with friends/family members, with the most frequent mode of contact being e-mail, followed by care packages, and telephone/text.

Not shown in the table are gender differences in the obesity indicators. Mean BMI values were 24.9(SE = 0.22), 24.0(SE = 0.18), 24.4 (SE = 0.27), 25.1(SE = 0.23) kg/m^2 for non-migrant women, migrant women, non-migrant men, and migrant men, respectively. WC values were 86.3(SE = 0.51), 85.0(SE = 0.45), 86.6(SE = 0.71), and 88.9 (SE = 0.61) cm; WHR values were 0.91(SE = 0.002), 0.89(SE = 0.003), 0.92(SE = 0.004), and 0.91(SE = 0.003); and WHtR values were 0.39 (SE = 0.003), 0.40(SE = 0.005), 0.37(SE = 0.003), and 0.42 (SE = 0.004), for the respective categories.

Table 2 displays the multivariable models that regress the 4 obesity indicators on English proficiency and pre-migration preparation. In unadjusted analyses, migration status, English proficiency and preparation were not significantly related to BMI. However, in Model 1, migrants have lower BMI ($b = -1.008$, $p < 0.001$) compared to non-migrants, and more preparation was associated with high BMI ($b = 0.338$, $p > 0.01$) after controlling for gender and age. These patterns persisted after further controlling for education, financial strain, diet and physical activity (Model 2). Model 3 shows no interaction between migration status and English proficiency. However, Model 4 indicates a significant interaction between migration status and preparation such that the effect of preparation was stronger for migrants than non-migrants (Fig. 1).

The bottom panels of Table 2 show the analyses for the outcomes of WC, WHtR, and WHR, respectively. Across all of these outcomes, migrants showed lower risk for adiposity than non-migrants after controls for covariates. English proficiency showed no consistent association with adiposity in multivariable models. However, preparation was associated with increased WC and WHtR. Further, the interaction between migration status and preparation was significant for WHtR ($b = 0.01$, $p < 0.05$) and marginally significant for WC ($b = 1.31$, $p < 0.10$). The former is plotted in Fig. 1. However, there were no significant interactions between migration status and English proficiency.

Table 3 provides the analyses for migrants only. Preparation was associated with increased BMI, WC, and WHtR in models adjusting for covariates. English proficiency was associated with BMI, WC, WHtR and WHR in unadjusted models, but becomes not statistically significant after adjusting for gender and age.

Table 4 shows the multivariable analyses for non-migrants. These results include measures of English proficiency and preparation, and also add measures of receiving care packages, texting/telephoning, and e-mail. The top panel shows the results for BMI. Controlling for gender and age, Model 1 shows that telephone or texting with family or friends in the U.S. was associated with lower BMI ($b = -0.654$; $p < 0.01$). This association persists after controlling for education and financial strain (Model 2; $b = -0.660$; $p < 0.01$), and diet and physical activity (Model 3; $b = -0.634$; $p < 0.01$). English proficiency, preparation, receiving care packages, or e-mail with family and friends was not associated with BMI in any of the models.

The second panel in Table 3 shows the results for WC. The estimates mirror that of BMI. Specifically, telephone or texting was associated with lower WC across all of the models, but English proficiency, receiving care packages or e-mail was not associated with WC in any model. The third panel in Table 3 shows the results for WHtR. None of the pre-acculturation measures were significantly associated with WHtR

Table 1
Sample characteristics, by migration status. Weighted. Health of philippine emigrants study, 2017

	Migrant (n = 830)		Non-Migrant (n = 802)		p-value
Demographics					
Male,%	33.57		33.57		
Age, mean (SE)	36.89	(0.41)	37.00	(.41)	
Education					***
Less than high school	8.01		12.72		
High school graduate	20.87		16.15		
Some college	18.23		37.39		
College graduate	52.90		33.74		
Financial Strain[a]	1.92	(0.02)	2.43	(0.03)	
Obesity indicators					
BMI (kg/m^b), mean (SE)	24.38	(0.14)	24.72	(0.17)	
Waist-to-hip Ratio, mean (SE)	0.896	(.002)	0.912	(0.002)	***
Waist circumference (cm), mean (SE)	86.31	(0.36)	86.37	(0.42)	
Waist-to-height Ratio, mean (SE)	0.386	(0.003)	0.386	(0.004)	
Behaviors					
Diet (0 = never; 4 = 6 + times/week)					
Fresh fruit	2.90	(0.03)	2.64	(0.03)	***
Fresh vegetables	3.01	(0.04)	2.86	(0.03)	***
Eat fast food	3.37	(0.03)	3.42	(0.03)	
Drink soda	1.79	(0.04)	2.31	(0.04)	***
Physical Activity					***
Sedentary	2.40		0.80		
Moderately inactive	14.91		3.34		
Moderately active	8.98		9.84		
Active	73.62		86.10		
Pre-Acculturation					
English proficiency					
Very well	8.20		2.00		***
Well	52.39		22.65		
Not very well	37.69		69.54		
Not at all	1.71		5.81		
Care packages[b]			0.75	(0.05)	n/a
Telephone[c]			0.23	(0.04)	n/a
E-mail[c]			1.46	(0.08)	n/a
Preparation for Move, mean[d] (SE)	1.70	(0.04)	0.12	(0.02)	***
Preparation for Move, any (vs. none)	83.70		4.50		

p-value tests migrants vs. non-migrants: *** <0.001; ** <0.01; * <0.05.
[a] 0 = enough money to 4 = considerable difficulty meeting expenses.
[b] 0 = never to 4 = three or more times a year.
[c] 0 = never to 4 = every day.
[d] Count of number of items used to prepare for migration.

Table 2
Linear regression of obesity risk on pre-acculturation factors (n = 1632). Health of philippine emigrants study 2017.

	Unadjusted bivariate associations	Model 1: Controls for Gender & Age	Model 2: Adds Education, Financial Strain, Diet & Physical Activity	Model 3: Interaction between Migration Status and English Proficiency	Model 4: Interaction between Migration Status and Preparation
	b[se]	b[se]	b[se]	b[se]	b[se]
OUTCOME: BODY MASS INDEX					
Migrant	-0.337	-1.008***	-1.093***	-0.388	-1.410***
	[-0.776 - 0.102]	[-1.609 to −0.407]	[-1.749 to −0.436]	[-1.619 - 0.844]	[-2.074 to −0.746]
English proficiency	-0.236	0.313	0.225	0.512	0.257
	[-0.565 - 0.093]	[-0.072 - 0.698]	[-0.222 - 0.672]	[-0.184 - 1.207]	[-0.193 - 0.706]
Preparation	0.141	0.338**	0.289*	0.277*	-0.172
	[-0.033 - 0.314]	[0.112–0.564]	[0.054–0.524]	[0.040–0.513]	[-0.737 - 0.392]
Migrant*English				-0.491	
				[-1.268 - 0.287]	
Migrant*Preparation					0.602*
					[-0.009 - 1.213]
OUTCOME: WAIST CIRCUMFERENCE					
Migrant	-0.052	-1.825**	-2.057**	-0.723	-2.750***
	[-1.138 - 1.034]	[-3.284 to −0.367]	[-3.629 to −0.485]	[-3.717 - 2.271]	[-4.331 to −1.169]
English proficiency	-0.868**	0.783	0.557	1.1	0.627
	[-1.682 to −0.054]	[-0.160 - 1.726]	[-0.521 - 1.636]	[-0.538 - 2.738]	[-0.457 - 1.712]
Preparation	0.663***	0.914***	0.892**	0.869**	-0.115
	[0.230–1.096]	[0.357–1.471]	[0.311–1.472]	[0.286–1.452]	[-1.503 - 1.273]
Migrant*English				-0.929	
				[-2.772 - 0.915]	
Migrant*Preparation					1.314+
					[-0.190 - 2.818]
OUTCOME: WAIST TO HEIGHT RATIO					
Migrant	-0.001	-0.014**	-0.015**	-0.004	-0.020***
	[-0.008 - 0.007]	[-0.024 to −0.004]	[-0.026 to −0.004]	[-0.024 - 0.015]	[-0.031 to −0.010]
English proficiency	-0.004	0.007*	0.004	0.008	0.004
	[-0.010 - 0.001]	[0.000–0.013]	[-0.004 - 0.011]	[-0.003 - 0.019]	[-0.003 - 0.011]
Preparation	0.005***	0.006***	0.005**	0.005**	-0.002
	[0.002–0.008]	[0.003–0.010]	[0.002–0.009]	[0.001–0.009]	[-0.012 - 0.007]
Migrant*English				-0.007	
				[-0.020 - 0.005]	
Migrant*Preparation					0.010*
					[0.000–0.020]
OUTCOME: WAIST TO HIP RATIO					
Migrant	-0.016***	-0.017***	-0.018***	-0.019**	-0.021***
	[-0.022 to −0.009]	[-0.025 to −0.010]	[-0.027 to −0.010]	[-0.035 to −0.002]	[-0.029 to −0.012]
English proficiency	-0.015***	0.001	0.005	0.005	0.005
	[-0.019 to −0.010]	[-0.005 - 0.006]	[-0.001 - 0.011]	[-0.004 - 0.013]	[-0.001 - 0.011]
Preparation	-0.002**	0.001	0.002	0.002	-0.001
	[-0.005 to −0.000]	[-0.002 - 0.004]	[-0.001 - 0.005]	[-0.001 - 0.005]	[-0.007 - 0.005]
Migrant*English				0	
				[-0.010 - 0.010]	
Migrant*Preparation					0.004
					[-0.003 - 0.011]

+ p ≤ 0.10 * p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.
b = unstandardized beta; se = standard error Models 3 and 4 control for gender, age, education, financial strain, diet, and physical activity.

in any model. The bottom panel in Table 3 shows the results for WHR. As with BMI and WC, text and telephone with friends and family were associated with decreased WHR.

Discussion

Using unique data from the Philippines, our analyses provide preliminary evidence in support of the idea of pre-acculturation as a risk factor for obesity. Contrary to assumptions that immigrants are passive "empty vessels" who acculturate only after arrival, we find support for the first hypothesis that many Filipinos are in contact with U.S. ideas in their home country.

One indicator in support of this argument is English proficiency, which is reported by many Filipinos in their home country. Consistent with our second hypothesis, we found that nearly 60% US-bound Filipino migrants and 25% of non-migrants say they speak English well or very-well. We caution that the specific estimates are subject to reporting error, but do believe that a major insight is in the relative magnitude of the estimates: many Filipinos are proficient with English, especially those who are planning to emigrate. This finding is aligned with the idea of pre-acculturation — migrants might actively seek to improve their English skills prior to immigration in order to facilitate a smoother transition in the U.S. post-migration. Further, migrants might also be more attentive to American ideas by virtue of globalization. However, other explanations are plausible. For example, this gap in proficiency might represent greater use of English among migrant households growing up. Alternatively, proficiency may represent socioeconomic resources more so than cultural adoption, given that English language is a skill that reflects educational achievement and expands employment options (Gee et al., 2010). Although we do not have data to further understand these differences in language between migrants and non-migrants, the data imply an important lesson for the broader literature that assumes that English proficiency reflects acculturation only after migration (Murillo et al., 2015). At least in the Philippines context, such an assumption is questionable.

Migrants actively prepare for their move in other ways, with nearly 84% of them engaging in preparatory activities compared to less than 5% of non-immigrants. At the same time, many non-migrants do communicate with people in the U.S. More than half had a friend or family member in the U.S. with whom they text, phone, e-mail and/or

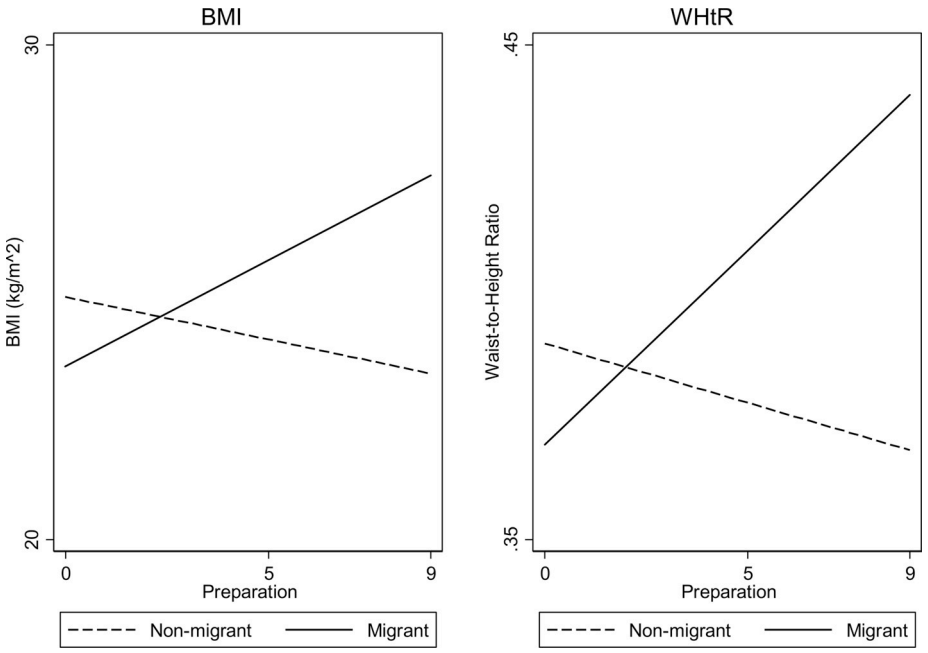

Fig. 1. Interaction between Migration Status and Preparation for the Outcomes Body Mass Index (BMI) and Waist-to-Height-Ratio (WHtR). Estimates control for covariates.

Table 3
Linear regression of obesity risk on pre-acculturation factors among migrants (n = 830). Health of philippine emigrants study 2017.

	Unadjusted	**Model 1: Controls for Gender & Age**	**Model 2: Adds Education & Financial Strain**	**Model 3: Adds Diet and Physical Activity**
	b[se]	b[se]	b[se]	b[se]
OUTCOME BODY MASS INDEX				
English proficiency	-0.418	0.197	0.036	0.081
	[-0.857 - 0.021]	[-0.260 - 0.654]	[-0.483 - 0.554]	[-0.453 - 0.615]
Pre-migration preparation	0.554***	0.424***	0.401***	0.355***
	[0.327–0.781]	[0.197–0.652]	[0.171–0.631]	[0.114–0.597]
OUTCOME: WAIST CIRCUMFERENCE				
English proficiency	-1.455**	0.547	-0.029	0.073
	[-2.568 to −0.342]	[-0.588 - 1.682]	[-1.312 - 1.255]	[-1.244 - 1.391]
Pre-migration preparation	1.546***	1.092***	1.010***	0.976***
	[0.963–2.129]	[0.524–1.659]	[0.438–1.582]	[0.376–1.576]
OUTCOME: WAIST TO HEIGHT RATIO				
English proficiency	-0.009**	0.005	0	0.001
	[-0.017 to −0.002]	[-0.003 - 0.012]	[-0.008 - 0.009]	[-0.008 - 0.009]
Pre-migration preparation	0.012***	0.008***	0.007***	0.007***
	[0.008–0.016]	[0.004–0.012]	[0.004–0.011]	[0.003–0.011]
WAIST TO HIP RATIO				
English proficiency	-0.011***	0.001	0.001	0.002
	[-0.017 to −0.004]	[-0.006 - 0.008]	[-0.006 - 0.009]	[-0.006 - 0.009]
Pre-migration preparation	0.005***	0.002	0.002	0.002
	[0.001–0.008]	[-0.002 - 0.005]	[-0.002 - 0.005]	[-0.002 - 0.005]

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.
b = unstandardized beta; se = standard error.

receive care packages. These patterns highlight the global nature of immigrant communities and communications, a point just beginning to be recognized in the health literature (Acevedo-Garcia et al., 2012; Viruell-Fuentes & Schulz, 2009).

As another possible sign of globalization, our participants showed risk for obesity. For both migrants and non-migrants, their mean BMI was about 24 kg/m^2, their mean waist circumference was about 86 cm, and their mean waist-to-hip ratio was about 0.90. These values suggest risk for morbidity, as the WHO Asian BMI threshold for "overweight" is 23 kg/m^2 (Jih et al., 2014). Similarly, the waist circumference threshold for risk for metabolic syndrome are 0.8 for women and 0.9 for men (Huxley, Mendis, Zheleznyakov, Reddy, & Chan, 2010). Regardless of migration status, on average, women in our study exceeded this threshold, whereas many men were below it. Traditionally, the

Table 4
Linear regression of obesity risk on pre-acculturation factors among non-migrants (n = 802). Health of philippine emigrants study 2017.

	Unadjusted	Model 1: Controls for Gender & Age	Model 2: Adds Education & Financial Strain	Model 3: Adds Diet and Physical Activity
	b[se]	b[se]	b[se]	b[se]
OUTCOME: BODY MASS INDEX				
English proficiency	-0.368	0.142	0.396	0.464
	[-1.143 - 0.407]	[-0.688 - 0.972]	[-0.562 - 1.353]	[-0.508 - 1.436]
Pre-Migration Preparation	-.438	-0.331	-0.33	-0.296
	[-.951 – 0.076]	[-0.849 - 0.186]	[-0.845 - 0.184]	[-0.814 - 0.221]
Receive care packages	0.143	0.217	0.197	0.216
	[-0.251 - 0.538]	[-0.247 - 0.682]	[-0.263 - 0.657]	[-0.257 - 0.689]
Text or phone family/ friends in U. S.	-0.43	-0.654**	-0.660**	-0.634**
	[-1.019 - 0.159]	[-1.271 to −0.036]	[-1.266 to −0.055]	[-1.260 to −0.009]
Email family/ friends in U. S.	-0.049	0.104	0.152	0.175
	[-0.343 - 0.244]	[-0.247 - 0.455]	[-0.201 - 0.505]	[-0.193 - 0.543]
OUTCOME: WAIST CIRCUMFERENCE				
English proficiency	-1.38	0.407	1.274	1.376
	[-3.289 - 0.529]	[-1.681 - 2.495]	[-1.086 - 3.633]	[-1.004 - 3.757]
Pre-Migration Preparation	-1.065	-0.72	-0.703	-0.645
	[-2.415 – 0.285]	[-2.046 - 0.607]	[-2.015 - 0.609]	[-1.934 - 0.643]
Receive care packages	0.731	0.884	0.847	0.885
	[-0.237 - 1.699]	[-0.242 - 2.010]	[-0.276 - 1.970]	[-0.287 - 2.057]
Text or phone family/ friends in U. S.	-1.113	-1.932**	-1.909**	-1.863**
	[-2.789 - 0.563]	[-3.546 to −0.317]	[-3.485 to −0.332]	[-3.462 to −0.265]
Email family/ friends in U. S.	-0.121	0.329	0.472	0.47
	[-0.890 - 0.649]	[-0.580 - 1.238]	[-0.451 - 1.395]	[-0.489 - 1.430]
OUTCOME: WAIST TO HEIGHT RATIO				
English proficiency	-0.007	0.003	0.007	0.008
	[-0.020 - 0.006]	[-0.010 - 0.017]	[-0.009 - 0.022]	[-0.008 - 0.023]
Pre-Migration Preparation	-0.006	-0.006	-0.006	-0.005
	[-0.015 - 0.003]	[-0.014 - 0.003]	[-0.014 - 0.003]	[-0.014 - 0.003]
Receive care packages	0.003	0.002	0.002	0.003
	[-0.003 - 0.010]	[-0.005 - 0.010]	[-0.005 - 0.010]	[-0.005 - 0.010]
Text or phone family/ friends in U. S.	-0.004	-0.008	-0.008	-0.008
	[-0.014 - 0.006]	[-0.019 - 0.003]	[-0.019 - 0.002]	[-0.019 - 0.003]
	0	0.003	0.004	0.004
Email family/ friends in U. S.				
	[-0.005 - 0.005]	[-0.003 - 0.009]	[-0.002 - 0.009]	[-0.002 - 0.010]
OUTCOME: WAIST TO HIP RATIO				
English proficiency	-0.012**	0.004	0.012	0.012
	[-0.023 to −0.001]	[-0.009 - 0.016]	[-0.001 - 0.025]	[-0.001 - 0.025]
Pre-Migration Preparation	-0.008*	-0.005	-0.005	-0.004
	[-0.157 – 0.001]	[-0.012 - 0.002]	[-0.011 - 0.002]	[-0.011 - 0.003]
Receive care packages	0.003	0.005	0.005	0.006
	[-0.003 - 0.009]	[-0.001 - 0.012]	[-0.001 - 0.011]	[-0.000 - 0.012]
Text or phone family/ friends in U. S.	-0.007	-0.011**	-0.011**	-0.011**
	[-0.018 - 0.004]	[-0.021 to −0.001]	[-0.020 to −0.001]	[-0.020 to −0.001]
Email family/ friends in U. S.	-0.003	0	0.001	0.001
	[-0.008 - 0.001]	[-0.005 - 0.005]	[-0.004 - 0.007]	[-0.004 - 0.006]

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.
b = unstandardized beta; se = standard error.

Philippines has had lower risk for obesity, but reflecting global trends seen in many countries, this risk has increased with time (Adair, Kuzawa, McDade, Delia, & B Borja, 2018).

We also found support for the third hypothesis that pre-acculturation is related to obesity risk, and for the fourth hypothesis that this relationship varies by migration status. Individuals engaging in more preparation for migration had higher BMI, WC, and WHtR. Further, these associations were stronger for migrants than non-migrants with regards to BMI and WHtR (and also showed similar trends for WC, but with marginal statistical significant). One prior study has suggested that preparation for migration may be protective for migrants (Gong et al., 2011), but our data show the opposite pattern. One potential explanation is that preparation further encourages (or reflects) individuals engaging in the broader worldwide trends of consuming higher calorie foods and less physical activity.

To probe these findings further, our stratified analyses showed that among migrants, pre-migration preparation was related to increased 3 of the 4 measures of adiposity. We examined whether these associations would be due to socioeconomic advantages or westernization of diets; however, these associations did not appear to be explained by education level, financial strain, physical activity, or consumption of fruits, vegetables, soda or fast food. That said, it is premature to rule out physical activity and diet as potential explanations because they were based on self-report, which has well-known limitations (Ainsworth, Lawrence, Buman, & Ross, 2015; Subar et al., 2015). Further, we accounted for frequency of consuming these foods, but did not account for quantity. Thus, it is still possible that dietary and/or physical activity patterns underlie the association between pre-acculturation and obesity risk among migrants.

In stratified analyses among non-migrants, our index of preparation was not related to obesity outcomes. However, among non-migrants, texting or telephone communications with family and friends in the U.

S. were related to lower BMI, smaller waist circumference, and a lower waist-to-hip ratio. We speculate that such communications might include the transmission of health promoting ideas, such as watching one's weight, being healthy, and treatment or prevention of prevalent conditions such as diabetes (Adair et al., 2018). Emerging research has suggested that short text messages can help encourage healthy behaviors (Akhu-Zaheya and Wa'ed 2017). However, we caution that we do not have data on family members abroad, so it is possible that they may not have healthy diets either. Nonetheless, our data suggest that studying cross national communications of health promoting and adverse messages remains a promising avenue for future research (Acevedo-Garcia et al., 2012).

Broadly speaking, our results imply that different measures of pre-acculturation may affect obesity in different ways. Although several of our pre-acculturation measures were not associated with obesity risk, it is possible that more refined measures may show otherwise. For example, our measure of receipt of care packages was based on a single item of receiving any packages. It is possible that more targeted questions, such as receiving high calorie foods from overseas, may show otherwise. Thus, future research should develop more refined and comprehensive measures of pre-acculturation that are related to the underlying pathways.

We should acknowledge some additional limitations of our research. First, these analyses employ cross-sectional data, and thus should not be seen as causal. They are taken from the baseline wave of the HoPES study, which in the future will provide longitudinal data from which to further evaluate our hypotheses. Second, measures of diet and physical activity are based on self-report, constraining our ability to assess the underlying mechanisms. Third, the response rates for the migrant sample were relatively low, but these are tempered somewhat because analyses show that the migrant sample is representative of recent Filipino immigrants to the U.S. with regards to gender, education, and age (Gee et al., 2018). Nonetheless, caution is warranted in extrapolating the findings further. Fourth, although we accounted for financial strain, there is the potential for residual confounding due to other omitted socioeconomic measures such as income or job related factors (Fujishiro, Gee, & de Castro, 2011). Fifth, we could not directly assess the content of participants' care packages or communications. Future research should explore these issues more comprehensively.

The limitations are balanced by several strengths. Our data provide a novel investigation of future immigrants to the U.S. and their non-migrant peers. As a unique feature of our study, we collected information from migrants days to months before they would depart for the U.S., with approximately 98% of migrants saying they would depart for the U. S. within 2 months of data collection. Further, we examine indicators of adiposity that were measured by trained staff. The inclusion of 4 measures of adiposity is useful because literature has yet to come to a consensus as to the most appropriate measure. By including 4 interrelated measures, we have a more complete understanding of these patterns than if we had selected just a single outcome.

Our results are preliminary, but suggest that immigrant acculturation can occur prior to migration (Torres, Ro and Sudhinaraset 2019). Supposing this was true, it suggests that simple dichotomies of "western" versus "eastern" cultures may not sufficiently capture the complexities of a globalizing world. This is significant because many studies of acculturation have suggested that public health interventions should encourage immigrants to retain "traditional" diets and other behaviors of their homelands (Alidu & Grunfeld, 2018). Rather than rely on these relatively ambiguous notions, it may be more fruitful to emphasize health promoting resources that may be developing across multiple contexts.

Ethical statement

This article received approval from the Office of Human Subjects Protection at (BLINDED) and at (BLINDED). Participants signed a consent statement to voluntarily join this study.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2019.100482.

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Update

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Erratum

Erratum regarding missing Declaration of Competing Interest statements in previously published articles

Declaration of Competing Interest statements were not included in the published version of the following articles that appeared in previous issues of SSM - Population Health.

The appropriate Declaration/Competing Interest statements, provided by the Authors, are included below.

Displacement due to armed conflict and violence in childhood and adulthood and its effects on older adult health: The case of the middle-income country of Colombia (SSM - Population Health, 2019; 7C) https://doi.org/10.1016/j.ssmph.2019.100369 The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Examining the relationship between U.S. incarceration rates and population health at the county level (SSM - Population Health, 2019; 9C) https://doi.org/10.1016/j.ssmph.2019.100466 The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Gender differences in the pathways from childhood disadvantage to metabolic syndrome in adulthood: An examination of health lifestyles (SSM - Population Health 2018; 4C) https://doi.org/10.1016/j.ssmph.2018.01.003 The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The migration journey and mental health: Evidence from Venezuelan forced migration (SSM - Population Health, 2020 10C) https://doi.org/10.1016/j.ssmph.2020.100551 The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Life course trauma and muscle weakness in older adults by gender and race/ethnicity: Results from the U.S. health and Retirement Study (SSM - Population Health, 2020; 11C) https://doi.org/10.1016/j.ssmph.2020.100587 The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Do rising tides lift all boats? Racial disparities in health across the lifecourse among middle-class African-Americans and Whites (SSM - Population Health, 2018; 6C) https://doi.org/10.1016/j.ssmph.2018.07.004 The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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