

Patient Adherence to the Dietary Approaches to Stop Hypertension (DASH) Diet for Non-Primary English Speakers

by

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Abstract

Objectives: Hypertension is a chronic condition affecting approximately 50 million people in the United States (US); however levels of hypertension vary among different ethnic populations living in the US. The DASH diet, a major component of all hypertension treatment, is a behavioral method of lowering blood pressure in patients with hypertension. The DASH diet focuses on fiber, fruits and vegetables, lean meat, low fat milk, potassium, saturated fat, sodium, sweets, total fat, and whole grains. I evaluated if non-native speakers with adequate English proficiency (ESL) have different levels of adherence to the DASH diet, in comparison to native English speakers (non-ESL). *Methods:* Participants language ability was determined during the baseline interview. Adherence was assessed separately for each of the 10 subgroups using the Willett Food Frequency Questionnaire (FFQ, and calculated a DASH Adherence Index score (0-100). Using robust regression analysis, I examined the relationship between ESL and adherence to the DASH diet, while accounting for age and education. *Results:* The FFQ was administered to 341 hypertensive veterans, 30 (9%) were ESL. While the ESL group had lower levels of adherence to the DASH diet (mean = 47.3) in comparison to the non-ESL group (mean = 49.5), this was not statistically significant ($p = .67$). However, both age and less than a high school education were significant predictors of overall adherence ($p = .04$; $p = .07$). Additionally, less than a high school education, within the ESL group, was predictive of increased adherence to lean meats ($p = .06$), sodium ($p = .07$), saturated fats ($p = .03$), and total fats ($p = .04$). ESL was predictive of decreased adherence to whole grains ($p = .06$), and a college education or greater, within the ESL group, was predictive of decreased adherence to total fats ($p = .08$). *Implications:* While not speaking English as a primary language did not have a large impact on overall adherence to the DASH diet, education levels within the ESL group had a significant effect. If this evidence proves robust, busy practitioners can tailor their advice to focus on the problematic areas and strengths of adherence to the DASH diet in non-native English speakers.

Hypertension

Hypertension affects at least 50 million people in the United States (US), and as many as 1 billion people throughout the world.¹ According to the World Health Organization, 62% of cerebrovascular disease and 49% of ischemic heart disease is attributable to systolic blood pressure (SBP) greater than 115 mm Hg. Hypertension is also responsible for approximately 7.1 million premature deaths worldwide.² In the US, out of all patients with hypertension, 70% are aware of their condition, 59% are being treated and 34% have their hypertension under control.³ Thus, out of the US hypertensive population, 66% currently have uncontrolled hypertension. Controlled hypertension is defined by the Joint National Committee as SBP below 140 mm Hg, diastolic blood pressure (DBP) below 90 mm Hg, and the use of antihypertensive medication(s). Hypertension is more common later in life, with 62% of the population with Hypertension at least 55 years of age.⁴

Hypertension as a Risk Factor

Uncontrolled hypertension is a major risk factor for cardiovascular disease. Increased blood pressure also leads to an increased chance of myocardial infarction, congestive heart failure, stroke, ischemic heart disease, peripheral vascular disease, atrial fibrillation, chronic and end-stage renal disease, and retinopathy.⁵ Additional risk factors such as high LDL, low HDL, smoking, diabetes mellitus, and left ventricular hypertrophy all compound risks for the above

¹ Chobanian (2003)

² World Health Report (2002)

³ Chobanian (2003)

⁴ Kaplan (2003)

⁵ Soto-Greene (2004)

stated events.⁶ As evidenced in Table A below, the lowering of blood pressure in hypertensive patients to prehypertensive levels is beneficial from a health outcome standpoint.

Table A: Benefits of Lowering Blood Pressure ⁷	
Adverse Event	Risk Reduction
Stroke incidence	35-40%
Myocardial infarction	20-25%
Heart failure	>50%

Diagnosis and Treatment

Diagnosis

Hypertension accounts for 35 million office visits a year in the United States, and is the most common primary diagnosis. In clinical practice, co-morbidities are taken into account and two cut-off points are often used in diagnosis. In patients with compelling conditions, diabetes mellitus or chronic kidney disease, hypertension is defined as SBP of greater than or equal to 130 mm Hg and/or DBP of greater than or equal to 80 mm Hg. In all other patients, hypertension is defined as sustained SBP of greater or equal to 140 mm Hg and/or DBP of greater or equal to 90 mm Hg.⁸ The full classification of hypertension can be seen in Table B. In research, some studies choose to follow these clinical guidelines in classifying patients as hypertensive and others use prescribed antihypertensive medication(s) in combination with blood pressure readings, or as the sole evidence for a diagnosis.⁹

⁶ Chobanian (2003)

⁷ Chobanian (2003)

⁸ Chobanian (2003)

⁹ Chobanian (2003)

Table B: Classifications of Hypertension¹⁰		
Category	SBP Range (mm Hg)	DBP Range (mm Hg)
Normal	<120	<80
Prehypertension	120-139	80-89
Stage 1 hypertension	140-159	90-99
Stage 2 hypertension	≥ 160	≥ 100

Treatment

The goal of antihypertensive treatment is to lower blood pressure for patients without compelling conditions to less than 140/90 mm Hg, and to less than 130/80 mm Hg for patients with compelling conditions.¹¹ Treatment plans for these patients include medication(s) and lifestyle modifications. The goal of antihypertensive treatment for patients with prehypertension is to lower blood pressure to the normal range, below 120/80 mm Hg. The only treatment options for patients with prehypertension are lifestyle modifications.

Lifestyle Modifications: Lifestyle modifications can be used in the prevention or delay of hypertension, as the sole treatment for hypertension, and as treatment in combination with antihypertensive medication. The effective lifestyle modifications can be seen in Table C, along with their approximate SBP reduction. The major lifestyle modifications are the adoption of the Dietary Approaches to Stop Hypertension (DASH) diet, and cardiovascular exercise.¹²

Table C: Reduction in Blood Pressure due to Lifestyle Modifications¹³	
Modification	Approximate SBP Reduction
DASH diet	8-14 mm Hg
Reduce sodium intake (no more than 100 mmol/day)	2-8 mm Hg
Cardiovascular exercise (30 min/day, 5 days/week)	4-9 mm Hg
Moderation of alcohol consumption (max 2 drinks/day)	2-4 mm Hg

¹⁰ Chobanian (2003)

¹¹ Compelling conditions are diabetes mellitus and chronic kidney disease.

¹² Appel (1997)

¹³ Chobanian (2003)

As evidenced in Table C, adopting the DASH diet is a very effective lifestyle change to lower blood pressure. The components of the DASH diet can be seen in Table D. Aspects not necessarily included in a general “healthy” diet are the reduction in sodium intake, and the increase in the intake of potassium and whole grains. The DASH diet has been shown to have a greater effect on African Americans in comparison to other ethnic subgroups, which is thought to be a result of the sodium content within the typical African American diet.¹⁴ Other traditional diets of minority groups in the United States have higher than recommended sodium content, however these other groups have not been studied thoroughly.

Table D: Guidelines of the DASH Diet¹⁵				
Food Group	Daily Servings	Serving Sizes	Examples	Significance of Each Food Group
Grains	6-8	1 slice bread; ½ cup cooked rice, pasta, or cereal	Whole wheat bread and rolls, whole wheat pasta, cereals	Major sources of energy and fiber
Vegetables	4-5	1 cup raw or ½ cup cooked vegetable	Broccoli, carrots, green peas, lima beans, potatoes	Rich sources of potassium, magnesium, and fiber
Fruits	4-5	1 medium fruit; 1/2 cup fresh or frozen fruit	Apples, apricots, bananas, dates, grapes, oranges, grapefruit	Important sources of potassium, magnesium, and fiber
Low-fat milk	2-3	1 cup milk or yogurt	Fat-free (skim) milk, low-fat cheese	Major sources of calcium and protein
Lean meats and fish	6 or less	1 oz cooked meats, or fish	Lean meat, broiled, roasted, or poached	Rich sources of protein and magnesium
Nuts, seeds, and legumes	4-5 per week	1½ oz nuts; 2t peanut butter; 1/2 cup legumes	Mixed nuts, sunflower seeds, peanut butter, kidney beans, lentils	Rich sources of energy, magnesium, protein, and fiber
Fats and oils	2-3	1t margarine; 1t vegetable oil; 1t mayonnaise	Soft margarine, vegetable oil, low-fat mayonnaise	The DASH study had 27 percent of calories as fat
Sweets and sugars	≤5 per week	1t sugar; 1t jelly or jam	Fruit-flavored gelatin, fruit punch, hard candy	Sweets should be low in fat

¹⁴ Chobanian (2003)

¹⁵ YOUR GUIDE TO Lowering Your Blood Pressure With DASH

Medication: Controlled hypertension is attainable in the majority of patients through medication, in addition to the prescribed lifestyle changes, however more than 66% of patients will require at least 2 antihypertensive medications.¹⁶ The recommended initial drug class to begin therapy with is the thiazide-type diuretics, since they have a history of low levels of side effects, proven success and low cost. However there are 5 additional major classes of antihypertensive medications that have also been proven effective.

Prevention

Preventing hypertension can be achieved in most individuals with blood pressure in the normal to prehypertensive range by following the treatment plan for prehypertension. Major barriers in the prevention of hypertension can be broken up based on access/availability and cost. Barriers of the first group include access to places to exercise, availability of exercise programs in schools, availability of healthy food choices and small portions in schools, workplaces and restaurants, and the availability of low-sodium processed and restaurant food. Barriers of the second group include the cost of healthy food, low-sodium and low-calorie food, and the cost of health services.¹⁷

Causes, Factors and Minorities

Medical and Genetic Causes

The major identifiable medical causes of hypertension can be seen in Table E. There are several rare forms of hypertension that can be attributed to rare genetic disorders, however

¹⁶ Chobanian (2003)

¹⁷ Whelton (2002)

individually or in combination these do not account for a significant proportion of the general population.¹⁸

Table E: Identifiable Causes of Hypertension	
Coarctation of the aorta	Pheochromocytoma
Cushing syndrome and other glucocorticoid excess states including chronic steroid therapy	Primary aldosteronism and other mineralocorticoid excess states
Drug-induced or drug-related (eg. Cocaine)	Renovascular hypertension
Obstructive uropathy	Sleep apnea
Thyroid or parathyroid disease	

Psychosocial Factors

There are four main psychosocial factors that have been empirically shown to be predictors for hypertension: socio-economic status, occupational stress, acculturative stress, and psychological distress.¹⁹ Both level of education and income, the major socioeconomic factors, have been shown to be independent predictors of hypertension in some studies, however additional studies have failed to show significance.²⁰ This could be because some studies fail to adequately account for these factors. Occupational stress, or job strain, has shown to be a predictor for hypertension in a number of studies.²¹ These studies have shown that work environments with a high level of psychological demands and with low levels of control or decision latitude predict the highest rates of hypertension. The third factor, acculturative stress, is the stress of assimilating to a new culture. This will be discussed in great detail in the next section of this paper. In brief, multiple studies have shown that the occurrence of high blood pressure increases as populations migrate to a more developed country, and higher levels of

¹⁸ Chobanian (2003)

¹⁹ Kaplan (2003): For the following paragraph.

²⁰ Kaplan (2002); Espino (1990); Kim (2007); Eamranond (2009); Veath (2005)

²¹ Schnall (1990); Theorell (1991); Schnall and Landsbergis (1992); Schnall and Schwartz (1992); Van Egeren (1992); Theorell (1993)

acculturation are positively correlated with rates of hypertension²². Lastly, psychological distress is the most complicated predictor of hypertension, as there many factors that conflict with and impact each other.

The mechanism in which psychological distress affects hypertension is not fully understood. One theory by Raikonen et al. describes two basic trajectories.²³ One group of patients experience a trajectory with increased risk to psychological distress, whereas another group of patients experience little risk to psychological distress. At baseline, the two groups of patients are indistinguishable, and it is unknown how to classify a person until they undergo a period of psychological stress. Throughout the lifetime of the individuals, the two groups undergo similar amounts of psychological distress. The distress would increase the risk of hypertension in the first group, who responds adversely to psychological distress, but not the second group. While this theory is useful in understanding the different effects that psychological distress can have on different types of people, it is not yet useful in clinical practice.

Minorities

Specific ratios of hypertension diagnosis and control between races vary slightly across different studies, however most studies conclude that non-white races have worse control of hypertension in comparison to whites. It has been found that a lot of the variance in controlled and uncontrolled hypertension across racial and ethnic groups can be accounted for by socioeconomic factors, access to healthcare, and attitudes and beliefs about health and

²² Salant (2003); Kaplan (2003)

²³ Raikonen (2001): For the following paragraph.

healthcare services.²⁴ Therefore, since these factors are not universally accounted for in all studies, this may represent some of the discrepancies in results between studies. Additionally, many of the studies that place numerous countries of origin into one ethnic group for study, produce mixed results as a result of this grouping. In a 2007 study by Moran et al., higher levels of hypertension were found in Hispanics born in the Caribbean and Central America, in comparison to US-born Hispanics, however lower levels of hypertension were found in Mexican or South American born Hispanics.²⁵ Hispanic is an ethnic grouping typically used, however it can include people of over 20 different nationalities. While all Hispanics tend to have similar colored skin, they do not all have the same cultural background, and can exhibit different or even conflicting health behaviors.²⁶

African Americans: A number of studies have found hypertension to be more prevalent, less controlled, and with greater negative outcomes in African Americans, in comparison to non-Hispanic whites.²⁷ Svetkey et al. in a 1996 study of elderly men and women in North Carolina, found African-Americans to be 67% more likely to have uncontrolled hypertension in comparison to whites.²⁸ While a major factor that contributes to uncontrolled hypertension is low medication adherence, it remains inconclusive if disproportionate levels of control can be attributed to medication adherence in the case of the African American population.²⁹ A 1997 study carried out through the VA Medical System by Appel and Moore studied the difference in

²⁴ Chobanian (2003); Hunt (2004)

²⁵ Moran (2007)

²⁶ Hunt (2004)

²⁷ Chobanian (2003); Whelton (2002); Hunt (2004); Kressin (2007)

²⁸ Svetkey (1996)

²⁹ Appel (1997)

patient-provider interactions, medication adherence, and patient beliefs about blood pressure and antihypertensive medications, in efforts to answer this question.³⁰ They found African Americans to receive more active counseling from their healthcare providers in regards to blood pressure and antihypertensive medications, however non-Hispanic whites were more likely to request a follow-up visit for blood pressure care. Additionally, perceptions on medication adherence were comparable across race, however, it was found with significance at the trend level ($p \leq .10$), that African Americans were less adherent to medication. Thus while there were small differences between African Americans and non-Hispanic whites on behaviors surrounding medication, it is not significant enough to explain the higher levels of hypertension in the African American population.

Hispanic: The majority of the research on Hispanics has focused on those of Mexican origin. In 1993 study of Mexican Americans and non-Hispanic whites living in Texas, Haffner et al. found that Mexican Americans were more likely to have their hypertension uncontrolled in comparison to their non-Hispanic cohorts.³¹ While Mexican Americans represent a large subgroup of the Hispanic population, especially in the Southwestern region of the United States, not all subgroups of the Hispanic population show equal behavior.³² The Hispanic population as a whole is fairly understudied, and more research within the different subgroups of the population is needed.

³⁰ Appel (1997)

³¹ Haffner (1993)

³² Soto-Greene (2004)

Acculturation

Acculturation Theory

Acculturation is a process discussed as early as Plato.³³ The first recorded use of the term in modern history was by J.W. Powell in his 1880 report from the Bureau of American Ethnography, reporting on changes in the languages spoken by Native Americans.³⁴ In 1883 he defined acculturation to be “psychological changes induced by cross-cultural imitation.”³⁵ Another notable definition is that by anthropologist Robert Redfield. In 1936, Redfield stated: “Acculturation comprehends those phenomena which result when groups of individuals having different cultures come into continuous first-hand contact, with subsequent changes in the original cultural patterns of either or both groups.”³⁶ The earliest psychological study on acculturation is thought to be a 1918 study by Thomas and Znaniecki on Polish peasants in Europe and America.³⁷

Numerous theories have been postulated on the process of acculturation since Powell’s first use of the term.³⁸ The earlier theories have focused on a linear model of acculturation, where the individual both gains the host culture and loses the original culture in a unidirectional progression towards greater acculturation.³⁹ Although there have been more recent models in acculturation theory reflecting its true complexity and multidimensionality, the majority of

³³ Plato (1892)

³⁴ Oxford English Dictionary (1989)

³⁵ Rudamin (2003)

³⁶ Redfield (1936)

³⁷ Thomas (1918)

³⁸ Rudamin (2003)

³⁹ Abrado-Lanza (pp.1342, 2006); Rudamin (2003): In this model, greater acculturation would be equal to acceptance of the host culture and rejection of the original culture.

current public health research has stayed with the older linear models, as evidenced in the types of scales and proxy measures used, which will be discussed in the section entitled “Acculturation Measurement.”⁴⁰

In 1980, John Berry set terminology that is widely used today for four major classifications of acculturation.⁴¹ The terminology can be seen in Table F, using symbols for favoring (+) and rejecting (-) the contact culture (C) and the first culture (F).

Table F: Berry Model 1		
Positive Relations With Dominant Society	Retain Native Culture	
	<i>Yes (+F)</i>	<i>No (-F)</i>
<i>Yes (+C)</i>	Integration	Assimilation
<i>No (-C)</i>	Rejection	Deculturation

Berry made additional classifications based on the minority’s right [R] of choosing between the options: having freedom to choose [+R] versus not having the freedom to choose [-R]. This defines 8 types of acculturation, and can be seen in Table G. From this table it can be seen that while the ultimate outcomes are the same (e.g. rejection), the modes of getting there are very different (e.g. withdrawal vs. segregation). While these 8 classifications, which are currently used in research on acculturation theory, have yet to be used thoroughly in public health research, the reason for acculturation and the method of acculturating could foreseeable have an impact on overall health outcomes.

⁴⁰ Abrado-Lanza (pg 1342, 2006)

⁴¹ Berry (1980): For the following paragraph and Table G and H.

Table G: Berry Model 2				
Positive Relations With Dominant Society	Retain Native Culture			
	Yes [+F +R]	Yes [+F -R]	No [-F +R]	No [-F -R]
Yes (+C)	Integration by multi- culturalism	Integration by pluralism	Assimilation by melting pot	Assimilation by pressure cooker
No (-C)	Rejection by withdrawal	Rejection by segregation	Deculturation by marginality	Deculturation by ethnocide

There are multiple theoretical models on acculturation, however the operant theory of acculturation is presented here to give a sense for the type of complexity and theory behind one of these modern models.

Operant Theory of Acculturation

Designed by Landrine and Klonoff in 2004, this model introduces a mechanism for recognizing changes in health behaviors based on acculturation status.⁴² This model is based on learning theory, and a summary of the empirical and theoretical findings on learning theory will precede a full discussion on the operant theory of acculturation.

*Learning Theory*⁴³: Learning theory is based on the theory of contingency-governed learning. Contingencies are consequences that increase or decrease the probability of specific behaviors. Therefore contingencies can be either positive (e.g. affection) or negative reinforcers (e.g. yelling), yet they each increase the probability of the behavior that they follow. Punishers (e.g. jail) decrease the probability of the behaviors that they follow, however are less effective than contingencies. Reinforced behaviors are learned and behaviors that are maintained are those that are constantly being reinforced. Once behaviors are no longer being reinforced, they are

⁴² Landrine (2004)

⁴³ Landrine (2004): For the following section on Learning Theory.

lost. Behaviors that are reinforced consistently are lost more quickly with the removal of the contingency, whereas behaviors that are reinforced sporadically are lost most slowly with the removal of the contingency. Additionally, the use of punishers can also extinguish a behavior, however it is less effective than removing the reinforcer.

Two additional types of learning, observational learning and rule-governed learning complement contingency-governed learning. In these two models, the individual acquires or extinguishes behaviors based on either observation or information about the behavior and its specific contingencies. In summary, these three models of learning result in *2-term contingency* as there are two separate aspects: the behavior and its contingencies.

While the *2-term contingency* model is logical on paper, in reality, individuals exhibit discrimination when making decisions. A discriminative stimulus is a feature of the context, which either increases or decreases the likelihood of a specific contingency to occur. It is known that some teenagers are motivated to smoke around friends, but not around parents. Within this model, the discriminative stimuli in the first scenario is “friends” and in the second scenario is “parents.” It can be seen from this example, that different discriminative stimuli can have different effects on the behavior choice, as “friends” and “parents” have different psychological meanings in the mind of the teenager. The different psychological meanings are a result of the understanding of the specific contingencies that would result in each scenario. This understanding is based on learning the different identities of these groups, rather than any specific experience with the consequence for the action within each group. Therefore, because

the teenager has come to know the identity of both parties over time, it is unnecessary to have experienced or watched the scenario previously to know how each party will react this time.

This idea of discriminative stimuli and psychological meanings are incorporated in the *3-term contingency* model. As described by Landrine and Klonoff, “reinforcement and punishment in the presence of specific objects, people, and places gives psychological meaning to those objects, people, and places; it is these omnipresent meanings—rather than the consequences of behavior per se—that explain behavior.”⁴⁴

This theory can be applied to the population level, where it can be used to study health outcomes. The frequencies of certain behaviors are studied, and cultural contingencies replace individual contingencies. Examples of cultural contingencies, also termed metacontingencies, are laws, social norms, prices of goods, and advertising. These metacontingencies impact numerous health-related behaviors including smoking, exercising, diet and alcohol consumption. Different levels of exercise or smoking among different economic classes in the same population can be in part explained by the different metacontingencies present within the different groups of the society. It has been shown that the lower class has a greater intake of alcohol than that of the middle class. This is supported by a higher proportion of bars, liquor stores, and billboards advertising alcohol in lower class neighborhoods.⁴⁵ There are numerous other studies showing similar patterns, giving strength to the metacontingencies model.

⁴⁴ Landrine (pp. 533-34, 2004)

⁴⁵ Landrine (pp. 535, 2004)

The three term contingency model can also be applied at the ethnic or cultural level. As defined by Landrine and Klonoff “culture refers to self-construals, cognition, emotion, and behaviors that are shared by the members of an ethnic group, but are not necessarily stable over time because cultures are adaptations to local environmental niches and hence evolve much as species do.”⁴⁶ Behaviors that are prevalent in an ethnic group are supported by cultural discriminative stimuli, and behaviors that are infrequent in an ethnic group are hindered by cultural discriminative stimuli. Thus, if you remove an individual from his/her indigenous culture and place him/her into a host culture, his/her behaviors will invariably change, as the links created by the cultural discriminative stimuli are broken. Landrine and Klonoff define this as “frame-switching” or “culture-alteration.”⁴⁷ “Hence, to learn culture is to acquire links between patterns of culturally-specific behaviors and their cultural context; to change cultural contexts is to lose those links.”⁴⁸

*Operant Theory of Acculturation:*⁴⁹ The operant theory of acculturation states that behaviors, which are affected by culturally specific discriminative stimuli, will change when migrating to a new culture. There are five components to the operant theory:

1. Losing established behaviors is defined as extinction, and gaining new behaviors is defined as acquisition. Changing cultural context results in acquiring behaviors that are specific to the host culture, and the extinction of behaviors that were culturally specific to the indigenous culture.

⁴⁶ Landrine (pp. 536, 2004)

⁴⁷ Landrine (pp. 537, 2004)

⁴⁸ Landrine (pp. 537, 2004)

⁴⁹ Landrine (2004): For the following paragraph.

2. Extinction and acquisition are independent of each other, and occur at different rates, as they are predicted by different variables. Acculturation is defined as both the extinction of indigenous culturally specific behaviors, and the adoption or acquisition of behaviors specific to the host culture.
3. Acculturation occurs since the culturally specific discriminative stimuli are lost when the cultural metacontingencies are no longer present.
4. The behavioral outcomes of acculturation can thus be predicted prior to a cultural change, based on the frequency of the behavior specific to the indigenous culture. Based on their empirical evidence, which can be seen in Table H in the “Public Health Research” section, behaviors with high frequency will decrease in frequency with increased acculturation, and behaviors with low frequency will increase in frequency with increased acculturation. Behaviors with moderate frequency have no predictable change with increased acculturation through this model.
5. When metacontingencies allow certain behaviors to be more acceptable for one sex and less acceptable for the other sex, the outcome of acculturation will be the opposite for each sex. For example, if having multiple sexual partners is supported for males and not females in the indigenous culture, increased acculturation will likely lead to an increase in sexual partners for females in the host culture, and a decrease in sexual partners for the males in the host culture, assuming that the metacontingencies of the host culture does not discriminate between sexes for the given behavior. Thus, the point made in number four should be applied in a gender-specific way when applicable.

In summary, Landrine and Klonoff have developed a method of predicting changes in health behaviors and health outcomes resulting from the process of acculturation, based on factors of the host culture and the culture of origin. This model has many benefits, two of which I will discuss. The first is its recognition of the role that changes in prices, a type of metacontingency has on different food choices. For example, the prices of fruits and vegetables are much lower in Latin and Asian countries, than the prices of fast food and meat. In the US, all three become essentially equal, and the previously undesirable and expensive fast food, for Latinos and Asians living in the US, becomes much more desirable. The second major benefit is its avoidance of the Fundamental Attribution Error, which is the tendency of placing fault on the individual without accounting for the context or situation.⁵⁰ The downside to the model is that it doesn't look into factors of acculturative stress, which will be discussed in the "Public Health Research" section.

Acculturation Measurement

In order to study acculturation in both psychology and public health research, there has been a large focus on the development of acculturation scales and methods of understanding changes of acculturation on the level of the individual. In order to measure levels of acculturation, it is necessary to recognize the length of time an individual has been living in the host culture, as well as different factors of the individual's environment that could lead him/her to be in more or less in contact with either the host or the original culture. This will allow researchers to differentiate between two different individuals with the same length of residence, which have different levels of acculturation. Therefore, many of these scales ask questions on the basis of

⁵⁰ Landrine (pp. 546, 2004)

language spoken at home, primary language, country of birth, number of years of residence in the host country, which language is used to complete a survey, beliefs in biomedical versus folk medicine, and residence in an integrated versus segregated neighborhood.⁵¹ While many researchers are very diligent in asking numerous questions, the scales are often summed at the end, with patients classified as either acculturated or not acculturated.⁵² This is reflective of the linearity model, which is no longer used in acculturation theory, and thus fails to recognize all of the complexities incorporated in the modern models. Additionally, proxy measurements such as years of residence or language do not inherently measure cultural traits of the population in question.⁵³ Lastly, there is no universal standard for the types of questions asked to determine acculturation levels, so comparing the findings of different studies is imperfect.⁵⁴

Another potential problem is that the majority of the scales have only been validated for the Hispanic population as a whole. Therefore they are not designed to distinguish between different ethnic groups within the Hispanic population, and unable to be used on other ethnic groups without additional validation. This being said, there are a small number of validated scales for other ethnic groups, and not all studies use validated scales to determine levels of acculturation.

Public Health Research on Acculturative Induced Hypertension

Acculturation has been found to affect a number of health outcomes, ranging from diet,

⁵¹ Landrine (2004); Stephenson (2000)

⁵² Landrine (2004); Salant (2003); Steffan (2006)

⁵³ Hunt (pp. 977, 2004)

⁵⁴ Hunt (pp. 974, 2004)

hypertension, and cholesterol, to cancer screening rates.⁵⁵ The remainder of this section will focus on the effects of acculturation on hypertension.

Causes

Steffen et al. completed a meta-analytic review of all studies on hypertension and acculturation published on or before 2004.⁵⁶ They looked at populations of people from Africa, Asia, Latin America and Polynesia moving to host countries in the United States and Europe. Consistently, higher levels of hypertension were found in the more acculturated groups of each immigrating population. SBP was 4 mm Hg higher in more acculturated individuals, and DBP was 3 mm Hg higher in more acculturated individuals. This degree of difference is comparable to the effects of diet, weight, exercise, and levels of work stress, on blood pressure.⁵⁷

The two major causes that are believed to drive this increase in rates of hypertension are stressors that are associated with changing cultures, and health behavior changes as a result of changing cultures.⁵⁸ Stressors of culture change include decreased levels of social support, socioeconomic status, and increased level of stress in the work environment, as Western cultures tend to have higher stress work environments, and individuals with higher levels of acculturation tend to hold jobs that are more integrated into Western culture.⁵⁹

Health behavior changes include decreased physical activity and poorer diet habits. The majority of pre-existing studies, as discussed by Steffen et al., were found to focus more on

⁵⁵ Landrine (2004)

⁵⁶ Steffen (2006): For the following paragraph.

⁵⁷ Steffen (pp. 392, 2006); Chobanian (2003)

⁵⁸ Steffen (2006); Kaplan (2003)

⁵⁹ Steffen (2006)

variables related to diet, such as cholesterol and BMI measures, as opposed to direct dietary or exercise habits. This is a major downfall of current research, as cholesterol and BMI measurements are not sensitive to some of the more subtle diet changes that could impact hypertension.⁶⁰ This paper will confront this problem in looking directly at adherence to the DASH diet. Salt intake, one component of the DASH diet, which has previously been studied, was not consistently found to rise with increased levels of acculturation.⁶¹ Landrine and Klonoff were able to predict certain behavior changes through their operant model of acculturation. Table I shows the major health behavior changes that they were able to predict.⁶²

Table H: Operant Model of Acculturation				
Health Behavior	Ethnic Group	Gender	Indigenous prevalence rate	Acculturation effect
Smoking	Hispanics	Men	High	Decreases
		Women	Low	Increases
	African Americans	Men	High	Decreases
		Women	High	Decreases
	Asian Americans	Men	High	Decreases
		Women	Low	Increases
Fruit and vegetable consumption^h	Hispanics	Men	High	Decreases
		Women	High	Decreases
	Asian Americans	Men	High	Decreases
		Women	High	Decreases
Alcohol Use	Hispanics	Men	Moderate	No Change
		Women	Low	Increases
	African Americans	Men	Low	Increases
		Women	Low	Increases
	Japanese Americans	Men	High	Decreases
		Women	High	Decreases

⁶⁰ See the discussion of the DASH diet above; for example, changing potassium intake won't inherently impact BMI or cholesterol.

⁶¹ Waldron (1982); Timio (1988)

⁶² Landrine (pp. 544, Table 2, 2004)

As you can see from the table, fruit and vegetable consumption decreases with increased acculturation for both Latinos and Asian Americans.

Steffen et al. examined the relative contribution of each of the two factors on changes in blood pressure in more acculturated populations. They found three major pieces of evidence supporting the theory that increased stress is the major driving force in increasing blood pressure.⁶³ First, they compared cholesterol levels and BMI, the most widely used measurements of health behavior change, and neither of these measurements were statistically significant in relating to the change in rates of hypertension for these populations.⁶⁴ Second, the changes in blood pressure decrease significantly as the length of residence in the host culture increases, which leads more towards the initial stress reaction of changing cultures. Individuals tend to go through a period of rapid acculturation in the first couple years they are in the host culture, and then a much slower rate of change over their remaining years in the host culture.⁶⁵ Graph A shows this trend in hypertension.⁶⁶ In the graph, “d” is equal to the standardized mean difference. This is the effect size used in the meta-analysis by Steffen et al. to indicate the magnitude of differences in the participant's blood pressure as a function of acculturation. Lastly, the changes in blood pressure in response to acculturation across numerous studies were more noticeable in men. This can be supported by the evidence that men spend a greater amount of time in the workplace, a factor that is associated to more time spent in the dominant culture and overall higher levels of demand on the acculturating

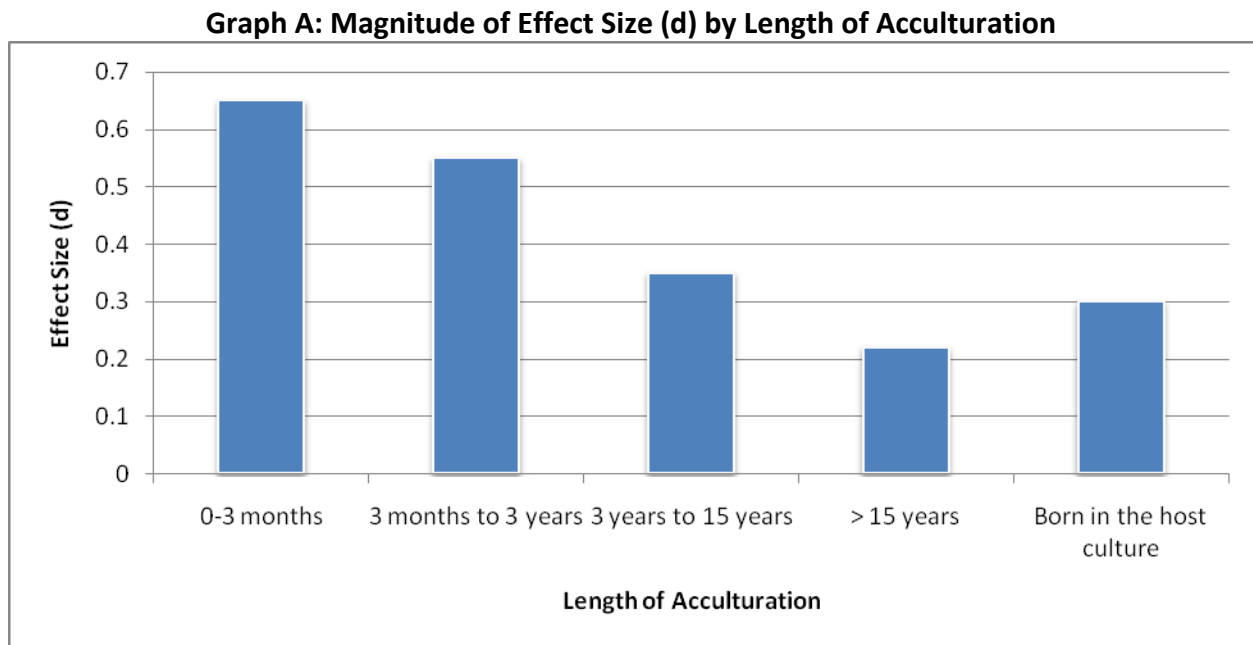
⁶³ Steffen (pp. 393, 2006): For the following paragraph.

⁶⁴ As discussed above, this wouldn't be the best way to examine changes in health behavior, but these were the only measurements used often enough to make a widespread analysis feasible.

⁶⁵ Landrine (pp. 547, 2004); Steffen (2006); Abraido-Lanza (2006)

⁶⁶ Steffen (pp. 392, Figure 2, 2006)

individual. In summary, there are two competing factors for the reasons acculturated individuals show higher levels of hypertension, behavioral changes and stress levels, however there is more evidence towards the latter.



Physiological Connections: In a 2001 study, Timio et al. found higher blood concentration levels of norepinephrine among more acculturated individuals.⁶⁷ Norepinephrine is a hormone secreted by the adrenal medulla as part of the body's short-term response to stress. Norepinephrine, along with epinephrine, triggers the vasoconstriction of the body's blood vessels. Thus, the blood vessels get narrower as the major arteries and veins contract. This vasoconstriction leads to an increase in systematic vascular resistance. In two independent studies, Lund-Johansen (1988) and Folkow (1990) each found increased systematic vascular resistance to lead to an increase in blood pressure over time.⁶⁸ Therefore, while Timio's findings

⁶⁷ Timio (2001)

⁶⁸ Lund-Johansen (1988); Folkow (1990)

are still relatively new, it introduces a possible physiological mechanism for how acculturative stress increases levels of hypertension in a population.

Immigrant Populations

There have been numerous studies examining the relationship between hypertension and acculturation in the Asian and Hispanic populations. The following is a brief summary of the findings.

Asian: Kaplan et al. used data collected in the 1996-1997 Canadian National Population Survey to compare levels of hypertension in Asians who had immigrating to Canada. They found higher levels of hypertension in individuals with higher levels of acculturation, as defined by years of residence in Canada (0-4, 5-9, or ≥ 10), after controlling for health factors (e.g. BMI, access to healthcare, chronic conditions, etc.).⁶⁹ Kim et al. performed a study in 2002 to assess the differences in diet between hypertensive and normotensive native Koreans and Korean Americans, in efforts to determine factors effecting rates of hypertension in Korean-Americans.⁷⁰ Using a 24-hour dietary recall, they found Korean Americans to consume more fast food and to eat out of the home more frequently than native Koreans. Korean Americans also had lower intake of sodium, potassium, energy from carbohydrates, and fruits and vegetables. Additionally, hypertensive Korean Americans had lower intake of sodium, potassium, and fruits and vegetables than hypertensive native Koreans. There were no significant differences in diet found between hypertensive and normotensive Korean

⁶⁹ Kaplan (2002)

⁷⁰ Kim (2007): Native Koreans are defined as Koreans currently residing in Korea.

Americans. Therefore, while the levels of hypertension are higher in more acculturated Asian individuals, this may not result from changes in dietary patterns, in the Korean population.

Hispanic: Espino and Maldonado found levels of acculturation to be a stronger predictor of hypertension than socioeconomic factors in a population of Mexican Americans, aged 55-64. In the 1990 study, for participants aged 65-74, both age and acculturation were significant predictors over socioeconomic status.⁷¹ Veath and Willett in a 2005 study of Hispanics living in Dallas County, TX also found greater acculturation to be a significant predictor of hypertension, after accounting for socioeconomic factors.⁷² In 2009, Eamranond et al. found Hispanic patients that spoke Spanish at home to have higher blood pressure than Hispanic patients who spoke English at home. However, once accounting for education, this difference in blood pressure lost its significance.⁷³ Thus, it is evident that there are higher levels of hypertension in Hispanics with higher levels of acculturation, however it remains uncertain if this relationship can be fully, or partially, accounted for by differences in socioeconomic status.

African Americans

African Americans have been shown to have higher rates of hypertension, as well as higher levels of uncontrolled hypertension, in comparison to non-Hispanic Whites, however this research does not focus on factors of acculturation.⁷⁴ This is primarily because the majority of African Americans are US-born and have been living in the US for multiple generations. The

⁷¹ Espino (1990)

⁷² Veath (2005): The majority of the Hispanic population (57%) under study was born in Mexico.

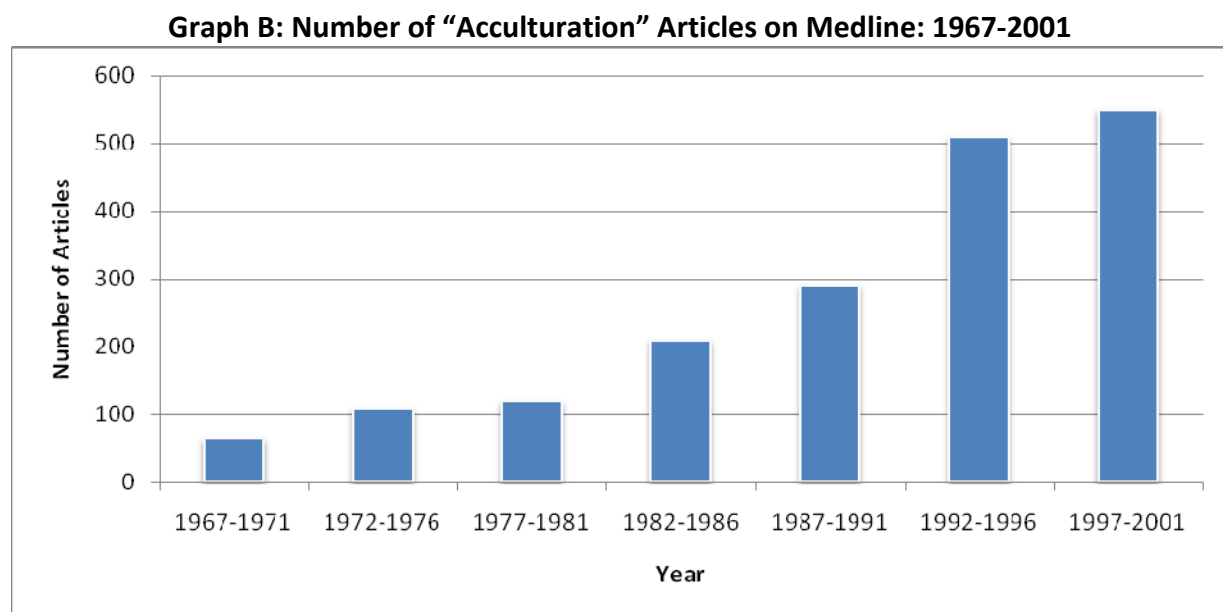
⁷³ Eamranond (2009)

⁷⁴ Moran (2007); Chobanian (2003); Whelton (2002); Hunt (2004); Kressin (2007); Svetkey (1996); Appel (1997)

African American population still is of interest to acculturative research, since a large portion continue to reside in ethnic enclaves. Thus, while the African American group is not currently immigrating to the US, there is still the possibility for significant culture change.

Challenges

Acculturation has become a catchy phrase in public health research and the number of articles and studies focused on acculturation have increased dramatically. Graph B shows the number of articles on Medline that are returned for the keyword “acculturation” published between the years 1967 and 2001.⁷⁵ As evidenced by the graph, the fifteen years between 1981 and 1996 showed a dramatic increase in research. The risk of acculturation being used as a popular catch phrase is that it is not receiving enough scrutiny by those who are using it. It has become a somewhat “fuzzy” or all encompassing factor that allows “an almost limitless set of elements” to be incorporated.⁷⁶



⁷⁵ Hunt (pp. 975, Figure 1, 2004)

⁷⁶ Hunt (pp. 982, 2004)

This is a significant problem for the reputability of public health research, which incorporates acculturation as a predictor variable, as well as public policy decisions that are based on studies using acculturation.

One major group of complaints, which has already been discussed, is based around the problems in measurement methodology. Other criticisms that were previously discussed are the use of the linear model of acculturation in the majority of health research, without recognition of the subsequent advances in research on acculturation theory, and the clustering of ethnic groups together without consideration of country of origin.⁷⁷ Additional criticisms in the use of acculturation as a predictor in health research will be discussed here.

Historical context: Acculturation initially became relevant during European colonial expansion.⁷⁸

As mentioned earlier, J.W. Powell used the term acculturation to “describe the ‘great changes’ experienced by the Native American population faced with the ‘overwhelming presence of millions.’”⁷⁹ From this point until the 1930’s, acculturation research was centered on the defectiveness of immigrants, or the idea that immigrants were less mentally advantaged.⁸⁰ In the 1930’s Redfield, created a standard definition to use in research, as quoted earlier, which decreased the ethnocentric angle that most previous studies had taken, and the volume of acculturation research slowed significantly. Health research using acculturation as a variable did not begin to rise again until the 1969 study by Henry and Cassel, which showed the connection between modernization and blood pressure. Graph B shows this increase in research.

⁷⁷ Hunt (pp. 978, 2004); Abriado-Lanza (2006)

⁷⁸ Hunt (pp. 974, 2004): For the following paragraph.

⁷⁹ Herskovits (1958)

⁸⁰ Hunt (pp. 975, 2004): For the following paragraph.

Cultural Contact: The previously discussed models of acculturation all require an initial contact between the population from the first culture and the population from the contact/host culture. The assumption is that this is the initial contact.⁸¹ A simple vacation outside of the US will prove this assumption false. American culture is exported to many countries across the world, from television shows and movies, to soft drinks and soap products. Even further, a majority of the Hispanic population that is studied in acculturation research are Mexican-Americans. Those living on the border of Mexico and the Southwest US have been in deep cultural contact with each other for numerous years. Lastly, some studies fail to differentiate between subjects that are immigrants to the US and those that are US-born, and other studies use this as the primary factor of determining acculturation.

Cross-sectionalism: The majority of studies on acculturation are cross-sectional rather than longitudinal.⁸² The downside of a cross-sectional study is attempting to measure a variable that has been shown to respond differently within different lengths of residence (see Graph A), from a static viewpoint. Longitudinal studies would allow the observation of the same subject's blood pressure over time with increasing, decreasing, or constant rates of acculturation.

Contextual features: Examining the cause of immigration for the population in question is not a typical component of acculturation research.⁸³ Groups seeking political asylum or those without proper immigration papers will likely have higher acculturative stress than those who are not

⁸¹ Hunt (pp. 979, 2004): For the following paragraph.

⁸² Steffen (pp. 393, 2006); Kaplan (2002)

⁸³ Abaido-Lanza (pp. 1345, 2006): For the following paragraph.

faced with these issues. Additional contextual features include the political and social climate in the host country, both of which can affect the stress levels of the immigrants.

Focusing on the ethnic or racial differences in health outcomes through acculturation can also lead the public eye away from issues of socioeconomic concern. Thus, the burden of negative health outcomes can be taken away from governments that could provide economic relief to this population, and placed on abstract factors of culture. Additionally, while most articles account for these socioeconomic factors, some do not.⁸⁴ It was found by Moran et al., that acculturation levels as a predictor of controlled hypertension lost its significance in Hispanics and Chinese populations after socioeconomic factors were taken into account.⁸⁵ Kaplan et al. who in their study of the Chinese population in Canada found that acculturation was a significant predictor of hypertension whereas socioeconomic factors were not.⁸⁶ While these studies were looking at slightly different outcomes and measured acculturation in slightly different ways, it is clear that socioeconomic factors are variables that have the ability to impact the outcome of the study, and should thus be included in all acculturation analyses.⁸⁷

Two additional challenges to acculturation research are the choice and explanation of the reference group, and the presence of ethnic stereotyping. Acculturation to a host population in most current studies is referencing a White American population that is assumed to be representative of standard American culture.⁸⁸ This first fails to account for the acculturating

⁸⁴ Hunt (pp. 980-81, 2006)

⁸⁵ Moran (2007)

⁸⁶ Kaplan (2002)

⁸⁷ Moran (2007)

⁸⁸ Abriado-Lanza (pp. 1344, 2006); Hunt (2004)

population's interaction with non-White individuals in America.⁸⁹ While some immigrating populations live in self-segregated areas, others are dispersed into areas with large proportions of non-White residents. The idea of "ethnic minority acculturation" as discussed by Abriado-Lanza, where immigrants are coming into contact with a minority culture within the US as opposed to the standard white American culture used in previous research, has yet to be thoroughly studied.⁹⁰ Second, equating American culture to White-American culture may be fundamentally wrong. Not only are acculturating populations interacting with non-White individuals, minority populations are no longer of negligible size to American culture as a whole, and they are not always segregated into certain neighborhoods.

Researchers run the risk of stereotyping in defining certain behaviors as "ethnic," without the empirical evidence showing actual trends of behaviors in both the host culture and the first culture.⁹¹ This includes the idea that the acculturating population is moving from a general state of "traditional" values to a general state of "mainstream" or "modern" values. The wording hints that there is something inherently better about the host culture, a bias that the researcher in this case takes on. Secondly, researchers tend to be very diligent and specific in defining the psychometric measurements of study, yet will make broad and sweeping statements, often biased and stereotypical in regards to the mechanism for the results, undermining the validity of their research. While neither is relevant to this analysis, they each are important criticisms to this field of research.

⁸⁹ Abriado-Lanza (pp. 1344, 2006)

⁹⁰ Abriado-Lanza (pp. 1344, 2006)

⁹¹ Hunt (pp. 976, 2004): For the following paragraph.

Methods

Data Collection

Data were obtained from a clinical study currently underway at the Veteran's Administration Medical Centers (VAMC) in Brooklyn, NY and Manhattan, NY. The demographics of the two centers are given in Table I.

Table I: Demographics of the New York and Brooklyn Medical Centers			
Demographics		Manhattan	Brooklyn
Number of unique patients		33,550	33,265
Veterans with hypertension		8,348	7,667
Race	Black	18%	24%
	White	34%	42%
	Hispanic	9%	6%
	Asian	0.60%	0.30%
	Unknown	36%	32%
Listed telephone		>90%	>90%

As is evidenced by Table I, just fewer than 25% of the patients at each VAMC are currently diagnosed with hypertension. The study, A Behavioral Intervention to Improve Hypertension Control in Veterans, currently has 528 active subjects, 341 of which were included in this analysis.⁹² In order to describe the population within the analysis of this paper, I will first discuss the population, from which the smaller sub-group is drawn.

A Behavioral Intervention to Improve Hypertension Control in Veterans

IRB approval was obtained and all participants were consented prior to being enrolled. All patients approached about the study were veterans with hypertension, as documented in their

⁹² Based on the time it takes to run the initial analysis of the Willet Food Frequency Questionnaire by an outside organization, these patients represented the only available data set for study at the time of the analysis.

medical records, and patients at either the Manhattan or Brooklyn VAMC.⁹³ The two major inclusion criteria are as follows. First, uncontrolled hypertension is defined by SBP $\geq$ 130 mm Hg or DBP $\geq$ 80 mm Hg in patients with co-morbid diabetes mellitus or kidney disease, and SBP $\geq$ 140 mm Hg or DBP $\geq$ 90 mm Hg in all other patients. Second, patients are required to have been on antihypertensive drug therapy for at least 6 months prior to enrollment in the study. Additional inclusion criteria include the following: a telephone to receive the telephone intervention component of the study, to be of at least 21 years of age, and to have continuous care by the VA, as defined by at least 2 visits per year to their doctor in the primary care clinics.⁹⁴ Exclusion criteria are as follows: a cardiovascular disease event or diagnosis within the last 6 months, a non-cardiovascular disease terminal illness, a major surgery within the last 3 months, cognitive deficit or memory problems, alcohol abuse, inability to understand English, lack of a telephone, plan to move outside of the New York area in less than one year, inability to follow the study protocol, and those unable or unwilling to provide informed consent.⁹⁵ After eligible patients are identified and contacted by study personnel, they are screened and enrolled by research assistants. There is a “run-in period of 4 weeks before the baseline visit, where the data used in this analysis is taken.

⁹³ Natarajan (2005): For the following paragraph.

⁹⁴ The initial study includes a stage-matched behavioral intervention to improve the veterans’ self-management of their own care. Patients are placed into one of three groups, two of which receive monthly 30-minute phone calls from trained specialists.

⁹⁵ Cardiovascular disease as defined as chronic stable angina, unstable angina, uncomplicated myocardial infarction, coronary artery bypass surgery, percutaneous coronary angioplasty, atherectomy or stent placement, chronic stable angina pectoris, stable Class I or Class II congestive heart failure, stroke, and/or peripheral vascular disease. Non-cardiovascular terminal illnesses are any cancer other than non-melanoma skin cancer, cardiovascular disease < 6 months ago, Class III or IV coronary heart failure, severe psychiatric illness such as psychosis, manic depression, and serious chronic conditions like AIDS, tuberculosis, lupus and end-stage renal failure. Alcohol abuse is defined as greater than 21 drinks per week.

Sub-Population for Analysis

This analysis includes the first 341 participants that were enrolled into the above study. Out of 341 hypertensive veterans, 30 (9%) were non-primary English speakers (ESL). The demographics of this group are given in Table J.

Table J: Demographics			
Demographic Category		ESL Frequency (%)	Non-ESL Frequency (%)
Age	Mean age in years (SD)	65.9 (9.3)	65.0 (10.4)
Sex	Male	30 (100)	307 (91)
Marital Status	Never Married	1 (3)	64 (21)
	Married	15 (50)	103 (33)
	Divorced	7 (23)	79 (25)
	Separated	3 (10)	25 (8)
	Widowed	4 (13)	34 (11)
Race	White	2 (7)	150 (48)
	Black	1 (3)	119 (38)
	Hispanic Origin (any race)	24 (80)	19 (6)
	Asian/Pacific Islander	0 (0)	4 (1)
	American Indian	0 (0)	2 (1)
	Other	2 (7)	7 (2)
	Multi-Racial	1 (3)	10 (3)
Education	Less than high school	4 (13)	6 (2)
	Some high school	4 (13)	31 (10)
	High school graduate or GED	10 (33)	94 (30)
	Some college	8 (27)	109 (35)
	College graduate or greater	4 (13)	68 (22)
Employment Status	Employed full-time	3 (10)	45 (14)
	Employed part-time	2 (7)	17 (5)
	Looking for work	1 (3)	17 (5)
	Homemaker	0 (0)	2 (1)
	Retired	21 (70)	185 (59)
	Unable to work	2 (7)	31 (10)
	Unemployed - not looking	1 (3)	9 (3)

The majority of the patients in each group were male. In the ESL group, 80% are Hispanic, while only 6% of the non-ESL group is Hispanic. Twenty-one percent of the non-ESL group reported to

never having been married, whereas only 3% of the ESL group reported to have never been married. The significance of this is unknown, however it may be connected the fear many veterans have of providing the VAMC with too much personal information, which might jeopardize their healthcare benefits. The ESL group had lower overall education levels, only 74% were high school graduates in comparison to 88% of the non-ESL group. Additionally, only 7% of the ESL group was college graduates, whereas 14% of the non-ESL group was. This could impact the socioeconomic status of the respective groups, as level of education is a major component to most socioeconomic calculations.

Language

Participant's language ability was determined during the baseline interview. ESL was used as a proxy measurement for acculturation. These patients are classified as highly acculturated given their fluency in English that was required as a criterion for enrollment in the initial study, and their time spent in the US, which is discussed below. Other measurements discussed previously were ruled out due to the homogeneity of the veteran population. All of the veterans have spent time in the US military. The maximum age for enrollment is 35, however many of the subspecialties have lower ages, such as age 28 for the marines.⁹⁶ Given the average age of 65 for the patients in this study, the average participant would have spent at least 30 years in the US. The majority of studies that used time spent in the US, did not specify the brackets of time beyond 15 or 20 years, therefore all of the patients in this analysis would be placed in this latter group. Measurements of acculturation that may have made an impact and that I was unable to

⁹⁶ 10 USC § 505: In 2006 this was changed to age 42, however this is not applicable to the veteran population in this study.

attain, were place of birth and language spoken at home. Overall, I was not as specific in measuring acculturation as the above analysis of acculturation recommended. I was limited in my ability to collect data in addition to what had already been collected for the Behavioral Intervention to Improve Hypertension Control study.

DASH Diet

Adherence was assessed separately for each of the 10 food categories using the Willett Food Frequency Questionnaire (FFQ).⁹⁷ This information was collected from participants at their baseline visit and is one of the most specific clinical methods of measuring patient dietary habits. The FFQ asks the patient to record all of the foods eaten in a typical week, with sections for all food groups, and lists of the most common foods within that group. For example, the section on fruit would contain fresh fruit choices such as apples or bananas, as well as canned fruit choices such as mandarin oranges. The patient then fills out the relative frequency he/she eats each food per week with the approximate amount he/she eats each time. There is also a space to handwrite foods that the questionnaire does not cover. The FFQ is analyzed for the DASH diet by assessing the participant's dietary habits to each 10 components of the DASH diet standards. As shown in Table D (previous), the 10 main components are fiber, fruits and vegetables, lean meat, low-fat milk, potassium, saturated fat, sodium, sweets, total fat and whole grains. Advantages are the specificity and completeness in measurement. Disadvantages are the time length in administering the FFQ, as well as the cost of having it analyzed.⁹⁸

⁹⁷ Willett (1985): For the following paragraph.

⁹⁸ FFQs are sent to an outside facility where they are analyzed.

The second most commonly used clinical method to assess dietary habits is the 24-hour dietary recall.⁹⁹ This method involves the participant recalling all the food or drink that s/he has eaten within the last 24 hours. It is not thought to be as reliable, since it is only a 24-hour sample of the patient's dietary habits. Advantages are the speed and ease through which it is administered, as well as the low cost of having it analyzed.¹⁰⁰

Data Analysis

Using a robust regression analysis, I examined the relationship between high levels of acculturation and adherence to the DASH diet, while controlling for age. A DASH index score (DAI; 0-100) was created with the dietary information collected from the FFQ. The DAI score is a sum of the 10 component scores (0-10); calculated using the criteria shown in Table K. ESL was used as a proxy variable for high levels of acculturation.

Table K: DASH Adherence Index (DAI)		
Component	Criteria	Score
Lean meats	Lean meats/meats	Proportion*10
Low fat dairy	Low-fat dairy/dairy	Proportion*10
Whole grains	Whole grains/grains	Proportion*10
Fruits and vegetables*	7.5, 9, 11 servings/day	10; -1 for each 10% less
Sweets*	0, 5/7, 2 servings/week	10; -1 for each 10% more
Fiber	28 g	10; -1 for each 10% less
Potassium	3932 mg	10; -1 for each 10% less
Sodium	1800 mg	10; -1 for each 10% more
Saturated fat	6% of calories	10; -1 for each 10% more
Total fat	27% of calories	10; -1 for each 10% more

* Calorie Specific (<1800 kcal, 1800-2300 kcal, >2300 kcal)

⁹⁹ Lenner (1977)

¹⁰⁰ Kim (2007): The information from the 24-hour recall can be put into a computer program without the need of shipping it to an outside facility.

Results

ESL was not a significant predictor of overall adherence to the DASH diet ($p=.648$), however on average, ESL individuals had a lower DAI score (47.3) in comparison to non-ESL individuals (49.5). Table L shows the relationships between ESL and the 10 components of the DASH diet, while accounting for age. Race was not used since it was highly correlated with ESL ($p\leq.001$).

Table L: Robust Regression: DAI = ESL + Age				
Dependent Variables	ESL (SD)	Non-ESL (SD)	ESL: P value (coefficient)	Age: P value (coefficient)
Lean meats	3.7 (1.9)	4.3 (7.9)	.665 (.15)	.512 (-.01)
Low fat dairy	4.0 (3.9)	4.4 (3.3)	.398 (-.68)	.231 (.03)
Whole grains	3.4 (1.9)	4.3 (2.2)	.080 (-.83)	.188 (.02)
Fruits and vegetables	5.1 (2.6)	5.2 (2.6)	.650 (-.25)	<.001 (.05)
Sweets	1.5 (3.0)	2.1 (3.5)	.995 (.002)	.405 (.01)
Fiber	4.8 (2.5)	5.3 (5.6)	.434 (-.45)	.003 (.05)
Potassium	5.3 (2.6)	5.7 (2.3)	.289 (-.56)	.067 (.03)
Sodium	8.1 (3.0)	8.2 (2.8)	.262 (.37)	.545 (.01)
Saturated fat	3.6 (3.4)	3.1 (3.2)	.410 (.71)	.140 (.03)
Total fat	7.8 (2.1)	7.2 (2.4)	.233 (.58)	.545 (.01)
Overall adherence	47.3 (12.5)	49.5 (14.3)	.648 (-1.23)	.001 (.26)

ESL was a predictor of decreased adherence to whole grains with significance at the trend level ($p=.08$). ESL was not a significant predictor for the other food subgroups.

I ran two additional analyses. The first regression incorporated perceived stress into the initial model, and the second incorporated education into the original model, comparing less than a high school diploma and college, to high school diploma. The results of the first additional analysis are given in Table M. When accounting for both perceived stress, age became a less significant predictor of overall adherence, going from $p=.001$ in the initial analysis, to $p=.036$ in the second analysis. ESL remained an insignificant predictor of overall ESL, but became a more

significant predictor of whole grain intake, with $p=.059$. Perceived stress was not a significant predictor of overall adherence to the DASH diet, with $p=.165$, however was a significant predictor of whole grain intake ($p=.011$), fruits and vegetables ($p=.002$), saturated fat ($p=.025$), and at the trend level, total fat ($p=.090$). This gives weight to the argument that acculturative stress is the main driver of higher levels of hypertension in highly acculturated populations.

Table M: Robust Regression: DAI = ESL + Age + Perceived Stress (PS)			
Dependent Variables	ESL: P value (coefficient)	Age: P value (coefficient)	PS: P value (coefficient)
Lean meats	.887 (.05)	.548 (-.01)	.751 (.01)
Low fat dairy	.701 (-.32)	.307 (.03)	.384 (.03)
Whole grains	.059 (-.92)	.843 (.01)	.011 (-.05)
Fruits and vegetables	.474 (-.42)	.002 (.05)	.002 (-.07)
Sweets	.855 (-.06)	.992 (-.01)	.395 (-.01)
Fiber	.488 (-.42)	.019 (.04)	.377 (-.02)
Potassium	.439 (-.42)	.122 (.02)	.556 (.01)
Sodium	.359 (.33)	.539 (-.01)	.224 (-.02)
Saturated fat	.490 (.51)	.519 (.01)	.025 (-.07)
Total fat	.447 (.38)	.752 (-.01)	.090 (-.04)
Overall adherence	.667 (-1.3)	.036 (.18)	.165 (-.14)

The results of the second additional analysis are given in Table N. Less than high school education, within the ESL model, was a significant predictor of increased overall adherence on the trend level ($p=.071$). Additionally, less than high school was a significant predictor lower consumption of total fat ($p=.039$) and saturated fat ($p=.028$), while college degree or greater was predictive of increased consumption saturated fat at the trend level ($p=.074$). Lastly, less than high school education was a significant predictor of increased adherence to both lean meats ($p=.060$) and sodium ($p=.067$) targets at the trend levels. Thus, there is a significant difference in levels of adherence to dietary measures by patients with lower levels of

education, as defined by less than a high school education. This is very striking, since I would hypothesize that the opposite would be true. Even more so, having higher levels of education predicted worse adherence to the DASH diet. While both groups had fairly equivalent adherence to typical “healthy” foods, the less than high school group had much better adherence to “non-healthy” foods: saturated fat, total fat and sodium.

Table N: Robust Regression: DAI = ESL + Age + Education				
Dependent Variables	ESL: P value (coefficient)	Age: P value (coefficient)	Education: P value (coefficient)	
			Less than High School	College
Lean meats	.89 (.05)	.55 (-.01)	.060 (.68)	.102 (.376)
Low fat dairy	.70 (-.32)	.31 (.03)	.724 (.29)	.242 (.62)
Whole grains	.06 (-.92)	.84 (.01)	.622 (-.25)	.44 (-.25)
Fruits and vegetables	.47 (-.42)	.01 (.05)	.264 (.66)	.657 (.16)
Sweets	.85 (-.06)	.99 (-.01)	.450 (.23)	.946 (-.01)
Fiber	.49 (-.42)	.02 (.04)	.636 (.29)	.511 (.26)
Potassium	.44 (-.42)	.12 (.02)	.402 (-.45)	.849 (.07)
Sodium	.36 (.33)	.54 (.01)	.067 (.62)	.983 (.01)
Saturated fat	.49 (.51)	.52 (.02)	.028 (1.6)	.074 (.84)
Total fat	.45 (.38)	.75 (-.01)	.039 (1.1)	.793 (.08)
Overall adherence	.67 (-1.2)	.04 (1.1)	.071 (5.4)	.246 (2.2)

Discussion and Implications

Discussion of the Results

The findings in this analysis are primarily based on overall adherence, and specific adherence, to the DASH diet. An important distinction is that the dietary habits of the acculturated individuals in this analysis reveal the dietary habits of acculturated individuals with hypertension, not the dietary habits of the general acculturating population. Patients with hypertension have previously been made aware of the DASH diet, or at least components of the

DASH diet, from their physician. This changes their dietary habits if they had adopted or adjusted their diet to help lower their blood pressure. Therefore, the results reveal acculturated hypertensive individuals' overall adherence to the DASH diet, in comparison to the "host" control group.

For the initial analysis, since only the lower intake of whole grains was a significant result, and the acculturated population was not overall less adherent to the DASH diet, it could be viewed that the acculturated population is roughly no less adherent to the dietary aspects of hypertension control than the host population. While there is a slight variation, which is important for clinical care, it is not an overarching difference. Therefore, this analysis may simply be evidence for the argument that acculturative stress, as opposed to behavioral changes, is the driving force behind increased rates of hypertension in the acculturated population.

To further understand the implications of this idea, I conducted an analysis on the levels of exercise and medication adherence in the 2 initial groups for this analysis. I did two robust regressions, one examining the relationship between exercise and ESL and the other examining the relationship between medication adherence and ESL. ESL was not a significant predictor of exercise ($p=.45$) or medication adherence ($p=.26$). This becomes strong evidence for the acculturative stress argument, from the angle that acculturated individuals have equal levels of adherence to the behavioral and medication-based treatments. Since many prehypertensive patients are given behavioral recommendations, this could potentially be expanded to the prehypertensive population, however not without further analysis. These findings do not have

any implications on the normotensive population, as this analysis does not cover the dietary habits of normotensive patients. Therefore, while it provides evidence to the acculturative stress argument in the hypertensive acculturated population, it does not account for the increased levels of blood pressure in the acculturated normotensive population.

Alternatively, the analysis including educational factors could be an argument against socioeconomic factors, within immigrating populations, or more specifically, immigrating Hispanic populations. The increased levels of adherence in the ESL group with the lowest level of education, and the decreased levels of adherence in the ESL group with the highest level of education, contradicts many studies on non-immigrating populations – where increased education was a predictor of increased adherence. One reason that I hypothesize the individuals in the group with a college education or greater had decreased adherence to the DASH diet, most significantly in the total fats category ($p=.08$), is because the members of this group are more immersed in “American culture,” and potentially more subject to some of the aspects of American culture that increase blood pressure (i.e. fast paced lifestyle, stressful job environment, diets high in sodium and fats, etc.). However, this population group would need to be more heavily studied before any conclusions could be drawn, as only 14% ($n=4$) individuals in the ESL group reported a college education or greater.

A hypothesis for the less than high school education ESL group, which goes in conjunction with the previous hypothesis, is that this group is, in a sense, less acculturated. Since the individuals with less than a high school degree may be more likely to work in manual labor, or the food services industry, these individuals may be less likely to hold jobs in environments with a high

proportion of non-immigrant workers. Thus, this group will be in effects less exposed to the “American culture” that the highly educated group is, and therefore less likely to eat the unhealthy American foods that help contribute to hypertension. This rational would rely on the notion that “American culture” leads to hypertension, which may or may not be an assumption that can be made. To contradict this, the individuals with less than a high school education may also have lower income levels, which would put them in a category greater targeted by fast foods, such as McDonalds, and thus more susceptible to the unhealthy foods within “American culture.” Either way, a larger more conclusive study would need to be undertaken before any conclusions could be made. However, this does give some weight to the argument that increased levels of hypertension in highly acculturated populations may be more heavily attributed to behavioral changes associated with acculturation, rather than acculturative stress or socioeconomic factors.

Implications

There are a couple of implications that can be derived from my results. The first is the impact on the clinical treatment of acculturating individuals. Physicians should focus on helping these patients look for ways to substitute whole grains into their diets. I hypothesize that the consumption of white rice and flour tortillas are the driving force behind decreased consumption of whole grains, as 80% of the ESL group in this analysis reported Hispanic as their ethnicity, in comparison to 6% of the non-ESL group. White rice and flour tortillas are major components of the typical Central and Southern American diet. While some patients may be reluctant to reduce their consumption of either, whole grain cereals and whole grain breads

can be substituted for non-whole grain cereals and white breads, without impacting white rice or flour tortilla consumption.

The second implication is for health care policy. More funding should be placed into programs that target blood pressure control in recently immigrated populations. Individuals with lower levels of acculturation were consistently shown in the previously discussed research to have lower levels of hypertension in comparison to their more acculturated cohorts. Individuals with higher levels of acculturation did not show significant difference in their adherence to treatment plans (medication, diet and exercise), in comparison to the host population. This leads to the conclusion that the higher levels of diagnosed hypertension in highly acculturated populations are not fully attributable to behavioral changes. Thus, implementing behavioral changes in highly acculturated individuals is not a feasible treatment mechanism to lower blood pressure. Therefore it is important to make all efforts to prevent hypertension in the less acculturated population, before hypertension has set on.

The last implication is in regards to future research. Research money should focus on examining the effects and the physiological and psychological mechanisms of acculturative stress, as opposed to health impacted behavioral differences between the different groups. If further research money is directed towards the behavioral changes resulting from acculturation, the studies should use a multivariate model of acculturation, as well as health measurements specific to the health changes themselves. When studying changes in diet and exercise, exercise and dietary logs should replace BMI and cholesterol, the measurements that are commonly found in the literature. This will allow studies to be compared in a more effective manner, as

well as focus the research on the inputs of health, rather than the outputs. In summary, this research is relevant both clinically and for the direction of policy making and research.

Limitations

There are a number of limitations to this analysis. The majority of the limitations stem from the fact that I was unable to conduct a new study, or ask additional questions of the participants in the Behavioral Intervention to Control Hypertension study. Because this study was not designed around acculturation, I was constricted to knowing which patients spoke English as a primary language, and which patients did not. As a result, I was unable to determine the ethnicities or country of origin, beyond those listed in Table J. Thus, I could not examine the relative frequencies of certain behaviors, such as intake of whole grains, in the original country versus the host country, in efforts to follow the operant theory of acculturation.¹⁰¹ I also was unable to separate out the different adherence rates among different languages and/or races. There were additional limitations to my method of measuring acculturation, which were discussed in the “Methods” section.

Relying upon the given data set also exposed this analysis to all of the limitations faced by the initial study. Most importantly, the patients enrolled in the study had to have seen their physician at least twice over the course of the previous year. This is biased to individuals who are either more active in their healthcare, or who have more serious health complications. This could also limit some patients if they are unable to make the trip to the hospital more than once a year due to financial concerns. Another implication is that this study is only applicable to

¹⁰¹ Landrine (2004)

a specific subset of the US population. The study is 99% male, with an average age of 65. The veteran population also spent time in the military, which may have an impact on their health behaviors.

The size of my study is an additional limiting factor. While there currently are 528 patients enrolled in the behavioral intervention study, only 341 patients had FFQ data that was available to be analyzed. This restricted my ability to separate out different ethnicities, in addition to my limited knowledge of race, as there were only a handful of patients within each racial category. A larger and more effectively designed study also would have allowed me to compare multiple population groups, such as individuals with low levels of acculturation, individuals with high levels of acculturation, individuals of the host culture and individuals of the first culture. I could also have examined the differences in normotensive and hypertensive individuals across these different groups. The current study only allowed me to compare individuals with hypertension in the highly acculturated population and the host population.

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