Concept, Measurement and Use of Acculturation in Health and Disease Risk Studies

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ABSTRACT

Acculturation, a concept with its root in social science and cultural anthropology, is a process intimately related to health behavior and health status of minority populations in a multicultural society. This paper provides a brief review of the subject of acculturation as it relates to health research, showing that this concept has a potential to identify risk factors that underlie increased prevalence of chronic diseases, particularly in immigrant populations. A proper understanding of this is helpful in designing intervention programs to reduce the burden of such diseases and to increase the quality of life in such populations. The concept is defined with an outline of its history showing its evolution over time. Criteria for measuring acculturation are described to illustrate the need of accommodating its multidimensional features. Drawing examples from health research in US Hispanics, the role of acculturation on health behavior is discussed to document that the discordant findings are at least partially due to either use of incomplete dimensions of the concept, or not accounting for the dynamic aspect of its process. Finally, with illustration of a finding from a study among overweight Mexican American women of South Texas, a model of acculturation study is proposed that may be used in other immigrant populations undergoing the acculturation process.

Key words: acculturation, health behavior, immigrant populaton, risk factors of chronic diseases, hispanic population, acculuration models

Introduction

As sub-disciplines of social science, concepts of both physical and cultural anthropology play roles in researches on health behavior and risk of chronic diseases. Physical anthropological concepts have been used widely in health and disease risk studies for a long time. As early as in 1955, Tanner[1] published his classic monograph documenting the use of physical measurements from birth to maturity and how they can be used to study the role of heredity and environment on health problems resulting from abnormal growth and development. Likewise, Yuhasz[2] estimated the percent of body fatness (a risk factor for several chronic diseases) from skin fold measurements at several body sites. Sensitivity and specificity of different physical measures of centralized obesity (e.g., Body Mass Index, BMI; Waist-Hip Ratio, WHR; and Waist Circumference, WC) in the context of the obesity component of metabolic syndrome (a world-wide epidemic risk factor condition of chronic diseases) remains an active area of current research[3].

In contrast, the use of cultural anthropological concepts in health and disease risk research has a comparatively recent history. Apart from racial and ethnic grouping of people for describing the genetic variation and disease prevalence, before the recognition of health habit and health behavior as risk factors of chronic diseases, the use of cultural anthropological concepts in heath research had been at best peripheral. Cultural tradition, belief, attitude, and language of study participants began receiving attention in health care and disease risk studies when population-based intervention strategies started being implemented[4]. Though the concept of acculturation has an older history[5], its measurement and use in health and disease risk research has a comparatively newer history[6–9].

The objective of this paper is to provide a brief review of the subject of acculturation as it relates to health and disease risk research, drawing attention to the fact that this social science and cultural anthropological concept has a potential to identify risk factors that underlie increased prevalence of many chronic diseases, particularly in immigrant populations. A proper understanding of this from the view point of social science should be helpful in designing intervention programs to reduce the burden of such diseases and to improve the quality of life in such patient populations. First, the term acculturation is defined with a brief outline of its history showing how this concept evolved over time. Criteria for measuring acculturation are then described to illustrate the need of accommodating its multidimensional features. Drawing examples from health research in US Hispanics, the role of acculturation on several health behaviors (e.g., tobacco and alcohol consumption, drug use, exercise and sleeping habits), child birth and care (e.g., teen-age pregnancy and breast feeding), and health care access is discussed to document that the discordant findings are at least partially due to the fact that some such studies either used incomplete dimensions of the concept, or did not account for the dynamic aspect of the process of acculturation. Finally, with illustration of an important finding from an earlier study[8], a model of acculturation study is proposed that may be used in other immigrant populations undergoing the acculturation process.

Definitions of Acculturation and Their Historical Origins

Acculturation is described as a process of change of cultural features that occurs as a result of continuous contact between two or more groups. It is generally a two-way process; but one aspect of acculturation is cultural assimilation, which generally consists of adaptation of the cultural features of the larger group by the minority group. Though it was formally defined in the above way in the fourth decade of last century[5], the history of theorizing the concept of acculturation goes back to the time of Old Testament, Moses and Babylonian law of Hammurabi. In 4th century BC, Plato argued that human tendency is to imitate strangers, and hence through contact with foreigners during travel or migration, different cultural habits are introduced in both migrant (traveler) as well as host groups.

Despite such ancient references to acculturative processes, this subject became a topic of intense research since the 19th century. Rudmin[10] catalogued a systematic history of evolution and use of the concept, in which he stated that in 1835 a French political thinker, Alexis de Tocqueville (1805–1859), described it as a process of assimilation in the context of studying the American political culture that he predicted it would bring descendants of foreign nationals together. In a report of US Bureau of American Ethnography, Powell[11] coined for the first time the term »acculturation« to describe changes in Native American languages after their contact with the European settlers in the New World. Credited for first coining the word »acculturation«, he also explained this as psychological changes induced by cross-cultural imitation[12]. McGee[13] used this term as processes of exchange and mutual improvement by which societies advance. He argued that »human development is essentially social, and may be measured by the degree in which devices and ideas are interchanged and fertilized in the process of transfer; i.e., by the degree of acculturation«. This signified a paradigm shift of the utility of the concept, in sharp contrast with its ancient negative interpretations in Babylonian and Plato's laws[14].

Definitions closer to the current use of the term evolved at the beginning of the nineteenth century. Simons[15] described it as a process of »reciprocal accommodation«, »Amalgamirungsprozess« (amalgamation processes, in German), or »assimilation« (in English), which latter resulted this being used as a metaphor for »cross-fertilization of cultures«[16]. The description proposed in 1936, namely, »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 culture patterns of either or both groups« is still the most popular current definition of the term[5]. Though distinction of assimilation and exchange of cultural features was somewhat blurred in such descriptions, Kottak[17] stated that while cultural patterns in all such groups may be altered, in the acculturation process the involved groups generally remain distinct. Thus, intrinsically acculturation entails two-way processes of change. Nonetheless, the cultural exchange aspect of it, which generally consists of adaptation of the cultural features of the larger group by the minority group, is generally the focus of most acculturation studies.

Features, Processes and Measurement of Acculturation

Features

Since the concept of »culture« is used in every description of the acculturation process, in order to understand the features and processes of acculturation, to measure its degree in involved groups, and to investigate its impact, it is necessary to understand what is meant by culture. It is a multidimensional concept (with different meanings in different context). Everything that makes a person who he/she is can be a dimension of culture. Attitude, language, tradition, life and family value, life experience, knowledge, behavioral pattern, and life style are examples of cultural dimensions. As a consequence, cultural features may have relationship with education, life achievements, health-related behaviors, and health status. Acculturation processes are also called »Cultural Appropriation«, which may be described as adoption of some specific features of one culture by a different cultural group. Such features may include forms of dress or personal adornment, music and art, language, religion, or behavior. These elements are typically imported into

the existing culture, and have considerably different meanings, or lack subtleties of their original cultural context. In such scenarios, cultural appropriation is sometimes viewed negatively, and called »cultural theft«. Broad-based import of cultural traits is, however, not always viewed as acculturation, though they satisfy a narrow definition of the term. Example of this is found in the case where the Chinese written language (Hanzi) was adopted, with various degrees of modification in places where no previous written records were found, such as in Japan (as Kanji), Korea (as Hanja) and Vietnam (as Chunôm), but in today's definition, this does not constitute an acculturative phenomenon.

Processes

With this description of culture, it is obvious that acculturation is a multifaceted and complex process. It involves individuals of one culture living in another culture with continued exposure. As a consequence, it involves a process (or processes) by which one group adapts characteristics of another group's culture, consciously or unconsciously. Some of these adapted characteristics are essential for survival (e.g., language), particularly for a migrant minority group, and hence, adaptation of these generally starts immediately or soon after the contact. Other characteristics adopted may have effect on health and/or achievement levels, which are generally seen as a consequence of adjustments arising from acculturation.

Thus, acculturation generally consists of three phases. These are: (i) Contact, which happens when two or more cultural groups interact socially or due to special circumstances (e.g., for education of children, for job-related activity, or for medical reasons); (ii) Conflict that arises from clash of (apparent or true) cultural belief systems. This makes the changes stressful at societal/individual level (e.g., food, health habits, and social custom). Such conflict-related events are often called Acculturative Stress; and (iii) Adaptation, which generally takes three forms, often influenced by environmental, educational and economic demands (school and job-related). The three forms of adaptation are: (iii.a) Adjustment: whereby cultural and life style behaviors of the minority group gradually become similar to those of the dominant group. This may be reflected in language in use, value-system of life, custom, self-identification, taking translated names in school and job environment, etc. Adjustment is also the form of adaptation through which acculturative stress (arising from conflict) may be reduced; (iii.b) Reaction: occurs when the minority group's disagreement with the views of the dominant culture results in subtle or direct aggression against them. Such reaction forms of adaptation often lead to formation of advocacy/ political groups or organization within the minority group to promote their own culture. Reactions may also occur in the form where individuals do not respond when called with their translated names (often seen in children and adolescents in school or job environment); and (iii.c) Withdrawal: resulting in segregation

and refusal of joining in community/school/health programs.

Thus, at each phase of the acculturation process individual- and group-level changes occur, where individual's adjustment/reaction/withdrawal form of adaptation is influenced by familial, socio-ecological, as well as multicultural environmental settings of the contact, often interconnected with a feedback type of influences. A network description of this in the form of a path diagram (as shown in Figure 1) depicts how individual-, family-, as well as societal-levels of adaptation may influence acculturative changes[18].

Different Elements of
Acculturation

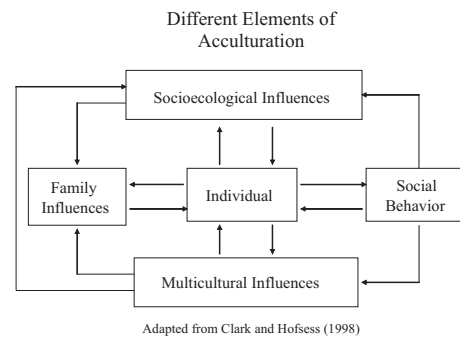

Adapted from Clark and Hofsess (1998)

Fig. 1. Component elements of acculturation and their inter-dependence (adapted from ref. 18).

Conceptualization of acculturative features, a subject that has developed mostly from the field of psychology, stresses that an understanding of the two cultures that have come in contact to initiate the process of acculturation is the first important step to describe the features of the process. This is so because an individual is not only affected by the dominant culture, but also by the change of the culture to which he/she belongs[19]. Further, every individual does not acculturate similarly[20], which necessitates conceptualization and measurement of acculturation at individual as well as at a group level. Berry[19] termed the group level acculturation as cultural, and the individual level as psychological acculturation. The first is featured by exchange of cultural features between the groups in contact, generally through mutual borrowing of vocabularies, sharing of religious practices, food habit, etc., while the later manifest as changes such as language preference, diet, or cultural identity. Psychological and/or socio-cultural adaptation at individual level is related to the way in which the individual links themselves to others in the dominant culture, allowing for change to occur to both the non-dominant and the dominant cultures as well at an individual level.

This general conceptual view of acculturation leads to two competing theories that describe the process of acculturation: one-dimensional and multidimensional. The one-dimensional approach assumes that individuals acculturate gradually (but to a variable degree) to the dominant culture while their connection with the minority culture simultaneously is gets weakened. This subsumes that as though the minority culture changes while the

dominant one remains unaltered or little perturbed[21]. This would lead to a continuum of the degree of acculturation in individuals of the minority group that can be measured (in a number of alternative scales described in the next section), that can be represented as shown in Figure 2.
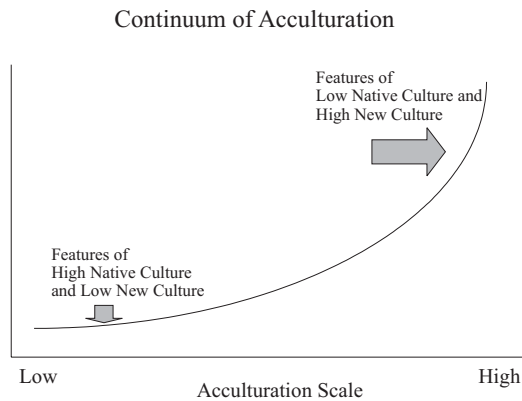
Continuum of Acculturation

Fig. 2. One-dimensional representation of continuum of acculturation.

While this one-dimensional process of acculturation does not explicitly deal with any changes in the dominant group, it is not quite correct to imply that this one-dimensional conceptualization of the process of acculturation does not allow for changes in the dominant culture. It simply does not account for it. In contrast, the multidimensional conceptualization of the process of acculturation simultaneously allows for acculturation to the dominant culture and maintenance of non-dominant culture that may occur hand-in-hand. This is pictorially shown in Figure 3, where acculturative changes at individual, group, and societal levels are portrayed, with the scale of retention of cultural identity is represented in the horizontal axis (measured at the level of individual, group, and societal levels), and the vertical axis representing the intent of interacting with the dominant or with other cultural groups. Ruiz[22] gives a more detailed description of this multidimensional conceptualization of the process of acculturation, particularly in the context of acculturation in the US Hispanics communities.
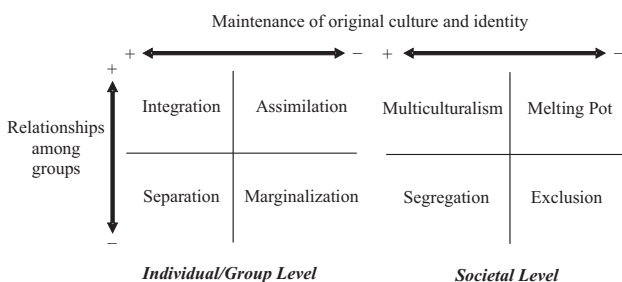

Fig. 3. Multidimensional representation of acculturation process (Adapted from ref. 19).

Measurement of Acculturation

As implied in the previous section, measurement of acculturation can be made at individual as well as group/societal levels. Further, such measurements may be based on behavioral and value dimensions, since these are the two major dimensions of cultural identity of individuals and groups. Acculturation variables thus would comprise factors such as psychological, socio-demographic, contact with native culture (in terms of degrees of loss, maintenance and adopting new traits of dominant culture), and language (preference as well as comfort of use). The popular dimensions of acculturation measurements in the literature (used mostly in the context of acculturation studies in US communities) may be listed as: (i) Language (used and/or comfort with) while speaking, reading, and thinking; (ii) Length of residence in US; (iii) Generation status, parents' birth place; (iv) Ethnicity of past and present friends; (v) Ethnic composition of past, current neighborhood; and (vi) Behavioral preference (for music, radio, TV, movies, books/newspaper, celebrating occasions, diet/food), used one at a time (one-dimensional scale of acculturation), or simultaneously (multi-component measure).

One-dimensional acculturation measure based on language has been used in the context of Hispanic studies, that consists of answers of: Most frequently, what language(s) do you use while: (i) reading and speaking, (ii) speaking at home, (iii) thinking; and (iv) speaking with friends, each scored as 1=only Spanish; 2=Spanish better than English; 3=Both equally; 4=English better than Spanish; and 5=Only English[23]. The summed score is the degree of acculturation. In contrast, in the context of Hispanic studies again, acculturation has been measured more comprehensively based on components that can be listed as: (i) Language (multiple items, based on: first language learned, understanding of spoken and written language of dominant culture, language preference for communication within families and friends, language preference for reading books, newspaper, listing radio and watching TV programs, etc.); (ii) Self-Identification of Ethnicity; (iii) Parents' Ethnic Identification; (iv) Ethnicity of past and present friends; (v) Generation status and length of residence in the dominant culture: (vi) Country in which raised; (vii) Contact with Mexico (as measured by the frequency and duration of visits to the origin of Native culture); and (viii) Ethnic pride. Each item was rated from Spanish/Latino orientation to English/non-Latino orientation by nominal numeric scores, which were subsequently standardized individually (to a mean of zero and a variance of one), before being summed over all components[24]. In applying the Cuellar Acculturation scoring technique[24] in other studies in Mexican-Americans, it had been observed that the language acculturation scale exhibits: 1) a strong positive correlation (r=0.60) with subject's generation of residence in USA; 2) a somewhat weaker but significant correlation (r=0.42) with the length of residence in the US for foreign-born immigrants; and 3) a negative correlation (r=–0.70) with the age at migration[25,26]. However,

these authors also noted that the detailed Cuellar Acculturation Scale questionnaire, when administered particularly to the less educated Mexican American women, leaves many of the language items unanswered because of failure of response. Nonetheless, acculturation scored by language preference is noted to be highly predictive of health behavior change, in the sense that with increasing trend of adaptation to the language of preference of the larger community, the health habits become closer to the norm of the society with which acculturation occurs[25]. Thus, the validation results emerging from these studies imply that the migration status measured based on birth places of subjects and their immediate ancestors, and years of residence in the US may be used as replacement of language-based acculturation scores. In turn such migration-history based scores can also serve the purpose of scaling the immigrant's adaptation ability to the norm of the host population, at least in reference to health behavior.

A shorter, but comprehensive, scale of acculturation for Hispanic studies was also developed[27], which encompassed language, cultural heritage, family value, and interaction with mainstream dimensions, whose applications lead of considerable research for testing the hypothesis that acculturation explains a significant portion of health behavior among Hispanics (discussed in the next section). However, the Hispanic Health and Nutrition Examination Survey (HHANES), 1982–1984, chose to consider a short 8 item questionnaire based on language and ethnic identification of subjects and parents to score acculturation[28]. While useful for Mexican-Americans, the easy to employ HHANES Acculturation scores, however, failed to observe enough variability among other Hispanic groups (e.g., Cubans and Puerto Ricans) to permit meaningful distinctions among individuals within a group.

Justifications of a multidimensional scale of acculturation are as follows: (i) Psychological features of acculturation are difficult to distinguish from the effects of acculturation on (health) behavioral changes; (ii) socio-demographic features are well captured by migration history, and the factor analysis of components of migration history validated the composite migration history score[29]; (iii) high internal reliability of response to language scale items have also been noted (e.g., 96% Cronbach alpha[26]); and (iv) high correlation between migrational history and language score (e.g., r=0.60 with participants' generation, –0.70 with age at migration; and 0.42 with the length of residence in US, in the context of Hispanic research[26]).

Also, in relation to association of acculturation with some health parameters, some authors noted that a single dimensional acculturation score does not always correlate with heath outcomes, while multidimensional ones do in the same sample. For example, it has been observed that acculturation measured by the language dimension alone is a less useful indicator of acculturation associated with perinatal complications in Mexican American women, while an acculturation index based on multiple dimensions does capture the association[30].

Comparisons of individual components of some of the acculturation scales mentioned above also demonstrate this to some extent. For example, the Cuellar scale mentioned earlier is highly correlated in Mexican-American women with Hazuda's two language dimensions[31]. In contrast, with the Hazuda scale dimensions, Mexican cultural values and traditional family attitudes, correlated least with the Cuellar scale. Such studies, though somewhat fragmented, illustrate the need of objectively defined multidimensional acculturation scales particularly for health related studies of effects of acculturation.

In spite of these justifications, two concerns have been noted for a general use of a multidimensional acculturation score, particularly in the context of studies within the US. First, responses to language and attachment to ethnic tradition questions are generally subjective and not verifiable from written sources. A number of authors found evidence of both socially desirable responses as well as predominance of extreme category responses[32,33]. Of course, how acculturation scores based on such biased responses affect the influence of acculturation on health behavior is still a debatable issue[34,35]. Second, the treatment of missing values and validation of a summed score had not been statistically justified in all acculturation studies.

Following the observation of strong positive correlation of language preference (i.e., trend towards that of the host culture) and generation status and length of residence, but negative correlation with age at migration[26], a composite Migration History Score (MHS) was defined[29], in which some of these concerns were addressed. First the components of MHS (namely, years of residence in the host country, immigration status, and birth places of subjects and their parents) are all verifiable from records (whenever responses were available). Second, each component was standardized to a mean of zero and variance of one to account for between component variations of the number of categorical responses. Third, validity of a summed score (of standardized values) was documented through a factor analytic approach. Most importantly, averages of available standardized components (defined as MHS), was tested for non-response bias, showing how missing values of some components could affect the ultimate acculturation score for any study population.

In summary, ideally acculturation scores should be defined with multidimensional components. Internal reliability of components should be evaluated, not simply in terms of their pairwise associations, but also in terms of bias of responses that are socially acceptable and/or of extreme category. Verifiable objective responses may be worth more important consideration when missing items are common and evidence of biased responses is found. Opportunities for any adaptation of language preference should also be examined before administering questionnaires for this dimension. Most of the validation studies of available acculturation have been done in the context of Hispanic studies in US questionnaires[24,27,28], but their utility for immigrants from other countries, or in a larger global context would need more extensive research.. This

last issue in even more relevant since in a multicultural society like that in USA, the immigrant minority populations are sometimes lumped in broad categories (such as Asian Americans and Pacific Islanders, AAPI) who are culturally too diverse to be scaled by the acculturation scores developed for Hispanic studies[36,37].

Relationship of Acculturation with Health Behavior and Disease Risks

Studies in US Hispanics and other populations

Consideration of acculturation in the context of health studies has been initiated after noting that acculturation influences life style and health behavior in many communities. In addition, acculturation has been shown to be associated with risk factors of complex disease phenotypes. Particularly, in a multicultural society like that of US, acculturation is an important phenomenon in the context of health studies in minority populations of US and to understand disparities of use of health care systems by these populations. Studies in Mexican Americans have shown that healthy behavior (such as physical activity, moderate alcohol consumption, tobacco avoidance, weight control and regular sleeping habit) is correlated with improved physical health and has a positive influence on survival in middle-aged as well as elderly man and women[38,39]. Consequently, unhealthy behaviors are major risk factors contributing to an increased risk of cardiovascular diseases in Mexican Americans[40,41]. In addition, there is a literature, largely separate from the above line of research, showing that health behavior changes in response to adaptation to the host culture among immigrants. Table 1 gives a summary of some of such findings, which illustrate that the range of health habits studied as well as that of the disease risk factors examined are quite broad and even with varieties of acculturation scores used, there is a general consensus that acculturative adaptation to host culture is relevant for health habits that are related to physical health and possibly to disease morbidity/mortality.

However, even a cursory look at the general conclusions reached in these exemplary studies shows that the results are not always in perfect agreement with each other. There are varieties of reasons for this, not necessarily apparent from examination of each study individually. First, as explained in the previous sections, the concept of acculturation is multidimensional and hence differences of measurement of acculturation across studies contribute to a great extent towards inter-study differences of conclusions. Second, because of heterogeneity of study populations, the range of acculturation scores across different studies is not comparable. As a consequence, when any acculturation score is categorized as low/high, or low/intermediate/high etc., inter-study comparisons of results are not always meaningful.

Perhaps more important is the designation of the study population name itself. Since majority of the acculturation studies in the USA are in the context of the US Hispanic population, heterogeneity within the US Hispanic population may be a major source of many of the discordant findings. To explain this further, let us first note that several of these authors noted generation and/or age difference of effects of acculturation on several health-related traits. For example, increased trend of alcohol consumption with acculturation was noted in middle-aged (44–64 yrs.) and younger (20–30 yrs.) Mexican-American, Mexican and Central American women[42–44], with one exception of middle-aged Mexican-American women of Texas[25], but no such effect was found among elderly (65 yrs. or older) Latinas. Likewise, some authors observed that acculturation negatively affects healthy habits (combined score) more strongly in middle-aged (64 yrs. or under) Latinas of Los Angeles, compared with the elders (65 yrs. or over) of the same population[26]. Thus, if multiple groups are combined in a study, the distribution difference between them will skew the result of association of acculturation with any health parameter. The Asian immigrant study on effects of acculturation on health-related quality of life (HRQOL) exemplifies it even more directly[36]. They noted that adjusted for demographic, socioecologic, and healthcare access factors, acculturation is associated with HRQOL in breast cancer patients of Asian Americans. However, this is mediated by subgroup membership of women from Asia. Within each component of the sample, subdivided by their coun-

TABLE 1
FINDINGS ON ASSOCIATION OF ACCULTURATION ON HEALTH BEHAVIOR AND DISEASE RISKS

Outcome Variable(s)	Study Population(s)	Acculturation Dimension(s)	General Results	Reference
		Hispanic Studies in US		
Smoking	San Francisco Hispanics	5-item scale [ref. 46]	Acculturation positively correlated with frequency of smoking for both gender	[46]
	Mexican Americans of HHANES 1982–84 Survey	HHANES questionnaire [ref. 28]	Acculturation positively associated with Smoking; effect stronger in women	[47]
	Hispanic women from Prenatal care patients of Massachusetts, USA	Language, and place of birth	Acculturation (US-born, with preference for English) associated with elevated smoking in pregnant Hispanic women	[48]

Alcohol Consumption	US Hispanics (Household probability sample)	Cuellar et al. scale [ref. 28]	Increase acculturation and social interaction associated with drinking	[49]
	HHANES 1982–84 Mexican Americans of Southwestern USA	HHANES questionnaire [ref. 28]	Acculturation effect not found in men; In younger women association was positive; Middle-aged women showed increased alcohol use with marital disruption and employment	[42]
	Mexican-American adult drinkers of San Antonio, TX (community survey)	Language dimension	Quantity and frequency of alcohol Consumption higher among least acculturated males, and among moderate acculturated females	[50]
	Mexican-American, Puerto Ricans, and Cuband American women from HHANES 1982–84 survey	HHANES questionnaire [ref. 28]	Acculturation positively related with chance of drinking as well as volume of alcohol consumption in all groups	[51]
	Mexican Americans of California	5-item scale [ref. 46]	Acculturation and higher professional Status positively associated with alcohol Consumption in MA women	[52]
	Latinos of Long Island (NY) and Connecticut	Language preference	Acculturation positively associated with drinking; stronger effect in women	[53]
Diet and Exercise	Mexican-Americans of San Diego, California	Language dimension	Increased parental acculturation positively associated with dietary fat intake and lack of exercise in Mexican-American children	[54]
Exercise and BMI	Mexican-American Women from San Antonio, TX	Hazuda et al. scale [ref. 27]	Acculturation positively correlated with SES and with greater likelihood of Increasing exercise habits and lower BMI	[55]
Eating Disorder	Mexican-American women	Acculturation Rating Scale for Mexican Americans (ARSMA)	2nd generation women with highest ARSMA score showed most disordered eating pattern	[56]
Multiple health risk behaviors	HHANES (1982–84) Hispanics (20–74 yrs.)	HHANES question-naire [ref. 28]	Acculturation correlated positively with alcohol use (specially in women) and nega-tively with dietary balance for Mexican American men and women	[57]
Composite score of health practices	Latinas aged 46–92 yrs. from Los Angeles, CA	Language and US Residence dimensions	Acculturation negatively affects the health practice in middle-age (64 yrs. or under) Latinas	[26]
Self-reported health Status (SRH)	US Hispanics from North Texas (Dallas-Fort Worth area)	Acculturation Rating Scale for Mexican Americans(ARSMA-II)	Adjusted for covariates, greater degree of acculturation associated with better SRH status	[58]
Health behaviors, Cardiovascular Disease risk factors	Overweight Mexican American women (18–65 yrs.) from Starr County, TX	Composite Migration History Score (MHS) [ref. 8]	Higher MHS associated with poorer Exercise habits and increased blood pressure; Exercise habits mediated negative relationship of MHS and BP; Age weakly moderated negative relationship of MHS and healthy exercise habits	[8]
Cancer screening	Mexican-American women aged 40 yrs. or older from Houston and El Paso, Texas	Cuellar et al. and Hazuda et al. scales [ref. 24, 27]	Stronger traditional Mexican family orientation associated with participation in mammography screening	[31]
Medical screening	Mexican-American women (55–92 yrs.) from Los Angeles, CA	Language preference Dimension	Participation in medical screening Increased with language acculturation	[59]
Obesity and Diabetes	Mexican-Americans Of San Antonio, Texas	3-dimensional scale [ref. 60]	Increased acculturation associated with decline of obesity as well as diabetes in both males and females	[60]
Obesity (BMI)	Cuban-Americans, Puerto Ricans, and Mexican Ameri-cans (HHANES 1982–84)	Language preference and generation of immigration	Greater preference for English associated With reduced BMI in women; Older generation of immigration (2nd and 3rd) positively associated with BMI; effect stronger in MA compared with Cubans and Puerto Ricans	[61]

Diabetes, Diabetic Complications, and Health Care Access	HHANES (1999–2002) Survey aged 18 yrs. or More	Language and birth Place	Low acculturation related with no routine health care; and higher prevalence of diabetes its and neuropathic complications	[62]
Waist circumference (WC), abdominal Obesity, and CVD risk factors	Mexican-American men And women from 3rd NHANES (1988–94) Survey (25–64 yrs. old)	Language dimension, country of birth	WC increases in the order: Mexican-born, US-born English speaking, US-born Spanish speaking in both genders; women of the last group also showed higher rate of CVD risk factors	[63]
Teen-age pregnancy and outcomes	Teenage parents of Mexican descent in Southern California	Language, birth place, years of US residency, and citizenship	Accultured teenagers were younger at first Pregnancy, sought earlier prenatal, but no difference in preterm delivery or LBW	[64]
Low Birth weight (LBW)	Mexican Americans of HHANES 1982–84 Survey	HHANES questionnaire [ref. 28]	Greater acculturation (i.e., reduced Mexican cultural orientation) associated with increased prevalence of LBW	[65]
Perinatal health complications after child delivery	Rural Mexican American women of California	Language, birth place, and combined index of acculturation	Acculturation based on combined index (US born with English preference) related with perinatal health complications, but not language preference alone	[30]
Hypertension (adjusted for BMI, Smoking, drinking, age and SES-variables)	Mexican-Americans From HHANES 1982–84 survey	HHANES questionnaire [ref. 28]	Middle-aged men at the middle-range of acculturation had higher prevalence of hypertension than those of lower and higher range of acculturation (termed as »acculturative stress«)	[66]
Lifetime prevalence of psychiatric disorders	Mexican migrant farm-Workers in California	Language and migration history dimensions	High acculturation and US residency increased likelihood of lifetime psychiatric disorders	[67]
Other Studies in Non-Hispanic Populations				
Hypertension	Asian immigrants in Canada	Length of migration	Reported hypertension more prevalent with longer period of immigration	[68]
Medical decision Making	Arab-speaking adults of Sydney, Australia	LISREL scale Comparable to Hispanic Studies	Inverse association between acculturation and patient's preference in medical decision making	[69]
Self-rated health and Activity limitation	Arab-Immigrants In USA, 2000-2001 NHIS survey	Length of residence in USA and citizenship	Length of residence has no effect on self-rated health and activity limitation but US citizenship does increase poorer health	[70]
Health-related Quality of Life (HRQOL)	Breast Cancer patients (Chinese, Japanese, Korean and Filipinos)	Eight-item scale of Marin et al. (1987)	Acculturation significantly associated with HRQOL via differences of acculturation levels in the different Asian subgroups	[36]

try of origin (Chinese, Japanese, Koreans, and Filipinas), acculturation and HRQOL are not associated. In other words, women from different Asian countries acculturated in this sample to different degrees, and they also have different HRQOL levels, causing correlation in the pooled sample.

Heterogeneity in Study Populations – US Hispanics, as an Example

Having mentioned this, it may be worthwhile to illustrate which elements of heterogeneity of a study population may confound acculturation study results. As Table 1 shows indications of discordant results mostly from studies undertaken in US Hispanics, the elements of heterogeneity in this community may exemplify this clearly. In the year of 2001, the US Census Bureau reported that 1 in 8 people in U.S were of Hispanic origin and within the next 50 years, 25% of total U.S. population will be of this category. Thus, the Hispanic community of USA is a

population of significant consideration for health-related studies, and consequently answers to questions at to who they are, and are they truly a homogeneous group are quite relevant.

Derived from the Latin word *Hispãnia* (for Spain), Webster Dictionary defines Hispanic as: »of or relating to the language, people, or culture of Spain, Portugal, or Latin«. This ethnic category evolved from a decision by the Office of Management and Budget (OMB) in 1978 which stated: »a person of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race« is described as a Hispanic. Operational as well as methodological problems of this definition have been discussed in the context of health research[45]. For census enumeration purposes, in 2000 the US Census Bureau described the major Hispanics/Latino Groups in US as of : 1) Mexican, 2) Puerto Rican, 3) Cuban, or 4) Other Hispanic/Latino origin, in which the last group was further elaborated as: Dominican (from Dominican Republic), Central American (from

Costa Rica, Guatemala, Honduras, Nicaragua, Panama, Salvador, Other Central Americans excluding Mexico), South American (Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Other South Americans), or other Hispanic/Latino (Spaniard, Spanish, Spanish American, Other unclassified) origin. This obviously indicates that Hispanic/Latino terminology in US does not necessarily define country of origin of the person.

Figure 4 shows the composition of US Hispanic populations by their country of origin in different regions of US (categorized as North-East, Mid-West, South, and West). As the constituents of the different regional populations of Hispanics are drastically variable across regions, it is not unexpected that acculturation study results would vary by regions because of cultural background of these populations (as noted in the context of studies done among Asian-American women[36]). Further, Table 2 shows that US Hispanics, grouped by their country of origin, appears to have very different age composition. For example, Mexican-American Hispanics are comparatively younger (with more than 36% of them being of age 18 years or younger), while the Cuban-Americans are comparatively older (over 20% of them are of age 65 years or older). Consequently, as noted in several studies (described earlier), age-dependent acculturation effects

TABLE 2
AGE COMPOSITION OF THE HS HISPANIC POPULATIONS BY THEIR COUNTRY OF ORIGIN

Group	Pop. under 18 yrs		Pop. over 18 yrs	
	Number*	%	Number*	%
Mexican	9.70 m	36.4%	1.07 m	4.0%
Puerto Rican	1.35 m	35.1%	0.26 m	6.7%
Cuban	0.37 m	22.9%	0.33 m	20.6%
Central Amer.	0.90 m	28.3%	0.10 m	3.3%
South Amer.	0.54 m	25.5%	0.12 m	5.7%
Other Hisp	1.00 m	32.5%	0.20 m	6.5%
Total	13.86 m	34.3%	2.08 m	5.1%

*»m« stands for millions

are necessarily discordant, unless adjusted for, in the different components of the US Hispanic populations.

Another reason of discordance in acculturation studies emerge from possible genetic heterogeneity of the study populations. Certainly disease risk and perhaps many health habits as well, are partly governed by genetic factors. Hence, should genetic structure of populations vary, it is expected that acculturation effects may
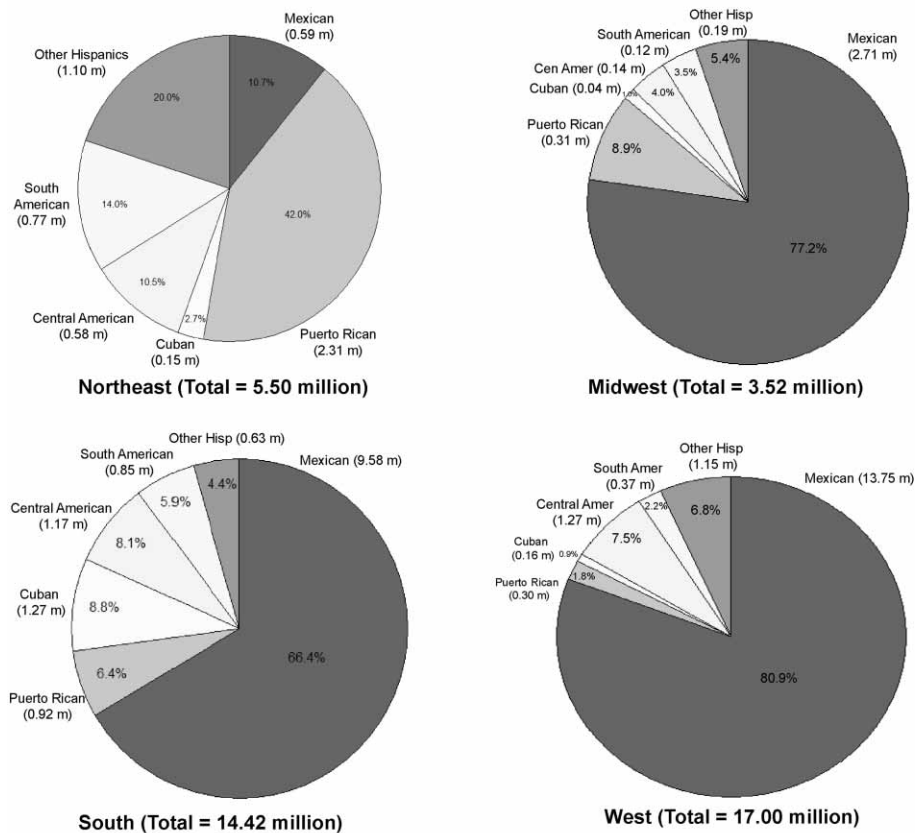

Fig. 4. Composition of the US Hispanic populations by their country of origin in different regions of the United States.

not be identical in different study populations. US Hispanic communities are in general admixed in their genetic structure, having genes of European, African, and Native American descent in their gene pool. Recent admixture studies show that the different US Hispanic communities are quite varied in terms of their ancestral admixture components. Further, historical documents implicate that the admixture process in these communities may have been gender biased (i.e., contributions from male and female lineages may not be exactly identical for each ancestral population components). Recent molecular studies offer opportunities to measure this by estimating admixture components based on autosomal genetic markers (which would estimate general admixture components, averaged over the paternal as well as maternal lineages), and mitochondrial DNA (mtDNA) markers, which exclusively determine admixture from maternal lineage alone. Table 3 provides some brief summary findings from such studies. These clearly indicate that by region and/or country of origin, the admixture components in the different Hispanic communities in continental US are quite varied. Further noticeable is the evidence of gender-bias (by paternal *versus* maternal lineages) in their admixture components. Evidence for this is reflected in differences of the admixture components within populations derived from autosomal *versus* mtDNA markers. Thus, any cultural factor (contributing to acculturative adaptation) that is maternally influenced might be influenced by such gender-biased admixture process in the US Hispanics, which in turn would vary by their country of origin. From these considerations it may be concluded that regional variation of cultural origin, and age/gender influence on acculturation may in part explain the discordances of acculturation-related health effects in various studies done on the US Hispanics.

Multi-dimensional Nature of Acculturation-related Effects on Health

Though a number of possible factors are discussed in the previous sections to reconcile the observed discordances in various health-related acculturation studies, a series of hypotheses may be postulated from the existing studies of health-related effects of acculturation. The first one is in relation to age and acculturation effect on health behavior. The hypothesis would be: With a higher level of acculturation, there is a change in health behavior towards that of the host country (e.g., for Hispanics it is towards the »unhealthy« aspects of health behavior in the US Whites). Since age and socio-economic status (SES) of immigrants affect the scope and opportunities of acculturative adaptations, corollary of this hypothesis is age/SES and related family-stress (e.g., unemployment, disturbed family environment) may moderate the influence and direction of acculturation effects on health behavior. A related, but different, second aspect is the relationship between health behavior and disease risk. This addresses the question of which health behaviors affect the disease risk factors. Obvious hypothesis in this regard is: healthy behaviors would be inversely related to disease risk factors (e.g., in the context of cardiovascular disease risk factors, abnormalities in combinations of body mass index (BMI), waist circumference, waist/hip ratio, blood pressures, plasma glucose, cholesterol and triglyceride levels, etc. would be associated with combined scores of excessive use of tobacco and alcohol consumption, lack of exercise, improper sleeping habits, and dietary habit). Again, age, SES may act as moderating factors in such associations as well. A third dimensional hypothesis examines the question of direct *versus* indirect effect of acculturation on the disease risk factors. A reduction of acculturation effects on the disease risk score after adjusting for heath behavior would reflect the possibility of the hypothesis that acculturation effects on disease risk is mediated by health behaviors. Of further interest would be to examine whether this last relationship is independent of potential interactions of health behavior and acculturation with covariates such as age, SES, family stress, etc.

Important aspect of this paradigm is that all three major variables (acculturation, health behavior, and disease risk) are to be measured with multiple components. This is so because, as discussed earlier, acculturation is a multidimensional process, culminating in possible changes of language preference and social contact with host culture, which necessitates its measurement with a multidimensional score (e.g., based on migration history, language, contact with native culture, etc.). Likewise, a single dimension of health behavior (e.g., smoking, alcohol consumption, exercise and sleeping habits, fatty diet,

TABLE 3

GENETIC ADMIXTURE COMPONENTS IN DIFFERENT HISPANIC POPULATIONS OF CONTINENTAL US, AS DETERMINED BY AUTOSOMAL AND MITOCHONDRIAL DNA (MTDNA) MARKERS

	Autosome	mtDNA
In Cubans:		
European	62%	50%
African	18%	46%
Native American	20%	4%
In Puerto Ricans:		
European	76%	12%
African	17%	27%
Native American	7%	61%
In San Louis Valley Hispanics:		
European	67%	15%
Native American	33%	85%
In San Louis Anglos:		
European	90%	99%
Native American	10%	1%
In Nuevo Leon Mexicans:		
European	55%	1%
African	40%	–
Native American	5%	99%

each taken singly) is not a proper predictor of chronic disease risk factors. At a third level (of disease risk factors) the multivariate feature is even more explicit. As a consequence, a factor analytical approach would be needed to test the above-mentioned hypotheses of health-related effects of acculturation.

Few studies addressed such acculturation effects on health parameters under such a paradigm. At least one study attempted one phase of it, namely, health behavior in relation to acculturation[26]. In a study on 573 Latinas, aged 46 to 92 years, recruited from 17 publicly subsidized housing projects in Los Angeles, California, they used a multidimensional scale of acculturation and a summed index of healthy behavior based on a combined score of healthy status defined from smoking habit, alcohol consumption, frequency of optimal sleeping hours, levels of exercise, and weight control practice). In addition to studying associations at individual variable level, they also sought for overall effects of acculturation on Healthy behavior *per se*. Their conclusions were: i) Acculturation (combined language and migration history-based) is negatively associated with the summed health habit score (based on tobacco and alcohol use, and sleeping and exercise habits), adjusted for age and educational level; and ii) The relationship is stronger in younger women (66 yrs. or younger), suggesting an interaction effect of age and acculturation. In other words, these authors showed that age (and possibly SES) is an important mod-

erator of the acculturation effects on healthy behavior in Latina women of Western United States[26].

This observation was taken even further to suggest a three-way link of acculturation, health behavior, and risk factors for cardiovascular diseases[8]. By examining 390 overweight non-diabetic Mexican American women of Starr County, Texas (aged 18 to 65 years), this study measured acculturation by a composite Migration History Score (MHS) based on a factor analysis of birth places of subjects and their parents, and length of residence in US. MHS in this sample was shown to be almost equally contributed by the 9 migration history variables. Health behavior score was derived from a factor analysis of six variables (tobacco and alcohol use, sleeping, exercise and dietary practices, the last one included total fat as well as saturated fat in their diet). The seven cardiovascular disease risk factor variables, CDRFVs (BMI, waist/hip ratio, triglycerides, total cholesterol, plasma glucose, and systolic and diastolic blood pressures) were condensed into three factors, largely represented by blood pressures, lipids/glucose, and body fat/glucose. MHS (the surrogate of acculturation) was seen to be positively associated with SES, and negatively with family stress. Older women (aged over 45 years) had healthier drinking and sleeping habits. Women with higher MHS exhibited poorer exercise habits, and increased blood pressures. After adjusting for the effect of healthy exercise habits on blood pressures, the impact of MHS on blood pressures became non-significant, suggesting that healthy exercise habits mediated the negative relationship of MHS with blood pressures. Age was independently positively correlated with CDRFVs., and it weakly moderated the negative relationship of MHS and healthy exercise habits. Though appears complicated, in terms of a possible mechanistic model, these results may be diagrammatically represented by the path diagram as shown in Figure 5. To date this is the best known study showing the three-way link of acculturation, health behavior, and disease risk that offers a plausible model of how acculturation can have impact on health status in an immigrant population.
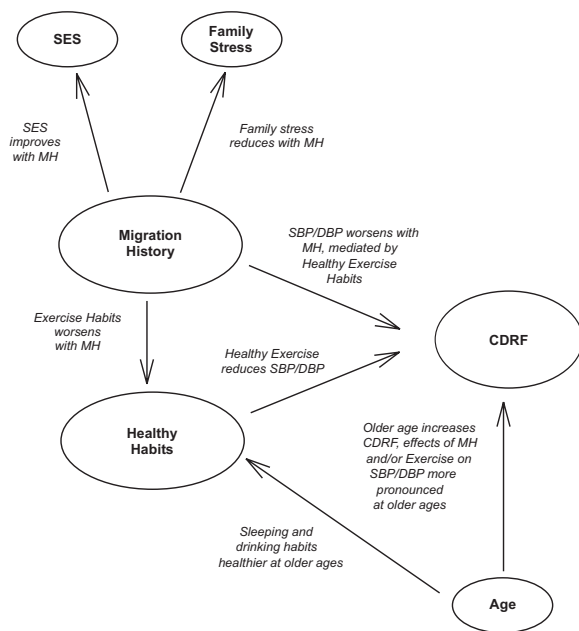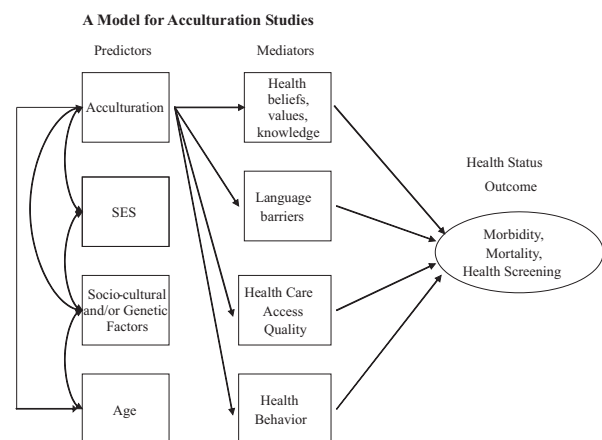

Fig. 5. A causal model representing the inter-relationship of migration history (MH), a surrogate of acculturation, healthy habit (HH), and chronic disease risk factor (CDRF), reproduced from ref. 8. Fig. 6. A Structural Model Paradigm for Future Studies of Health-Related Effects of Acculturation. Fig. 6. A Structural Model Paradigm for Future Studies of Health-Related Effects of Acculturation.

Fig. 6. A Structural Model Paradigm for Future Studies of Health-Related Effects of Acculturation.

Conclusion and Discussion – Modeling of Acculturation Research in Relation to Health

Based on these discussions and from the data reviewed in earlier sections, it is clear that in a multicultural society comprising of immigrants from different culture (as in the case of US), health status of minority groups is influenced by many factors, of which acculturation is a major one. By nature, acculturation is a multi-faceted concept, with determinants from various dimensions. However, its impact on health status and access to health care system is real, but complex. The relationship of acculturation on any health outcome (morbidity, mortality, as well as access to heath care system, such as screening for diseases) is possibly moderated or mediated by other factors. Age, gender, original cultural belief system, and even genetic background are examples of such moderating/mediating factors. Several of these factors may be more directly related to health outcome. Thus, a multi-stage structural model, such as the one shown in Figure 6, may be a plausible model for further research on acculturative adaptation effects on health outcome. Conceptualized this way, acculturation effect may be related to what is otherwise described as health disparities, often seen among minority groups in multicultural societies. Such a model further allows examination of acculturation effects on separate immigrant populations within the same country without generalization of results from one study to another, since variations of the predictor as well as moderating/mediating factors can be accounted for specifically for each immigrant populations.

In addition to such structural construct of acculturation studies, the scale of acculturation should also be culturally sensitive. This issue was raised in the context of discussing the extent to which conceptual and methodological critiques of acculturation studies in Hispanic populations apply to studies of Asian populations in the Western world[37]. In a sense, such structural models provide a unified platform but diverse ways to understand the relationship between cultural/acculturative adaptation and health, and to devise intervention strategies to remove health disparities, as well as to improve the health status of the immigrants, contributing in a positive way to this complicated and growing literature.

Acknowledgements

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KONCEPT, MJERENJE I KORIST AKULTURACIJE U ISTRAŽIVANJIMA RIZIKA ZDRAVLJA I BOLESTI

S A Ž E T A K

Akulturacija, koncept koji potječe iz sociologije i kulturalne antropologije, je proces usko vezan uz brigu o zdravlju i zdravstvenom stanju u manjinskih populacija multikulturalnog društva. Ovaj članak pruža kratki pregled na temu akulturacije i njenih povezanosti sa zdravstvenim istraživanjima, pokazujući da ovaj koncept ima potencijal identificirati rizične faktore koji su uzročnici povećane prevalencije kroničnih bolesti, pogotovo u imigrantskim populacijama. Ispravno razumijevanje ovog koncepta je korisno u određivanju interventnih programa za smanjenje pritiska ovakvih bolesti i za povećanje kvalitete života u takvim populacijama. Koncept se definira općim preglednom njegove povijesti, prikazujući njegov razvoj kroz vrijeme. Kriteriji za mjerenje akulturacije opisani su kako bi predočili potrebu za korištenjem njegovih mulidimenzionalnih karakteristika. Na primjeru zdravstvenih istraživanja među američkim Hispanosima, uloga akulturacije u brigu za zdravlje predočuje da su rezultati nesrazmjerni dijelom zbog parcijalnog korištenja dimenzija samog koncepta, ili zbog zanemarivanja dinamičkog aspekta procesa akulturacije. Konačno, primjer rezultata istraživanja meksičko-američkih žena s prekomjernom težinom u Južnom Teksasu, pokazuje da se model akulturacijskog istraživanja može koristiti u drugim imigrantskim populacijama koje su u procesu akulturacije.