JOURNAL OF RESEARCH ON ADOLESCENCE, 14(1), 49–72

Socialization Ambiguity in Samoan Adolescents: A Model for Human Development and Stress in the Context of Culture Change

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Rapid globalization is forcing youth around the world to confront new developmental challenges, and conceptual models are needed that can capture this experience and its developmental implications. Exposure to nontraditional lifestyles opens up new socialization opportunities and raises the possibility of stress-inducing dissonance between participating socializing agents and the messages they deliver. Socialization ambiguity is introduced as a model for culture change and adolescent stress, and it is applied to a sample of 10- to 20-year-olds ($N = 295$) in the islands of Samoa. A physiological marker of stress (antibodies against the Epstein-Barr virus) is employed to overcome some of the difficulties associated with measuring stress outcomes. Socialization ambiguity is found to be a significant source of stress on the remote island of Savai'i and the transitional area of rural Upolu, although the direction of the association is different, possibly reflecting divergent socialization goals in these two regions.

Around the world, rapid globalization and the blurring of cultural boundaries confront youth with a growing number of developmental challenges (Black & Krishnakumar, 1998; Blanc, 1994; Desjarlais, Eisen-

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berg, Good, & Kleinman, 1995; Harpham & Blue, 1995). The process of social change has been particularly problematic for youth in several islands of the South Pacific, where rates of adolescent suicide have risen dramatically over the past three decades to rank among the highest in the world (Hezel, 1987; Macpherson & Macpherson, 1987; Rubinstein, 1983). Despite recognition of the difficulties confronting youth, conceptual models of culture change and adolescent stress are conspicuously absent.

This report attempts to advance research in stress and human development by applying an integrative approach to adolescent stress in the context of culture change, as mediated and moderated through individual-specific social ecologies. Specifically, the concept of socialization ambiguity is introduced as a means of capturing the tensions and inconsistencies that may lead to stress for the youth of Samoa, and possibly elsewhere. Methods for assessing stress are borrowed from psychoneuroimmunology in an effort to derive an objective biomarker of stress that overcomes some of the difficulties associated with trying to measure stress outcomes in cross-cultural situations. We hypothesized that socialization ambiguity would be a significant source of stress and that the effect of socialization ambiguity would be moderated by the local ecological context within which adolescents live.

Cross-Cultural Research in Human Development and Stress

Margaret Mead set the stage for cross-cultural research on human development and stress when she traveled to the islands of Samoa in 1925 to challenge the contemporary belief that adolescence was ''a period during which difficulties and conflicts were absolutely inevitable'' (Mead, 1928/1973, p. 1). Anthropology has since elaborated these themes through its emphasis on the central importance of socialization (LeVine, 1990; Munroe & Munroe, 1994; Ochs, 1988; Whiting, 1963; Whiting & Edwards, 1988; Whiting & Whiting, 1975), the cultural and ecological determinants of parental behavior (Harkness & Super, 1996; Hewlett, 1992; Hoffman, 1988; LeVine, 1988; Tronick, Morelli, & Winn, 1987), and the complex interface between biological and social developmental processes (Worthman, 1987, 1993). Several investigators have focused on adolescents and the cultural processes that shape their experience, particularly in populations in transition (Burbank, 1995; Condon, 1988, 1995; Davis & Davis, 1988, 1995).

This emphasis on the central role of social, cultural, and ecological context in shaping development foregrounds population rather than individual differences and complements a parallel consideration of

context in the nonanthropological human development literature (Berry, Poortinga, Segall, & Dasen, 1992; Bronfenbrenner & Ceci, 1994; Goodnow, Miller, & Kessel, 1995; Moen, Elder, & Luscher, 1995; Winegar & Valsinger, 1992). Super and Harkness have proposed the developmental niche (aspects of the physical and social environment surrounding the child, locally accepted customs of child care, and the ideas and beliefs of caregivers regarding proper care and the normal pattern of child development) as a framework for bringing anthropology and developmental psychology together through an integration of culture into the study of child development (Harkness & Super, 1994, 1996; Super & Harkness, 1986).

Unlike the early days of Mead, few isolated societies remain, and rapid economic and cultural change has become the norm. The speed of global transformation is remarkable: In 1950, 30% of the world's population lived in urban areas; today, 47% live in urban areas and the number will exceed 60% by 2030 (United Nations, 2001). Populations that were once relatively isolated—geographically, linguistically, and culturally—are becoming increasingly exposed to, or interfacing with, novel lifestyles that may differ considerably from their own. Obviously, these changes bear significant implications for socialization, and cross-cultural research in human development needs to take social change into account.

Modeling these processes in a meaningful way is a formidable challenge: Qualitative, ethnographic approaches provide a rich, nuanced understanding of the demands and opportunities of adolescence but are difficult to link quantitatively to individual measures of stress and well-being. In contrast, quantitative analyses of adolescent environments can be overly simplistic and reductionistic and can overlook crucial cultural processes that shape adolescent experience. Models are needed that can capture culturally relevant aspects of the adolescent milieu at the individual level, and therefore be subject to analysis in relation to quantitative measures of well-being (Dressler, 1995).

Data presented in this paper attempt to address this need, following prior analyses from this data set. Previously, higher levels of stress were found in children and adolescents who live in the more Westernized, urban area of Samoa than those in more traditional[1] rural villages,

[1] The terms *Westernization, modernization,* and *acculturation* are used interchangeably in the literature on stress and culture change, and they often imply progress toward a Western ideal (Hobart, 1993; Spindler, 1984). No such implication is intended here. The terms *culture change* and *Westernization* are used throughout this article because they most accurately describe the ongoing processes at work in Samoa. In addition, the term *traditional* is used to describe historically significant practices and ideals, but it is recognized that current notions of tradition are locally constructed and subject to revision and may not be representative of the past.

consistent with previous research in adults in Samoa and elsewhere (McDade, Stallings, & Worthman, 2000). However, subsequent analyses painted a more complicated picture of the relationships between culture change and stress for the youth of Samoa by identifying marked intragroup heterogeneity in stress levels. Models of status inconsistency—borrowed from previous cross-cultural work on stress in adults—revealed significant associations between aspects of social status and stress in 10- to 20-year-olds (McDade, 2001). However, the question remains as to whether models developed for adults apply equally well to the experiences of youth.

Socialization Ambiguity: Culture Change and Stress in Adolescence

The premise of socialization ambiguity is simple: Inconsistent messages or conflicting expectations regarding appropriate beliefs and social behavior during the course of socialization may be a substantial source of stress for the developing individual. Culture change can be expected to have significant implications for socialization, as parents, extended families, and local peers lose their status as its exclusive agents. Although such agents certainly continue to play key roles, new channels of socialization emerge—schools, media, and interactions with individuals from other cultures—that may compete and shape the developmental experience in significant ways. Furthermore, new developmental goals and life history trajectories may open up through these channels. The impact of these experiences is not only a function of exposure but also of the particular social ecology (or developmental micro-niche) of that individual.

The socialization ambiguity model attempts to quantify the degree of consistency in the developmental environment by asking (and operationalizing) the following questions: What is the household's orientation toward emerging nontraditional ways of life? Are the experiences of youth outside of the household consistent with this orientation? Ambiguity in the socialization process may result when this is not the case, and such ambiguity was hypothesized to be a potentially important source of stress for children and adolescents.

Cross-cultural research with adults has reported significant associations between culture change and various biomarkers of stress (Brown, 1982; Chin-Hong & McGarvey, 1996; James, Baker, Jenner, & Harrison, 1987; McGarvey, 1999; Pearson, James, & Brown, 1993; Wessen, Hooper, Huntsman, Prior, & Salmond, 1992), and recent work has emphasized that status incongruities in an individual's psychosocial experience may be important proximate stressors (Chin-Hong & McGarvey, 1996; Dressler,

1990, 1991, 1999; Dressler & Bindon, 2000; Janes, 1990). The socialization ambiguity model builds on this research by proposing a model of culture change and stress specifically relevant to the experience of youth. It is not a model of the socialization process per se, but an attempt to link culture and individual experience in a meaningful way and to capture the complex person–environment dynamics that may define the everyday lives of adolescents in the context of change.

Assessing Stress

Recent methodological innovations have encouraged the application of physiological markers of stress in population-level research (National Research Council, 2001). An advantage of these markers is their relative objectivity, in the sense that they are beyond the conscious control of study participants and are therefore not vulnerable to recall or observer bias. They are also comparable and interpretable across different populations (despite cultural and linguistic differences) and provide insight into the biological pathways that may lead to impaired health. However, because of their relative distance from conscious control, biomarkers cannot provide the same insights into the mediating cognitive aspects of stress that self-report methods can. Nevertheless, biomarkers may provide social and behavioral scientists with additional tools for assessing the experience of stress and the quality of psychosocial environments.

This study borrows from the growing field of psychoneuroimmunology to employ an immunological marker of chronic stress: antibodies against the Epstein-Barr virus (EBV). The EBV is a ubiquitous herpesvirus to which nearly 90% of adults in industrialized nations, and nearly 100% of adults in developing nations, have been exposed (Henle & Henle, 1982). Once infected, individuals permanently harbor EBV, and adequate cell-mediated immune function is critical for maintaining the virus in a latent state. Stress-induced immunosuppression allows EBV to reactivate and release viral antigens into circulation, to which a humoral antibody response may emerge (Glaser et al., 1991). As a result, levels of antibodies against EBV antigens provide an indirect measure of an aspect of cell-mediated immune function, such that increased EBV antibody levels indicate lower immunity.

Although this model may at first seem counterintuitive—an increase in EBV antibody level, itself an aspect of immune function, is interpreted as indicating a decrease in cell-mediated immune performance—it is important to recognize that the immune system is composed of multiple

integrated subsystems that play complementary roles in protecting the body against disease. Cell-mediated immune processes against viruses such as EBV represent the body's first, and most important, line of defense. Humoral-mediated immunity (including the production of antibodies) represents a second line of defense that is called on when cell-mediated processes fail to control the virus. Therefore, increases in EBV-specific antibody levels can indicate relative decreases in aspects of cell-mediated immune performance.

Meta-analysis has identified EBV antibodies as among the strongest and most consistent correlates of chronic stress (Herbert & Cohen, 1993), and EBV antibody levels have been associated with stressors such as final exams (Glaser et al., 1999; Glaser et al., 1993; Glaser et al., 1987), involvement in a poor quality marriage (Kiecolt-Glaser, Fisher, et al., 1987; Kiecolt-Glaser, et al., 1988), and caring for a family member with Alzheimer's disease (Kiecolt-Glaser, Glaser, et al., 1987), as well as loneliness, defensiveness, and anxiety (Esterling, Antoni, Kumar, & Schneiderman, 1993; Glaser, Kiecolt-Glaser, Speicher, & Holliday, 1985). Conversely, stress management interventions and disclosure of previously repressed trauma have been associated with improvements in EBV antibody levels (Esterling et al., 1992; Lutgendorf, Antoni, Kumar, & Schneiderman, 1994).

These studies have validated the EBV model as an immunological measure of chronic stress, and McDade, Stallings, Angold, et al. (2000) have developed a method for measuring EBV antibodies in drops of whole blood from simple finger sticks. This convenient, minimally invasive method of sample collection provides an opportunity to take psychoneuroimmunology out of the clinic or laboratory and to conduct population-based research on the relationships between stress and immune function in a range of contexts.

Ethnographic Context: Samoa

The Independent State of Samoa—known until 1997 as Western Samoa—is a sovereign nation in the South Pacific that shares cultural and historical roots with other islands of Polynesia. More than 160,000 people live on the two main islands of Samoa—Savai'i and Upolu—in more than 300 rural villages and 1 urban area (Department of Statistics, 1991). Approximately 45,000 people reside on the island of Savai'i, where the mountainous terrain has limited economic development and population growth. Electricity has only recently become available, and most villagers engage in subsistence cultivation of family-owned lands, with limited

cash cropping. Although Savai'i is not totally isolated from the more developed areas of Upolu, families on Savai'i embody what Samoans recognize as the most traditional forms of Samoan culture currently in practice.

Across the channel and accessible by a 1-hr ferry ride lies the island of Upolu. It is geographically smaller than Savai'i but is home to nearly three fourths of the population in two distinct geographic regions: urban Apia and rural Upolu. Apia serves as the capital and urban core of Samoa, where economic development has created extensive commercial activity and opportunities for wage labor (O'Meara, 1990; Shore, 1982). Approximately 34,000 people live in a collection of relatively dense village settlements in Apia, and an additional 40,000 people reside along the 25-mile main road between town and the airport, where rapid development is transforming villages into incipient suburbs.

The remainder of Samoa's residents live in rural villages outside of Apia that ring the coastline and dot the interior of Upolu. When compared with the villages of Savai'i and urban (and urbanizing) Apia, the villages of rural Upolu represent an economic and cultural transition zone: The relative proximity of Apia, high-quality roads, and regular bus service provide alternatives to family plantations for a significant number of villagers who commute to Apia for work, education, or commerce.

Despite a long history of colonial (and postcolonial) influences, Samoans have managed to maintain a strong cultural identity. Samoa has been recognized as among the most conservative Polynesian societies (Holmes, 1980; O'Meara, 1990), and people continue to take pride in the *fa'aSamoa* (Samoan way of life). The *'aiga* (extended family) plays a fundamental role in everyday life and in the socialization of children, where age-grade hierarchies set the stage for learning the importance of service, respect, and submission (Ochs, 1988; Shore, 1982). Traditionally, these and other aspects of socialization break down a sense of subjective self and reinforce the child's identification with, and dependence on, the extended family and community (Mageo, 1988, 1989). These practices also reinforce the authority vested in the village *matai* (chiefs), who occupy positions of local social and political authority (Shore, 1982).

Although these practices continue today to varying degrees, the level of exposure to, and engagement with, nontraditional political, economic, and social institutions is increasing. Western-style media (English-language newspapers, radio, and television programming) are proliferating, and luxury consumer goods are increasingly available and desired. More children are attending schools modeled after Western education systems, and teachers are becoming major agents of socialization (Baker, 1986). Urban families are becoming smaller and less fluid, potentially

increasing conflict between parents and their children (Mageo, 1988). Sons and daughters are frequently sent to American Samoa, New Zealand, and Hawaii for education or to earn money for remittance to the family (Macpherson, 1994; O'Meara, 1990). New sources of power are emerging—education and wage labor, in particular—that circumvent the traditional service-based authoritarian social system (Shore, 1996).

This process of change and cultural diversification has been problematic, particularly for the youth of Samoa. Inquest records demonstrate a steady increase in the number of suicides from 1970 through the early 1980s, with young males at particular risk (Bowles, 1985). Between 1981 and 1983, 15- to 24-year-old males and females were committing suicide at rates of 71.0 and 35.8 per 100,000, respectively. More recent figures (1988–1996) indicate a drop in the annual suicide rate for males (39.0 per 100,000) but continued high levels for females (40.7 per 100,000).[2] A parallel suicide epidemic in the nearby islands of Micronesia led many to suggest that the encroachment of Western institutions and values, the decline of local communities, the rise of the nuclear family, and the lack of economic opportunity were contributing to adolescent distress in the South Pacific (Hezel, 1987, 1989; Macpherson & Macpherson, 1987; Rubinstein, 1983, 1992).

METHOD

Participants

Stratified random sampling was used to select 14 villages from a sampling universe of 331 across the three main geographic regions of Samoa: rural Savai'i, transitional Upolu, and urban Apia. All consenting individuals between the ages of 10 and 20 years (inclusive) present in each village on the day of data collection were included in the survey. Precise census data for each village are not available, but it is estimated that more than 80% of eligible residents participated. Overall, 316 individuals between the ages of 10 and 20 years were surveyed, with comparable age and sex distributions in each of the three regions (Table 1). The study was conducted under conditions of informed consent, as approved by the Emory University Human Investigations Committee and the Western Samoa Health Research Council.

[2] Suicide data for 1988 to 1996 were obtained from the local Suicide Awareness Organization, which tracks suicide deaths and suicide attempts based on inquest records provided by the National Hospital in Apia.

TABLE 1
Distribution of Participants Across the Three Geographic Regions of Samoa, and Mean ($\pm$ *SD*) Values for Selected Variables

	Apia	*Upolu*	*Savai'i*
N	88	112	95
Age	13.7 ($\pm$ 2.8)	14.3 ($\pm$ 2.8)	12.8 ($\pm$ 2.6)[a]
Sex (% female)	58.0	55.4	53.7
Body mass index (kg/m^2)	20.6 ($\pm$ 3.8)	21.3 ($\pm$ 3.9)	19.8 ($\pm$ 3.4)[a]
HH socialization environment	9.8 ($\pm$ 2.3)	7.5 ($\pm$ 2.0)	7.4 ($\pm$ 2.2)[b,c]
Extra-HH socialization experience	2.9 ($\pm$ 1.4)	2.5 ($\pm$ 1.1)	2.3 ($\pm$ 1.0)[c]

Note. HH = degree of Western influence in household socialization environment; Extra-HH = degree of Western influence in socialization experience outside of the household.
[a] $p < .05$, for post hoc Scheffe pairwise comparison between Upolu and Savai'i.
[b] $p < .05$, for post hoc Scheffe pairwise comparison between Apia and Upolu.
[c] $p < .05$, for post hoc Scheffe pairwise comparison between Apia and Savai'i.

Procedure

Whole blood samples were collected from finger pricks using a sterile disposable lancet. Two to five drops of blood were placed directly on standardized filter paper (#903 Schleicher and Schull, Keene, NH), samples were allowed to dry and then were stored, refrigerated, for up to 2 weeks before shipment to the laboratory in the United States, where they were frozen at -23°C until analysis. Immediately after blood collection, standard anthropometric measurements were taken (height, weight, skinfold thickness; Lohman, Roche, & Martorell, 1988), followed by an interview with a native Samoan speaker to collect demographic and psychosocial information through structured questionnaires. Questionnaires were translated, back-translated, and pilot tested before implementation. Responses were recorded on preprinted forms and subsequently entered into SAS for statistical analyses. Data were collected over a 4-month period in 1997 and during 2 months in 1998.

Following this stage of data collection, a series of in-depth, semi-structured interviews with open-ended questions were conducted with 16 adolescents (13 to 18 years of age) and 13 adults (35 to 54 years of age). Participants were asked about their experiences with, and attitudes toward, various aspects of Samoan culture in the context of Westernization. Interviews were conducted by a native Samoan speaker, audio recorded, and transcribed into English. These interviews provided qualitative perspectives within which the quantitative data could be contextualized and interpreted.

Scale Construction

The socialization ambiguity variable was constructed from two scales representing the degree of Western influence in different aspects of an adolescent's socialization experience. A household socialization environment score was constructed by summing responses to the following items for each individual: father's occupation; mother's occupation; type of house (traditional vs. European); means of cooking (fire or charcoal vs. kerosene, gas, or electricity); presence of electricity; and ownership of a refrigerator, stereo, television, or car. Wage labor and Western convenience goods are not part of a traditional Samoan lifestyle, and items such as these have been used in previous studies in Samoa and elsewhere as markers of engagement in nontraditional lifestyles (Bindon, Crews, & Dressler, 1991; Bindon, Knight, Dressler, & Crews, 1997; Chin-Hong & McGarvey, 1996). It is not assumed that these items have direct effects on adolescent experience; rather, they serve as proxies for the household's orientation toward a nontraditional lifestyle that take the place of direct observation or interviews with parents. Lower scores indicate a relatively traditional household socialization environment whereas higher scores indicate a relatively pro-Western orientation.

A separate scale was constructed to summarize those socialization experiences not explicitly shared by other members of the household: number of years the adolescent attended school; travel to American Samoa, New Zealand, Hawaii, or the United States; and friendships with Westerners. Ethnographic observations suggest that these are meaningful experiences for adolescents that may alter their attitudes toward life in Samoa. Higher scores on this extrahousehold domain indicate more exposure to nontraditional ways of living through socialization opportunities outside the direct domain of control of parents. Obviously, the experiences represented by these two scales cannot be considered to be completely independent, as parents (and other members of the extended family) often decide which children go to school or travel overseas. Nonetheless, these experiences provide youth with unique socialization opportunities. It should be emphasized that these scales do not attempt to represent the socialization environment in its entirety, but only with respect to its orientation toward nontraditional, Western ways of life.

The internal consistencies of the household and extrahousehold scales were 0.73 and 0.67, respectively (Cronbach's alpha, standardized). As expected, scores for both scales were highest for adolescents in Apia because of the pervasiveness of nontraditional institutions and experiences that characterize this relatively urban context (Table 1). Similarly,

scores were lowest in rural Savai'i, further supporting the validity of these scales as markers of experience with nontraditional lifestyles.

The difference between household and extrahousehold scale scores represents socialization ambiguity, and is modeled as a discrepancy effect. Following previous specifications of status inconsistency models (Dressler, 1995), both variables were transformed to a mean of 50 and standard deviation of 10 before subtracting the household score from the extrahousehold score. The relationship between socialization ambiguity and stress was evaluated with the following model:

$$\begin{aligned}\text{EBV} = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 \\ + b_6(x_6 - x_7) + b_7(x_6 + x_7) + e,\end{aligned}$$

where x_1 is sex, x_2 and x_3 are indicator variables for age group (groups: 10–12, 13–15, 16–20, where 10- to 12-year-olds equal 1, and all others equal 0), x_4 and x_5 are indicator variables for region (where Savai'i equals 1, and 0 otherwise), x_6 is extrahousehold socialization experience, and x_7 is household socialization experience. The quantity $(x_6 - x_7)$ represents socialization ambiguity such that a positive value denotes the situation where an adolescent's relative level of experience with nontraditional, Western lifestyles outside of the house exceeds the level of experience within the household. Conversely, a negative value describes the situation in which the household's Western orientation exceeds that of the adolescent's extrahousehold experiences.

The quantity (x_6+x_7) provides an aggregate Westernization experience measure that controls for the direct effects of the socialization variables. Without this term, it would not be possible to determine whether a significant effect of socialization ambiguity was due to a discrepancy between the household socialization environment and the extrahousehold environment, or due to the independent effects of these variables (Dressler, 1995; Hope, 1975; Whitt, 1983).

EBV Antibody Titer

A previously developed Enzyme-linked immunosorbent assay (ELISA) method was used to assay EBV antibodies in dried blood spots (McDade, Stallings, Angold, et al., 2000). Low and high control samples were included with each assay to assess precision and reliability. The percent coefficient of variation (CV; standard deviation/mean) for within-assay precision (10 determinations of each control) was 4.1% and 2.7% for the low and high controls, respectively. The between-assay reliability ($N = 32$ assays) was 11.2% and 7.3%, respectively. The correlation between plasma

and blood spot concentrations of EBV antibodies in matched samples has been previously shown to be linear and high (Pearson $R = 0.97$; McDade, Stallings, Angold, et al., 2000).

Because the model linking psychosocial stress to suppressed cell-mediated immune function and increased EBV antibody level does not apply to individuals who have not been exposed to EBV, analyses must be limited to seropositive individuals. Previous work in this population indicates that 98.8% of Samoans under the age of 20 show evidence of exposure to EBV (McDade, Stallings, & Worthman, 2000). Six of 316 individuals who were surveyed for this study were seronegative for EBV and were therefore excluded from further analysis.

Potential Confounders

Immune function is sensitive to nutritional and infectious disease stress, raising the possibility that associations between psychosocial stress and immune measures may be confounded by nutritional or infection status, or both (Kiecolt-Glaser & Glaser, 1988). Previous analysis of this data set has shown that Samoans under the age of 20 years are well nourished, and no significant relationships were found between EBV antibody level and multiple markers of nutritional status (McDade, Stallings, & Worthman, 2000). To verify this finding in the sample of adolescents used in this study, body mass index (weight in kg/height in m^2) was included in regression models as an overall measure of nutritional status (Lazarus, Baur, Webb, & Blyth, 1996; Pietrobelli et al., 1998).

The presence of current or recent infection was found in previous analyses to be significantly associated with elevated EBV antibody levels, emphasizing the need to control for this potential confounder. C-reactive protein—an acute phase protein that provides the body's first, nonspecific line of defense against infection—was assayed in blood samples using a previously developed ELISA procedure to provide a measure of current or recent infection (McDade, Stallings, & Worthman, 2000). C-reactive protein has been shown to increase in response to a wide range of viral, bacterial, and parasitic agents, making it a useful marker of infectious disease stress (Baumann & Gauldie, 1994; Fleck, 1989). Participants with elevated C-reactive protein, indicating current or recent infection, were removed from the sample before analysis to minimize the possibility of confounding. This is a conservative step that biases results toward the null because these individuals may be the same individuals who are suffering from the infectious consequences of stress-induced immunosuppression. Fifteen individuals showed evidence of recent infection and were removed from the analysis.

Statistical Analysis

Before analysis, EBV antibody levels were log-transformed to normalize the distribution. Age was considered as a categorical variable because previous analyses indicated a nonlinear association with EBV antibody level, and was broken into the following categories: 10 to 12, 13 to 15, and 16 to 20 years, inclusive. Initially, ordinary least squares regression models were used to evaluate the relation between EBV antibody level and socialization ambiguity, along with covariates of age, sex, region, and nutritional status. Interactions between socialization ambiguity and age group, sex, and region were also evaluated. Comparable multilevel models were then considered to account for potential bias due to the nonindependence of observations: Because villages, not adolescents, were randomly selected for this study, it is possible that significant intravillage correlation in EBV antibody level could lower standard error estimates and increase the risk of Type 1 error (Kreft & deLeeuw, 1998).

A mixed model was created that specified village as a clustering variable and set fixed effects for age, sex, region, body mass, socialization ambiguity, and overall Westernization experience. A random intercept effect was specified, thereby allowing the mean logEBV antibody level to vary across village (Singer, 1998). The random intercept effect was not significant ($z = 0.00$, $p = 1.0$). Intravillage correlation therefore does not appear to be a problem, and parameter estimates and tests of significance are not likely to be biased by the village-level selection procedures. Because the mixed models and least squares regression approaches yielded virtually identical estimates for parameters and standard errors, least squares regression results are presented as they conserve degrees of freedom and are more familiar to most readers.

RESULTS

Socialization Ambiguity and EBV Antibody Level

Table 1 presents descriptive statistics and the distribution of participants across the three geographic regions of Samoa. A total of 295 individuals provided data for these analyses. Scheffe post hoc pairwise comparisons across region reveal that participants from the rural area of Savai'i were slightly, but significantly, younger than participants from transitional Upolu and had smaller body mass. Table 2 describes the distribution of EBV antibody level across age group, sex, and region.

The potentially confounding role of current nutritional status was explored in a series of bivariate associations with EBV antibody level and

TABLE 2
Mean (*SD*) Epstein-Barr Virus Antibody Level by Age, Sex, and Region (ELISA Units)

Age Group		*Sex*		*Region*	
10–12 years ($n = 119$)	94.4 (71.5)	Female ($n = 164$)	111.6 (74.9)	Apia ($n = 88$)	120.0 (78.1)
13–15 years ($n = 98$)	116.4 (71.5)	Male ($n = 131$)	94.9 (69.1)	Upolu ($n = 112$)	105.0 (69.6)
16–20 years ($n = 78$)	103.8 (74.7)			Savai'i ($n = 95$)	88.6 (68.5)

socialization ambiguity. Body mass index was not found to correlate significantly with logEBV antibody level ($r = -.007$, $p = .91$), consistent with previous analyses from this population indicating no significant effect of nutritional status on immune function because of low rates of undernutrition (McDade, Stallings, & Worthman, 2000). However, body mass correlated positively with scores on the socialization ambiguity scale ($r = .21$, $p = .0003$) and the overall Westernization experience scale ($r = .49$, $p = .0001$). To minimize the possibility of confounding, body mass was included in all regression models.

To evaluate the potential relationship between socialization ambiguity and adolescent stress, a regression model was constructed with the following predictors: age, sex, region, body mass, socialization ambiguity, and overall Westernization experience. The model was highly significant, and socialization ambiguity was found to have a significant association with EBV antibody level in interaction with region (Table 3). These results are consistent with the hypothesis that inconsistency in an adolescent's socialization experience may be a significant source of stress.

Figure 1 presents the interaction between socialization ambiguity and region of residence. On the relatively traditional island of Savai'i, the highest EBV antibody levels were found among adolescents whose extrahousehold socialization experiences exceeded their household's orientation toward nontraditional, Western ways of life. Elevations in EBV antibodies indicate reduced cell-mediated immune function and suggest that these individuals bear a higher burden of psychosocial stress than adolescents whose household and extrahousehold experiences are more consistent. Comparably low antibody levels were also found for adolescents from households that exceeded the extrahousehold experience in Western orientation.

An opposite pattern of associations was found in the transitional area of Upolu. Elevated EBV antibody levels were present in adolescents whose

TABLE 3
Summary of Least Squares Regression Analysis for Variables Predicting Log Transformed Epstein-Barr Virus Antibody Level

Variable	*β*	*SE*
Intercept	2.136***	0.163
Age Group 1 (13–15 years = 1)	0.128***	0.048
Age Group 2 (16–20 years = 1)	0.116*	0.067
Sex (male = 1)	− 0.080**	0.038
Region 1 (Apia = 1)	0.164***	0.052
Region 2 (Upolu = 1)	0.084*	0.045
Body mass index	− 0.003	0.007
Overall Westernization experience	− 0.003*	0.001
Socialization ambiguity	0.003	0.003
Socialization Ambiguity × Region 1	− 0.002	0.004
Socialization Ambiguity × Region 2	− 0.010***	0.004

Note. $F_{10,284} = 3.09$, $R^2 = .10$, $p = .001$.
*$p < .10$; **$p < .05$; ***$p < .01$.

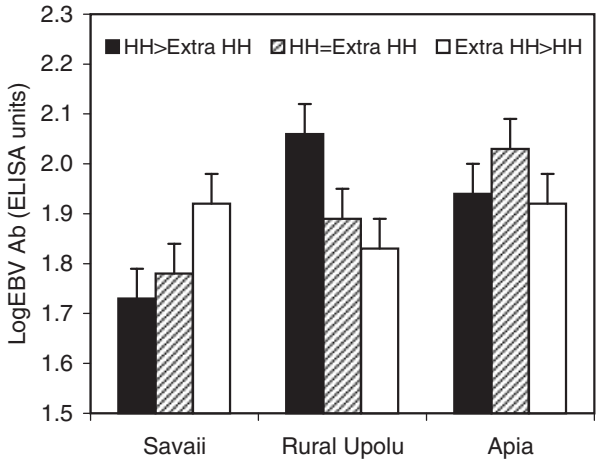

FIGURE 1 Socialization ambiguity and Epstein-Barr virus antibody level, by region. Higher antibody levels indicate suppressed cell-mediated immunocompetence and higher burdens of psychosocial stress (HH = degree of Western influence in household socialization environment; Extra HH = degree of Western influence in socialization experience outside of the household).

household orientation toward nontraditional, Western lifestyles exceeded their individual extrahousehold experiences. Lower antibody levels—indicating lower levels of stress—were found for adolescents with

consistent socialization experiences, and the lowest levels were present in adolescents whose extrahousehold experiences exceeded the household in degree of Westernization. No significant pattern of associations was found in the urban area of Apia.

Significant differences in EBV antibody level were also found across region independent of socialization ambiguity, and across age group and sex. Overall, adolescents from Savai'i had lower adjusted EBV antibody levels than adolescents from rural Upolu and Apia. These regional differences have been discussed previously in terms of psychosocial stress associated with differential levels of exposure to nontraditional, Western ways of life (McDade, Stallings, & Worthman, 2000). The significant effect of socialization ambiguity is beyond that found for region.

Girls were found to have slightly elevated antibody levels compared with boys. This difference is not due to inequities in nutritional status, as girls have higher mean body mass index (21.3 kg/m^2 vs. 19.9 kg/m^2). EBV antibody levels also differed across age groups, with 10- to 12-year-olds having lower adjusted mean levels than 13- to 15-year-olds and 16- to 20-year-olds. The reasons for this pattern are not clear but may be related to progression through puberty. The effects of socialization ambiguity were not significantly modified by age or sex.

Semistructured Interviews

Comments from parents and adolescents provided some insight into the proximate processes that may shape adolescent socialization experience in the context of cultural transitions in Samoa. For example, in response to questions regarding attitudes toward Western lifestyles, this observation from a father in Savai'i was typical in this relatively traditional environment: ''Foreign influences such as T.V. (result in) children answering back to their parents or going against their wishes while in the past that was never the case.'' If this is indeed the prevailing sentiment among parents in Savai'i, increased psychosocial stress might be expected in adolescents with a more pro-Western orientation.

In Upolu, a rural area with easy access to the urban core of Apia and a higher level of familiarity with Western goods and media, parents were more likely to express positive attitudes toward emerging, nontraditional lifestyles. According to one mother, ''I want my kids to know what the Westerners are doing and be able to exchange with them. Nowadays there are a lot of Westerners visiting compared to say 20 years ago when I was a young adult.'' Another parent explained the virtues of the Western

lifestyle as follows: ''People work for their own benefit'' and ''You can save money and you reap what you sow.''

Conversely, many adolescents in Upolu expressed a more conservative outlook. For one 18-year-old male, ''It has corrupted the youth. They watch movies and think that to smoke and drink are very cool and to dress like [Westerners] is nice but it is not.'' Another adolescent believed that a Western lifestyle ''is bad because people do not look after each other'' and it ''is bad because people have to fetch for themselves.'' Comments such as these indicate that it cannot be assumed that parents will always be more conservative with regard to culture change than their children. And in rural Upolu, where several families appeared to value the perceived advantages and opportunities provided by a more Western lifestyle, stress may result when an adolescent adheres to a more traditional way of life.

In the capital city of Apia, both parents and adolescents were more likely to emphasize positive aspects of emerging Western lifestyles and endorse developmental outcomes perceived to support achievement of such lifestyles. For example, most adolescents shared the sentiment of an 18-year-old female on the role of education in shaping their futures: ''I think [school] is very important because the better the education, the better the life will be for me.'' Similarly, according to a mother in Apia, ''The impact of not attending school will be unemployment, poverty, get[ting] left behind, starvation, crimes, and suicides.'' For a father from Apia, ''The thing that I really want for my kids is learning how to become independent, and think for themselves.'' Comments such as these suggest a higher level of consistency in socialization experiences in this relatively urban environment, perhaps accounting for the absence of association between socialization ambiguity and EBV antibody level.

DISCUSSION

The ongoing process of cultural diversification in Samoa opens up new socialization opportunities for children and adolescents, and raises the possibility of meaningful dissonance between socializing agents. Furthermore, children are not passive vessels but are active participants in the socialization process who gain access to a broader range of nontraditional experiences from which to select. Socialization ambiguity is a potential consequence, with significant implications for the experience of stress.

When the relative level of Western influence evident in one's extrahousehold experiences diverges from the level present in the household socialization environment, significant effects on EBV antibody levels emerge. However, these effects are region specific: There is a strong

negative association between socialization ambiguity and EBV antibodies in rural Upolu, a positive relationship in Savai'i, and none in urban Apia. In Upolu, individuals whose experiences exceeded their family's with respect to exposure to nontraditional ways of living had the lowest antibody levels, indicating lower levels of psychosocial stress. The individuals in Upolu who were most distressed were those whose experiences fell behind their family's with respect to Westernization. The opposite pattern was found in Savai'i. Comments from semistructured interviews suggest that divergent socialization goals may account for these regional differences.

Several limitations caution against overinterpretation of the reported findings. First, because the model relies on proxy markers of the socialization experience, it cannot reveal the proximate factors that increase adolescent stress. Comments from semistructured interviews provide some insight, but future research should consider attitudinal data from adolescents and parents—as well as measures of parent–adolescent conflict—as potential predictors of stress. In addition, the overall effect of socialization ambiguity on EBV antibody level is relatively weak, although the proportion of explained variance is comparable to previous research associating psychosocial stress with immunological outcomes (Herbert & Cohen, 1993). It is also possible that re-exposure to the EBV from an exogenous source resulted in elevated antibody levels in some individuals.

Several studies of immigrants and ethnic groups in multicultural societies have linked aspects of the acculturation experience to negative behavioral, psychological, and somatic symptoms (Berry, Kim, Minde, & Mok, 1987; Gil, Vega, & Dimas, 1994; Hovey & King, 1996; Krishnan & Berry, 1992; Liebkind, 1996; Montgomery, 1992; Sam & Berry, 1995). However, few studies have explicitly considered the impact of intergenerational processes on the experience of adolescent stress. Recent work by Phinney, Ong, and Madden (2000) is an exception, in which a study of three immigrant groups in the United States reported that parents consistently express a higher level of commitment to family obligations than their adolescents, and that value discrepancy between parents and children is associated with lower adolescent reports of life satisfaction. Similarly, an acculturation gap between youth of Chinese descent in Canada and their parents is associated with higher levels of delinquency (Wong, 1997). For Vietnamese adolescent girls in Australia, incongruity between adolescent and parental values regarding family and independence is associated with higher levels of intergenerational conflict (Rosenthal, Ranieri, & Klimidis, 1996).

These studies are consistent with the premise of the socialization ambiguity model—that incongruity in socialization environments may be

a source of adolescent stress—and suggest that these processes may be relatively general developmental phenomena that are particularly important for adolescent stress in the context of culture change. However, results from Samoa caution against an overly simplistic interpretation of these processes because local social ecologies may moderate their effect, even within a shared cultural context. At the same time, adolescent stress associated with learning to negotiate competing social values and life-course options may be ultimately beneficial if it supports the development of resilience and coping strategies that foster long-term success in complex socioeconomic environments.

Socialization ambiguity shows promise as a model for further cross-cultural research in human development and stress. Globalization is not a monolithic process, and change itself is not assumed to be problematic. Rather, it is the potential conflict between household and extrahousehold experiences that is most salient. Incongruity models such as socialization ambiguity provide a more dynamic, and more realistic, representation of the person–environment processes that are likely to define individual experience. Socialization ambiguity also builds on previous anthropological contributions with its emphasis on the sociocultural context surrounding development. Additional measures of this context—parenting style, attitudes of parents and their children toward traditional and nontraditional ways of life, socialization goals, and the degree of parent–child conflict—should be considered as potential moderators and mediators of stress in the context of culture change.

With regard to assessing stress, EBV antibody level may provide an objective biomarker of chronic stress to complement other physiological and self-report measures used in previous research. Collection of blood samples from finger pricks minimizes the inconvenience and burden imposed on participants and eases the requirements for sample collection, storage, and transportation before analysis. These advantages allow for the collection of samples away from the research laboratory or clinic, and they encourage research into stress and immune function with larger, more representative samples across a broader range of populations than previously feasible. EBV antibodies—as well as other biomarkers of stress—can serve as ethnographic tools that provide considerable insight into hidden cultural dynamics that might not be revealed by observational or self-report methods.

The preponderance of published work on human development assumes a cultural homogeneity surrounding normative developmental processes. Several investigators have attempted to consider the developmental effects of different cultural ecologies, but the range of current research remains fairly narrow, and the need for models to support

comparative analysis of adolescence remains high. Anthropology is well positioned to address this need, with its focus on processes related to cultural diversity and culture change, and its emphasis on childhood and adolescence as crucial periods of socialization into adult roles and responsibilities. Much work remains to be done to raise awareness of the issues confronting children and adolescents in the context of globalization and to develop specific models that capture the needs, desires, and pressures that are unique to this time of life. Socialization ambiguity is a step in this direction, and it is hoped that future refinements of this and other models will help identify sources of stress and developmental challenge for youth in the context of change.

ACKNOWLEDGMENTS

Financial support from the National Science Foundation, Wenner-Gren Foundation, and Society for the Study of Psychological Issues is gratefully acknowledged. Earlier versions of this paper were presented in sessions at the biennial meeting of the Society for Research in Child Development and annual meeting of the Society for Medical Anthropology. These sessions, as well as comments from anonymous reviewers, significantly improved the manuscript. Last, we are indebted to the study participants and to colleagues at the Samoa Department of Health for making this research possible.

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