

Cultural Change and Stress in Western Samoa: An application of lifestyle incongruity model by Thomas W McDade (Northwestern University)

<Points>

- Impact of cultural change on stress or immune function
 - Field-friendly blood spot methods for assessing cell-mediated immune function (EBV antibodies) and non-specific current infection (C-reactive protein)
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<Paper 1>

McDade TW et al. (2000) **Culture Change and Stress in Western Samoan Youth: Methodological Issues in the Cross-Cultural Study of Stress and Immune Function.** *American Journal of Human Biology*, 12: 792-802.

1. Introduction

Background: (1) Westernization or urbanization resulted in adverse health outcomes in the populations under transition (most studies for adults, e.g., HT). (2) Psychosocial experience may suppress the human immune function.

Hypothesis: Westernization or urbanization suppressed immune function in Western Samoa.

Another objective: Apply “field-friendly” methods for assessing immune function and current infection.

2. Research Context: Western Samoa

Three distinct geographic regions:

- (1) Savaii: subsistence cultivation, most traditional forms of Samoan culture
- (2) Rural Upolu: easy access to Apia, economic and cultural transition zone
- (3) Apia: urban area, movie theater, disco, restaurants

3. EBV antibodies: marker of cell-mediated immune function

Epstein-Barr virus: ubiquitous; 100% infection rate by the age of 5 years; once infected, individuals harbor the virus for life in infected cells; under adequate cell-mediated immune function, the virus is maintained in a latent state; immunosuppression allows EBV to reactivate and release viral antigens, to which a antibody response emerge; indirect measure of cell-mediated immune function (Fig. 1).

Previous studies: Increase of EBV antibodies was associated with (1) medical school examination, (2) poor-quality marriage, (3) chronic stress with caring a family member with Alzheimer’s disease, (4) loneliness, defensiveness, and anxiety.

4. C-reactive protein: marker of current infection

C-reactive protein: central component of the acute phase response, non-specific response to infection or injury; body’s first line of defence against pathogens; concentration increase $\times 100$ -1000 during the 24-72 hr following an injury or infectious challenges; level remain elevated during the course of infection; $>5\text{mg/l}$ plasma = cut-off that indicates the “current infection”

4. Methods

Participants: N=760 individuals, ages of 4 and 20 years; comparable age and sex distribution in three regions (Table 1).

Data:

- (1) Dried spots of whole blood for measurement of EBV antibodies (marker for immune function) and C-reactive protein (marker for current infection).
- (2) Anthropometric measures
- (3) Observable symptoms of respiratory diseases
- (4) Demographic and psychosocial information
- (5) Housing style, ownership of western goods, travel experience, occupation of their parents

Analytical Framework:

Y: Level of EBV antibodies (marker of cell-mediated immune function)

X: Region (level of urbanization/westernization)

Confounders: (1) nutritional status (NS), (2) Current infection (respiratory disease, C-reactive protein level ≥ 5 mg/l), age

5. Results

Regional difference in lifestyle (Table 2):

Apia (urban)-Upolu (transitional)- Savaii (rural)

Potential confounders:

- (1) Nutritional status did not differ by region; undernutrition is not a problem; no association between nutritional status and EBV antibodies (Tab2, Fig2/3)
- (2) Current infection (Respiratory infection or CRP ≥ 5 mg) (Fig 4):
Apia > Upolu > Savaii; individuals with current infection removed (144 of 760)

Regional differences in immune function:

PROC GLM (SAS): Y=EBV antibody,

X1=age, X2=sex, X3=region; interaction terms were NS.

- Significant predictors of EBV antibodies were sex and region
- Post-hoc Sheffe pairwise comparisons: EBV (Apia/Upolu) > EBV (Savaii)

6. Discussion

Lower level of cell-mediated immune function in urban and transitional areas in Western Samoa: Catecholamine was also higher in urban than in rural areas in W Samoa; BP and distance from urban areas correlated after controlling confounders in A Samoa; Psychological stress caused by westernization or urbanization played the role to suppress the immune function of the people in W Samoa.

Type of psychosocial stress: challenge associated with managing a more western life style (Apia); Confronting contradictions between old and new ways of living (rural Upolu); lifestyle incongruity theory??

<Paper 2>

McDade TW (2001) **Lifestyle incongruity, social integration, and immune function in Samoan adolescents.** *Social Science & Medicine*, 53: 1351-1362. <Analysis at individual level>

1. Model that explain the relationship between social change and disease risk

Status inconsistency models (a term of Medical Sociology)/ lifestyle incongruity model: Mechanisms: Individuals are motivated to accumulate elements of lifestyles in order for them to display their self-defined place in the system of social stratification. So, the individual struggling to maintain a higher style of life in the context of low SES feels stress. The individuals who are status-incongruent are continually scanning the social field searching to determine if they are being responded to with the sense of respect that they desire. "Previous eight field studies: (West Indies, Mexico, Brazil, USA, Samoa, England) all showed that the higher lifestyle incongruity was associated with higher BP after controlling for age, sex and anthropometric indicators (e.g., BMI).

Model structure:

$$Y = a + b_1(x_1 + x_2) + b_2(x_1 - x_2) + e$$

Y: Biological outcomes hypothesized to be influenced by the acquisition of westernized lifestyles (e.g., stress, immunosuppression), x1: lifestyle (e.g., material goods, information), x2: household economic resources (e.g., occupation, education).

2. Methods

Subjects: N=230, ages of 10-20 years living in Apia, Upolu, or Savaii

Model:

(1) Material score (x1): Table 2, range 2-17;

(2) SES score (x2): the occupational rank of father/mother and frequency of receiving remittance, range 2-9

Each score was standardized to a mean of 50 and SD of 10.

X1-X2=lifestyle incongruity score

X1+X2=overall measure of lifestyle

Confounders: age, sex, region

3. Results

(1) Lifestyle incongruity explained the variation in EBV antibody level after controlling the effect of age, sex and region. (Table 3; Fig 1)

(2) The extent of social integration modify the relation between lifestyle incongruity and EBV antibody level?

Social integration=rely on family/friends when in need of help + satisfied with the relationship with family/friends: "traditional way of life in W Samoa"

Among the individuals who did not rely on family/friends and who were not satisfied with the relationship with family/friends, the effect of lifestyle incongruity on EBV antibody diminished. "Traditional Samoans" who have lifestyle incongruity may experience the EBV antibody increase or immuno-suppression most markedly. (Table 4; Fig 2)

Field-friendly methods of EBV antibody and C-reactive protein measurements (papers 3,4,5)

- 1-1. Blood spot sample collection on filter paper (see Slides)
- 1-2. Quantification of Epstein-Barr (EB) virus antibodies (see Slides)
- 1-3. Quantification of C-reactive protein (see Slides)

<References>

1. Mei JV et al. (2001) **Use of Filter Paper for the Collection and Analysis of Human Whole Blood Specimens.** *Journal of Nutrition*, 131: 1631S-1636S. <Validation of using filter paper for the collection of whole blood specimens>
2. McDade TW et al. (2000) **Epstein-Barr Virus Antibodies in Whole Blood Spots: A Minimally Invasive Method for Assessing an Aspect of Cell-Mediated Immunity.** *Psychosomatic Medicine*, 62: 560-567. <Validation of quantification of EBV antibodies in dried blood spots >
3. McDade TW et al. (2004) **High-Sensitivity Enzyme Immunoassay for C-Reactive Protein in Dried Blood Spots.** *Clinical Chemistry*, 50: 652-653. <Validation of quantification of C-reactive protein in dried blood spots >