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**PATRICK F. CLARKIN**

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## **ABOUT THE AUTHOR**

Patrick F. Clarkin is an Assistant Professor of Anthropology at the University of Massachusetts Boston. His research has focused on the history, health, and physical growth of Southeast Asians living in the United States and French Guiana, South America.

*The views contained in this paper are those of the author and not necessarily of the Institute for Asian American Studies.*



# **Lao Health and Adjustment in Southern New England Three Decades after the Secret War**

**PATRICK F. CLARKIN**

## **Abstract**

This study explored Lao life histories, health, and social adjustment in the southern New England states of Rhode Island and Connecticut. In addition, it sought to examine whether there was a correlation between war experiences early in life and health in adulthood, a finding reported in previous research on the Hmong, another ethnic group from Laos. Overall, 99 Lao adults born in Laos or Thailand (mean age  $43.5 \pm 10.8$  years) completed orally administered questionnaires and were measured for blood pressure and various anthropometric markers. Lao in this sample appeared to have higher than average educational backgrounds in Laos, with most individuals originating in the more urban population centers of Laos, which were

largely spared from war. Therefore, as it became impossible to compare Lao born in war-zone and safe-zone areas, an improvised analysis was done by comparing Lao health data to the aforementioned Hmong study. Lao born in safe zones in Laos were taller, with lower body fat (but higher blood pressure) than the Hmong, who were more likely to be born in war zone areas. The first two findings are consistent with the developmental origins of health and disease hypothesis, a well-supported area of research which has linked prenatal malnutrition to later chronic diseases. However, the blood pressure finding is puzzling. Finally, a significant inverse correlation was found between adult height and the total number of refugee experiences for Hmong and Lao—a potentially new finding.



ditions. The current research is situated in the tradition of biocultural anthropology, which attempts to link various levels of analysis by documenting how larger historical and political-economic events interact with evolutionary forces, affecting human health and biology.

The rationale for this project stems from previous research on the Hmong, another ethnic group from Laos, which found that height and obesity were adversely affected by experiences related to war (Clarkin, 2008). In a sample of 279 Hmong adult refugees who resettled in the United States and French Guiana, those who were born in war-zone areas had higher body fat, while those who were forced to leave their villages as infants were shorter than Hmong who were in safer areas (see Figure 1). They reported high rates of stressful life experiences resulting from the Second Indochina War, including being born near military conflict, being displaced from their homes multiple times, experiencing hunger often as children, and having first-degree relatives who died from various war-related causes.

The correlation between early life stressors and later adult health is consistent with the rapidly expanding body of literature on early malnutrition and human biological development now known as the developmental origins of health and disease hypothesis, or DOHaD (Barker, 1998). For example, studies from the Netherlands and the former Soviet Union during World War II found that malnutrition in the prenatal and infant periods were associated with later chronic diseases such as diabetes, obesity, high cholesterol, and hypertension (Ravelli et al., 1976; Stanner et al., 1997;

Roseboom et al., 1999; Painter et al., 2005). The underlying biological reason for this is that a fetus or infant faced with scarce nutritional resources may make physiological compromises that help with immediate survival by being frugal with nutrients, but lead to health problems later in life. For example, fetal muscles may become resistant to glucose, in effect sparing it for the brain, but then increasing the risk for diabetes (Hales and Barker, 2001). These metabolic changes become “locked in” and made a permanent part of an individual’s physiology, perhaps as an adaptation in anticipation of future nutritional scarcity (Gluckman and Hanson, 2005). But when a thrifty metabolism is paired with an environment with nutritional abundance, as is the case when migrants go from extreme poverty or conditions of war to improved conditions or even affluence, the thrifty phenotype adaptation backfires, leading to increased risk for chronic diseases.

Prior to beginning the current research project, it was felt that a study of Lao refugees would help to strengthen previous research findings about the Hmong because of important geographic and economic differences between the two ethnic groups while they were in Laos. For example, differences in the village farming economies in Laos meant that Lao villages were larger and more permanent than Hmong villages, allowing for greater ease of historical documentation. The Lao (or Lao Lum, meaning “Lao of the valley floor”) were largely wet rice farmers, while Hmong and other Lao Soung (literally, “Lao of the mountain tops”) often grew dry rice and maize, and abandoned their villages every ten years or so after land became infertile. Second,



Hmong and Lao resided in different parts of Laos, with the Hmong concentrated in the north and the Lao residing throughout the country. Ideally, this geographic contrast could provide comparative data to determine if war-related food insecurity in different parts of the country had long-term effects on growth and health. It was unknown where in Laos the majority of Lao in southern New England originated, but the original objective of the project was to compare the health of Lao born in the virtually unscathed urban areas on the Mekong river to those born in the intensely bombed areas in Xieng Khouang province or in the southern provinces along the Ho Chi Minh Trail (Branfman, 1972; Quincy, 2000: 320). Thus, the wars in Laos were viewed not merely as interesting historical backdrop, but rather as an important variable to be tested for its impact on the health of the Lao in southern New England.

#### **A Brief History of the Wars in Laos**

The First and Second Indochina Wars (1945–54 and 1958–75, respectively) in Laos were largely a byproduct of the Cold War and the conflict in neighboring Viet Nam. In 1944, just prior to the end of World War II, France attempted to regain control over its former colony in Indochina, which had been disrupted by the war at home and by Japanese military expansion throughout Asia (Stuart-Fox, 1997). The French president, Charles de Gaulle, hoped that reclaiming Indochina would build the morale of the French population after the war, while the U.S. wished to see France reclaim Indochina in order to regain its strength economically to help deter com-

munist expansion in Asia and Europe (LaFeber, 2007). But communist-led independence movements, in particular the Viet Minh and Pathet Lao, mobilized against the French returning as a colonial power. Thus commenced the period of conflict in Laos, with Lao and Viet communist troops (with Chinese support) on one side and the French and Royal Lao Army (or RLA), bolstered by troops from Morocco and Algeria, Hmong guerrilla units, and American financial support, on the other (Conboy, 1995; Stuart-Fox, 2001: 59).

On May 7, 1954, the Viet Minh decisively defeated French troops in the battle of Dien Bien Phu in northern Viet Nam, effectively ending the First Indochina War. At the conclusion of the Geneva Accords on July 20, Viet Nam was divided at the 17th parallel, while Cambodia and Laos remained whole, keeping their royal governments intact. The neutrality of Laos was to be monitored by an International Commission for Supervision and Control (ICSC), comprised of delegates from pro-Western Canada, communist Poland, and neutral India who would oversee the withdrawal of all foreign troops from Laos and monitor the cease-fire. While well-intentioned, the ICSC was unable to fulfill its mission because both royalists and communists were determined to increase their military strength and obtain political power at the expense of the other, thus setting the stage for further conflict (Stuart-Fox, 1997).

In January 1955, the U.S. became more deeply involved in Laos when the French government severely cut financial aid to the RLA, leading the Royal Lao government to request direct American military assistance (Conboy, 1995: 17). To various American

political figures, Laos meant different things in the campaign against communism. Secretary of State Dean Rusk referred to Laos as “only the wart on the hog of Vietnam” (Stuart-Fox, 1997: 136). But to President Dwight Eisenhower, Laos was the key “domino” in Southeast Asia because of its geographical position. On April 28, 1953, in a meeting with the National Security Council, Eisenhower equated the status of Laos with that of all of southern Asia, stating “[If Laos is lost, we will] likely lose the rest of Southeast Asia and Indonesia. The gateway to India, Burma, and Thailand will be open” (Conboy, 1995: 5). His outlook was inherited by Presidents Kennedy, Johnson, and Nixon, translating into two decades of American military intervention in Laos.

Though technically a participant in the 1954 Geneva Accords, the U.S. was not a signatory to them, and therefore not legally bound by them (Castle, 1993: 12). At the same time, Eisenhower wished to keep any conflict to a limited scale and maintain the façade of Laos’ neutrality (Quincy, 2000: 108–14). In 1955, the U.S. Embassy in Laos created the Programs Evaluation Office (PEO), which was purported to be responsible for disseminating economic assistance in the country, though in reality was charged with monitoring the French training of the RLA (Conboy, 1995: 20). The PEO became directly involved in the RLA in 1959 by integrating 500 military advisors, including elite Filipino commandos and U.S. Special Forces (Quincy, 2000). In 1955, at the request of the Lao government, the U.S. dramatically increased its financial assistance, essentially funding the entire budget of the RLA. The Pathet Lao, in

turn, were funded by Ho Chi Minh’s Democratic Republic of Viet Nam, making the civil conflict in Laos a proxy war, where both sides were funded entirely by foreign nations (Stuart-Fox, 1997: 90–1).

After the Geneva Accords, the period between 1955 and 1958 was relatively calm in Laos, though skirmishes between communist and royalist forces broke out as Pathet Lao troops resisted integration into the RLA. In May of 1958, free elections led to a coalition government comprised of representatives from across the political spectrum, with communists holding 13 of 59 seats in the National Assembly (Toye, 1971: 112). But by cutting off financial aid to Laos, the U.S. forced prime minister Souvanna Phouma to resign in June for the offense of inviting Pathet Lao members into his cabinet, including his half-brother Souphanouvong. Funding resumed in August when pro-Western Phoui Sananikone became prime minister and removed Pathet Lao cabinet members (Castle, 1993: 17). Growing communist displeasure at these events led to the spread of fighting in 1959 in the provinces of Phong Saly, Luang Prabang, and Xieng Khouang, but was most intense in Sam Neua (Stuart-Fox, 1997: 109). This marked the beginning of the Second Indochina War in Laos, with the government in Vientiane controlled primarily by the neutral Souvanna Phouma (who would persistently return to power, despite multiple interruptions by hard-line rightists) until the eventual communist victory in May of 1975.

U.S. military involvement in Laos further intensified in January 1961 when the American colonel, James William Lair (with the approval of the RLA, the U.S.

Embassy, and the CIA), approached the Hmong lieutenant colonel, Vang Pao, at Tha Vieng in Xieng Khouang province. They agreed that Vang would recruit at least ten thousand anti-communist guerrillas, while the CIA would provide weapons and training (by Thai paramilitary advisors) for Hmong troops and food, salt, and medicine for civilians (Quincy, 2000: 177). The CIA saw the Hmong as the best option, given the relative ineffectiveness of the RLA, Eisenhower's reluctance to commit American troops to Laos, and the intimate familiarity of the Hmong with the geography of northeastern Laos, a strategically important area (Quincy, 2000: 181). Further, the Hmong, along with their American-trained Thai advisors, would be better able to maintain the appearance of Lao neutrality, without violating the Geneva Accords of 1954 (and the subsequent Accords of 1962). At the time, this operation would become the largest paramilitary operation in the history of the CIA, totaling over \$1 billion, though its existence was unknown to the U.S. Congress until 1969, leading to the conflict in Laos being referred to as the "Secret War" (Quincy, 2000: 5, 182).

But the war in Laos was not simply a Hmong war or a guerrilla war. Both the United States and the Democratic Republic of Viet Nam were in violation of the 1962 Accords, which reaffirmed Laos' neutrality. At the height of the conflict, there were 40,000 North Vietnamese troops in Laos (15,000 in the north, 25,000 on the Ho Chi Minh Trail in the south), 35,000 Pathet Lao, 40,000 Hmong troops under Vang Pao, 60,000 RLA and 10,000 neutralist troops under Kong Le (Stuart-Fox, 1997:

142). The war escalated into a high-intensity conflict with many casualties stemming from three largely separate military operations: (1) an American bombing campaign on the Plain of Jars in the northeast and the Ho Chi Minh Trail in the panhandle, (2) the regular units on the ground, and (3) the guerrilla war in the northeast (Stuart-Fox, 1997: 139).

The effects of the war on civilian life in Viet Nam, Cambodia, and Laos were devastating, and had lasting health costs. Laos was subjected to more than half a million bombing missions, which dropped 2.1 million tons of ordnance (Stuart-Fox, 1997: 144). This calculates as two tons for every inhabitant, giving Laos the infamous distinction of being the most heavily bombed nation, per capita, in the history of warfare (Morikawa, 1998). Of a population of three million people, an estimated 200,000 died while 750,000 were made internal refugees (Stuart-Fox, 1997). In one of the poorest nations in Asia, warfare further exacerbated the health of the Laotian population through physical trauma, starvation, infection, and psychological stress. Infant mortality rates were as high as 50% in war-torn areas, while persons displaced by war in the northeast were reported to be starving, with protein, calorie, and micronutrient deficiencies (Weldon, 1999: 125; Yang, 1993: 51).

The following quotations reveal that it was the rural areas in northeastern and southern Laos that endured extremely harsh conditions, while urban areas remained better off. This allows an opportunity to compare the health outcomes of persons exposed to war in Laos to those who were relatively protected:

Those who suffered most from the escalating conflict were populations living in the east of the country: overwhelmingly the highland minorities, Lao Thoeng and particularly Lao Sung (Mien as well as Hmong), but also upland Tai, the Phuan of Xiang Khuang and the Phu-Tai of east central Laos (Stuart-Fox, 1997: 139).

The urban populations of Vietnam, Laos, and Cambodia have been relatively unscathed. It is the 90 percent who earn their livelihoods by tilling the soil and raising livestock who are the soldiers, the refugees, the corpses (Branfman, 1972: xi).

Virtually every resident of northeast Laos was at some time a war refugee, either driven from his native village by the action of the two sides, or brought to near starvation by the total disruption of the primitive rural economy of the region (Schanche, 1970: 245).

Military Region II [Sam Neua and Xieng Khouang provinces] bore the brunt of the war for almost fifteen years. Nearly 80% of the refugee population in Laos originated in MR II, including the refugees on the Vientiane Plaine. Almost the entire population of Houa Phan [Sam Neua] and Xieng Khouang Provinces were gradually forced south into the Long Tieng, Ban Xon, Muang Cha crescent (USAID, 1976: 210).

### Laotian Refugees in New England

Laos' part in the Second Indochina War officially ended in May of 1975 with the ascension of the Lao People's Democratic Republic. By the end of that year, 40,000 refugees of all ethnicities fled to Thailand; eventually, 340,000 people (or 10% of the population) would leave Laos by 1977 (Quincy, 2000: 376, 387). More than 220,000 refugees from Laos (including 125,000 lowland Lao and 100,000 ethnic minorities—Hmong, Yao, Khmu—from the mountains), would resettle in the United States between 1975 and 1991 (UNHCR, 1995). The first Lao refugees arrived in 1975, though most arrived in the 1980s. Some resettled more recently from Thailand, while others moved to southern New England after first resettling in another state and then voluntarily making a secondary or third migration. According to Anderson (2005: 197), the particular draw of the state of Rhode Island (where most of the participants of this study resided) was its fairly friendly social environment and "plentiful job opportunities in light, labor-intensive industries, especially the jewelry industry, where job performance requirements depended less on English-language proficiency than on the meticulous care and precision needed for the jewelry assembly line." By the year 2000, 3,507 Laotians resided in Rhode Island, while 3,267 lived in neighboring Connecticut (SEARAC, 2004). Along with Hmong and Cambodians, Lao comprise one of the most linguistically isolated communities in the state. According to recent census data, roughly 28% of Laotians aged five or older in Rhode Island did not speak English well or at all.

## Methods

Prior to conducting research for this study, ethical approval was obtained from the Institutional Review Board at the University of Massachusetts Boston. The objective was to administer a questionnaire and collect blood pressure and anthropometric data on a sample of 100 adults of Lao ethnicity who were born in either Laos or Thailand. The rationale for confining the sample to persons born in Laos or Thailand was to look at whether pre-migration experiences were correlated with health data. In 2006, potential study participants from the Lao communities in Rhode Island and eastern Connecticut were contacted by phone by Vanna Phommavanh, who acted as the project's community liaison and interpreter. After making appointments, we visited participants in their homes. In addition, other participants were recruited opportunistically at the Lao Buddhist Temple (Wat Lao Buddhovath) in Smithfield, Rhode Island. Roughly half of the sample came from home visits and the other half from the temple.

The orally administered questionnaire pertained to a person's life history and current overall health status and social adjustment. Specifically, **pre-migration questions** included a person's place and date of birth, family background (urban or rural), parental literacy (Lao and French), whether they were forcibly displaced from their villages by war before they were two years old, the total number of times (up to six) one was displaced, and whether they had a sibling or parent who died when they were children. **Post-migration questions** included the age when they were first resettled in the United States, current household income

level, highest education attained, perceived stress levels, whether they were happy with their current living conditions, and whether they wished to return to Laos to live there permanently. **Health history questions** included whether a person had ever had migraine headaches, hypertension, high cholesterol, diabetes, or a heart attack. To protect individual privacy, no personal identifying information was collected.

**Anthropometric measures** included blood pressure, height, sitting height, weight, body fat percentage, abdominal circumference, and two skinfolds (triceps and subscapular). Blood pressure was taken using an Omron automatic monitor (model: HEM-711), with the participant seated and after administration of the questionnaire in order for them to be in a rested state. Height and weight were used to calculate the body mass index (BMI;  $\text{kg}/\text{m}^2$ ), a commonly used marker for overweight and obesity (a BMI over 25 or 30  $\text{kg}/\text{m}^2$ , respectively). Abdominal circumference was taken to the nearest 0.1 cm using a fiberglass tape measurer at the level of the umbilicus, or "belly button," to get an estimate of intra-abdominal body fat. Skinfolds were measured to the nearest millimeter using a Lange skinfold caliper (model: C-130) by pinching a cross section of skin and subcutaneous fat behind the arm (triceps) and under the shoulder blade (subscapular).

Weight and body fat percentage (BF%) were measured to the nearest 0.1kg and 0.1%, respectively, using a Tanita TBF-551 Body Fat Monitor/Scale. The machine calculates BF% via bioelectric impedance analysis, based on the principal that adipose tissue is comprised of a lower percentage of water than lean tissue (Baumgartner,

1996). The individual stands on the scale barefooted on two pairs of electrodes on the monitor, and a small, safe, and imperceptible electrical signal (50 kHz, 500 microamp) is sent through the feet via the anterior electrodes, traveling through the body and returning to the posterior electrodes, at which time the level of impedance is measured. Greater body fat will slow the signal's travel through the body. The machine then enters the impedance level into a regression equation, along with previously entered data on the individual's height, sex, and age. This method has been validated previously (Jebb et al., 2000).

Statistical analyses were conducted using SPSS 16.0, and included descriptive statistics, and bivariate analyses (Chi-square tests, t-tests, and Pearson correlation coefficients). Multivariate analyses included analysis of variance (ANOVA), with height, body fat percentage, and systolic blood pressure as the dependent—or outcome—variables. In all of the ANOVA models, predictor variables included birthplace (war-zone or safe-zone areas), sex, and ethnicity. Age was also included as a covariate when predicting body fat and blood pressure, and body mass index was included as a covariate in the blood pressure model.

### Results and Discussion

Overall, 100 Lao adults participated in this study, though one person was removed from the sample because she was born in the United States. The final sample consisted of 38 males and 61 females born in Laos or Thailand and had a mean age of  $43.5 \pm 10.8$  years (range 21–65 years). Birthplaces and family backgrounds are listed in Table 1.

**Table 1. Early life backgrounds for Lao adults in the study (n = 99)**

<i>Was birthplace rural or urban?</i>	
Urban	69.7%
Rural	27.3%
Missing	3.0%
<i>Approximate population of birth place</i>	
10,000+ people	63.6%
1,000–10,000 people	18.2%
250–999 people	12.1%
< 250 people	5.1%
Missing	1.0%
<i>Place of birth in Laos or Thailand</i>	
<i>Laos, province</i>	
Vientiane	59.6%
Savannakhet	10.1%
Luang Prabang	9.1%
Paksane	5.1%
Champasak	4.0%
Khammuan	2.0%
Saravan	1.0%
Nam Tha	1.0%
Thailand	8.1%
<i>Could either parent read Lao before 1975?</i>	
Yes	89.9%
No	8.1%
Missing	2.0%
<i>Could either parent read French before 1975?</i>	
Yes	51.5%
No	46.5%
Missing	2.0%

Most Lao in the sample were born in urban areas in Laos (69.7%) with a population of ten thousand or more people (63.6%). The questionnaires revealed that birthplaces

tended to be clustered in the towns along the Mekong river, such the capital of Vientiane, as well as Luang Prabang, Savannakhet, Thakhek, and Champasak. By contrast, in a sample of 279 Hmong in the United States and French Guiana, birthplaces were primarily small, rural villages in the northern part of the country (Clarkin, 2008). For example, 59.6% of Lao in the current study were born in Vientiane province (primarily in the capital city), versus just 7.9% for the Hmong, while 49.5% of Hmong were born in Xieng Khouang province, versus none for the Lao. This is not to suggest that there were no Lao in Xieng Khouang, one of the hardest hit areas of the war, but only that it appears that the Lao in southern New England originate primarily from safer areas in Laos.

The majority of people (89.9%) stated that at least one of their parents was literate in the Lao language before the end of the war in 1975, while slightly more than half (51.5%) stated they had a parent who was literate in French. These figures were higher than expected, given that the literacy rate of Laos in 1995 was only 60% (UNESCO, n.d.). But literacy rates in Laos were much higher among males of the Lao ethnic group (86% vs. 65% for females) in 1995, indicating that the national rate is skewed downward by disparities between the sexes, between urban and rural areas, and among Laos' various ethnic groups. The figure for the Lao adult male may be the most relevant for our purposes here, since we asked if either, not both, parent could read or write.

We also asked about the primary occupation of the respondent's father. The

answers are too varied to include in Table 1, but the most common response for father's occupation was farmer (30.3%), followed by soldier (17.2%), businessman/merchant (10.1%), teacher (9.1%), and police officer (6.0%). It is not surprising that the most frequently cited profession was farmer, given that roughly 90% of the population of Laos was comprised of rural farmers before 1975. But the Lao in this sample appear more likely to come from educated, urban families than the rest of the country, a factor that may have an impact on health and social adjustment after coming to the United States.

The responses to questions pertaining to war-related experiences early in life are shown in Table 2, with comparisons made to previous research on the Hmong. The responses are consistent with those in Table 1, where Lao individuals in the current sample were born in urban areas largely safe from war. Only 3% of Lao were born in a war zone, while the same percentage was displaced from their homes in infancy (before age two years) because of war. Categorization of birthplace was determined by both the participant and by cross-checking birthplaces with the historical record. By comparison, 30.5% of Hmong were born in a war zone while 38.8% were displaced from their villages as infants. One of the objectives of this project was to utilize birthplace (war-zone vs. safe-zone areas) and being displaced in infancy as proxy variables for exposure to food insecurity and malnutrition to test against the biological and health variables. But it is apparent that this is not possible, as the frequencies for these were too low in the current sample. Instead, Lao data are com-

**Table 2. War-related experiences for Lao and Hmong† adults (means ± s.d. and percentages)**

	Lao (n = 99)	Hmong (n = 279)	P-value‡
Born in a war zone	3.0%	30.5%	<0.001*
Displaced from home < age 2 yrs	3.0%	38.8% <sup>b</sup>	<0.001*
Total number of times displaced	1.0 ± 0.7	2.5 ± 1.9 <sup>b</sup>	<0.001*
Experienced hunger as a child	---	48.9% <sup>b</sup>	---
Went without food for a long period as a child	11.1%	---	---
Had sibling who died as a child	40.4%	76.8% <sup>a</sup>	<0.001*
Parent died in person's childhood	11.1%	24.2% <sup>b</sup>	0.006*

† Hmong data are from refugees in French Guiana and various U.S. states (Clarkin, 2008).

‡ P-values are Chi-square tests for percentages and t-tests for means.

\* Significant P-values (< 0.05).

<sup>a</sup>Two case missing.

<sup>b</sup>Six cases missing.

pared to Hmong data for the biological variables as a means of testing the validity of the previous research.

Other significant differences included that, in comparison to the Hmong, the Lao were displaced from their homes less frequently (regardless of age when displaced), they were less likely to have a sibling who died as a child (regardless of cause—illness, injury, starvation), and they were less likely to have a parent who died during the respondent's own childhood. When asked about direct experiences with hunger, 11.1% of Lao said they went without food for a long period as a child. This question was modified from a more generic question asked of the Hmong about childhood experience with hunger to a more descriptive one. This modification helped to assess whether food insecurity lasted for a sustained duration, though it prevented a direct comparison between Lao and the

Hmong responses.

Table 3 provides descriptive statistics for variables pertaining to general well-being and social adjustment after migrating to the U.S. On average, the Lao arrived in the U.S. just under two decades ago, with the average age at resettlement being about 24 years old. Just one person (1%) answered they were unhappy with their current living conditions. By comparison, 16.0% of Hmong in the United States reported being unhappy (Clarkin, 2005). In fact, the majority of Lao described their life in the U.S. as either “always enjoyable” (42.4%) or “mostly enjoyable” (35.4%), while just one person said their life was “mostly stressful.” Nonetheless, a sizeable number of people said they wished to return permanently to Laos one day (23.2%), though this was less than the 44.8% figure reported by Hmong in the U.S. (Clarkin, 2005). Most Lao in the cur-



**Table 3. Descriptive statistics (means  $\pm$  s.d. and percentages) for general well-being and social adjustment after migration for Lao adults (n = 99)**

<i>Age first resettled in U.S.</i>	23.9 $\pm$ 11.2
<i>Total number of years in U.S.</i>	19.4 $\pm$ 7.1
<i>Unhappy with current living conditions<sup>a</sup></i>	1.0%
<i>Response to "how would you describe your life in the U.S.?"</i>	
Always enjoyable	42.4%
Mostly enjoyable	35.4%
Average	21.2%
Mostly stressful	1.0%
Always stressful	0.0%
<i>Desire to one day live in Laos permanently<sup>a</sup></i>	23.2%
<i>Employment status</i>	
Full time	78.8%
Part time	5.1%
Student	1.0%
Homemaker	9.1%
Unemployed	6.1%
<i>Household income level<sup>b</sup></i>	
\$50,001+	31.5%
\$25-50,000	41.3%
\$10-25,000	20.7%
<\$10,000	6.5%
<i>Education level</i>	
Graduate degree	1.0%
Bachelor's degree	14.1%
Some college	18.2%
High school graduate/GED	23.2%
Some high school	10.1%
< 9th grade	33.3%

<sup>a</sup>One case missing.

<sup>b</sup>Seven cases missing.

rent sample were employed full time. In addition, 6.1% were unemployed, which is slightly higher than the 2006 unemployment rates in Rhode Island (5.1%) and Connecticut (4.4%) (data from Rhode Island and Connecticut Departments of Labor). Seven people declined to disclose their household income level (defined as the combined income of all adults living in the home), though 27.2% had an income below \$25,000. The level of highest education attained was quite varied, with one-third of the sample (33.3%) having less than a 9th grade education and another 33.3% having at least some college education.

Self-reported health conditions are presented in Table 4. Participants were asked if they ever had a variety of chronic health conditions. The most commonly reported conditions were migraine headaches, followed by high blood pressure (hypertension) and high cholesterol, then diabetes, and heart attack. A sizeable percentage of people (11.1%) were uncertain as to whether they ever had high cholesterol, possibly indicating a lack of access to medical care. In addition, when we measured and recorded the participants' actual blood pressure, the rate of hypertension (defined as either greater than 140 mmHg for systolic pressure, 90 mmHg for diastolic pressure, or both) was, in fact, higher than the self-reported rate (38.8% vs. 24.2%). Certainly, blood pressure varies throughout the day and a single measure at one point in time is insufficient to diagnose hypertension. But the disparity between self-reported and actual hypertension is a possible indication of the Lao in this sample overestimating their own health. In this way, measuring blood pressure acted as a screening

**Table 4. Self-reported health conditions for Lao adults (n =99).**

<i>Has person ever had...</i>	Yes	No	Not certain
Migraine headaches	26.3%	72.7%	1.0%
High blood pressure	24.2%	69.7%	6.1%
High cholesterol	24.2%	64.6%	11.1%
Diabetes	11.1%	83.8%	5.1%
Heart Attack	4.0%	94.9%	1.0%

**Table 5. Descriptive statistics for blood pressure and anthropometric data for Lao men and women (means  $\pm$  s.d.)**

	Men (n = 38)	Women (n = 61)
Systolic blood pressure (mmHg)	134.28 $\pm$ 22.45	136.00 $\pm$ 25.22
Diastolic blood pressure (mmHg)	82.84 $\pm$ 11.15	83.34 $\pm$ 13.15
Height (cm)	163.75 $\pm$ 7.20	153.03 $\pm$ 5.03
Sitting height (cm)	86.00 $\pm$ 3.51 <sup>a</sup>	81.72 $\pm$ 3.27
Leg length (cm)	77.61 $\pm$ 4.90 <sup>a</sup>	71.26 $\pm$ 3.22
Sitting height ratio (sit height/height)	0.526 $\pm$ 0.013 <sup>a</sup>	0.534 $\pm$ 0.013
Weight (kg)	65.83 $\pm$ 10.15	61.85 $\pm$ 14.16
Body mass index (kg/m <sup>2</sup> )	24.51 $\pm$ 3.16	26.39 $\pm$ 5.72
Body fat percentage (bioelectric impedance)	23.05 $\pm$ 5.09 <sup>a</sup>	37.61 $\pm$ 9.44
Abdominal circumference (cm)	82.65 $\pm$ 8.00	82.11 $\pm$ 13.22
Triceps skinfold (mm)	10.51 $\pm$ 4.40	25.89 $\pm$ 9.29
Subscapular skinfold (mm)	15.32 $\pm$ 4.62	22.23 $\pm$ 8.21

<sup>a</sup>Five cases missing.

tool. We suggested to individuals with high blood pressure readings that they visit their physician.

Descriptive statistics for blood pressure and the anthropometric variables are shown in Table 5. Differences between men and women are consistent with patterns found in populations around the world

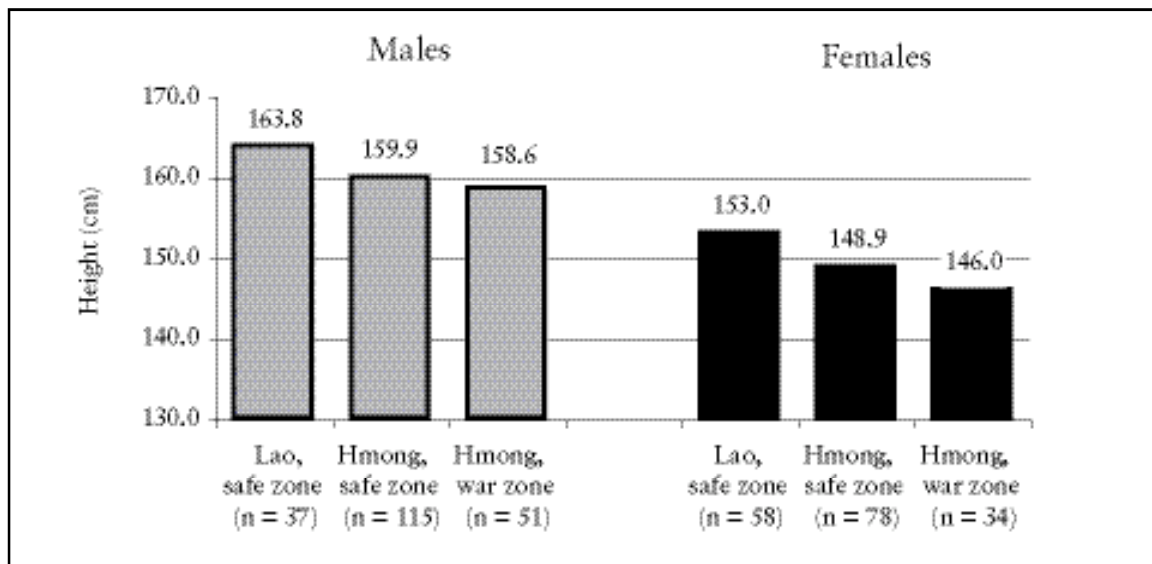
with men, on average, being taller and heavier, and women having higher body fat (Eveleth and Tanner, 1990). Because of time constraints while collecting data, information on sitting height and body fat percentage was missing for five men who were measured in the same session. Overall, 43.4% of Lao adults were at least over-

weight (defined as a body mass index of 25 kg/m<sup>2</sup> or more), while 20.2% were obese (a BMI of 30+). By comparison, these figures are below the U.S. national rates of overweight and obesity, at 65% and 31%, respectively (Flegal et al., 2002).

Figure 2 shows how height of Hmong and Lao adults correspond to place of birth, a proxy for prenatal nutrition. As mentioned previously, only 3% Lao in the current sample were born in a war zone. Thus, they were excluded from the current analysis, as their small numbers would provide misleading results. Instead, they are compared to Hmong data from previous research (Clarkin, 2008). Hmong born in a war zone were shorter than those born in a safe zone, likely pointing to the long-term

effects of early malnutrition. The Lao born in a safe zone were the tallest of the three groups. In an analysis of variance (ANOVA) with sex and ethnicity in the model, the effect of birthplace on height was statistically significant ( $P = 0.009$ ). It would have been preferable to compare the correlation between birthplace and height among individuals from the same ethnic group in order to control for possible genetic or cultural/dietary factors. Nonetheless, the Lao data help to corroborate previous findings in the Hmong. It is likely that the Lao in this sample had childhood conditions that were more conducive to physical growth and development than either Hmong group, regardless of birthplace. Hmong born in a war zone faced the

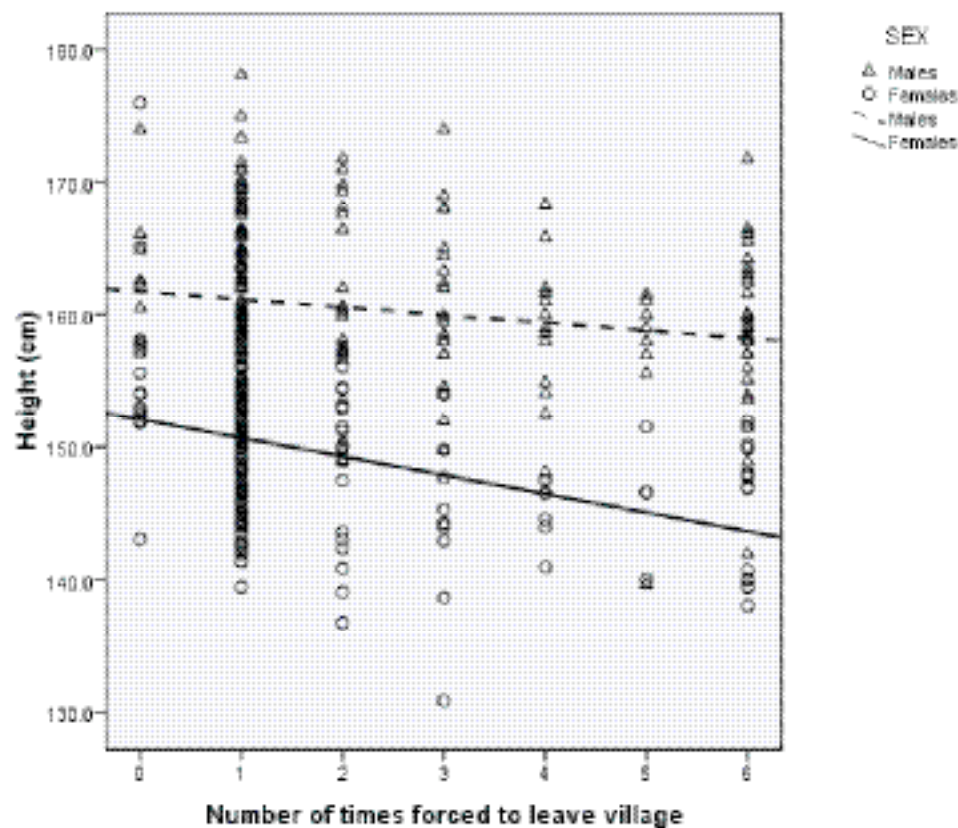
Figure 2. Height by birthplace, sex, and ethnicity. Gray bars represent males, while black bars represent females. Numbers are raw means. For both sexes, the shortest individuals were Hmong born in a war zone, while Lao born in a safe zone were the tallest. The effect of birthplace on height was statistically significant ( $P = 0.009$ ) in an ANOVA model. Ethnicity and sex were also significant ( $P < 0.001$ ), with males and Lao being taller.



harshest environmental conditions in early life, and this is manifest in their shorter height. However, Hmong born in a safe zone were somewhat better off at birth, but likely faced more stressful conditions than the Lao at some point in their childhood. The significance of this finding is that height is often used as a gauge of the wider environment, including nutritional and social conditions (Tanner, 1986). This is demonstrated further below.

The correlation between adult height and the number of refugee experiences a person had in their lifetime, regardless of age, is shown in Figure 3. Data from Lao and Hmong were merged but analyzed separately by sex. For both sexes, the number of times a person was forced to leave their home because of war was inversely correlated with adult height (using Pearson correlation coefficients). Refugee experiences are inherently detrimental to physical

Figure 3. Effect of the number of times being displaced by war on adult height. Lao data were combined with Hmong. For both sexes, height decreased significantly as the number of refugee experiences a person had increased (males,  $n = 202$ ;  $r = -0.171$ ;  $P = 0.015$ ; females,  $n = 170$ ;  $r = -0.391$ ;  $P < 0.001$ ).



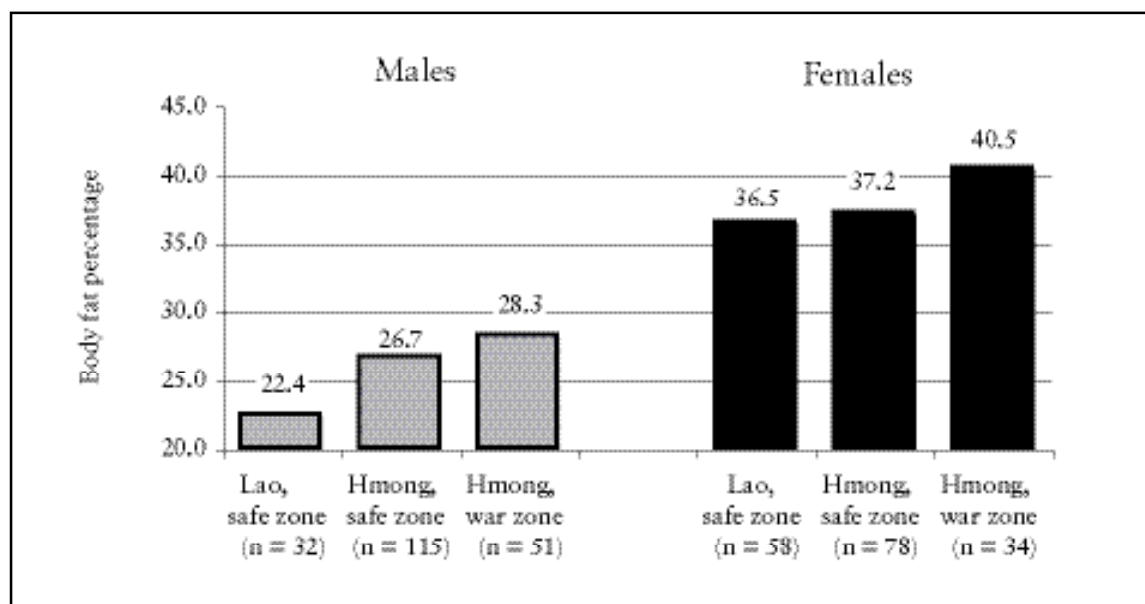
growth, as they are usually accompanied by food insecurity, as well as other stressors such as infection and psychological stress. During the wars in Laos, civilians were often forced to flee their villages, or whatever temporary refuge they happened to find for themselves, in the face of encroaching military activity. The low population density in Laos meant that entire villages were sometimes able to find new homes in uninhabited, secure areas. But others were not so fortunate and some wandered for months only to find refuge in scattered locations where ecological conditions were often less than favorable (U.S. Congress, 1970: 16; Schanche, 1970: 100; Yang, 1993: 59; Kuhn, 1995: 69; Weldon, 1999: 52, 124–9, 151, 235; Quincy, 2000: 426–7).

There are some limitations to this analysis. Not all refugee experiences are equal, and some are more stressful than others. We did not ask about potentially important qualifiers such as whether a person or family had time to plan before fleeing to safety, or if nearby conflict warfare was unanticipated, leaving them unprepared and without shelter, food, or water. For example, we counted the time that a person fled Laos to Thailand as a refugee experience. This was a planned event for most individuals, given the logistics involved in evading authorities and crossing the Mekong river. It is likely that they had supplies with them to last at least a short while. By contrast, others reported fleeing on multiple occasions, sometimes shortly after reaching relative sanctuary, which is surely a more biologically taxing situation. Also, we did not ask about the timing or duration of refugee experiences. In order to have an effect on height, a refugee experi-

ence obviously needs to occur before final adult stature is reached (i.e., while a person is still growing). Given the ages of the individuals in this study, however, it seems likely that most refugee experiences occurred in childhood. Similarly, the duration of time spent seeking asylum from conflict is important, as longer periods of travel under duress would have greater impact on nutrition and growth. Such information would have strengthened the analysis in this study. Nonetheless, it seems logical that, on average, a greater number of refugee experiences would be correlated with a reduction in stature. Though other studies have found that refugee children and adolescents exhibited high rates of malnutrition and growth deficiencies (Toole and Waldman, 1993), this study is the first to link the total number of displacement episodes in one's lifetime to height in adulthood. This is important, since growth deficiencies due to bouts of malnutrition or illness can be overcome in childhood, a phenomenon known as "catch-up growth." This study demonstrates that the effect of refugee experiences can remain permanently embedded in the height of an individual into adulthood.

The relationship between birthplace and body fat percentage is illustrated in Figure 4. The ANOVA model was similar to that used for height, except that age was also added as a covariate, to control for greater fat accumulation in older individuals. For both sexes, Lao born in a safe zone had less body fat than Hmong born in either a safe zone or a war zone. The heaviest individuals were Hmong born in a war zone, and the effect of birthplace on body fat was statistically significant ( $P = 0.019$ )

Figure 4. Body fat percentage by birthplace, sex, and ethnicity. Numbers are means after controlling for age. Gray bars represent males, while black bars represent females. For both sexes, Lao born in a safe zone had less body fat than Hmong born in either a safe zone or a war zone. The heaviest individuals were Hmong born in a war zone, and the effect of birthplace on body fat was statistically significant ( $P = 0.019$ ) in an ANOVA model.



in an ANOVA model. Ethnicity ( $P = 0.017$ ), sex ( $P < 0.001$ ), and age ( $P = 0.006$ ) were also significant, with females, Hmong, and older persons having proportionately greater body fat. It may seem counterintuitive that individuals born in a war zone, who likely experienced prenatal malnutrition, would have more body fat as adults, but this is consistent with the developmental origins of health and disease hypothesis. For example, rates of obesity were higher among Dutch men who were exposed prenatally to famine during World War II compared to non-exposed controls (Ravelli et al., 1976). Other studies have found similar effects of prenatal malnutrition on later

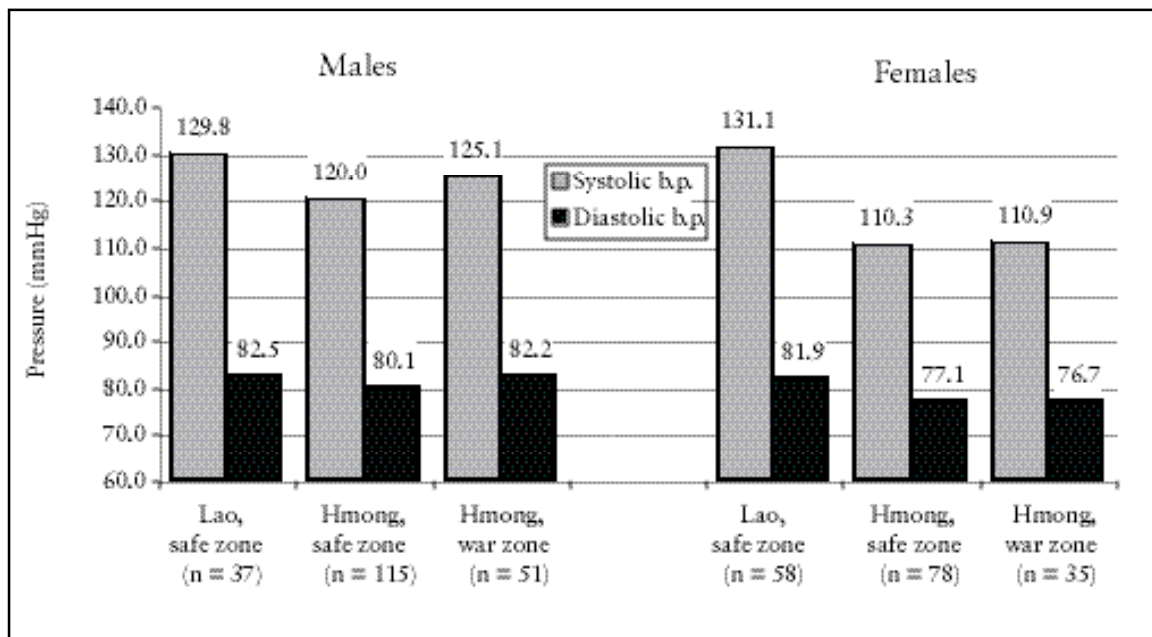
body fat in both humans (Loos et al., 2001; Rogers et al., 2003; Yajnik, 2000) and even in other mammalian species (Budge et al., 2005). It has been hypothesized that prenatal malnutrition signals to the fetus the state of environmental conditions outside the womb. Early in life, when physiology remains highly plastic, the fetus has the ability to increase storage of body fat that would act as an adaptive nutritional reservoir in times of scarcity (Gluckman and Hanson, 2005). The Dutch famine study mentioned above, which had a sample size of roughly 300,000 young adult males, provides evidence that the critical period for shifting this “metabolic thermostat” occurs

early in gestation, perhaps in the first trimester.

Finally, Figure 5 illustrates the relationship between birthplace and blood pressure (systolic and diastolic). After controlling for age, sex, ethnicity, and current body mass index, birthplace was not a statistically significant factor for either systolic or diastolic pressure. In fact, Lao had higher blood pressure than Hmong, which was contrary to what was expected in light of the DOHaD. It is difficult to explain this finding. One possibility may be the rather non-random recruiting of the Lao sample. While recruiting potential participants at

the Wat Lao Buddhovath temple, we made ourselves somewhat visible to passersby (while retaining the privacy of those who volunteered) to entice others to take part. A few individuals hinted that they wished to participate in the study for the blood pressure reading because they had previously been told by a physician they had hypertension and wanted a check on their status. Thus, the current Lao sample may be biased in that it contains a higher rate of people with hypertension than is true of the general Lao population in southern New England. Another obvious factor is that blood pressure is affected by variables

Figure 5. Blood pressure by birthplace, sex, and ethnicity. Numbers are means after controlling for age and body mass index. Gray bars represent systolic pressure, while black bars represent diastolic. Birthplace was not a significant predictor of systolic ( $P = 0.164$ ) or diastolic pressure ( $P = 0.483$ ) in an ANOVA model. Body mass index, sex, ethnicity, and age were all significant predictors for both systolic and diastolic pressure ( $P < 0.05$ ).



other than prenatal conditions (e.g., current diet, smoking, exercise, and stress levels). Data on diet and exercise were not collected, though we did ask about smoking and stress (for example, “Do you desire to one day live in Laos permanently?”). When these were added to a second ANOVA model, smoking was not a significant factor, though persons who responded that they wished to live in Laos permanently had higher blood pressure ( $P = 0.003$ ), perhaps a marker of dissatisfaction with their current lives.<sup>1</sup>

### Conclusions

The three objectives of this study were (1) to examine the incidence of chronic diseases in the Lao in southern New England, (2) to describe Lao life histories before and after migration to the U.S., and (3) to test whether war-related experiences in Laos were correlated with physical growth, blood pressure, body fat, and self-reported chronic health conditions.

This study is one of the few to examine chronic disease incidence in Lao in the U.S. Again, the sample in this study is small and not random and cannot be viewed as a highly accurate portrayal of the true rates of Lao chronic diseases. Some interesting patterns arise nonetheless. Migraine headaches were the most commonly reported condition. The inclusion of a question on migraine headaches was actually suggested by a colleague during the finaliza-

tion of this study’s protocol (Phitsamay Sychitkokhong Uy). This study provides empirical evidence that corroborates her suspicion that migraine headaches were common in the Lao in the U.S. This finding should be explored further because the results may represent a truly high rate of migraines or what medical anthropologists refer to as a “culturally bound syndrome” (McElroy and Townsend, 1996) where psychological stress becomes somatized into physical symptoms (Kleinman, 1982). The scant evidence collected here suggests the latter. The prevalence of migraine headaches in the U.S. is much higher in females than males (18.2% and 6.5%, respectively; Lipton et al., 2001). By contrast, 27% of Lao males and 23.7% of Lao females in this sample reported having migraine headaches.

Rates of other chronic conditions were substantial as well, though the prevalence of overweight and obesity were less than that of the general U.S. adult population. The high rate of hypertension is a concern, and should be explored further. But as mentioned previously, this rate could be deceptive because some individuals (the exact number is unknown) may have participated *because* they had high blood pressure and wished for a quick check on their status. The self-reported rate of hypertension was 24.2%, while the measured rate was 38.8%. By comparison, the national rate among adults was 29.3% (Ong et al., 2007).

<sup>1</sup>The question “are you unhappy with your current living conditions?” appears a better gauge of stress than whether a person wished to return to Laos. But this was not included in the model because there was so little variance in the responses (only one Lao person answered “yes”).



We found that the Lao in the current sample tended to have relatively well-educated backgrounds in Laos, as 90% had at least one literate parent, a figure much higher than Laotian national literacy rates even as recently as 1995. These factors appear to have helped ease the transition to life in the U.S. for the current sample, as just one person reported that their life in the U.S. was stressful, with the remainder stating their lives were average or primarily enjoyable.

But the current sample appears somewhat better off than the Lao in the U.S. in general. Data from the U.S. Census reveal that just 7.6% of Lao over the age of 25 in the U.S. had at least a bachelor's degree; in the current sample that figure was 15.1% (SEARAC, 2004). On the other hand, there was a wide range of educational attainment in the sample, as one third had less than a ninth grade education. Similarly, the Census revealed that 22.7% of adult Lao in the U.S. had no formal education. Nationally, poverty rates for the Lao (19.1%) are lower than other Southeast Asian groups such as Cambodians (29.3%) and Hmong (37.6%), though this figure is still well above the national rate (12.4%). In southern New England, Lao communities face the same challenges found elsewhere in the nation including poverty, linguistic isolation among older adults, and cultural clashes between generations (Schwartzapfel, 2004). In Rhode Island, gangs with dozens of Lao youth have taken root in Providence and Woonsocket (Malinowski, 2008). Thus, some segments of the Lao population appear underrepresented in the current study, which cannot claim to be wholly representative. One rea-

son for this is that we recruited some participants at the temple, which is attended by more culturally traditional individuals rather than the full spectrum of the community. Future research should investigate more deeply into the socio-economic disparities in the Lao community and whether these translate into health disparities.

This study was unable to find many Lao who were exposed directly to war early in life. Unfortunately, this meant that the third and final objective of this study (to test whether early-life exposure to war was correlated with biological variables) became impossible. Instead, a methodological compromise was made by comparing the Lao data to a previous study on the Hmong (who also originated in Laos), which used a very similar protocol. Despite this limitation, some interesting conclusions can be made from the data.

First, the Lao in this sample had their origins in the more urban population centers of Laos, and they had fewer war-related stressful life events than the Hmong. This is consistent with the historical record which reported that the conflict occurred primarily in rural areas in the northeast and south of the country. This bolsters the reliability and veracity of the study participants, who appear not to have embellished the accounts of their experiences with military conflict or as refugees.

Second, the fact that the Lao were taller and had lower body fat percentage than the Hmong is consistent with the developmental origins of health and disease hypothesis. The Lao in this study were *relatively* spared from war, and presumably from food insecurity early in life. The greater accumulation of body fat and

shorter stature in the Hmong *could* be an effect of early living conditions and possible fetal adaptations to nutritional scarcity, although genetic, dietary, or cultural factors cannot be discounted based on the current data. On the other hand, blood pressure results were contrary to what was predicted by the DOHaD, which should be explored further.

Third, this study is the first to link the total number of displacement episodes in one's lifetime to reduced height in adulthood. This is a further indictment against the biological effects of warfare on human biology, as physical growth has long been viewed by pediatricians, epidemiologists, and biological anthropologists as a marker of health. It is clear that war consistently creates harmful conditions for civilians as well as combatants and the biological effects of war last beyond the period of war itself. This is true regardless of the politics or motives of any given war's antagonists.

Finally, although this study had difficulty in finding Lao who were born in war-zone areas or who were displaced by war as infants, it is clear from the historical record that such individuals do, in fact, exist. Future research should locate Lao affected by war early in life, either in the refugee diaspora or in Laos itself, and assess whether their health has been affected in a manner consistent with the findings here and in previous studies.

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