

# MORBIDITY AND MORTALITY PATTERNS, HEALTH BELIEFS, AND HEALTH RISK FACTORS OF KAREN HIGHLANDERS OF NORTHWEST THAILAND

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**Abstract.** Morbidity and mortality patterns, health care practices, and health care beliefs were assessed over three seasons in Pwo and Sgaw Karen preschool children living in the highlands of northwest Thailand. The sample consisted of all preschool children from 77 Pwo and 71 Sgaw households. Although the Pwo and Sgaw Karen residing in the highlands of northwest Thailand live in isolated villages in the same ecozone, utilize similar technologies, have similar access to health facilities, and maintain a certain level of socio-cultural homogeneity through their identification as Karen, Pwo preschool children exhibit significantly higher levels of morbidity and mortality than their Sgaw counterparts. It is argued that these differences in morbidity and mortality are primarily the function of historical patterns which resulted in an earlier contact of the Sgaw with modern societies and particularly with an earlier exposure to western health care.

## INTRODUCTION

The Pwo and Sgaw Karen residing in the highlands of northwest Thailand live in isolated villages in the same ecozone, utilize similar technologies, have similar access to health facilities, and maintain a certain level of sociocultural homogeneity through their identification as Karen (Keyes, 1979; Kunstadter, 1979). Despite these similarities, a preliminary investigation of growth patterns and the prevalence of common diseases indicated that Sgaw children tended to be significantly healthier than their Pwo counterparts (Omori and Greksa, 1993). A follow-up study designed to determine the causes of the health differences between these groups was therefore conducted. The present report compares morbidity and mortality patterns between Pwo and Sgaw Karen preschool children and compares measures of lifestyle, health beliefs, and health care practices between the Pwo and Sgaw which could be responsible for their different morbidity and mortality patterns.

## STUDY POPULATION

The Karen, which are the largest tribal popu-

lation in Thailand, had an estimated population of 275,615 members in 1990 (National Statistical Office of Thailand, 1990). Most Thai Karen belong either to the Sgaw or the Pwo ethnic groups. The sample for the present study resides in Mae Hong Son Province, which had an estimated Karen population of 67,967 in 1990 (National Statistical Office of Thailand, 1990). The Sgaw Karen began migrating from Myanmar to northern Thailand at the end of the 17<sup>th</sup> century, while the Pwo followed early in the 18<sup>th</sup> century (Keyes, 1979; Kunstadter, 1979, 1986; Lewis and Lewis, 1984). Despite possessing mutually unintelligible dialects, all highland Karen maintain a certain level of sociocultural homogeneity through their maintenance of identity as Karen (Keyes, 1979; Kunstadter, 1979). While Karen now live in both lowland and highland villages, this study focused on Karen residing in highland villages.

The highland Karen tend to live in geographically isolated villages at altitudes of from 600 to 2,000 meters. Their subsistence system is based primarily on swidden rice production, sometimes supplemented by wet rice production at lower elevations, opium production at higher elevations, and occasional wage labor (Keyes, 1979; Kunstadter, 1986; Lewis and Lewis, 1984). Rice, chili peppers, and salt are their primary staple foods. Meats, including both domestic animals (chicken, pork) and hunted wild animals, fish (river and pond), vegetables, and fruits are used as supplementary foods.

Until the 1960s, when a number of develop-

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ment and public health programs were initiated in the highlands, most highland Karen communities were fairly isolated from lowland Thai society. These programs, which began affecting the Karen in the highlands of Mae Hong Son Province in the 1970s, resulted in an increased access of many highlanders to markets through the construction of new roads, as well as the provision of services such as primary schools, agricultural assistance, health clinics and domestic water supplies (Kunstadter, 1986; Stern, 1979). However, these programs have had a minimal impact on the more isolated highland Karen villages in Mae Hong Son Province, including those described in the present report. For example, there are no roads leading to these villages, no permanent health clinics, and there has been little success in establishing permanent primary schools.

For reasons that are not entirely clear, modernity appears to have had a greater impact on highland Sgaw Karen than on highland Pwo Karen (Kunstadter, 1979, 1986; Keyes, 1977, 1979). One cause of the greater exposure to the outside world of the Sgaw may have been the decision of Christian missionaries to focus their activities on the highland Sgaw. The traditional Karen religion is a form of animism which focuses on ancestral and nature spirits (Keyes, 1977; Lewis and Lewis, 1984). Christianity was first introduced to the Thai Karen by Karen Christians from Myanmar over a century ago. In addition, Christian medical missionaries began working primarily among the Sgaw after World War II (Keyes, 1977; Lewis and Lewis, 1984; Stern, 1979). This differential pattern of medical missionary activity resulted in an early exposure of many Sgaw to modern health care practices and was presumably also associated with exposure to other aspects of western societies (Bellah, 1965; Lieban, 1967; Rubel, 1966; Spindler, 1977). Because the traditional animistic Karen religion requires the participation of all villagers in several important ceremonies, individuals who change their religious affiliation tend to move to a village containing individuals of the same affiliation.

## METHODS

The research design for the present study involved comparisons between Christian Sgaw Karen and more traditional animistic Pwo Karen. This research design was chosen because most Sgaw in the study area are Christians while most Pwo are traditional animists and because previous analyses (Omori and Greksa, 1993) had suggested that there

were significant differences in health status between these groups. Although not all Sgaw are Christians and not all Pwo are animists, that was the case in the present study and therefore, for the sake of simplicity, the samples are simply described by the terms Sgaw and Pwo.

The study was conducted in four highland Sgaw and four highland Pwo villages in the Mae Sariang district of Mae Hong Son Province from January through December 1991. Observations were made during each of the three major Karen seasons: post-harvest (January - March), pre-harvest (June - September), and harvest (October - early December). The Pwo villages contained 20 to 49 households and the Sgaw villages had 18 to 37 households. All of these villages were isolated, with the closest road (which was not always accessible to vehicles) being 5 to 12 hours walk through jungle and over rugged mountain terrain. Initial access to the study villages was obtained through a mobile clinic associated with the Mae Sariang Christian Hospital. This mobile clinic began providing intermittent health care in 1972 to highland Sgaw villages which are sufficiently isolated that the Thai government has not yet established a health clinic in that village or in a nearby village. The mobile clinic began providing services to isolated Pwo villages in 1981. Due to difficulty of access, the team was able to visit each village only a few times a year. Villagers were under no obligation to accept health care from the mobile clinic.

Data were collected on individuals from 77 Pwo and 71 Sgaw households in the study villages. All households with preschool ( $\leq 71$  months) children (55% of the total households among the Sgaw and 75% of the total households among the Pwo) participated in the study. Information on health and vaccination status was collected on a total of 262 (135 Pwo and 127 Sgaw) preschool children during the post-harvest survey, 275 (149 Pwo and 126 Sgaw) preschool children during the pre-harvest survey, and 268 (146 Pwo and 122 Sgaw) preschool children during the harvest survey. Health status was assessed by a registered nurse (KO) who determined if specific diseases or disease symptoms were present in each preschool child. In particular, it was determined whether subjects were exhibiting (1) diarrhea (minimum of 6 watery bowel movements for previous day); (2) symptoms of respiratory infections (*eg*, cough, fever, sore throat, runny nose and sneezing, and breath sounds by stethoscope); (3) skin diseases (*eg*, scabies, ringworms, or severe rashes); (4) chronic otitis media (ear pain and ear

discharge); (5) worms (detected by visual examination); (6) pigeon breast; (7) eye symptoms (*eg*, eye itching, eye discharge, or redness from eye infections); (8) vitamin A deficiency (Bitot's spots and keratomalacia eye lesions); (9) malaria (shaking chills, fever and severe headache) (10) toothache and tooth abscesses; and (11) anemia (pale eyelid). If a pre-school child was ill, the mother was advised on the proper treatment of her child.

Each mother was also asked about her child's current and past health status and medications her child received at home. Each child's vaccination history was determined through interviews with the mothers and through examination of the mobile clinic records.

Structured interviews with each mother were used to obtain basic demographic and economic data on her family. Data on health beliefs and practices were collected using structured interviews with both open- and closed-ended questions. The responses to these questions were validated through observations of each family and by follow-up interviews during each succeeding measurement season. All statistical analyses were performed with SPSS/PC+, version 3.0.

## RESULTS

### Characteristics of Pwo and Sgaw households

The characteristics of the sample households have been described in detail elsewhere (Omori and Greksa, 1996) and will therefore only be briefly described here. First, Sgaw families tended to be slightly larger than Pwo families (7 vs 6 family members) but these differences were not statistically significant ( $\chi^2 = 2.8$ ,  $p > 0.05$ ). Second, several measures suggested that Sgaw families had greater contact with modern society than Pwo families. For example, Sgaw families were more likely than Pwo families to use birth control ( $\chi^2 = 41.9$ ,  $p < 0.001$ ); Sgaw fathers ( $\chi^2 = 17.2$ ,  $p < 0.05$ ) and mothers ( $\chi^2 = 4.8$ ,  $p < 0.05$ ) were significantly more likely than Pwo parents to have obtained some education; and Sgaw mothers were significantly more likely than Pwo mothers to be Thai citizens ( $\chi^2 = 19.8$ ,  $p < 0.05$ ) and to own a radio ( $\chi^2 = 17.9$ ,  $p < 0.01$ ). Third, Sgaw families tended to be of superior economic status than Pwo families. For example, Sgaw families tended to own larger swidden ( $\chi^2 = 11.0$ ,  $p < 0.05$ ) and irrigated rice ( $\chi^2 = 36.6$ ,  $p < 0.001$ ) fields. In addition, Sgaw families were more likely to have obtained some income from wage labor and through selling agricultural products and handicrafts

during all three seasons, with the difference being significant for the pre-harvest ( $\chi^2 = 11.7$ ,  $p < 0.001$ ) and harvest ( $\chi^2 = 16.4$ ,  $p < 0.001$ ) seasons.

### Morbidity and mortality patterns

The point prevalences of selected diseases and disease symptoms in each season are compared between Pwo and Sgaw preschool children in Table 1. Chi-square analyses indicated that there were no significant sex differences in disease rates within each ethnic group ( $p > 0.05$ ) and therefore sexes were combined for these comparisons. The overall disease load tended to be significantly higher among Pwo than Sgaw preschool children in each season ( $p < 0.001$ ). For example, between about 1.3 and 1.8 times more Pwo than Sgaw children exhibited at least one disease symptom each season while between 2.2 and 3.2 times more Pwo than Sgaw children had two or more diseases simultaneously each season (Table 1,  $p < 0.001$ ).

The seasonal point prevalences of the specific diseases to which Karen children are exposed are also included in Table 1. The diseases with the highest point prevalences were worms, skin diseases, respiratory infections, and diarrhea. Most diseases tended to occur at higher rates in Pwo than in Sgaw preschool children, with skin disease, worms, eye disease, and severe anemia being significantly higher among Pwo preschoolers in all three seasons ( $p < 0.05$ ). In addition, the point prevalence of ear disease was significantly higher among Pwo than Sgaw preschool children in the pre-harvest and harvest seasons ( $p < 0.05$ ).

A total of 424 live births were reported in the 77 Pwo families in the study while the corresponding value for the 71 Sgaw families was 400 live births. Of these births, 78 Pwo children and 44 Sgaw children were reported to have died before reaching an age of 60 months. Thus, the Under-Five Mortality Rate [(number of deaths before 60 months/number of life births) x 1,000] was 184 per 1,000 among the Pwo and 110 per 1,000 among the Sgaw, a difference which is statistically significant ( $\chi^2 = 8.9$ ,  $p < 0.05$ ).

Although Pwo children were more likely than Sgaw children to die during the first 5 years of life, the causes of death were similar in the two groups. In particular, the reported causes of death for Pwo children under 5 years old were premature birth (25.6%), malaria (18.0%), respiratory infections (15.4%), diarrhea (14.1%), measles (5.1%) and unknown (21.8%). Among the Sgaw the reported causes of death for this age group were malaria

Table 1  
Morbidity patterns of Pwo and Sgaw preschool children.

	Post-harvest						Pre-harvest						Harvest					
	Pwo (N=135)		Sgaw (N=126)		$\chi^2$	%	Pwo (N=149)		Sgaw (N=126)		$\chi^2$	%	Pwo (N=146)		Sgaw (N=121)		$\chi^2$	%
	No.	%	No.	%			No.	%	No.	%			No.	%	No.	%		
<b>Overall morbidity rates</b>																		
1 disease/symptom	104	77.0	72	57.1	12.8 <sup>a</sup>	108	72.5	51	40.5	28.6 <sup>a</sup>	90	61.6	58	47.9	5.4 <sup>b</sup>			
2 diseases/symptoms	71	52.6	30	23.8	23.6 <sup>a</sup>	64	43.0	17	13.5	28.5 <sup>a</sup>	55	37.7	20	16.5	14.9 <sup>a</sup>			
<b>Specific diseases/symptoms</b>																		
Diarrhea	19	14.1	10	7.9	1.9	15	10.1	6	4.8	2.0	9	6.2	5	4.1	0.2			
Respiratory infection	25	18.5	22	17.5	0.0	25	16.8	15	11.9	0.9	35	24.0	22	18.2	1.0			
Skin diseases	42	31.1	13	10.3	6.8 <sup>b</sup>	38	25.5	14	11.1	4.1 <sup>b</sup>	45	30.8	20	16.5	3.7 <sup>b</sup>			
Ear diseases	6	4.4	3	2.4	0.1	11	7.4	1	0.8	4.3 <sup>b</sup>	10	6.8	2	1.7	3.6 <sup>b</sup>			
Worms	86	63.7	51	40.5	13.2 <sup>a</sup>	75	50.3	26	20.6	24.7 <sup>a</sup>	54	37.0	27	22.3	6.1 <sup>b</sup>			
Pigeon chest	6	4.4	2	1.6	1.0	7	4.7	2	1.6	1.5	5	3.4	2	1.6	0.3			
Eye diseases	12	8.9	3	2.4	4.1 <sup>b</sup>	16	10.7	4	3.2	4.7 <sup>b</sup>	9	6.2	1	0.8	3.9 <sup>b</sup>			
Vitamin A deficiency	0	0.0	0	0.0	0.0	4	2.7	0	0.0	1.8	3	2.1	0	0.0	1.0			
Malaria	0	0.0	0	0.0	0.0	0	0.0	1	0.8	0.0	0	0.0	0	0.0	0.0			
Tooth abscess	0	0.0	0	0.0	0.0	0	0.0	2	1.6	0.7	1	0.7	1	0.8	0.0			
Severe anemia	9	6.7	1	0.8	4.6 <sup>b</sup>	15	10.1	1	0.8	9.1 <sup>c</sup>	12	8.2	3	2.5	3.6 <sup>b</sup>			

Significant differences between groups: <sup>a</sup>p < 0.001, <sup>b</sup>p < 0.05, <sup>c</sup>p < 0.01

Table 2  
Tobacco and opium smoking status of Pwo and Sgaw Karen adults.

	Pwo		Sgaw		$\chi^2$
	No.	%	No.	%	
Mother smoke?					
Yes	52	67.5	17	23.9	
No	25	32.5	54	76.1	26.5 <sup>a</sup>
No. of times mothers smoke per day					
0	25	32.5	54	76.1	
4-7	39	50.6	17	23.9	
8-15	13	16.9	0	0.0	35.7 <sup>a</sup>
Other adult smokers					
0-1	54	70.1	48	67.6	
2-5	23	29.9	23	32.4	0.1
No. of times other adults smoke per day					
0	6	7.8	7	9.9	
2-7	42	54.5	57	80.3	
8-15	29	37.7	7	9.9	37.7 <sup>a</sup>
Husband smoke opium?					
Yes	12	15.6	0	0.0	
No	65	84.4	71	100.0	10.0 <sup>b</sup>
No. of times opium is smoked per day					
0	65	84.4	71	100.0	
1-3	12	15.6	0	0.0	10.0 <sup>b</sup>

<sup>a</sup>Significant difference between groups,  $p < 0.001$ .

<sup>b</sup>Significant difference between groups,  $p < 0.01$ .

(22.7%), premature birth (20.5%), respiratory infections (20.5%), diarrhea (13.6%), measles (13.6%), and unknown (9.1%).

#### Risk factors and utilization of modern health care

Disease risk factors in the lifestyles of the Pwo and Sgaw Karen are described in this section, beginning with the smoking of tobacco, which increases the risk for respiratory disease (UNICEF, 1988). Most Karen who smoke tobacco use a homemade pipe. Pwo mothers were significantly more likely to smoke than Sgaw mothers (Table 2,  $p < 0.001$ ). In particular, approximately 68% of Pwo but only 24% of Sgaw mothers smoked every day. Smoking frequency among smoking mothers ranged from 4 to 15 times per day, with a median of 6 smokes per day for Pwo mothers and 5 smokes per day for Sgaw mothers. On the other hand, when considering house-

Table 3  
Tobacco and opium smoking status of Pwo and Sgaw Karen children.

	Pwo		Sgaw		$\chi^2$
	No.	%	No.	%	
No. of preschool smokers					
0	64	83.1	71	100.0	
1-2	13	16.9	0	0.0	13.1 <sup>a</sup>
No. of times pre-schoolers smoke/day					
0	64	83.1	71	100.0	
1-5	13	16.9	0	0.0	13.1 <sup>a</sup>
Number of older child smokers					
0	47	61.0	70	98.6	
1-4	30	39.0	1	1.4	31.6 <sup>b</sup>
No. of times older children smoke/day					
0	47	61.0	70	98.6	
2-4	18	23.4	1	1.4	
5-7	12	15.6	0	0.0	32.1 <sup>b</sup>

<sup>a</sup>Significant difference between groups,  $p < 0.01$ .

<sup>b</sup>Significant difference between groups,  $p < 0.001$ .

hold adults other than mothers (96% of whom are males), there were no significant differences between groups in the number of adult smokers (Table 2,  $p > 0.05$ ), although other adults in Pwo households tended to smoke significantly more often than those in Sgaw households ( $p < 0.001$ ). In addition, there was also a significantly higher rate of opium smoking by adult males in Pwo than in Sgaw households, with 16% of the Pwo husbands, but none of the Sgaw husbands, smoking opium (Table 2,  $p < 0.01$ ).

With respect to children, some Pwo children begin smoking tobacco as early as 4 years of age. As a result, significantly more Pwo than Sgaw preschool children were observed smoking (Table 3,  $p < 0.01$ ). In particular, approximately 17% of Pwo preschool children, but no Sgaw preschool children, smoked tobacco every day. There were relatively few child smokers in the Pwo households but there is some suggestion of a sex bias. In particular, of the 13 Pwo children who smoked, about twice as many were males ( $N = 9$ ) as were females ( $N = 4$ ). Smoking frequency for these Pwo preschool children ranged from 1 to 5 times per day, with a median number of twice per day. Pwo children are even more likely to begin smoking as they mature and,

as a result, the difference between Pwo and Sgaw children in the frequency of smokers tends to increase with age. For example, approximately 40% of older (6 - 17 years) Pwo children but only one older Sgaw child smoked every day.

The frequency with which mothers bathe their children and wash their children's clothes influences the prevalence of skin disease, especially fungus infection (King *et al*, 1978). Only 1% of Pwo mothers, as opposed to 44% of Sgaw mothers, reported bathing their children daily. In addition, 92% of all Pwo mothers normally used only water for a child's bath while 21% of Sgaw mothers regularly used soap and another 39% of Sgaw mothers sometimes used soap. Also, only 31% of the Pwo mothers washed their children's clothes at least once a week while 93% of the Sgaw mothers washed their children's clothes several times a week.

Sanitary facilities and water sources influence exposure to water- and fly-borne pathogens and are thus related to the prevalence of diarrhea (Black, 1984; Hollister *et al*, 1955; Rajasekaran *et al*, 1977). Nearly half of the Sgaw households (47%), but no Pwo households, used pit latrines with covers. Other households used the fields (under a bush) for elimination. The primary reasons given by those not using pit latrines was that they were smelly and uncomfortable. In addition, some Pwo Karen (24.7%) reported that they feared the influence of the spirit world. The idea of a deep, dark hole or small enclosed place was frightening to those Karen who consider such a place to be the realm of the spirits.

The Pwo and Sgaw also exhibit different patterns of tending their pigs which has implications for the spread of water-borne pathogens. In particular, pigs are used as scavengers of human waste in Pwo villages and thus have free run of the village, including access to both water supplies and latrines. In Sgaw villages, on the other hand, pigs are penned or tethered under or near the house. They thus come into contact with humans but they do not have access to either water supplies or latrines.

There were no significant differences in water sources between the Pwo and the Sgaw ( $p > 0.05$ ). Approximately 32% of Pwo households and 25% of Sgaw households lived in villages with water pipes (3 to 5 per village). The village water pipes flowed from a reservoir in the mountain hills which is fed by mountain streams and was built by the government in 1988. Other households usually got their water directly from mountain streams. Both Pwo and Sgaw households carried the water to their

homes. The distance of the water supply (one way in minutes) ranged from 5 to 12 minutes among both groups. Significantly more Sgaw (54.9%) than Pwo (0 %) families generally used boiled water for drinking and covered their drinking water reservoirs ( $p < 0.05$ ).

Finally, the frequency with which Pwo and Sgaw mothers utilized western medical care differed substantially between groups. In particular, clinic attendance was significantly higher among Sgaw than Pwo preschool children for all seasons (Table 4,  $p < 0.01$ ). There were also significant differences between groups in the rates of acceptance of vaccinations for preschool children, with significantly more Sgaw children having received a complete series of vaccinations in all three seasons ( $p < 0.001$ ). In addition, Sgaw mothers were more likely to have some idea of the purpose of a vaccination. All Sgaw mothers, but only 32 (41.6%) Pwo mothers, stated that vaccinations were good for children because they prevent childhood diseases. On the other hand, none of these mothers knew the exact names of all of the childhood diseases the vaccinations prevented. Only six (8.5%) of the Sgaw mothers knew the names of one or two of the six childhood diseases (diphtheria, pertussis, tetanus, polio, BCG, and measles) for which their children were being vaccinated.

When asked why they had their children vaccinated, seven (9.1%) Pwo mothers responded that a weak child or a child with impure blood will improve her blood and thus will be healthier. Eight (10.4%) Pwo mothers made statements such as "I don't know, but other villagers said it is good for children and I should do it, so I just follow other mothers" or "My child got it once; I do not know what kind of benefits it has, but people tell us that it is something good, so I just follow them; but once is enough for my child because after the injection my child had fever and pain. He cried a lot and could not sleep that night—I do not like that." For reasons such as this, many Pwo mothers only had their children vaccinated once, rather than completing the vaccination cycle (Table 4).

Thirty (39%) Pwo mothers had never had their children vaccinated. Sixteen of these mothers responded they did not like vaccinations because their child was still small and crying a lot and a vaccination was something painful. Nine mothers felt the vaccination might be so emotionally stressful that it would result in *kala ha* (see below), which would in turn result in sickness. Five Pwo mothers had no specific reason for not vaccinating their children.

Table 4  
Clinic attendance and vaccination acceptance rates among Karen preschoolers.

	Post-harvest						Pre-harvest						Harvest					
	Pwo		Sgaw		$\chi^2$		Pwo		Sgaw		$\chi^2$		Pwo		Sgaw		$\chi^2$	
	No.	%	No.	%			No.	%	No.	%			No.	%	No.	%		
Used mobile clinic?	75	55.6	125	99.2	66.9 <sup>a</sup>		95	63.8	126	100.0	54.5 <sup>a</sup>		103	70.5	121	100.0	40.3 <sup>a</sup>	
Vaccinations																		
DPT: None	61	45.2	3	2.4			59	39.6	1	0.8			51	34.9	1	0.8		
Incomplete	63	46.7	49	38.9			78	52.3	51	40.5			83	56.8	43	35.5		
Complete	11	8.1	74	58.7	102.0 <sup>a</sup>		12	8.1	74	58.7	104.2 <sup>a</sup>		12	8.2	77	63.6	104.7 <sup>a</sup>	
Polio: None	61	45.2	3	2.4			59	39.6	1	0.8			51	34.9	1	0.8		
Incomplete	63	46.7	48	38.1			78	52.3	50	39.7			83	56.8	43	35.5		
Complete	11	8.1	75	59.5	102.2 <sup>a</sup>		12	8.1	75	59.5	104.3 <sup>a</sup>		12	8.2	77	63.6	104.7 <sup>a</sup>	
BCG	55	40.7	123	97.6	94.6 <sup>a</sup>		81	54.4	123	97.6	64.5 <sup>a</sup>		84	57.5	121	100.0	64.6 <sup>a</sup>	
Measles	41	30.4	94	74.6	49.3 <sup>a</sup>		47	31.5	105	83.3	72.1 <sup>a</sup>		50	34.2	104	86.0	70.3 <sup>a</sup>	

Significant differences between groups. <sup>a</sup>p < 0.001

### Key components of traditional Karen health belief systems

The health care practices of the traditional Pwo Karen in the present study can only be understood in the context of the operation of three related but essentially separate components of their health ideology. The first of these systems, and the one which is reported to be the primary determinant of well-being, involves interrelationships between nature spirits and *kala*, or souls, which are believed to reside within each person's body. A second system influencing health involves ancestor spirits while the final is a modified version of the hot/cold humoral model of health.

Beginning with the first system, traditional Karen believe that all components of nature possess spiritual forces which influence village life, including health and illness patterns. Although located in separate components of nature (eg, rocks, trees, streams), these spirits are believed to be part of a larger whole and are referred to as a group as the Lord of Land and Water. Nature spirits influence health through their interactions with *kala*. The Karen in the present study believed there were 33 or more *kala* which reside in each human's body, with six residing in the head, two residing in the ears and nose, two residing in the eyes, and the remainder residing in unknown locations.

Traditional Karen believe that under certain circumstances a *kala* can leave the human body (*kala ha*) and when this occurs, the person becomes sick or dies. *Kala ha* can occur either by a *kala* being 'stolen' by an angered nature spirit or it may leave on its own accord as a result of exposure to a very strong stimulation (such as a vaccination for a child). The health care practices of traditional Karen revolve primarily around the belief that good health requires the maintenance of all *kala* within the body and that the restoration of health requires performing a ceremony in order to entice the escaped *kala* to return to the body (*kwae kala*). The specific ceremony utilized depends on which *kala* has left the body. Since this is not always clear, it is assumed that any ceremony which did not result in a cure must have been directed towards the wrong *kala*, making another ceremony necessary.

As one example, if a family member gets ill after returning from the field, it may be assumed that the illness was caused by an angry spirit of the field (such as the biggest tree, the biggest rock, or a rapid stream). The patient's family immediately asks the village's religious leader, or spirit doctor, to determine the specific cause of the sickness. The

village spirit doctor chants a spell, uses divination with chicken bones or feathers, or counts rice grains in order to identify which spirit (soul-calling ceremony) is displeased. He then orders the family to sacrifice a certain type and number of animals. The family builds a miniature house in the jungle, kills the animal in front of this house and pours blood from the animal over the house. Rice, meat from the sacrifice, and a small cup of rice liquid are then placed inside the house and the family then prays to the nature spirit. The family returns home after finishing this ceremony and then often also holds a *keaju* ceremony, where white cotton string is tied around the patient's wrists, neck or another part of the body. Traditional Karen believe that any lost *kala* will return to the patient's body as a result of these ceremonies and will never again leave the body, thus also providing protection from future illness. If the patient does not get well, they continue sacrificing to the angry spirit until the patient either becomes better or dies.

Infants and small children are believed to be especially susceptible to the loss of *kala*. In fact, almost all (92.2%) of the more traditional Pwo (but none of the less traditional Sgaw) mothers reported a strong belief that *kala* occasionally leave a child's body. It is therefore not surprising that there are ceremonies which are specifically directed towards protecting young children from the loss of *kala*. For example, the placenta and the umbilical cord of a newborn are wrapped in a cloth or big leaf and put in a bamboo tube. The baby's father usually takes the bundle outside the village and hangs it in a tree. Traditional Karen believe that if one of the infant's *kala* leaves its body, it will return to the tree where the umbilical cord and placenta were placed. If the infant becomes sick within a few months after birth, the baby's parents must return to this tree and perform a ritual to restore the *kala* to the body. If the baby still does not recover, the parents look for a crossroads near the tree and perform a ritual at this location. Karen questioned on the subject could not explain the significance of performing the ritual at a crossroads, simply referring to it as the traditional site. In addition, when the baby's navel has healed (4 to 6 days after birth), traditional Karen parents tie the infant's wrist with white cotton strings (*keaju* ceremony) and hang small stones around the baby's neck to keep the baby's *kala* inside the body. This ceremony is believed to protect the infant from illness, as well as foster healthy growth. All of the more traditional Pwo Karen in the sample performed these rituals. Although the more modernized Sgaw Karen claimed not to as-



cribe to the same beliefs, over half (54%) of the Sgaw parents in the present study reported burying the placenta of a newborn while the remainder (46%) hung it in a tree near the village.

All of the Pwo mothers and many of the Sgaw mothers (46.5%) reported making a sacrifice to appease a nature spirit when someone was sick. However, all the Pwo in the study group had made such a sacrifice within the last 2 years while the most recent sacrifice of this type by a Sgaw family had occurred at least 2 years before the present study (median length of time since a ceremony = 6 years; range: 2 - 24 years). Only two of these Sgaw families had made a sacrifice after they converted to Christianity; the remaining 31 had made it when they were still animists. The most recent sacrifices had been held for children (68.8% of the Pwo and 42.4% of the Sgaw). Seventy-three (94.8%) Pwo and 26 (36.6%) Sgaw noted that the person was healed as a result of the sacrifice.

The second system which traditional Karen believe influences health involves ancestor spirits. Illnesses are sometimes believed to be caused by an angered ancestral spirit, in which case a ceremony designed to appease the angry ancestor spirit is held. However, the primary role of ancestor spirits is in influencing the future well-being (including but not restricted to health) of a kin group as a whole, rather than the health of specific individuals. In order to ensure the continued good will of ancestor spirits, a ceremony dedicated to the worship of ancestors is held at least once every year. A family member must attend this annual ceremony in order to be recognized by others as a kin.

The final system which is believed to influence health by the more traditional Pwo Karen (and, as demonstrated later for specific diseases, which is also accepted to some extent by the less traditional Sgaw Karen) is a version of the hot/cold humoral model of health and illness. As is typically the case, traditional Karen believe that some parts of the body normally vary in temperature. In particular, internal organs (eg, heart, stomach, blood, bladder and liver) are viewed as being warmer than external regions of the body (eg, mouth, eyes, nose, skin) and good health requires the maintenance of a balance in the temperature of these two contrasting regions.

In general, the internal organs are viewed by traditional Karen as being much more important than the body exterior in determining health. The informants did not name any condition which was caused

by either an increase or decrease in the temperature of the body exterior. Rather, the exterior of the body is viewed as a constant against which the internal organs must be balanced. Either an increase or a decrease in the temperature of internal organs can result in a temperature imbalance. Such an imbalance is believed to occasionally result in a specific illness. For example, a cooling of the intestines, stomach and blood are believed to be possible causes, respectively, of diarrhea, vomiting, and malaria. However, the primary impact of a temperature imbalance is to make an individual more susceptible to a successful theft of *kala* by an angry nature spirit.

There are two primary causes of temperature imbalance. The first involves foods, which are classified as hot (eg, chilis), cold (juicy fruits, green vegetables), or neutral (rice) in temperature. Hot and cold foods must be consumed in appropriate proportions in order to maintain the temperature balance of the body. Thus, an overconsumption of either hot or cold foods is believed to be one cause of temperature imbalance. The second potential cause of a temperature imbalance is exposure of the body to substantial changes in temperature, such as taking a cold bath immediately after working all day in the hot sun. Probably because the greatest risk from a temperature imbalance is a loss of *kala*, the primary response to a perceived temperature imbalance is moderation. For example, if the cause of an illness is thought to be the overconsumption of cold foods, the solution is to consume only neutral foods, particularly rice, rather than hot foods.

#### Specific health beliefs and practices

Given the previous general discussion of traditional Karen health beliefs and practices, it is now possible to compare the beliefs and practices of the more traditional Pwo with those of the less traditional Sgaw Karen with respect to several common diseases and disease symptoms of preschool children. There were no sex differences in the treatment of any of these diseases or symptoms and therefore sexes were combined for all analyses.

**Diarrhea:** In general, Pwo and Sgaw Karen mothers held similar beliefs about the causes of diarrhea and its proper treatment, although there were some important differences, as indicated below. Most Sgaw (81.7%) and Pwo (72.7%) mothers believed that diarrhea was caused by an excessive cooling of internal organs as a result of an overconsumption of cold foods. Some Sgaw (10.9%) and Pwo mothers (10.4%) even felt that if a mother ate too many cold

foods this could cause diarrhea in an infant who consumed her breast milk. A few Pwo (6.9%) and Sgaw (4.4%) mothers believed that diarrhea could occur if the mother's breast milk was too hot (eg, if the mother worked outside and breastfed her child while her own body was still hot, her breast milk would also be hot). A few Pwo (5.4%) and Sgaw (4.4%) mothers believed that diarrhea is caused by cold air or by changing weather and temperature patterns. Others (6.9% of Pwo and 2.9% of Sgaw) believed diarrhea is caused by worms stimulating a child's guts. Finally a few Pwo mothers (3.8%) stated that displeased nature spirits sometimes attack a child, causing diarrhea.

Most Pwo mothers chose ritual (49.4%) or herbs (45.5%) as the first treatment for children with diarrhea while most Sgaw mothers chose herbs (60.6%) or western medicines (33.8%). Both Pwo and Sgaw mothers generally gave only boiled soft rice with salt and boiled water when a child had diarrhea in the belief that the child's stomach could only tolerate neutral foods. Both Pwo and Sgaw mothers usually stopped giving cold foods, chili (which mothers tended to view as being difficult for children, particularly sick children, to digest), cold water, hard foods (*ie*, gourd or meat), and lard when a child was sick with diarrhea because they believed these foods would harm the stomach and ultimately result in a worsening of the diarrhea. Also, approximately 70% of Sgaw mothers but only 20% of Pwo mothers felt that boiled water with salt should be given to children to ensure that they do not become dehydrated.

**Vomiting:** Twenty-four (33.8%) of the Sgaw mothers and 33 (42.9%) of the Pwo mothers believed that vomiting was caused by stimulation of the abdomen due to movement of worms in the guts. The fact that they sometimes saw worms when their children vomited was cited as evidence for this belief. In addition, about half of the mothers in both ethnic groups mentioned that when their children ate stale or rotten foods, the child's stomach later became upset and she started to vomit. Six Sgaw mothers (9.2%), but none of the Pwo mothers, also mentioned that when a child is not healthy or not happy, she may vomit while three Pwo mothers (4.1%), but no Sgaw mothers, felt that angry spirits may attack a child and cause vomiting.

Mothers in both Karen ethnic groups usually stop feeding many foods (except mother's milk), especially cold foods, strong smelling meats (*ie*, rat, pork, buffalo), fishy smelling foods (*ie*, fish paste,

shrimp paste, salty dry fish), sweets, yam, chili, and lard when a child has vomited because these foods are believed to induce more nausea and vomiting. After a while, most mothers (87.0% of the Pwo and 94.4% of the Sgaw) fed small amounts of boiled soft mashed rice with salt and water to their sick children. Also, approximately 70% of Sgaw mothers, but only 20% of Pwo mothers, felt that boiled clean water with salt should be given in order to ensure that the child does not become dehydrated.

**Malaria:** Malaria is one of the most common and most serious diseases among the Karen. Many villagers have suffered from malaria and most people expressed fear that they would get it again. (The prevalences of malaria in Table 1 are low because only active cases were assessed.) Pwo and Sgaw mothers held different and somewhat inconsistent beliefs about the causes of malaria but they utilized similar treatments for it.

On the one hand, most Sgaw mothers (90.1%) and a few Pwo mothers (10.4%) felt that malaria is caused by mosquitos, although they did not understand the process. Sgaw mothers said "when we sleep in the hill farm or jungle without a mosquito net, we get malaria later" or "a poison mosquito bit us and we got malaria later." On the other hand, most Pwo mothers (77.9%) believed that angry jungle spirits attack a person and give them malaria. In support of this belief, they often noted that a person who develops malaria has usually just returned from the jungle. In addition, some Pwo (9.0%) and Sgaw (7.0%) mothers responded that an imbalance of body temperature caused by a sudden cooling of the body may cause malaria.

Most (89.6%) Pwo mothers chose a ritual as the first treatment for a child with malaria while most (80.3%) Sgaw mothers usually took the child to the nearest clinic. Both Pwo and Sgaw mothers felt that children with fever should be clothed and their bodies covered with blankets, even if the outside temperature was hot. Children sometimes became semi-dehydrated under these circumstances. Even though Sgaw mothers were careful to give a lot of water to children who had been vomiting, they did not do the same for children with malaria. The reason given by mothers was that the child's fever, a condition which caused great concern for all mothers, would be worsened if the child drank cold water, possibly resulting in death. In addition, children with malaria are only allowed to eat neutral foods, usually boiled soft rice with salt and boiled water. Also, all Pwo and most Sgaw (88.7%)

mothers normally restricted the consumption of cold foods, strong smelling meat, or cold water when a child had malaria. Although temperature imbalance was not believed to be the primary cause of malaria by these mothers, they nevertheless believed that the body of a child with malaria cannot adjust to these foods.

**Poor growth and weight loss:** The Karen believe that either a loss of body weight or a smaller than normal body size, if they occur in conjunction with other symptoms, particularly diarrhea and fever, are a symptom of poor health. Such children are described as being 'skinny' or 'tiny'. On the other hand, most Pwo (92.2%) and nearly half (45.1%) of Sgaw mothers reported that poor growth or small body size in the absence of additional symptoms are not particularly harmful. Over 90% of Karen mothers of both groups believed that the youngest child is the most susceptible to poor growth.

Most Sgaw mothers (91.5%) believed that poor growth and weight loss were caused by an inadequate consumption of food and believed that poorly growing children should be fed additional meat, eggs, and fish and less of foods which contain chilis. On the other hand, most Pwo mothers (88.3%) felt children grew poorly or lost weight because they had green stools (*khla*). All Pwo mothers expressed a fear of *khla*, which is believed to result in a loss of appetite, a bloated abdomen and enlarged head, and ultimately in a cessation of growth. Pwo mothers believe that one cause of *khla* is the consumption of certain raw foods (green vegetables, eggs, roasted meat, fish). Therefore, if a child has *khla* these foods are not fed to the child until the child is healthy or begins gaining weight. Instead, the mother will experiment with different foods until she finds one which the child will eat. The mother will first boil these foods before giving them to the child and will then use the boiled water to wash the child's body in order to purify her. If the child still does not improve, Pwo mothers have the village spirit doctor chant spells, give charmed water to the child, and apply stone pressure to the child's abdomen. Finally, a few Pwo (6.5%) and Sgaw (5.6%) mothers believed that poor growth and weight loss were caused by worms in a child's abdomen. Worms, they believed, consumed the nutritious food which a child eats, leaving only food that is not beneficial for the child's body.

Force-feeding of young children was never observed among either Karen ethnic group, even when the child was losing weight as a result of an

illness. Infants were fed when they wanted to eat or when the family ate. Most Pwo and Sgaw mothers served the child rice on a plate which was placed on the floor. Once the food was given to the child, most Pwo mothers generally did not pay much attention to her, unless the child demanded more food, in which case it was given to her. Most Pwo mothers reported that if the child did not demand more food or left food on the plate, she usually interpreted this as meaning that the child was full. On the other hand, over half (56.3%) of the Sgaw mothers encouraged a child to eat or supervised a child to ensure she ate her food.

Finally, most Pwo mothers believed that the maintenance of good health in their younger children required prescribing certain foods. In particular, most Pwo mothers (88.3%) believed that children should not eat green vegetables, some meats (eel, tortoise, boar, bear), eggs, or fish until they were at least one year of age and, in fact, many (88%) did not provide such foods until their child reached two years of age.

## DISCUSSION

A preliminary investigation of preschool highland Pwo and Sgaw Karen children residing in northwest Thailand suggested that Sgaw children tend to be healthier than their Pwo counterparts (Omori and Greksa, 1993). A comparison of morbidity and mortality patterns between the Pwo and Sgaw in the present study confirmed the results of the preliminary study, as described below.

Both Pwo and Sgaw children exhibited high levels of morbidity, with 40 - 77% of the children in both groups exhibiting at least one disease symptom over the three seasons of the study (Table 1). The prevalences of worms, skin diseases, respiratory infections, and diarrhea were particularly high in both ethnic groups (Table 1). Kunstadter (1986) has also reported high levels of morbidity for highlanders residing in northwest Thailand. Although morbidity levels were high in both Pwo and Sgaw children, Sgaw children tended to be healthier than Pwo children. For example, Pwo children were 1.3 to 1.8 times more likely than Sgaw children to exhibit at least one disease symptom during the three seasons of the study (Table 1). The Pwo tended to have a higher prevalence for all of the diseases and symptoms which were investigated, with the frequency of skin diseases, worms, eye diseases, and anemia tending to be significantly more prevalent

among the Pwo than the Sgaw ( $p < 0.05$ ).

Given their higher levels of morbidity, it is not surprising that the Under-Five Mortality Rate was about 1.7 times higher in the Pwo than in the Sgaw (184 per 1,000 vs 110 per 1,000), a difference which is statistically significant ( $\chi^2 = 8.9$ ,  $p < 0.05$ ). Expressed differently, the Pwo fall into UNICEF's 'Very High Under-Five Mortality Rate' category while the Sgaw fall into the 'High Under-Five Mortality Rate' category (UNICEF, 1993). In other words, although the Pwo have higher mortality rates than the Sgaw, both ethnic groups experience high levels of childhood mortality. Kunstadter (1986) also found significantly higher mortality rates among the Pwo than the Sgaw.

Morbidity and mortality patterns are influenced by a variety of ecological, biological and socio-economic factors (Armelagos, Armelagos *et al*, 1978; McElroy and Townsend, 1985; Moore *et al*, 1980). The Pwo and Sgaw in the present study both lived in geographically isolated highland villages within the same ecosystem, utilized similar technologies, had similar access to health facilities and maintained a certain level of sociocultural homogeneity through their identification as Karen (Keyes, 1979; Kunstadter, 1979), suggesting that the differences in morbidity and mortality patterns described above are not due to gross ecological, sociocultural or technological factors. We will argue that these differences are most likely associated with differences between the Pwo and Sgaw in economic status and modernity.

Although all of the Pwo and Sgaw living in isolated highland villages in northwest Thailand tend to be poor and to have limited contact with modern societies, the Pwo are consistently described in the literature as being poorer and more isolated from Thai society than the Sgaw (Keyes, 1977, 1979; Kunstadter, 1979, 1986; Stern, 1979) and the same is true for the villages in the present study. For example, the Sgaw families in the present study tended to own significantly more agricultural land and to have greater incomes than the Pwo (Omori and Greksa, 1996). The Sgaw are also more likely to use birth control, to have obtained some education, to be Thai citizens, to own a radio and to utilize pit latrines, indicating greater modernity (Omori and Greksa, 1996).

Socioeconomic status and modernity have both been demonstrated to influence morbidity and mortality patterns in previous studies of modernizing societies (Cohen, 1989; Gage *et al*, 1989; Hull, 1979; Simonelli, 1987). In addition, both economic status

and modernity were previously demonstrated to be important co-determinants of the superior nutritional status of the Sgaw relative to the Pwo (Omori and Greksa, 1996). For these reasons, it seems likely that economic status and modernity are also likely to be important co-determinants of the superior health and lower mortality levels of the Sgaw compared to the Pwo in the present study. Although economic status and modernity may each independently affect the morbidity and mortality patterns of the Pwo and the Sgaw, such independent effects are difficult to evaluate since, not surprisingly, they are related. For example, the greater income of the Sgaw is related to their decision to perform wage labor in nearby towns and to sell agricultural products and handicrafts in these towns to a much greater extent than the Pwo (Omori and Greksa, 1996).

The historical patterns which have resulted in a higher socioeconomic status and greater modernity in the Sgaw compared to the Pwo are not at all clear but it seems likely that one historical pattern which may have played an important role in this was the decision by Christian missionaries to focus their activities on the Sgaw. In particular, Christian medical missionaries began providing health care to the Sgaw following World War II (Keyes, 1977; Kunstadter, 1967; Lewis and Lewis, 1984; Stern, 1979) while most Pwo villages did not begin receiving similar assistance until the 1960s. This longer period of exposure to western medicine was certainly associated with modifications in the health beliefs and behaviors of the Sgaw, as evidenced by the tendency of the Sgaw in the present study to accept fewer of the tenets of the traditional Karen medical belief system and to be more willing to utilize western medicine. The Pwo in the present study, on the other hand, continue to accept the traditional Karen medical belief system, a system whose components as reported by the Pwo in the present study are generally similar to those reported by others (Iijima, 1979; Keyes, 1977; Kunstadter, 1972; Larchrojna, 1983; Lewis and Lewis, 1984). The intensive contact of the Sgaw with medical missionaries was also presumably associated with exposure to other aspects of modern societies (Bellah, 1965; Levy, 1972; Lieban, 1967; Rubel, 1966; Spindler, 1977.)

The superior nutritional status of the Sgaw was probably primarily due to their superior economic status but it also involved changes in beliefs and behaviors relating to food as a result of their greater modernity (Omori and Greksa, 1996). For example, one reason for the lower protein intake of the Pwo

was an unwillingness to consume animals so that they would be available for ritual sacrifices. The Sgaw, on the other hand, either consumed their animals or sold them in local markets, often using the proceeds to purchase rice and other foods to supplement their diet. As another example, Pwo children and mothers had significantly less diverse diets than their Sgaw counterparts, resulting in a significantly lower intake of protein and seven essential nutrients. An important determinant of the lower diversity of the Pwo diet was that Pwo mothers were less willing than Sgaw mothers to gather available wild fruits and vegetables as dietary supplements, due to their fear of disturbing a nature spirit.

As indicated earlier, the Sgaw in the present study, unlike the Pwo, no longer accept many of the tenets of the traditional Karen health belief system. It is difficult to quantitatively evaluate the extent to which their different health beliefs are implicated in the higher morbidity and mortality levels of Pwo preschool children but it seems likely that they may have played a role. The clearest example of the effect of their differing health beliefs on the health of their children involves the greater willingness of Sgaw mothers to vaccinate their children and, in particular, to complete the vaccination series (Table 4). Sgaw mothers, presumably as a result of their longer period of exposure to western medicine, expressed less fear of this procedure and, in addition, believed that it was good for their child. Pwo mothers, on the other hand, were less familiar with the benefits of vaccinations and, in fact, often expressed the fear that such a traumatic event might result in the loss of *kala*, which would place the child at risk of illness and even death. As a result, even when Pwo mothers began a vaccination series, they often did not complete it if their child cried after the first vaccination.

Although the effect on the morbidity and mortality patterns of the Pwo and Sgaw of their differing health beliefs are difficult to test quantitatively, it was possible to determine if the differences between groups in the prevalence of specific diseases could be related to differences between groups in behaviors known to influence the risk of that disease. Surprisingly, although differences between groups in disease risk factors were detected, they were not always associated with expected differences in morbidity. In particular, the Sgaw pattern of bathing their children and washing their children's clothes more frequently than the Pwo was associated, as expected (King *et al*, 1978), with significantly lower levels of skin disease (Table 1,

$p < 0.05$ ). However, although Pwo children were more likely to exhibit symptoms of respiratory disease and diarrhea than Sgaw children, the differences between groups were not statistically significant, despite the existence of behaviors among the Pwo which would be expected to significantly increase the prevalence of both respiratory disease and diarrhea, as described below.

With respect to respiratory disease, many Pwo children begin smoking at an early age (with 40% of all children 6 years and older smoking to some extent) and the majority of adults in their households also smoke (Tables 2 and 3). Thus given the well-established effect of both direct and secondary smoke on respiratory disease (Cohen, 1981; Masironi and Rothwell, 1988; Norman-Taylor and Dickinson, 1979), the fact that the frequency of respiratory disease is not significantly greater among the Pwo than the Sgaw is somewhat surprising. One possible explanation is that the effects of cigarette smoking do not become evident until after early childhood. Another possibility is that exposure to other sources of smoke, particularly from cooking, may be similar in the two groups and may have a greater impact on respiratory disease than cigarette smoke (Ellegard, 1996; Larson, 1994; Qureshi, 1994). Unfortunately, the data on particulate levels within the household from cooking smoke and the morbidity of older children and adults which would be needed to evaluate these possibilities are not available.

Pwo and Sgaw children both live in largely unsanitary environments, or environments which are conducive to diarrhea. However, since significantly more Sgaw than Pwo use pit latrines and since the Pwo pattern of pig herding results in greater contact of their pigs with both latrines and water supplies, the lack of a significant difference between groups in the frequency of diarrhea is unexpected. Presumably the overall level of contact with pathogens is, contrary to our findings, similar in the two groups. The lack of such associations emphasizes the difficulties associated with attempting to detect the specific patterns of behavior which influence morbidity.

In conclusion, the highland Karen have become increasingly less isolated from lowland Thai society over the last several decades as a result of rapid population growth, migration into the lowlands from the highlands, and the initiation of a variety of governmental and non-governmental programs (Kunstadter, 1986; Lewis and Lewis, 1984). We have argued that the lower morbidity and mortality levels of the Sgaw than the Pwo in the present

study are associated with their being affected to a greater extent by this process, which has been associated with changes in their health beliefs and behaviors, and particularly in a greater willingness to utilize western health care. If this hypothesis is correct, it follows that as the Pwo undergo greater exposure to modern societies, their health beliefs and behaviors will undergo similar changes to those which have already occurred among the Sgaw. The impact of exposure to western medicine on health behaviors could even be seen during the course of the present study, since clinic attendance among the Pwo increased from 56% to 71% during the course of the study (Table 4). Assuming such changes in health beliefs and behaviors continue, the morbidity and mortality levels of the Pwo should decrease in the future to at least the level currently found among the Sgaw.

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