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ACCULTURATION AND SYMPTOMS: A COMPARATIVE STUDY OF REPORTED HEALTH SYMPTOMS IN THREE SAMOAN COMMUNITIES

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Abstract—A health questionnaire, which included a 91 item list of symptoms was administered to three groups of young Samoan adults. These young adults resided in a traditional Samoan village in Western Samoa ($n = 50$), several villages in modernizing American Samoa ($n = 50$) and in urban Honolulu, Hawaii ($n = 52$). Each yes response to a symptom was followed by an expanded interview providing details. The yes answer frequency and the contents of the expanded answers were examined with respect to site of residence. Western Samoan responses differed from the other sites in a number of areas suggesting possible differences related to the process of modernization. These response differences suggest four areas in which the stressors of modernization may have health influences: (1) wage employment outside of the family, (2) increased size of support networks by including non-family members and non-Samoans (3) the greater availability of alcohol, and (4) changes in the perceptions of food.

Key words—acculturation, stress, Samoans

Modernization, with its accompanying changes in life style and stresses of daily living, often results in an 'epidemiological transition' of morbidity and mortality patterns [1, 2]. In a very short period of time, even within a single generation, illnesses of modernization come to rival infectious diseases as primary health concerns. Rapid increases in major health problems such as diabetes [3], cardiovascular disease, high blood pressure [4, 5], minor health problems such as allergy, dental caries, backache [1] and psychosocial problems, including alcohol abuse, drug abuse and suicide [6–9] have been documented in populations undergoing change. While epidemiologists and biologists have tried to identify pertinent biological factors, social scientists have focused upon the changing psychosocial environment. They have usually employed a Selye-derived model in which environmental change precipitates adaptation and maladaptation. According to this model, changes in the psychosocial environment become stressful and lead to a greater morbidity through increased individual adaptive demands. These demands tax the adaptive capacity and lead to increased susceptibility to illness [10, 12]. Identification of the specific psychosocial stressors is difficult because they interact with other variables such as coping mechanisms, buffers, social supports, individual personality characteristics and perceptions which modify their expression [11, 13]. Because of the nature of these confounding variables and the complexity of links, the relationship between stressors and outcome often remains unclear.

Prospective studies to clarify psychosocial relations are difficult in humans, so investigators often take advantage of 'natural experiments' [12] to unravel their complex interactions. These experiments incorporate human populations which have been divided by *in situ* acculturation or by migration, thus permitting contrasts between those who modernize and the 'traditional', who are less modernized. This has provided a useful tool for investigators such as Scotch [14] and Henry and Cassel [15] who demonstrated the potential importance of psychosocial stressors in the regulation of blood pressure, which is a major risk factor for heart disease. They reported that an urban migration or a change in life style by rural peoples is related to subsequent elevations in blood pressure. Later work has verified these observations but has usually employed 'modernization', 'westernization' or 'migration' as state (category) variables. The specific aspects of the environment which contribute to the stressful experience remain undefined, although many examples of stress buffers or social supporting factors have been identified [16–19]. Without a more precise definition of these psychosocial variables as stressors we cannot understand their contributions to the epidemiological transition and thus reduce their role in morbidity and mortality.

There is ample evidence that an epidemiological transition in health patterns is taking place among Samoans. The 'natural experiment' includes populations living in traditional Western Samoa, populations exposed to pressures of American culture in American Samoa, and migrants to American cities [20]. The major health changes include a greater level of obesity [21], higher blood pressure [4], less favorable blood lipid profile [22], reduced physical fitness [23, 24] and elevations in urinary catecholamine

output in more modernized men [25]. Most work has focused upon the categorical, 'modernized' environment but some efforts have identified specific stressors in specific communities. Hanna and Baker [26] in Hawaii have presented data suggesting that within migrant communities, individuals with higher blood pressures may be more closely associated with Samoan organizations. DuBois [27] also reported increased family obligations were associated with elevated blood pressure in elderly Samoans living in San Diego. Based upon his study of migrants, Janes [28] has hypothesized that in some cases the social demands from the migrant communities may exceed the benefits received and result in some degree of subjective stress. In another study on the island of Upolu in Western Samoa, James *et al.* [25] have studied adult men exposed to differing degrees of modern influence. They found that college students and sedentary workers excreted higher levels of stress hormones than laborers or villagers. This higher rate of excretion was correlated to a 'modernization work level complex' including mental effort and a lesser degree of life satisfaction. Martz *et al.* [29] examined the effects of other psychosocial stressors in American Samoa. Also employing hormone excretion as a measure of stress they found self-reliant behavior, social support and community participation as significant correlates. Self reliance in particular is not a Samoan virtue, and may represent an acculturation effect. Janes [28] studying a migrant congregation living in the San Francisco Area, has also identified a number of potential stressors ranging from network obligations to low socioeconomic status.

It is clear that some aspects of the psychosocial environment are stressful for Samoans and some have been related to acculturation and modernization. However, because each of these investigations has focused upon a specific location we cannot determine whether the potential stressors are unique to that particular location or if they represent points along a continuum ranging from traditional to modern. The aim of this study was to attempt to identify some stressful aspects of the modernization process by employing a comparative approach. We hope that by taking advantage of the natural experiment experienced by Samoans we can identify some aspects of the change in the psychosocial environment which are perceived as stressful.

METHODS

In 1986 and 1987 we conducted a health survey among young adult Samoans (18–37 years of age) in three communities. These communities—located in rural Western Samoa, rapidly modernizing American Samoa, and urban Honolulu, Hawaii—represent a rough continuum of increasing 'modernization' reflecting *in situ* changes as well as migration to a western urban center. We believed that through a comparative study of young adults we could identify some specific aspects of psychosocial environment which were differentially affected by modernization processes.

Populations

The Western Samoan village is located on the southwest coast of the island of Savai'i and is recognized as one of the most traditional in modern Samoa. The economy is based upon horticulture, family cooperation and remittances from overseas, although some elements of a new market oriented economic system are beginning to emerge similar to those observed elsewhere on the island [30]. The traditional Samoan chiefly hierarchy functions as do many community organizations. There is some wage labor employment by the national government, but this is largely plantation-like. There is no electricity, running water or other hallmarks of a late-twentieth century life style.

The American Samoan sample was taken from seven small villages on the southern coast of the Island of Tutuila from an area which has experienced intensive *in situ* modernization since the end of the Second World War. Electricity, running water, automobiles, imported foods, television and radio are generally available. Although traditional Samoan social organization remains, it has been greatly modified and reduced in importance [31, 32]. The sample itself is composed of individuals who were restudied 5 years after an earlier survey. Their biological and social characteristics have been described elsewhere [23, 32]. The Hawaiian sample resides in urban Honolulu, mostly in high rise public housing developments. This was a convenience sample with age range and a greater than three years of residence in Hawaii as the major criteria. Most men and women are employed and participate in the local economy. Most work at entry-level positions and some are also on welfare [33]. There is a chiefly hierarchy, but its functioning is somewhat reduced and mostly limited to Samoan affairs [32]. Although this was a convenience sample, the socio-demographic characteristics are similar to those for Samoans living in Hawaii taken from the 1980 census. They seem fairly typical in terms of place of birth, education and employment [23, 33]. This community is clearly at the lower end of the socioeconomic spectrum, but seems substantially more affluent than the one in San Francisco described by Janes [28]. The three communities have been described in greater detail by Fitzgerald [34] and by Pearson [23].

Some of the characteristics of our samples are shown in Table 1. The samples are divided between men and women and are relatively young. While stature is similar in all sites, weight shows significant variation among sites with American Samoans heavier than Western Samoans and migrants to Hawaii the heaviest of all. Body Mass Index and skin folds suggest obesity is involved. This type of weight variation has been observed in Samoans and in other

Table 1. Mean characteristics of the samples

	Western Samoa	American Samoa	Hawaii
Men	$N = 25$	$N = 26$	$N = 23$
Age (years)	23.6	24.2	26.0
Height (cm)[a]	173.4	174.2	175.8
Weight (kg)[a]	73.4	84.4	93.7
Systolic pressure(mm)[a]	128.9	127	130.4
Diastolic pressure(mm)[a]	76.6	83.3	76.5
Total yes responses	16.3	27.2	23.7
Drinkers	9	20	12
Employed	7	19	13
Network size[b]	12	28	29
Women	$N = 25$[a]	$N = 24$	$N = 29$
Age (years)	23.6	23.3	24.4
Height (cm)[a]	161.3	162.9	163.7
Weight (kg)[a]	65.0	77.6	86.7
Systolic pressure (mm)[a]	121	113	118.2
Diastolic pressure (mm)[a]	74	74	75.5
Total yes responses	24	36.3	36.4
Drink	1	8	14
Employed	8	12	13
Network size	14	21	25

[a]Some individuals did not provide anthropometric data hence the physical measurements are based upon fewer individuals. These are WS men (24), WS women (25), AS men (26), AS women (22), HI men (22) and HI women (26).
[b]See text for explanation.

migrant and modernizing populations [21]. The blood pressure variation in our three samples is small not conforming with an acculturation model. This probably reflects the relative youth of the samples.

Instruments

As part of a comprehensive survey we administered a health questionnaire which included questions on individual and family health status. Part of that questionnaire was a series of 91 yes–no health items which consisted mostly of symptoms. Although a few items were not actually symptoms this term will be employed for simplicity. The item list is an expanded and modified version of one proposed by Woods [35]. Each person was asked if they had ever experienced any of the health symptoms and for each yes answer, follow-up questions determined the specific details. These expanded answers uncovered details of the symptom and, when appropriate, an example of when it might occur. Analyses of the expanded responses provided us with a greater understanding of the answers and of the specific problems occurring at each site. Examples of some of the items are: Have you ever experienced . . .? anger, anemia, anxiety, awakening at night, arthritis, asthma, automobile accident and so on. Questions were asked in either English or Samoan depending upon subject preference and the subject was able to follow on a bilingual printed sheet should they wish to do so. Each time a yes answer was given the additional, expanded information was requested.

At the completion of data collection the Item List was reviewed and reduced from 91 to 80 items by eliminating those having no affirmative responses. For example, there were no reported heart attacks and none of the subjects reported cancer so these were dropped from further analysis. For the remaining items the number of yes answers was then computed for each item. An analysis of the expanded answers for each yes was undertaken by listing all given answers for all of the respondents at a given site and then categorizing them into several domains through content analysis [36]. This procedure revealed that many of the yes responses were really normal conditions and did not reflect health problems. Feeling tired, for example, was often answered yes, but during the subsequent follow-up the respondent would suggest this only followed hard work. These normal, non-pathological responses were considered to be 'no' responses, Similarly, many of the yes answers were associated with reproduction (menstruation, pregnancy or lactation) and had little to do with general health. Fitzgerald [34] has described the reproduction-related responses elsewhere. In this paper we will use the answer set with 'normal' yes answers deleted, that is we will discuss only those yes responses which are not expected of healthy people in normal situations.

The frequency of yes responses was averaged for each of the three populations (Table 1). In tabulating the average number of items checked, an analysis of variance revealed that there were significant differences between the sites ($F = 10.9$, df 2,137, $P < 0.01$) and the genders ($F = 19.7$, df 1,137, $P < 0.01$). The average rate of yes responses of men were less than those of women and those of Western Samoans less frequent than American Samoans and Hawaiian migrants.

To further examine this variation we considered two contrasts based upon models from earlier investigations [20]. First, we followed earlier Samoan research which suggested that for many social and biological characteristics the residents of American Samoa more closely resemble the migrants to Hawaii than they do to Western Samoans. This is a simple acculturation model and was apparent in studies of

Table 2. Western Samoa contrasts with other sites—acculturation effects

Item	W. Samoa	A. Samoa	Hawaii
N	50	50	52
Depression	22	38	40
Nervousness	6	25	27
Awakening in the night	8	21	23
Decreased desire to talk	10	22	21
Dental problems	6	22	29
Desire to be alone	12	31	39
Difficulty in concentrating	9	21	24
Difficulty in making decisions	8	21	20
Feelings of guilt	4	19	25
Headaches	17	38	32
Impatience	8	23	27
Impulsiveness	7	15	17
Increased appetite	6	15	17
Feeling weight gain	2	16	14
Decreased appetite	15	25	24
Decreased food intake	11	23	22
Muscle weakness	7	17	19
Feeling in control	22	36	32
Feelings of well being	28	44	44
Swelling of joints	2	10	9
Restlessness	5	14	16

One way analysis of variance show these items differ at $P < 0.05$ level of significance.

blood pressure, body size, growth [20] and some social characteristics [34]. The general similarity is not only the result of acculturation, but also reflects the fact that many of the migrants to Hawaii are from American Samoa. Items following this pattern are listed in Table 2.

As a second approach we contrasted the three sites by looking for items which differed among them in a regular manner such that Western Samoa was at one extreme and Hawaii was at the other with American Samoa intermediate. This pattern most closely approximates the rough continuum of modernization in which Western Samoa represents a traditional population, American Samoa is experiencing *in situ* acculturative pressures and migrants to Hawaii are exposed to both acculturation and migration pressures. The mode is additive for acculturation and migration. Items following this pattern are listed in Table 3.

After grouping items according to frequency of yes responses some items showed significant variation but did not fall into either of the above categories. These were mostly items in which the number of yes responses in American Samoa was higher than in the other two sites (Table 4).

After each grouping there were some items which showed small differences that were clearly not significant. These were not further analyzed. Other items which showed larger differences were tested with a one way analysis of variance to establish statistical significance and Duncan's New Multiple Range was employed to determine site differences. Items showing statistically significant variation are listed in Tables 2–4.

RESULTS

Acculturative pressures—American Somoa and Hawaii grouping

In much of our earlier research we found that American Samoa and Hawaii were often more similar to each other than either was to Western Samoa. Twenty-one of the items which follow this pattern, and show statistically significant differences are listed in Table 2.

'Feelings of depression' was common at all sites, but the sources of depression, named in the expanded remarks, were quite different. Western Samoans associated depression only with death, illness or separation from family. These themes were also present in American Samoa and Hawaii, but depression additionally resulted from friends' misfortunes (AS) or from problems in the workplace or with love interests (HI). Western Samoan depression is largely

Table 3. Three site contrasts—additive effects of acculturation and migration

Item	W. Samoa	A. Samoa	Hawaii
N	50	50	52
Feelings of anger[a]	40	45	51
Increased food intake[a]	2	11	19
Frequent crying[a]	5	12	22
Feeling lonely[a]	8	23	31
Craving certain foods[a]	20	27	37
Feelings of confusion[a]	13	19	25
Bloating[a]	0	4	10
Muscle cramps[b]	4	18	32

[a]Significant difference between W. Samoa and Hawaii $P < 0.05$.
[b]Three sites differ significantly from each other $P < 0.05$.

Table 4. Items showing other differences

Item	W. Samoa	A. Samoa	Hawaii
N	50	50	52
Parasites	1	1	6
Increased sleeping	0	13	8
Hearing problems	6	14	2
Feeling out of control	3	13	6
Digestive problems	3	9	3
Aches and pains	4	17	8

occassioned by family matters, while elsewhere there are more inclusive causes—friends and work. A similar expanded spectrum is evident in response to other items such as nervousness. In Western Samoa nervousness is infrequent ($n = 6$) and limited to cases of sick children, but in American Samoa ($n = 25$) and in Hawaii ($n = 27$), individual performance becomes the prominent factor. Performance before groups, in school or on the job surpasses family problems as causes for nervousness. Again the causality extends beyond the immediate family and into non-family and work settings. Modernization may thus provide more opportunities for depression and nervousness through expanding the circle of potential causes, beyond the immediate family and into the broader community.

Life in American Samoa and Hawaii also occasions increased difficulty in concentration and in making decisions (Table 2). Expanded explanations for the few occurrences in the village seem trivial—difficulty arises from minor events such as speculation about the future or being distracted in Sunday School. The higher frequency of concentration and decision making problems in the modernized sites is accompanied by some degree of preoccupation. Most prevalent is 'having too much to do', or 'having too many things on my mind', usually with a reference to work or to some social obligation. Once more there seems to be a spectrum of stressors arising from beyond the family and home environment extending to the workplace and the community.

Increased impatience and impulsiveness reflect the differences between the traditional and a more acculturated lifestyle. In Western Samoa, impatience is linked to being angry and impulsiveness to 'all of the time', that is, these are viewed mainly as personality characteristics. In the other sites impatience is closely related to work and to waiting in lines, while impulsiveness is also linked to work and non-desired family social obligations. The underlying difference seems to be an individual personality perspective in Western Samoa as opposed to a situational perspective in the more modernized sites. This is also evident in the item 'feelings of guilt or shame' which is attributed to similar causes in all sites—usually to doing something 'wrong', but the somewhat higher frequencies in Hawaii are further attributed to 'making mistakes on the job' and to behavior associated with drinking which are largely situational.

A desire to be alone was frequently answered affirmative. In Western Samoa 12 individuals reported a desire to be alone, the reasons being to think, to escape family problems or 'to be alone at night'. The 31 American Samoans and 39 Hawaiian residents who wanted to be alone listed similar reasons but were more likely to want to be alone on a regular basis. That is, they clearly wanted to be able to be alone when they chose to do so. Both sites are crowded as compared to the Western Samoan village so this probably reflects a problem common to many urban situations.

Another item 'awakening in the night' is lowest in Western Samoa, and almost exclusively attributed to events surrounding child care which is an activity appropriate for this age group. In the other locations there are additional causes. People in both sites describe noises in the night and nightmares as primary reasons for awakening. Neither is mentioned in Western Samoa. Noise can be a product of living in a more crowded, electronic environment such as Tutuila or Honolulu, but the high frequency of dream-related awakening suggests a psychological component may exist.

The decreased desire to talk also has a common origin at all locations—being tired or angry is the most frequent response. In American Samoa additional reasons were being drunk ($n = 2$) and feeling lonely ($n = 2$). In Hawaii similar causes were given—angry, tired and lonely—but additional causes were being interrupted from some task ($n = 3$) or while watching television ($n = 3$).

In light of the number of studies which have described the obesity of modernized Samoans [21] the 'feeling sensations of weight gain' item is of some interest. Western Samoans do not report feeling weight gain, but American Samoans and Hawaii residents do. They report that they are aware of it most of the time, but especially when they try on clothing. Among women in American Samoa and Hawaii, but not among Western Samoan women, pregnancy is related to weight gain.

There were also two items related to food consumption—decreased appetite and decreased food intake. The expanded answers at all sites indicated sickness or unavailability of specific foods lead to decreases, but in the two modernized locations there were also psychological links. Answers such as 'when I worry' or 'when I'm depressed' were common in American Samoa and Hawaii. Likewise dieting was never given as a reason for reduced food intake in Western Samoa, but was frequently mentioned elsewhere. Drinking alcohol was also a cause for

decreased appetite and food intake, but less frequently in Western Samoa than at the other sites. Coincidentally, in Hawaii, of the 24 expanded answers to the difficulty of concentration item, 15 were linked to food. That is, difficulty in concentration was linked to some general preoccupation with or the consumption of specific foods—Samoan foods, milk, oil, raw food—or, eating too much food or too much good food. The significance is not clear but this linkage seems strong in the Hawaii population.

In American Samoa and in Hawaii food seems to have a stronger psychological character than in the Western Samoan villages. In the expanded answers to food related questions villagers focused upon nutrition and taste, while in the more modernized populations there were additional strong linkages to what are often negative affective symptoms—preoccupation, depression, worry and difficulty in concentrating. Modernization may modify the psychological links to foods for these young Samoans.

Two positive items, 'feeling in control' and 'feelings of well being' were also more frequently answered affirmative in the modernized sites. At all locations the most common explanation was 'everyday' or 'all of the time,' thus describing a self perceived personality attribute. In Western Samoa a recent improvement in health was given as the cause of well being ($n = 4$) while in Hawaii a big paycheck was involved ($n = 2$). Such responses were not given in other locations. Feeling in control was also a personality attribute at all locations, but in Hawaii was often associated with anger. We investigated the possibility that the same individuals were answering yes to these two items. This could result in a few individuals skewing the population response. A sign test was performed to determine concordance on the two answers; of the 150 individuals, 46 differed in response with 35 changing in one direction 11 in the other. This was statistically significant ($P < 0.0005$) and a hypothesis of concordance on these two questions was not supported.

Minor physical problems often associated with modernization [1] and the reported physical symptoms support this for the present sample. Among physical items, muscle weakness was reported at all sites and was usually associated with over-exertion on the job. Additional causes in American Samoa and Hawaii were physical workout and drinking. Joint swelling, another physical problem, also differed across the sites but explanations were similar in all locations. The reported swelling included knee and shoulder joints and the causes were hard work. The frequency in joint swelling in American Samoa and Hawaii was simply higher.

Reported dental problems significantly increase from Western Samoa to Hawaii. In the villages few dental problems were reported and these were tooth or gum pain. In American Samoa there are additional reports of pain, a large number of caries and 13 extractions. In Hawaii there are numerous reported fillings with only 6 extractions, probably representing a different type of dentistry. Significantly in Hawaii there are also a number of individuals recognizing dental problems and wanting to see a dentist, but there are also a number ($n = 5$) who admit having cavities and fear seeing the dentist. Even though more extractions are recalled in American Samoa this fear of the dentist is not reported. The more frequent complaints about minor physical problems is probably related to acculturation pressures [1].

Headaches were also more common in the two more modernized locations and were related to aspects of the modern lifestyle. Western Samoa attributed practically all headaches to 'too much sun' ($n = 11$), while lack of sleep and no rest was listed in American Samoa ($n = 4$) and Hawaii ($n = 8$) as principal causes. Hawaii residents listed hangover as the second major cause ($n = 6$). Specific physical and traumatic causes for headaches were equal ($n = 3$) at all sites.

Additive effects of migration and acculturation—three sites contrasts

There were eight questions whose frequencies differed significantly among the three sites in such a manner that the frequency was lowest in Western Samoa, intermediate in American Samoa and highest in Hawaii (Table 3). This may reflect a migration effect superimposed upon modernization. In all cases there were statistically significant differences between Western Samoa and Hawaii, but only for muscle cramps did the three sites differ significantly. In most cases American Samoa and Hawaii did not differ in the statistical sense, but the former was clearly in an intermediate position.

Muscle cramps show significant elevations from Western Samoa to American Samoan to Hawaii. The four reports of cramps in Western Samoa describe excess physical activity associated with chores—carrying wet laundry or long walks. In American Samoa cramps are equally associated with physical work or exercise workouts, while in Hawaii cramps are mostly from workouts with recalled employment-related cramps minimal ($n = 1$). Also included in the expanded answers are descriptions of nighttime cramps: they were absent in Western Samoa, reported twice in American Samoa and seven times in Hawaii. Other studies [23, 24] have discussed apparent parallel differences in levels of physical fitness between the sites. According to those observations the Western Samoan sample is relatively fit, hence they experience the least cramping. In the other locations physically working out, which leads to cramps, may be an attempt to maintain some degree of fitness. It is further noteworthy that 'working out' has become important in American culture and the behavior of these young Samoans reflects that trend.

Of the food related items, a craving for special foods varies across the sites. In Western Samoa the

craving is universally for fish or seafood, a normal, but not always available, component of the diet. In American Samoa there are a similar cravings but also for fast foods. The brands specifically mentioned are not found in American Samoa but are probably seen in television commercials imported from the Mainland. In Hawaii the cravings are for fast foods, which are readily available, and Samoan foods, which are not. The variety of foods named also increases in the latter two sites. The item 'increased food intake' has common aspects across the sites. In general, seeing or smelling good food is associated with increased consumption and social events are also closely linked. But, in American Samoa and Hawaii being pregnant is associated with increased food intake. Similarly, at the latter sites drinking alcohol and food consumption are more frequently associated. A response unique to Hawaii is boredom—three individuals say they eat when bored. Thus, in the latter two sites there is a pregnancy association and more frequent linking with alcohol as well as a link to boredom in Hawaii. These are not characteristic of Western Samoan responses. Abdominal bloating is absent in Western Samoa, but is closely linked to eating too much at the other two locations. In Hawaii there is an additional explanation—it accompanies meals, that is bloating is apparently a normal consequence of eating.

In the psychological realm, feelings of loneliness are least frequently reported in Western Samoa with only 16% answering yes and a variety of reasons are given. The levels are much higher in American Samoa (46%) and in Hawaii (62%). In the latter two sites the absence of friends and relatives is reported as the major cause of loneliness. This is a particularly interesting contrast because we have extensive data on genealogical and network relationships for each respondent. Western Samoans report about half of the number of friends and relatives as do the other two sites, yet less frequently feel lonely. This suggests that the quality of the larger networks in Hawaii and American Samoa is in some way inferior to that of networks in the villages. Quantity and quality are clearly not the same.

Two other psychological items, 'anger' and 'feeling confusion' are also shown in Table 3. They follow the trend of increasing frequency but display statistical significance only between the extremes of the Western Samoa and Hawaii sites. Anger was the most frequent affirmative response (WS $n = 40$, AS $n = 45$, HI $n = 51$). The numbers were high and there was little difference between the sites in reported causes. Anger was occasioned by children and spouse in that order. There seemed to be nothing unique to any environment which occasioned anger, except an anger-work association, which was fairly strong in the modernized sites, and not reported in Western Samoa.

Feelings of confusion, while less frequent than anger also increase across the sites becoming greatest in Hawaii. This supports a hypothesis that expectations are more clearly defined in more traditional locations [18, 28] and that acculturative pressures lead to some ambiguity with respect to expectations. As one is further removed from cultural tradition, daily behavior becomes less predictable.

The item 'tearfulness or crying easily' is related to family conflicts in Western Samoa, due to anger or "being beat by my father". In American Samoa and in Hawaii the causes are generally similar—family problems—but an additional cause is provided. Movie and television generated sadness is responsible, especially in Hawaii where 7 of the responses were due to entertainment. Also more prevalent in the modernized sites was empathy with friends or acquaintance's misfortunes.

Other patterns of responses

There were a small number of items which showed statistically significant differences but did not fit into one of the above patterns (Table 4). The item 'have you ever had parasites?' was highest in Hawaii ($n = 6$) and equal in the other sites ($n = 1$). All recalled parasite incidents were pinworms experienced as children, so there seems to be little relevance for the present time. It should be noted that other investigations have suggested the parasite load in Western Samoa is considerable [39] so a 'no' answer to this question from some Western Samoans may be more perception than reality.

The remaining six items were highest in American Samoa with the other sites showing variable relationships. These were: 'increased sleep', 'hearing problems', 'aches and pains', 'digestive problems' and 'feeling out of control'. Increased sleeping was associated with drinking, sickness and pregnancy. It was reported most often in American Samoa and totally absent in Western Samoa. Hearing problems were site specific. In Hawaii working conditions were linked to hearing problems ($n = 2$), while in American Samoa ear infections ($n = 6$) were the cause and in Western Samoa water in the ear ($n = 4$) was the cause. In both Samoas diving for fish on the reef is part of daily subsistence for many individuals in this age group. The responses suggest that water in the ear and ear infections may result from this normal activity. On the Island of Oahu, where all of the Hawaii residents live, reef fishing is not a common undertaking for most Samoans. The reduced number of ear complaints probably reflects the absence of fishing from daily activities.

American Samoans reported feeling 'out of control'—usually as a result of anger ($n = 8$). In Hawaii 3 cases were due to anger and as was one in Western Samoa. Various other causes were given, including drinking at the two more modernized sites (1 each). Digestive problems were also highest in American Samoa and were attributed to either food ($n = 4$) or to some sickness ($n = 3$). In Hawaii all were due to physical pathology and in Western Samoa all were

due to food. Finally, in terms of aches and pains American Samoa is highest ($n = 17$). These are attributed to sickness, arthritis and work. The causes are similar in the other sites, just less frequent.

DISCUSSION

In this study we have tried to expand upon the approach of social epidemiology by adding depth. Extending the questionnaire from a simple yes/no format to include an opportunity for expanding upon the answers added a richness to the data that would have otherwise been lost. Analysis of the expanded answers has allowed us to address a broader range of issues than were apparent from the symptom check list. In this discussion we have focused on aspects of symptom reports which seem to reflect a modernization or acculturation effect; an effect which might be related to increased health risk.

There were substantial differences among the three sites in terms of the frequency of yes responses to the eighty items and in the underlying explanations for those responses. The most profound differences were in the contrast between Western Samoa and the other sites. Responses in American Samoa and Hawaii were similar, and even when the reported frequencies differed, the underlying causes tended to be analogous. In many respects American Samoa is both American and Samoan. As noted earlier [32, p. 47] "When compared with Western Samoa, American Samoa appears to have undergone some rather profound changes in response to commercialization of its economy, to urbanization, and to Americanization." We can now extend to the psychosocial sphere a conclusion derived from biological, epidemiological [20] and demographic [32] observations. In addition the present study has defined four areas in which acculturation and migration may prove stressful. These are in the work environment, extension of social networks, increased availability of alcohol and changes in food perceptions.

Occupational stress

Problems in the workplace is a recurrent theme which contributes substantially to individual stress levels and is most evident in American Samoa and Hawaii. An acculturation model is appropriate. Western Samoan men were mostly horticulturists, working on a family plantation and exploiting the reef. Women tended to household chores as well as plantation activities, but occasionally participated in fishing and collecting. Everyday work is carried out with close family members and is not formally supervised. In American Samoa and in Hawaii employment was more varied with clerical, blue collar positions and housekeeping predominating. The element of family participation is more removed so that there is a clear differentiation between employment and family obligations. These populations seem more fully engaged in a modern-style work complex.

Expanded answers illustrate the contrast and provide details of the differences. In Western Samoa the only references to work were in physical terms relating to ear problems, muscle weakness, and swelling of the joints, symptoms which can result from over exertion. Working did not appear in the expanded answers as a factor contributing to other symptoms. On the other hand, in Hawaii and American Samoa, working and the workplace were often discussed and frequently named as contributing factors in other contexts. This was most evident in the items dealing with depression, nervousness, decision making, confusion, impulsiveness, feelings of guilt, and anger; but passing references to occupational problems often appeared in other items as well. Job related stress seems to permeate the lives of many respondents in these two communities.

Perhaps the nature of their employment was a major factor. Clerical and bluecollar workers are especially subject to organizational stresses which are tied to the social character of the unskilled job. These include little chance for advancement, a lack of job security, ambiguity in expectations and role conflicts [12, 40]—aspects of the work situation which characterize many in the present sample of American Samoans and migrants in Hawaii. But there are some other aspects of this type of employment which also have special significance for Samoans. Working is separated from family activity, a situation seldom experienced in traditional Samoa. There is also constant exposure to non-Samoan values [41, 42], and a requirement for a degree of self reliance, which has been associated with elevations in stress hormones for American Samoans [29]. Finally, clerical and office jobs tend to involve some degree of mental effort, a characteristic which has been shown to be more stressful than traditional plantation occupations for Western Samoans [24]. There are many opportunities for occupational stressors in the more modernized sites.

For American blue-collar and clerical workers the consequences of such organizational stresses are often displaced into other, non-work settings where they contribute to violence and family discord [12, 40]. This kind of displacement may contribute to the violence, substance abuse and family problems which seem to characterize migrant communities in Hawaii [43]. In a similar manner the higher levels of physical symptoms in American Samoa and in Hawaii follow a tendency toward somatization of more general complaints by Polynesians [28, 44] and may also represent a displacement. Stressful events on the job become somatisized into headaches, muscle weakness and joint swelling complaints.

It seems clear that in the acculturated communities the existence of occupational stress is greater than in traditional Samoa. For villagers the reported job-related symptoms are largely physical, while in the more modernized communities job-related stress seems to be more frequent, more variable and dis-

placed into other aspects of life. In American Samoa and in Hawaii, work-induced stress may be one of the key psychosocial factors contributing to development of a modern disease profile.

In his study of a Samoan congregation living in the San Francisco area, Janes [28] concluded that participation in a market economy and the concomitant economic deprivation was a major stressor. The workplace itself was also important, but mostly in terms of " social inconsistency" [28, p. 118] wherein a worker held a position above their level of training. As noted earlier the socioeconomic status of the present samples from Hawaii and American Samoa appears somewhat higher than that described in San Francisco. Unemployment at the time of this study was also less of a problem, so economic worries were less important than those related directly to the workplace. In these communities the symptoms were linked to the workplace and the working environment, not to wages or money. We cannot discuss status inconsistency because this was not a focus of our study, but Janes also reported a substantial number of psychosomatic complaints, which is compatible with the displacement phenomenon which we describe.

Social networks

Another apparent stressor accompanying acculturation is an increase in the size of social networks. We estimated individual social networks by requesting each individual to name all of their friends and relatives and to describe interactions with them [32]. The average number of named individuals who were available for support in Western Samoa (mean = 12) was significantly smaller than in American Samoa (mean = 24) and in Hawaii (mean = 27) (Table 1). The major difference was that the larger networks include greater numbers of non-kin social groups, friends, and work mates as well as greater numbers of non-Samoans. These larger networks were not entirely supportive because expanded answers to the items relating to depression, nervousness, feeling angry, difficulty in concentrating, and difficulty in decision making contained negative references to them. The main stressful element seems to be increased social obligations. Other studies among migrant Samoans have suggested how these obligations may evolve. Initially immigrants are heavily dependent upon other Samoans to find employment and to find a place to live as well as assistance with language and cultural problems [41, 42, 45]. In Samoa the immediate family is usually helpful with these concerns, but in Hawaii they can be solved only through developing a larger network of varying composition. While this expanded (and largely ethnic) network continues to be an asset in time of need [46], it can become burdensome in time. Helping other arrivals, support of church and civic activities and remittances to Samoa continue to tax resources and in the long term may have adverse health effects. This may appear as higher blood pressure in Hawaii [26], where those Samoans living in rural and more ethnically Samoan communities show higher blood pressures than those Samoans living in urban and more ethnically mixed areas. Similar suggestions have been forwarded by observers in California where larger networks are also correlated with higher overall health risk [27, 28].

Among non-migrant American Samoans the structural aspects of network demands are less clear, although many of the same features probably exist. American Samoa has been under strong acculturative pressures for a generation with substantial changes in family and traditional social organization [32]. Participation in the local wage economy as a clerk probably has much of the same effect as in Hawaii. Working in the cannery or in government offices extends social networks beyond the traditional family units and will also include non-Samoans with regular exposure to non-Samoan values. The problems of helping new arrivals are not present, but many of the other aspects of migrant networks are present.

In a general way these observations are in conflict with studies stressing the value of ethnic networks and social support in terms of their buffering and stress alleviating capacity [16–19, 47, 48]. While these functions are also characteristic of Samoan networks [27, 45], the evidence shows that this is not invariable. For Samoans in American Samoa, Hawaii and California non-family networking can clearly become a stressor. While some of the negative aspects can arise from acculturation and from non-Samoans, there also appears to be an element which is Samoan, but non-family. We suggest that other investigators also examine ethnic networks from that perspective, since we doubt that Samoans are unique in this respect.

Drinking alcohol

Access to alcohol was a major factor differentiating Western Samoa from the other sites. The number of yes answers for the craving for alcohol item does not significantly differ among the research locations, yet alcohol was a contributing factor to a variety of other symptoms. This was especially true in American Samoa and Hawaii where reported alcohol use was more frequent. Alcohol was related to depression, decreased food intake, decreased talking, muscle weakness, and numerous other items. It was a cause of anger at all sites, but most particularly in Hawaii and American Samoa. There thus appears to be a link of alcohol, anger and aggression with adverse effects on relations with family and friends. This relationship has been established in laboratory and in epidemiological studies [43, 49–52]. In the present study many indirect attributes of alcohol use were described by women who listed a husband or boyfriend's drinking as a cause for anger, depression or other psychological symptoms similar to experiences of Native American women [53]. Men volunteered headaches, anger,

decreased appetite and muscle weakness associated with excessive drinking. Alcohol abuse is more prevalent in Hawaii and American Samoa because of easy access to alcohol. The Western Samoan village did not permit alcohol within its limits and strong social pressure was exerted to keep it out. In American Samoa and Hawaii alcohol and the cash to buy it were readily available.

Food

References to food also follow an acculturation model paralleling that described in earlier studies. Bindon [54] and Brown *et al.* [55] have documented an increase in the variety of foods which are consumed in modernized communities as well as a decrease in the consumption of traditional foods such as taro and breadfruit. The food references in the present study depict such a pattern. In the Western Samoan village 'craving special foods' was the least frequent and there were no reported linkages with affect or other psychological parameters. The villagers simply responded that they wanted more of their normal foods. Although they were not totally happy with their diet, western foods did not appear as a craved item. In the modernized sites more complex relationships were described with food related to affect. This was true especially in Hawaii where there was a psychological link between difficulty in concentration, boredom and food. The kinds of food named were also different in acculturated locations with advertised foods most evident. In American Samoa even foods never sold there were craved. The modernization effect of electronic advertising was clearly in evidence.

It might be hypothesized that the differential view of food results from economic considerations. Western Samoans are food producers while the other populations are more dependent upon a paycheck whose future may be uncertain. While we cannot rule out economics, save for complaints surrounding social obligations, financial distress was not closely linked to symptoms and did not seem a major theme in this protocol. Money never appeared in the same context as food.

CONCLUSIONS

In terms of responses to reported health symptoms the acculturated communities in American Samoa and Hawaii more closely resemble each other than does either resemble Western Samoa. There are four main areas of contrast.

(1) The transition from a traditional, family based employment to a modern style occupation is probably a source of stress for acculturated and migrant Samoans. In acculturated communities stresses arising from events surrounding the workplace seem substantial and responses to them may be displaced into other aspects of life.

(2) Migration and acculturation have resulted in larger social networks. The greater size is due to inclusion of more distant relatives, non-kin Samoans and non-Samoans. These larger extra familial networks seem to produce a degree of stress as well as offering social support.

(3) Problems associated with alcohol are more frequent and widespread in the acculturated communities. Drinking is associated with negative health items in all locations, but because of limited accessibility in Western Samoa, alcoholic problems do not seem so prominent. In American Samoa and Hawaii, where alcohol is readily available, both physical and psychological symptoms are associated with its use.

(4) There seem to be changes in perceptions of food and, perhaps, the addition of some psychological elements in the more acculturated communities. The origin and significance of these new elements is not clear.

An aim of this study was to identify some elements which cause a change in morbidity patterns in Samoans as they become modernized and as they migrate from Samoa. This comparative study has suggested there are four areas of difference which may be involved. Reported changes in occupational relations, social networking, alcohol and food consumption can be stressful and in the long run unhealthy. Further investigation of these changes is suggested. We hesitate to extend these conclusions to other non-Samoan populations, but the basic findings may also characterize other groups exposed to pressures of modernization.

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