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Health Transition: Examples from the Western Pacific

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The articles for this symposium are revisions of presentations given at the Seventeenth Pacific Science Congress in Honolulu, Hawaii, May 27 to June 2, 1991. The symposium was organized by us and was entitled "Changes in Disease Patterns in the Western Pacific and Southeast Asia." It was one of several symposia pertaining to the theme of health transition in the Pacific region. In this introduction we briefly review the problem of health transition in some western Pacific nations, as exemplified in these articles. We also suggest how studies of human populations undergoing the transition can help to predict the developing health problems of countries. In addition, we examine how such studies can serve as guides for research strategies on how specific gene-environment interactions operate to produce intra- and interpopulation differences in the human phenotype, including health and morbidity.

Although our species has demonstrated an impressive ability to adapt to diverse physical and cultural environments in the past, the modified stresses that relate to new environments often evolved slowly. Thus, with the development of sedentary agricultural life, the changing diseases and altered nutrient patterns to which populations were exposed evolved over what were often scores of generations. This allowed new behavioral and cultural adjustments to develop and in some cases evolutionary genetic adaptations to occur.

On the other hand, the Industrial Revolution and its consequent effect on people has altered much of the environment in only eight generations or less. For many human populations a change from a semi-isolated traditional lifestyle to full participation in the modern environment has occurred in a single generation. Some of the biological consequences for human populations appear to be nearly species-wide. The demographic transition with rising life expectancy, declining infant mortality, and at least some subsequent decline in fertility appears to be one of the biological consequences (Demeny 1968).

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Table 1. Life Expectancy Change in Selected Pacific Basin Countries[a]

Life Expectancy	*Papua New Guinea*	*Thailand*	*China*	*Japan*	*United States*
Males					
Period	1975–1980	1975–1980	1975–1980	1979	1980
Life expectancy (yr)	50.00	53.60	62.10	73.46	69.50
Period	1985–1990	1985–1986	1985–1990	1988	1988
Life expectancy (yr)	53.18	63.82	67.98	75.54	71.38
Increase (yr)	3.18	10.22	5.88	2.08	1.88
Females					
Period	1975–1980	1975–1980	1975–1980	1979	1980
Life expectancy (yr)	49.50	58.70	65.90	78.89	77.20
Period	1985–1990	1985–1986	1985–1990	1988	1988
Life expectancy (yr)	54.84	68.85	70.94	81.30	78.30
Increase (yr)	5.34	10.15	5.04	2.41	1.10

a. Data from United Nations (1980, 1991).

Initially, the increased life expectancy was mostly a consequence of reduced infant mortality, but with the increasing control over infectious diseases, child and adult mortality also declined, resulting in mortality in many groups caused mostly by accidents and degenerative diseases. These changes in causes of death have been labeled the mortality transition (McKeown 1976). The special environmental changes that led to this altered mortality was labeled the epidemiological transition (Omran 1971). The most recent term to be coined is *health transition,* which is intended to cover not only the changes in health, morbidity, and mortality but also the way social systems are changing in response to new health requirements (Ruzicka and Kane 1990).

Although it is clear that end points in life expectancy have probably not been reached in any nation, it is obvious that some countries are in rapid transition and that others are slowing down. For example, the life expectancy and infant mortality rates over the past decade are examined for the countries discussed in this symposium. As can be seen in Tables 1 and 2, for countries such as Japan and the United States the rates of change are now slower than in the less economically developed countries. Nevertheless, Japan, with an already higher life expectancy than the United States in 1979, increased this expectancy in the subsequent decade more than the United States did.

Benfante (this issue) reports the results of an extensive long-term set of studies on cardiovascular and malignancy-caused mortality among Japanese in three environmental settings. The study is an excellent example of how a natural experiment design can be used to determine the

Table 2. Infant Mortality Change in Selected Pacific Basin Countries[a]

Infant Mortality	*Papua New Guinea*	*Thailand*	*China*	*Japan*	*United States*
Period	–	1975–1980	–	1980	1980
Rate/1000	–	26.5	–	7.5	12.5
Period	1988	1985–1990	1985–1990	1988	1988
Rate/1000	58.0	39.0	32.4	4.4	9.9
Change	–	+12.5	–	−3.1	−2.6

a. Data from United Nations (1980, 1991).

impact of specific environmental factors on given diseases for a single ethnic group. Among other results Benfante strongly suggests that some of the differences in life expectancy between Japan and the United States may be caused by environmental factors in the United States that produce higher rates of heart disease. However, the overall difference in life expectancy and infant mortality between Japan and the United States may also be related to ethnic diversity and to health care differentials by social class.

China as a nation has life expectancy and infant mortality rates that are intermediate in this group of Pacific rim countries, but as Zhai and McGarvey's analysis (this issue) of cardiovascular disease suggests, the development of this characteristic marker of mortality transition is geographically and occupationally specific. It appears from their detailed analysis that urban conditions and occupations that involve factory work are clearly associated with increased cardiovascular risk. Given the low range of income and medical care variability between the various Chinese groups studied and the fact that the groups examined are ethnically similar, special research opportunities exist for examining the effects of exercise and psychological stress on cardiovascular risk. China's culturally and genetically diverse ethnic groups also provide many natural experiment opportunities to examine the mortality and epidemiology transition.

Thailand in the late 1970s was a nation only moderately into the health transition. With a rapidly growing economy and the development of an effective health care system during the 1980s, life expectancy rose more than 10 years for both sexes. This brought Thailand close to the Chinese level in the mortality transition. Kunstadter et al. (this issue) report that the changes in Thailand that created this improved life expectancy also led to dramatic declines in infant death rates. One assumes that, given their information and the rather sharp rise in life expectancy, the low infant mortality reported in Table 2 from the *United Nations Demographic Yearbook* (United Nations 1980) was based on a nonrepresentative sample.

The research of Kunstadter and his co-workers demonstrates several major deviations from the generalizations involved in transition theories. In essence, Kunstadter et al. found that at least for one ethnic group infant and child mortality can decline dramatically, despite continued high fertility, low educational levels, low female status, and even poor household sanitation. Access to immunization and modern medical care for acute disease appears to be the only critical variable. Thus it may be that the broad transition generalizations garnered from national surveys have little bearing on the underlying causes for the mortality and fertility of identifiable ethnic units in a country.

Whereas some tropical countries such as Thailand are progressing substantially in the health transition process, most, including Papua New Guinea, are progressing slowly. The basic reason is lack of good control over infectious disease, even such common ones as malaria. In addition, as Yanagihara (this issue) indicates, new variants of infectious diseases continue to be discovered and many of these require unknown human genetic or environmental triggers to produce manifest morbidity. HTLV-I presents all these problems, and although classical epidemiological approaches have provided some indications of how to control the spread of the virus strains, the question of why so few individuals develop symptoms remains an intriguing research problem.

As populations progress along the health transition continuum, it is probable that individual genetic characteristics become increasingly important as a cause of morbidity and mortality. This is particularly obvious in prenatal and infant mortality, where specifically identified genetic disorders cause a high percentage of infant deaths and disabilities. The increased homozygosity that occurs with inbreeding leads to a higher frequency of many of these disorders, but inbreeding effects are often considered relatively unimportant in developed countries because the high internal migration rates have generally broken down breeding isolates.

Fujiki et al. (this issue) show that, indeed, the high level of inbreeding common to traditional Japanese villages has declined substantially but has not totally disappeared. They also acknowledge that isolate breakdown has reduced inbreeding in many other countries. However, reduced inbreeding is not necessarily the case for many modernizing countries. Indeed, the reverse may be occurring in some fundamentalist Muslim countries. Furthermore, countries with large immigrations from countries with traditional social preferences for inbreeding may also experience a rise in homozygosity-related genetic disorders.

An overview of these papers suggests to us that the demographic, mortality, epidemiological, and health transitions, although common to all countries, are composites of subpopulation changes that progress at different rates and directions according to a variety of controlling variables. Depending on the country, the variables include ethnic populations, social stratification categories, occupation groups, health care delivery systems, climatic characteristics, and even subgroup food traditions.

Given the major changes that are occurring in all these countries, the opportunities for studying how the gene structure of a population or designated social group responds to specific environment changes are endless. As these papers show, any research strategy that fails to control for the complexity of the change process will offer only descriptive results rather than explanatory linkages.

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