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Edited by Ryutaro Ohtsuka and Stanley J. Ulijaszek

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# 1 *Health change in the Asia-Pacific region: disparate end-points?*

STANLEY J. ULIJASZEK AND RYUTARO OHTSUKA

## Introduction

The Asia-Pacific region encompasses South East Asia, East Asia, Pacific Islands and the islands of Melanesia. In the present day, strong economic forces link it to the Pacific Rim nations of the United States, Australia and New Zealand. While epidemiologists have studied some of the relationships across geographical and population units within this region, there is thus far no formal consideration of health impacts of linkages within and across these units in historical and evolutionary contexts. While migrations across the region are known and common, these have both evolutionary and colonial histories. The nature and extent to which knowledge of population movements, past and recent, can impact on present-day human biology in this region has not been synthesized, despite having been considered separately by various authors and research groups. This volume considers recent evidence concerning prehistoric migration, and colonial, regional and global processes in the production of health in the Asia-Pacific region. Using their own research findings and/or by synthesizing those of others, the contributors to this volume describe health change in various populations in relation to their biological, cultural and/or socioeconomic attributes at various scales of time.

This region, consisting of the southeastern frontier of the Eurasian continent and the vast South Pacific, was the geographical locale of the first crossing of wide seas and oceans by human groups. A consequence of this was the adaptation of such migrant groups to a variety of novel environments. Many Pacific population maritime range expansions are likely to have taken place throughout the late Pleistocene, earlier than anywhere else in the world. Between the Pleistocene and the Holocene, various migrations, subsistence introductions and human biological changes took place. However, these took place at rates much slower than the rates of those introduced by European contact and the subsequent subjection of local populations to colonial regimes. Great variation in

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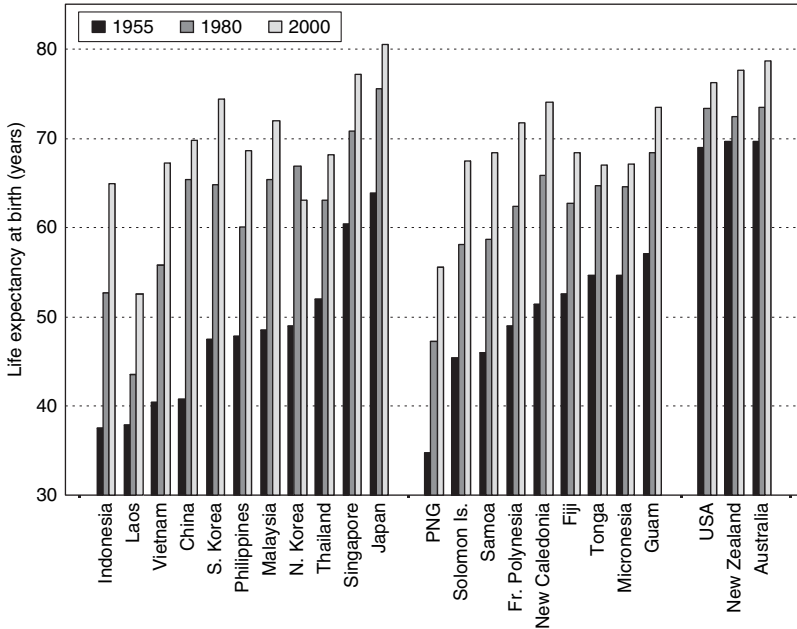
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Fig. 1.1. Changing life expectancy at birth in the Asia-Pacific region, 1955–2000 (data from United Nations University 2006).

exposure to, and development of, new political and economic structures across the region has led to varying health profiles across and within populations. Throughout the past century, this region has seen great social, cultural, economic and environmental changes, triggering hasty health transitions in many populations, with this trend accelerating in the past few decades. The forces driving this change now include the following: the emergence of Asian economies as significant global influences; political change; globalization of trade; the penetration of the world food system to all parts of the region; adoption of Westernized foods and dietary habits; widespread dissemination of primary health care; increased adoption of health-conscious behaviours; and increasing urbanization and migration of populations.

Young-child mortality has declined considerably in the Asia-Pacific region since the 1950s. One consequence of this has been increases in life expectancy at birth (LEB) across the region between 1955 and 1980, and further increases between 1980 and 2000 in all nations except North Korea (Fig. 1.1). Almost 30 years have been added to LEB in the last 130 to 150 years in New Zealand, Australia and the United States, most of this

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increase having taken place before 1980. Life expectancy at birth in Singapore and Japan has increased similarly across the twentieth century, while increases of similar proportion have taken place since the 1950s in Indonesia, Vietnam, China and South Korea. Increases in LEB of between 20 and 30 years across the period 1955 to 2000 have taken place in the Philippines, Malaysia, Papua New Guinea (PNG), the Solomon Islands, Samoa, French Polynesia and New Caledonia. In the 1950s, the United States, New Zealand and Australia had the highest LEB in the region. By the year 2000, they had been overtaken by Japan, whose LEB came to exceed 80 years. Furthermore, South Korea, Malaysia, Singapore, French Polynesia, New Caledonia and Guam had joined the United States, New Zealand and Australia with LEBs exceeding 70 years.

A potential brake on these dramatic increases in human longevity is the rise in the burden of non-infectious diseases across the region since the 1980s, as well as the persistence and emergence of infectious diseases in some nations, including PNG. Evidence for decline in LEB after generations of increase comes from various nations where there are significant increases in infectious disease mortality, as in Zimbabwe, South Africa, Lesotho, Swaziland, Namibia, Zambia and Botswana (HIV/AIDS and tuberculosis) and increased mortality associated with severe undernutrition (North Korea). It has been suggested that LEB in the United States may decline by up to five years across the next two or three decades unless the rising rates of obesity are somehow controlled (Olshansky *et al.* 2005). In the United States, obesity rates (as defined by body mass index (BMI) exceeding 30 kg/m<sup>2</sup>) currently stand at 26% and 32% of males and females respectively, with rates of increase of 0.4% per year in both sexes (Nishida and Mucavele 2005). If an obesity rate of more than 30% can be taken as a level beyond which serious reversals in LEB due to chronic disease mortality may occur, various Pacific Island nations, including Nauru, the Cook Islands, French Polynesia, Tonga, Samoa, and American Samoa, exceeded this value several decades ago and do not appear to be undergoing a reversal in LEB yet. Obesity levels are rising in most nations where records are available (Nishida and Mucavele 2005), and some Pacific Islander populations are the most obese in the world. Indeed, the populations of Nauru, the Cook Islands, French Polynesia, Tonga, Samoa and American Samoa may be close to a possible ceiling on obesity prevalence and its associated chronic disease mortality. Given that it is unlikely that any nation outside of the Pacific has reached a ceiling in obesity prevalence, careful observation and understanding of obesity and chronic disease patterns in this region is therefore of much more than local interest.

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While most Asian and Pacific Island nations experienced colonization by European nations in the nineteenth and twentieth centuries, the latter gained independence later. They also experienced slower economic growth, and, in Polynesia in particular, higher levels of out-migration to industrialized nations led to the formation of significant transnational communities by the end of the twentieth century. The most characteristic health outcomes of this rapid change among Pacific Islander populations are the extraordinarily high levels of obesity, non-insulin dependent (type 2) diabetes and cardiovascular diseases in urban populations, in contrast to rural ones, and the continuing high prevalence of malaria and malnutrition in rural populations in Melanesia. In this volume, various authors examine ways in which a health pattern dominated by undernutrition and infection has been displaced in many places by obesity and the degenerative diseases associated with it. The potential impacts of emerging and resurgent infectious diseases on the trend of increasing LEBs are not ignored, since they have the potential to reverse all gains in LEB at some stage in the future. The influence of infant and young-child mortality on LEB is much greater than that of mortality in later life; furthermore, the factors influencing mortality in earlier life are much stronger agents for natural selection than those influencing mortality in later life.

Forces driving increases in levels of obesity and chronic disease include modernization and the geographical and economic relationships between Pacific Island nations and the industrialized and industrializing nations that surround the Pacific. These relationships are also explored by various authors in this volume for the Samoas, Tonga, the Cook Islands, the Solomon Islands and PNG, and in respect of emergent transnational communities that link Tonga with the United States, New Zealand and Australia; the Cook Islands with New Zealand and Australia; American Samoa with the United States; and Samoa with New Zealand.

**Physical and human geography in prehistory and its implications for present-day human biology**

The Asia-Pacific region is characterized by many islands bounded by Pacific Rim nations, which include China, the United States, Australia and New Zealand. The largest islands, such as Sumatra, Java, Borneo (Kalimantan), Sulawesi (Celebes) and New Guinea, lie in the west of the region, in contrast with the eastern range of this area, where scattered small islands are separated by long distances. Geomorphologically, several deep ocean troughs run in the south–north direction between the island of Bali in the west and

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New Guinea in the east, these two being approximately 1,500 km apart. This zone, with its many islands, including Sulawesi, Flores, Timor, Maluku (Mollucas), Halmahera and Seram, is called Wallacea (Dickerson 1928), and makes a zoogeographic boundary between the Palaeotropical region (the Oriental subregion) and the Australian region. Among several zoogeographic lines here, the westernmost is Wallace's (or Huxley's) Line, while the easternmost is Lydekker's Line, close to Weber's Line (Simpson 1977; Hayami 1987). Tropical rainforest predominates from island South East Asia to Melanesia, with monsoon forest in several islands of Wallacea and in some portions of New Guinea, and mountainous vegetation occurring sporadically on several of the large islands. Zoogeographically, the Oriental subregion differs from the Australian region, in that placental mammals dominate in the former and marsupial mammals dominate in the latter. However, flora scarcely differs between the two regions. Another important biogeographic difference among the islands in Oceania is their size and land formation. Large continental islands such as New Guinea, New Caledonia and New Zealand contrast with medium-sized volcanic islands and small coral reefs which abound in Polynesia and Micronesia. Terrestrial flora and fauna are richer on the continental than on the volcanic islands, and both more so than on the coral reefs. In Wallacea (present-day East Indonesia), island Melanesia, Polynesia and Micronesia, however, marine food resources are abundant and were much more abundant in the past.

Wallacea had long been a barrier to human migration from the west to the east. Palaeoanthropological evidence suggests that the island of Java was inhabited by *Homo erectus* more than a half million (perhaps 750,000) years ago (Jacob *et al.* 1978), whereas Oceanian islands located east of Wallacea were not inhabited until much more recently. According to archaeological studies in Oceania, the earliest dates for two sites of human habitation, determined by thermoluminescence in northern Australia, range between 60,000 and 50,000 years before the present (Roberts *et al.* 1990, 1994). Furthermore, the oldest artefact, a stone tool discovered in the Huon Peninsula of the northeastern tip of New Guinea, has been dated to between 60,000 and 40,000 years ago (Groube 1986). Lower global temperature around 50,000 years ago was associated with a sea level lower by between 100 and 150 m than that at present. Land formations on both sides of Wallacea also differed markedly from the present day. Its western and eastern sides were, respectively, Sunda Land, comprising the Asian continent and islands of South East Asia, including Borneo, Java and Bali, and Sahul Land (Australasia), comprising New Guinea, Australia and Tasmania.

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The first settlers of Oceania, who were hunter-gatherers, are likely to have crossed Wallacea by 60,000 to 50,000 years ago, using water craft such as logs or weed-bundled rafts (White and O'Connell 1982; Denoon 1997). Several tens of millennia later, when the sea level had risen to the present level, another human group, who had a markedly different material culture, crossed Wallacea. This group's habitation is evidenced by their unique Lapita red-slipped pottery with its intricate geometric patterns, and settlement remains which were discovered in the Bismarck and Solomon Archipelagos. The oldest sites in the Mussau Islands of the Bismarck Archipelago have been dated to between 3,550 and 3,500 years ago (Kirch 2000). Long-distance maritime movement of obsidian probably started from around 20,000 years ago, its trade being carried out across increasing distance by 8,000 years ago. Horticulture and arboriculture began in Near Oceania by 9,000 to 10,000 years ago, earlier than in island South East Asia to the west of the Wallace's Line. The Neolithic subsistence base of Oceanic populations was derived from South East Asia and New Guinea, never having been rice-based.

The bulk of the contemporary inhabitants of the South Malay Peninsula, Taiwan, island South East Asia and Oceania speak Austronesian languages. Historical linguistic analysis has shown that nine of ten Austronesian language subgroups were spoken by indigenous (non-Han speaking) Taiwanese, with the implication that all Austronesian languages outside Taiwan may have diversified from the same proto-Austronesian language in or near Taiwan, and then spread to the wider area (Blust 1999). The Austronesian language sphere abuts the territories of speakers of three language families, one to the east of Wallacea and the other two in mainland Asia (Capell 1969; Wurm 1982; Wurm and Hattori 1983; Bellwood 1985; Bellwood *et al.* 1995). The first is the Non-Austronesian (Papuan) complex of language families in New Guinea and its surrounding islands. The second is the Austro-Asiatic family in mainland South East Asia, while the third is the Thai family in the central and northern parts of mainland South East Asia, extending to South China.

South East Asia and the Pacific region combine elements of ancient and recent colonizations and of admixture and entry into chains of uninhabited islands with extreme founder effects, alongside the powerful and interacting selective effects of nutrition and infectious diseases. The next two chapters, by Stephen Oppenheimer and Ryutaro Ohtsuka, respectively, paint broad pictures of adaptation and health among various human populations in the Asia-Pacific region, from peopling to the present. Oppenheimer (in Chapter 2) presents new insights into population genetic traits, paying attention to their selective interactions with nutrition and

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infectious diseases. Human iron deficiency is likely to have emerged as a major culturally induced change in the South West Pacific at an earlier time than in the Near East, because of the earlier transition to agriculture in New Guinea. High rates of alpha thalassaemia are shown not only to be a major cause of anaemia in coastal New Guinea populations, but, as with iron deficiency, to be protective against malaria. This disorder was probably selected for by malaria in lowland areas of Near Oceania. In the early 1980s, detailed DNA mapping of the alpha globin gene identified three deletional mutations that caused the disorder, and which were indigenous to, and geographically distributed across, this region. One of them was a good candidate marker for the population expansion giving rise to the Polynesian dispersal, while the relative distribution of the other two suggested that the Polynesian dispersal had bypassed the New Guinea mainland. Detailed analysis of mitochondrial and Y-chromosome DNA in the past decade has been consistent with this view. This has led to a now dominant view of the peopling of this region, which involves several Pacific expansions across the Holocene, from admixed communities in Wallacea.

Populations that successfully colonized the Pacific Islands may have been adapted to periodic food shortages through biological selection of individuals with more efficient metabolism; while this would have favoured them in the past, the emergence of plentiful diet in the second half of the twentieth century has probably penalized this adaptation. Some present-day Pacific Island nations, such as those of Tonga, Nauru, the Cook Islands, American Samoa, Samoa and French Polynesia, have among them the highest rates of obesity in the world, as well as very high rates of cardiovascular diseases and type 2 diabetes. Ohtsuka (in Chapter 3) examines migration histories of Pacific populations from a biocultural perspective, and identifies some of the changing environmental circumstances which may have led to changes in adaptation and health of present-day Melanesian populations in PNG.

**Modernization and health change**

While patterns of health change in the Asia-Pacific region are outcomes of powerful economic and political forces across the twentieth century, they are also contingent upon cultural and ecological processes in history and prehistory. Factors influencing health in the prehistoric and pre-colonial past include patterns of migration, transitions in subsistence ecologies, and economic change associated with changing exchange patterns across the

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region. Social factors influencing human population size, distribution and health during the colonial period in many countries of the region include different models of colonial administration and different patterns of economic modernization. Western health workers reached the Pacific from the 1880s onwards, after devastating epidemics that seemed to threaten the survival of whole populations. Depopulation was the focus of government anxiety, missionary alarm and scholarly concern up to, and including, the 1950s (Ulijaszek 2006). Before the divorce of anthropology and psychology from medicine, multi-disciplinary analysis was the usual way of trying to understand such crises. Once depopulation fears faded in the decades after the Second World War (Ulijaszek 2006), and segregation, quarantine and anti-malarial medication were seen to keep Europeans alive, the Pacific became an arena for the development of new public health responses. The new availability of penicillin and sulfa drugs prompted quasi-military health campaigns in the Pacific against specific diseases, until the advent of primary health care in the 1970s. Since colonial administrations accepted a mandate to improve population health, and usually had adequate resources for this task, overt arguments over health policies and programmes surfaced mainly after political independence in many nations of the Asia-Pacific region. Resources became more limited, and the cost-effectiveness of fulfilling colonial mandates for health and other areas came to be questioned increasingly. Global health campaigns, as promoted by the World Health Organization and other agencies, often came into opposition with local realities. Some populations have seen far-reaching changes associated with entry into the cash economy in the context of broader economic modernization, including changes in diet, morbidity and mortality, while others have seen less change. Patterns of nutritional health varied and continue to vary enormously, from high levels of under-nutrition in some societies, to a dominance of overnutrition in others.

The nations of South East Asia have varied enormously in their economic profiles across the second half of the twentieth century, poor nutrition remaining a significant contributor to morbidity and mortality in most nations, but overnutrition increasingly becoming a contributor to poor health in places where increased economic prosperity has emerged. In Chapter 4, Geoffrey Marks describes how urbanization, and social and political changes in South East Asia have led to more complex patterns of nutritional health. Where poor nutrition remains prevalent, protein-energy malnutrition and deficiencies of vitamin A, iodine and iron are the most common manifestations of this. Overnutrition has led to increased rates of cardiovascular disease, type 2 diabetes and cancer. Marks argues that while changes in nutritional health are clear to see,



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there are also changes in community expectations, governance and other factors that affect how agencies might respond to improved population health. The traditional divide between urban and rural populations is now less important as a classifier of nutritional health in South East Asia, and the nutrition agenda in all countries now involves both undernutrition and overnutrition among most age groups, and not just among young children and women of reproductive age.

Overnutrition has become an increasingly important contributor to chronic disease morbidity and mortality in one nation of South East Asia – Hong Kong. Recent studies of body fat percentage and BMI in the Hong Kong Chinese population have identified lower BMI cut-offs as being more salient for the identification of overweight and obesity than in the case of European populations; in contrast, BMI cut-off values for Pacific Islander populations are higher than those recommended for Europeans. In Chapter 5, Gary Ko shows that Hong Kong Chinese people, and perhaps Chinese elsewhere, may be prone to obesity-associated morbidities at lower BMI levels than Europeans.

The large body size and muscular build of Pacific Islanders was noted by Europeans from the time of Captain Cook's voyages (Pollock 1995). Photographs taken in the 1800s also indicate that body fatness was common among the higher classes of Islander societies (Baker 1984). However, there is little evidence of significant body fatness more generally across all levels of Pacific Islander societies prior to the Second World War. The emergence of fatness and obesity generally among Pacific Islander populations began during the second half of the twentieth century, this being largely attributed to health impacts of economic modernization. Most importantly, dietary change and changes in patterns of physical activity associated with levels of education, occupational status, and rural residence have been invoked as being central to the emergence of obesity in this region (Evans and Prior 1969; Bindon and Baker 1985; McGarvey 1991).

Historically, traditional diets of the populations of the Pacific Islands and Melanesia have been very low in fat, and high in complex carbohydrates, dietary fibre, and foods of plant origin (Shintani and Hughes 1994). Dietary change in the Pacific region has been documented, showing a higher contribution of fat and protein to total energy intake among urban communities than among those practising traditional subsistence (Ringrose and Zimmet 1979; Hanna *et al.* 1986; Hezel 1992). In Chapter 6, Yamauchi describes changes in diet and physical activity among Highlanders in PNG and among coastal Solomon Islanders. Although the increased consumption of energy-dense store-bought foods explains some of the difference in body fatness between urban and rural New

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Guinea Highlanders, reduced physical activity is as important. In particular, the decline in gender inequality in the division of labour in the urban populations, which caused the greater decline in physical activity of women, may go some way to explaining their greater body fatness relative to males. In contrast, there was no difference in body fatness between the rural and urban Solomon Islander populations. The traditional diet in the Solomon Islands, based on fish, root crops, and coconut, is nutritionally good, and it is perhaps unsurprising that the nutritional status of rural villagers is similar to that of the more modernized villagers. Unlike the groups seen in PNG, Yamauchi finds no clear difference in physical activity between traditional and more modernized Solomon Islander women, although traditional village men were more physically active than their more modernized counterparts. Yamauchi concludes that the less modernized Solomon Islander population is at an earlier stage of transition from subsistence to cash economy. Thus the influence of modernization on nutritional health is only partly manifest, but constitutes a potential health risk for the future.

While modernization and urbanization took place quickly in the Pacific after the Second World War, with far-reaching effects on human biology, the effects of these changes continue to penetrate many isolated Pacific islands to the present day. In Chapter 7, Tsukasa Inaoka and colleagues describe changing lifestyles, and associations between obesity and metabolism-related factors among the Tongan population in Tonga. The majority of Tongans live in urban areas, although rural populations are not very isolated when compared with populations in many other countries in the region, including PNG, the Solomon Islands and Vanuatu. In addition, about 100,000 Tongan citizens are out-migrants to various developed countries, including the United States, Australia and New Zealand. Many Tongans move between their own country and that of overseas residence, and flows of information between Tonga and the larger developed nations to which they migrate are great, as are remittances from out-migrants to Tongan relatives. For these reasons, it is unlikely that the rate of lifestyle modernization and the concomitant rise in obesity and non-infectious disease mortality will slow down there in the near future.

In Chapter 8, Ember Keighley and colleagues present data on physical and dietary characteristics of modernizing Samoans on independent Samoa, American Samoa and Hawaii respectively. In both Samoas, the prevalence of obesity increased between 1976 and 2003, to one of the highest levels on earth. Levels of overweight and obesity among adults in American Samoa in the 1970s matched the levels in Samoa some 30 years later. Furthermore, levels of overweight in children and adolescents from