Differential Mortality among Pacific Island Countries and Territories

Pacific island countries show highly variable patterns of mortality. While high mortality populations are affected particularly by infectious diseases and under-nutrition (especially children), adults in low mortality countries are afflicted with non-communicable diseases and injuries.

By Richard Taylor and Alan Lopez*

Pacific island countries and territories are at different stages of demograhic transition, with some populations still experiencing relatively high mortality and fertility and others manifesting lower mortality and declining fertility. These countries are also passing through the epidemiological transition, with a progressive increase in proportionate mortality from chronic diseases and

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widening sex differentials in death rates (Taylor, Lewis and Sladden,1991; Taylor, Lewis and Levy,1989).

The availability of accurate and current data on mortality levels, causes of death and trends is of vital importance to assist countries to channel public and private resources into priority health-related activities. The consequence of inaccurate (usually lower) mortality data is an under-estimation of the gravity and urgency of health problems, often leading to under-investment in health development. Many international and aid agencies use infant and childhood mortality rates and life expectancy as part of the decision-making process for allocating funds. Trends in mortality can also provide a useful and simple overall assessment of the results obtained following investments in social and economic development, and health services.

The purposes of the present article are to: (a) document levels of uncertainty in mortality estimates in Pacific island countries, (b) identify the major quality and analytical problems affecting estimates of mortality in Pacific island countries, and (c) provide best possible estimates based on an assessment of published data and application of demographic techniques. The scope of the current exercise is limited to total mortality levels from the 1990s to 2005 and is an update of previously published studies (Taylor, 2001; Taylor, Bampton and Lopez, 2005).

A similar assessment of causes of death data and causes of death estimates is essential to help determine the need for priority health programmes.

The present study focuses on:

- Melanesia which refers commonly to Fiji, New Caledonia, Papua New Guinea, Solomon Islands, Vanuatu;
- Micronesia: Federated States of Micronesia, Guam, Kiribati, the Marshall Islands, Nauru, the Northern Mariana Islands, and Palau
- Polynesia: American Samoa, Cook Islands, French Polynesia, Niue, Samoa (formerly Western Samoa), Tokelau, Tonga, Tuvalu, Wallis and Futuna.

Methods

A systematic survey was undertaken of international and regional health and development agencies, as well as universities and research institutes in 1999-2000 known for their involvement in the production and dissemination of mortality data concerning the Pacific islands. A data collection instrument was sent to the health and statistics ministries/departments of Pacific island countries through the offices

of the World Health Organization (WHO) and its representatives in 1999-2000, requesting published and unpublished mortality data from 1990 onwards (Taylor, 2001). In total, 167 references to recent mortality information were obtained for the 21 States included in the survey. Mortality data was evaluated with respect to: (a) sources and methods, (b) plausibility, and (c) consistency. During 2006-2007 the survey has been extended with a review of reported mortality for most Pacific island countries using published reports and web sites of countries and international and regional agencies. Data on some Micronesian and Polynesian countries have not yet been updated.

Sources and methods

The primary source of mortality data was identified, and the methods used for computation and projections were ascertained as far as possible; these were evaluated with respect to known strengths and weakness of sources and methods. (Taylor, 2001; Taylor, Bampton and Lopez, 2005; United Nations, 1983; Lopez and others, 2002). Empirical data from vital registration that had been assessed for under-registration were preferred to the use of model life tables for imputation of adult mortality from child mortality, or as part of indirect methods (the model life tables used may not have been appropriate in several instances). Indirect methods were employed extensively, especially the children ever born/children surviving (CEBCS) method, as well as the widowhood and orphanhood techniques for adult mortality (United Nations, 1983). These methods are capable of providing reasonable estimates of mortality as long as recall of demographic events is accurate and appropriate model life tables are used to translate recorded proportions of children/siblings surviving into estimates of infant and child mortality. Vital registration data covering short periods for small populations are unreliable because of stochastic variation. Projections were examined with regard to methodology and assumptions, where these were available; projections were often based on standard assumptions about mortality decline over time from international rather than local data, and are therefore deemed unreliable (Lopez and others, 2002).

Plausibility

Infant and childhood mortality and life expectancy figures were evaluated with respect to plausibility compared with levels prevalent in other countries (e.g. infant mortality rates below 10/1000 are only usually seen in developed countries); the cause-structure of mortality, where it is reliably known (e.g. relatively low infant mortality is plausible in countries with relatively high life expectancy if considerable non-communicable diseases cause mortality among adults); and

reported changes in relation to previous estimates (e.g. sudden rises or falls in life expectancy and infant mortality over short periods are improbable).

Consistency

Finally, there is greater confidence in mortality estimates that are derived by independent methods requiring different assumptions yet which yield approximately similar results. However, estimates produced by different agencies may be consistently wrong because they tend to derive from each other, or are produced from the same faulty data source or based on inappropriate methodologies. Thus consistency must be judged in relation to the above-mentioned parameters; sources and methods, and plausibility.

The "best estimates" of life expectancy and infant mortality for each Pacific island country have been derived from the data and information available, following application of the above considerations. A range of uncertainty is given as the minimum and maximum estimates for life expectancy and infant mortality identified from the available data for each country from the 1990s to 2005. These data emanate from a range of country sources (especially Health and Statistics Departments), and from international and regional agencies including the Asian Development Bank (ADB), the Economic and Social Commission for Asia and the Pacific (ESCAP), the Secretariat for the Pacific Community (SPC), the United Nations Children's Fund (UNICEF), the United Nations Population Division, the United Nations Development Programme (UNDP), the United Nations Population Fund (UNFPA), the World Bank, and the World Health Organization (WHO).

Data presented in tables 1-3 from life tables have been rounded to the nearest whole year of life expectancy (at birth) and nearest number of deaths (per 1,000) for the infant mortality rate (IMR). Some IMRs shown in tables 1-3 were calculated by averaging the sex-specific values.

Table 1. Mortality estimates for Pacific island countries: Melanesia

Country/territory (year) Population (in thousands)	**Best recent estimate available** (and range of estimates)*					
	Year	**Life expectancy at birth** (years)		**Year**	**Infant mortality** (per 1,000)	**Source and method of best recent estimate**
		Males	**Females**			
Fiji (1997) 810	1996	65 (61-72)	69 (65-76)	1996	20 (7-26)	Demographic analysis of 1996 census [a/]
New Caledonia (1996) 197	1999	70 (67-73)	76 (73-77)	1999	6 (6-8)	Accurate vital registration [b/]

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Table 1. *(Continued)*

Country/territory (year) Population (in thousands)	Best recent estimate available (and range of estimates)*					
	Year	Life expectancy at birth (years)		Year	Infant mortality (per 1,000)	Source and method of best recent
		Males	Females			
Papua New Guinea (1990) 3,608	2000	55 (51-58)	54 (54-62)	1995	73 (61-73)	Life expectancy 2000 census analysis and surveys [c/]
Solomon Islands (1999) 404	1999	61 (61-70)	62 (62-74)	1999	66 (20-66)	Demographic analysis of 1999 census [d/]
Vanuatu (1999) 193	1999	66 (64-70)	69 (65-74)	1999	29 (17-39)	Demographic analysis of 1999 census [e/]

Sources: [a/] Rakaseta (1999); Secretariat of the Pacific Community (2001);Fiji Bureau of Statistics (1998) and Fiji Government (2006).

[b/] *Situation Sanitaire en Nouvelle-Caledonie (1999);* South Pacific Commission (1998); Secretariat of the Pacific Community (1998); Papua New Guinea National Statistics Office (1996) and National Statistical Office (2003).

[c/] Secretariat of the Pacific Community (1998); Papua New Guinea National Statistics Office (1996) and National Statistical Office (2003).

[d/] National Statistical Office (2003) and Solomon Islands National Statistics Office (2006).

Note: * The ranges for life expectancy and infant mortality are the work out the sources of this table and tables 2, 3 minimum and maximum estimates identified from a range of country and international and regional agency sources.

Table 2. Mortality estimates for Pacific island countries: Micronesia

Country/territory (year) Population (in thousands)	Best recent estimate available (and range of estimates)*					
	Year	Life expectancy at birth (years)		Year	Infant mortality (per 1,000)	Source and method of best recent estimate
		Males	Females			
Federated States of Micronesia (1997) 118	1994	64 (63-65)	67 (65-67)	1994	46 (20-46)	Life tables imputed from childhood mortality from indirect methods [a/]
Guam (1997) 146	1995	73 (70-73)	77 (74-77)	1995	9 (9)	Accurate vital registration [b/]
Kiribati (1999) 81	1995	59 (58-59)	65 (62-65)	1995	62 (53-67)	Demographic analysis of 1995 census [c/]

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Table 2. *(Continued)*

Country/territory (year) Population (in thousands)	Best recent estimate available (and range of estimates)*					
	Year	Life expectancy at birth (years)		Year	Infant mortality (per 1000)	Source and method of best recent
		Males	Females			
Marshall Islands (1999) 51	1994	60 (60-66)	63 (63-69)	1994	63 (14-63)	Life tables imputed from childhood mortality [d/]
Nauru (1992) 10	1991-1993	54 (54-55)	61 (61-64)	1991-1993	13 (11-25)	Hospital death registration data[a/]
Northern Mariana Islands (1995) 59	1994-1996	67 (67)	73 (73)	1992-1996	10 (7-10)	Vital registration data[e/] Probably accurate
Palau (1998) 19	1995	64 (64-66)	70 (69-74)	1995	20 (19-28)	Vital registration data[f/] Probably accurate

*Source*s: [a/] South Pacific Commission (1998).

[b/] Secretariat of the Pacific Community (1999).

[c/] Republic of Kiribati, Ministry of Health .

[d/] South Pacific Commission (1998).

[e/] Secretariat of the Pacific Community (2001) and Secretariat of the Pacific Community (1999).

[f/] South Pacific Commission (1998) and Secretariat of the Pacific Community (1999).

Notes: * The range for life expectancy and infant mortality are the minimum and maximum estimates identified from a range of country and international and regional agency sources.

Table 3. Mortality estimates for Pacific island countries: Polynesia

Country/territory (year) Population (in thousands)	Best recent estimate available (and range of estimates)*					
	Year	Life expectancy at birth (years)		Year	Infant mortality (per 1,000)	Source and method of best recent estimate
		Males	Females			
American Samoa (1999) 63	1995	68 (67-68)	76 (71-76)	1991-1995	13 (10-16)	Sources and methods unclear [a/]
Cook Islands (1999) 17	1995-2005	69 (59-71)	73 (65-75)	1991-1996	22 (4-34)	Vital registration data[b/]

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Table 3. *(Continued)*

Country/territory (year) Population (in thousands)	Best recent estimate available (and range of estimates)*					
	Year	Life expectancy at birth (years)		Year	Infant mortality (per 1000)	Source and method of best recent
		Males	Females			
French Polynesia (1996) 220	1995-2005	71 (70-71)	76 (75-77)	1996	6 (5-7)	Accurate vital registration data [c/]
Niue (1997) 2	1991-1997	70 (63-74)		1991-1996	18 (18-22)	Probably accurate vital registration data [d/]
Samoa (1999) 175	1998	65 (65-70)	72 (67-72)	1998	25 (11-25)	Vital statistics sample survey [e/]
Tokelau (1996) 1.5	1996	68 (68)	70 (70)	1991-1995	32 (32-38)	Vital registration data Probably accurate [a/]
Tonga (1999) 97	2000	70 (64-71)	72 (67-74)	1996	16 (8-24)	Demographic analysis of 1996 census [f/] Annual Report Ministry of Health [g/]
Tuvalu (1999) 11	1991	64 (64)	70 (70)	1990-1999	27 (16-56)	Life expectancy data from demographic analysis of 1991 census [h/]
Wallis and Futuna (1996) 14	1990-1995	67 (67-70)	71 (71-74)	1990-1995	15 (6-18)	Probably accurate vital registration [i/]

Sources: [a/] South Pacific Commission (1998).

[b/] Secretariat of the Pacific Community (2001); Secretariat of the Pacific Community (1999); Demmke (1999); Secretariat of the Pacific Community (2004) .

[c/] *Institut Statistique de Polynésie Francais. Etat-civil, Mai* (2006a and 2006b)

[d/] Secretariat of the Pacific Community (2001) and Demmke (1999).

[e/] Secretariat of the Pacific Community (2001); Secretariat of the Pacific Community (1999) and Government of Samoa, Department of Statistics and Secretariat of the Pacific Community (1999).

[f/] Secretariat of the Pacific Community (2001) and Rakaseta (1999).

[g/] Ministry of Health Tonga. (2006).

[h/] Secretariat of the Pacific Community (2001); South Pacific Commission (1998); Rakaseta, Haberkorn, Demmke and Lepers (1998) and Tuvalu Government Statistics Office (2001).

Note: * The range for life expectancy and infant mortality are the minimum and maximum estimates identified from a range of country and international and regional agency sources.

Results

This analysis reveals uncertainty around mortality estimates for Pacific island countries and territories (tables 1-3). The ranges for life expectancy and infant mortality are the minimum and maximum estimates identified from the published and unpublished data obtained from a detailed review as described above. In some countries, life expectancy variations of 10 years or more were recorded. The review of published mortality estimates suggests that there is considerable use of under-enumerated death records or vital registration data, especially within countries, without any attempt to estimate and correct for under-enumeration. Both infant and adult mortality data are under-estimated in many Pacific island countries.

In some small island countries, especially with populations below 50 000, vital registration or death recording data are frequently used by countries to produce annual mortality estimates. The small number of deaths produces significant fluctuations from year to year with some mortality estimates being implausibly high and others implausibly low.

In some countries, adult mortality has been imputed directly from infant and under-five mortality using inappropriate life tables which do not reflect the Pacific island patterns of relationship between child and adult mortality. (Taylor, Lewis and Sladden, 1991; Taylor, Lewis and Levy,1989). An additional problem is that the infant and childhood mortality calculated from death registration or indirect methods may not be, in itself, accurate. Some estimates of mortality from indirect demographic methods do not produce plausible results (compared with previous estimates and similar countries), and this may be owing to uncorrected inaccuracies in the census or survey data, or uncritical analysis.

There are indications that projections are frequently employed to produce "current" mortality estimates (since mortality and life expectancy figures are given for the year of publication of the data), but projection methodology is hardly ever mentioned or described. There is indirect evidence that projections of life expectancy using as an increment a fixed fraction of a year of life expectancy per annum (such as half a year per annum) have been used in some countries, since published annual life expectancies increment by such fixed values each year from the last empirical estimate. Such increments are likely to be based on the generic models of mortality decline assumed by the United Nations (2003).

Based on an evaluation of data and methods, life expectancy across the Pacific appears to vary from a low in Papua New Guinea to a high in Guam and New Caledonia (table 1). Infant mortality was lowest in Guam and New Caledonia

(<10/1000) and relatively high (60-80/1,000) in several countries across Melanesia, Micronesia and Polynesia, although there is substantial uncertainty around these estimates.

Discussion

This study provides a critique of available mortality estimates for Pacific island countries using multiple sources of information published between the 1990s and 2005. The references acquired on mortality in Pacific island countries indicate that contradictory and unreliable estimates are often published with regard to levels of mortality in these countries.

In general, there is very poor documentation of data sources and methodology of mortality estimation in most published reports. The age-specific mortality rates upon which life expectancies are based are frequently not provided. There are significant differences between data published by different agencies for similar periods for many countries. It is usually not clear how such different estimates were derived. It may be the case that, for some countries, published mortality estimates are derived from similar neighbouring countries or regional averages, or imputed from macro-economic (for example, GDP per capita) or social data, which could explain some of the large differences existing between figures provided by different agencies.

Under-enumeration of deaths in vital registration data is common, yet few countries attempt to estimate and correct for under-enumeration. Mortality rates derived from these data are often implausibly low in relation to mortality reported from countries at similar levels of social and economic development and are inconsistent with measures of mortality derived from indirect demographic techniques. In some small island countries, especially with populations below 50,000, the small number of deaths produces significant fluctuations from year to year. Averages over 3-5 years, or in some cases 7-10 years, are required to avoid spurious high and low mortality estimates due to stochastic variation.

In some small island countries with extensive connections with more developed countries, out-migration of seriously-ill persons for treatment may lead to under-enumeration of deaths. This applies especially to States associated with New Zealand, the United States of America and France. Furthermore, sailors, expatriate workers or military personnel may die overseas and their death may not be registered in their country of origin, although they had originally been counted in the census. These deaths may be considerable in some island countries such as Kiribati and United States-associated Micronesian States.

Indirect demographic methods including the children ever-born/children surviving (CEBCS) techniques for infant and child mortality, and the orphanhood and widowhood methods for adult mortality, are extensively used in the census analyses for these populations. While these methods are valuable in populations without accurate vital registration, the results depend on the quality of the data reported in the census. Moreover, these approaches have their own methodological problems (United Nations, 1983; Lopez and others, 2002); and they can be inappropriately or inexpertly applied, thus producing spurious findings.

Model life tables from the United Nations or Coale-Demeny systems are extensively used to smooth empirical death data, or are employed at some stage in the variety of indirect methods used in mortality analysis from census or survey material (Murray and others, 2003; United Nations, 1981; Coale and Demeny, 1966). These model life tables are now well out of date and their ability to capture contemporary age-specific mortality patterns in countries at different stages of the health (epidemiological) transition is questionable (Murray and others, 2003). During the health transition, many populations experience a plateau in life expectancy at birth (at around 55-65 years) which may last for decades as reductions in infant and childhood mortality from infectious disease and under-nutrition are counter-balanced by increases in adult mortality from non-communicable conditions (especially cardiovascular disease). This was observed in Australia in males between 1945 and 1970 and in females between 1960 and 1970 (Taylor, Lewis and Powles, 1998a; 1998b) and is quite likely to be the case in many Pacific island countries given the documented proportional mortality (Taylor, Lewis and Sladden,1991; Taylor, Lewis and Levy,1989) and morbidity from non-communicable disease and risk factor prevalence (Taylor and others, 1992). This is seen, for example, in Nauru (Taylor and Thoma, 1985) and among Australian Aborigine (Cunningham and Condon, 1996, Cunningham and Yin, 2000) and also in Eastern Europe and in the former Soviet Union (Chenet and others, 1998; Shkolnikov and others, 1999). There may well be a variety of age-specific patterns of mortality that yield the same level of life expectancy, and these are not adequately covered by model life tables. The new model life table system proposed by Murray and others (2003) should help to overcome some of these problems in incorrect choice of a family of model life tables, but this system presupposes reasonable estimates of adult mortality.

Furthermore, there are problems in life expectancy projections. The average rate of improvement in life expectancy (years per annum) in countries at various levels of life expectancy depends on many factors, including the impact of risk factor dispersion on levels of mortality from non-communicable diseases.

Projections which incorporate a rate of increase in life expectancy (at birth) derived from past international experience rather than local data may be implausible for countries in the midst of the epidemiological (health) transition with an epidemic of non-communicable diseases. Some Pacific countries have shown a plateau in life expectancy during one or two decades, which is likely to be associated, to some extent with the emergence of non-communicable diseases (Taylor, Lewis and Powles, 1998a, 1998b).

Pacific island countries show highly variable patterns of mortality. While high mortality populations are affected particularly by infectious diseases and under-nutrition (especially children), adults in low mortality countries are afflicted with non-communicable disease and injuries. However, even the least-developed, high-mortality countries show urban-rural differentials with non-communicable diseases emerging as health problems in urban area (Taylor and others, 1992). In Nauru, non-communicable diseases and accidents, particularly for males, are sufficiently problematic to greatly increase adult mortality and reduce life expectancy. This cause structure of mortality also explains wide sex differentials in death rates, with much higher death rates in male. Compared with previous studies mortality appears to have declined over the past two decades in all Pacific island countries, with the smallest changes occurring in those States that already had relatively high life expectancy (such as Guam and American Samoa). Nevertheless, important differentials remain.

Reliable, current data on levels and causes of child and adult mortality are critical for prioritizing health sector interventions and health policy development in the Pacific islands, alike elsewhere. Vital registration systems, the internationally recognized "gold standard" for assessing levels, patterns and causes of mortality, are inadequate in most of these countries. The results highlight substantial uncertainty in mortality estimates and probable wide variation of mortality levels and patterns across the Pacific. The very different stages of the demographic and health transitions suggest that these States should not be grouped together in international health analyses.

References

Chenet, L. and others (1998). "Alcohol and cardiovascular mortality in Moscow; new evidence of a causal association", *Journal of Epidemiology & Community Health,* vol. 52, No. 12, pp. 772-774.

Coale, A. and P. Demeny (1966). *Regional Model Life Tales and Stable Populations*. Princeton, New Jercy, Princeton University Press.

Cunningham J. and J.R. Condon (1996). "Premature mortality in aboriginal adults in the Northern Territory, 1979-1991", *Medical Journal of Australia*, vol.165, no. 6, pp. 309-312.

_____ and P. Yin (2000). *Mortality of Aboriginal and Torres Strait Islander Australians*. *Australian Bureau of Statistics Occasional Paper, ABS Cat no.3315.0*. Canberra, Australian Bureau of Statistics.

Demmke, A. (1999). *Cook Islands Population Profile Based on 1996 Census: A Guide For Planners and Policy Makers*. Nouméa, New Caledonia, Secretariat of the Pacific Community.

_____ and F. Haberkorn (1999). *Niue Population Profile Based on 1997 Census: A Guide For Planners and Policy Makers*, Nouméa, New Caledonia, Secretariat of the Pacific Community.

Fiji Bureau of Statistics (1998). *1996 Fiji Census of Population and Housing: Analytical Report, Part 1 Demographic Characteristics,* Parliamentary Paper No. 49, Suva, Parliament of Fiji; 1998.

Fiji Government. Ministry of Information (2006). *Fiji Today 2000.* Accessed in 2006.

Gakidou, E., M. Hogan and A.D. Lopez (2004). "Adult mortality: time for a reappraisal", *International Journal of Epidemiology*, vol. 33, No. 4, pp. 710-717.

Government of Samoa, Department of Statistics and Secretariat of the Pacific Community (1999). *Analytic Report. Samoa Demographic and Health Survey,* Nouméa, New Caledonia, Secretariat of the Pacific Community.

Hayes, G. (1996). *Estimates of Mortality in Papua New Guinea Based On The 1990 Census and the 1991 Demographic and Health Survey,* UNFPA/ILO Project PNG/94/P01 "Integration of population factors into development planning", Port Moresby, Papua New Guinea.

Institute de la Statistique et des Études Économiques (1996). *Décès: Évolution du nombre de décès, Historique depuis 1965.* Accessed through http://www.isee.nc/tec/popsociete/popdeces.html, July 2006

Institut Statistique de Polynésie Francais. Etat-civil, Mai (2006a). *Espérance de vie en Polynésie Française de 1984 à 2005*, accessed through www.ispf.pf , August 2006.

_____ *(2006b). Principaux indicateurs démographiques de 1975 à 200*', accessed through www.ispf.pf, August 2006.

L'Institut Territorial de la Statistique et des Etudes Economiques (2006). *Etat-civil - Résultats: PD4 - Espérance de vie à la naissance par sexe et province.* Accessed through http://www.itsee.nc/etatcivil/etciviltableaux.html, August 2006.

Lopez, A.D. and others (2002). *World Mortality in 2000: Life Tables for 191 Countries*, Geneva, World Health Organization.

Ministry of Health Tonga (2006). *Annual Report of the Minister of Health*, cited in 'Key Statistics' worksheet, table 'Health Indicators', available via SDT website http://www.spc.int/prism/country/to/stats/Social/Health/health.htm, March 2007.

Murray, C.J.L and others (2003). "Modified logit life table system: principles, empirical validation, and application", *Population Studies*, vol. 57, No. 2, pp. 165-182.

National Statistical Office (2003). *Recent Fertility and Mortality Indices and Trends in Papua New Guinea: A Report Based on the Analysis of 2000 Census Data. Port Moresby, Papua New Guinea.* Table III-4: "Average life expectancies at birth (in years) by sex and geographic sector for PNG and its regions and provinces derived from 1971, 1980 and 2000 Census and 1996 DHS data".

Papua New Guinea National Statistics Office (1996). *National Report on the 1996 Demographic and Health Survey*.

Rakaseta, V. (1999a). *Fiji Islands Population Profile Based on 1996 Census: A Guide for Planners and Policy Makers,* Nouméa, New Caledonia, Secretariat of the Pacific Community.

_____ (1999b). *Tonga Population Profile: A Guide For Planners and Policy Makers,* Nouméa, New Caledonia, Secretariat of the Pacific Community.

_____, G. Haberkorn, A. Demmke and C. Lepers (1998). *Tuvalu Population Profile: A Guide for Planners and Policy-Makers,* Noumea, New Caledonia, Secretariat of the Pacific Community.

Republic of Kiribati, Ministry of Health . *Fourth Kiribati National Health Plan 1999 -2002, vol 1, No 4*.

Secretariat of the Pacific Community (1998). *SPESS: Selected Pacific Economies – A Statistical Summary*, Number 14, Nouméa, New Calendonia, Secretariat of the Pacific Community.

_____(1999). *Pacific Island Populations Data Sheet.* Compiled by the Population and Demography Programme, 1999. Nouméa, New Caledonia, Secretariat of the Pacific Community.

_____ (2001). SPC Statistics Section. http://www/spc.org.nc/statsen/english/publications/. Nouméa, New Caledonia: Secretariat of the Pacific Community. Accessed 2001.

_____ (2004a). *Pacific Island Populations 2004.* SPC Demography and Population Programme, http://www.spc.org.nc/, Nouméa, New Caledonia, Secretariat of the Pacific Community, accessed in 2004.

_____ (2004b). *Pacific Islands Populations 2004*. Accessed through http://www.spc.int/demog/en/index.html, November 2006. Data at 1999 represents period 1996-2002.

Shkolnikov, V.M. and others (1999). "Cancer mortality in Russia and Ukraine: validity, competing risks and cohort effects", *International Journal of Epidemiology,* vol. 28, No. 1, pp. 19-29.

Situation Sanitaire en Nouvelle-Caledonie (1999). *Annee 1999.*

Solomon Islands National Statistics Office (2006). *Population Census: 1999 Census of Population Summary*; and *1986 Census of Population Summary*. http://www.spc.int/prism/country/sb/stats/Social/Soc-Index.htm, accessed in September 2006.

South Pacific Commission (1998). *Pacific Island Populations – Revised Edition*. Report prepared by the South Pacific Commission for the International Conference on Population and Development 1994: Cairo, Egypt. Nouméa, New Caledonia, South Pacific Commission; 1998.

Taylor, R. (2001). "Strengthening capability for collection, evaluation, analysis, projection and reporting of mortality data from Pacific Island counties", Pacific Island mortality project. Report submitted to The World Health Organisation, Western Pacific Regional Office. Sydney: Department of Public Health and Community Medicine, Faculty of Medicine, University of Sydney.

_____, D. Bampton and A. Lopez (2005). "Contemporary patterns of Pacific Island mortality". *International Journal of Epidemiology,* vol. 34, pp. 207-214.

_____and others (1992). "Dietary intake, exercise, obesity and noncommunicable disease in rural and urban populations of three Pacific island countries", *Journal of the American College of Nutrition,* vol.11, No. 3, pp. 283-293.

_____ and K. Thoma (1985). "Mortality patterns in the modernized Pacific Island nation of Nauru", *American Journal of Public Health*, vol. 75, No. 2, pp.149-155.

_____, M. Lewis and J. Powles (1998a). "The Australian mortality decline: cause-specific mortality 1907-1990", *Australian & New Zealand Journal of Public Health,* vol. 22, No. 1, pp. 37-44.

_____ (1998b). "The Australian mortality decline: all-cause mortality 1788-1990", *Australian & New Zealand Journal of Public Health*, vol. 22, No.1, pp. 27-36.

_____, N.D. Lewis and S. Levy (1989). "Societies in transition: mortality patterns in Pacific Island populations", *International Journal of Epidemiology*, vol.18, No. 3, pp. 634-646.

_____, N.D. Lewis and T. Sladden (1991). "Mortality in Pacific Island countries around 1980: Geopolitical, socioeconomic, demographic and health service factors", *Australian Journal of Public Health*, vol. 15, No. 3, pp. 207-221.

Tuvalu Government, Statistics Office (2001). Excel file data.

United Nations (1981). *Model Life Tables for Developing Countries,* (Sales No. E81.XIII.7), New York.

_____ (1983). Manual X: Indirect Techniques for Demographic Estimation*, Population Studies,* No. 81, New York.

_____ (2003). *World Population Prospects: The 2002 Revision,* (Sales No. E.03.XIII.6), New York.

Vanuatu National Statistics Office. *Health Indicators.* http://www.spc.int/prism/Country/VU/stats/Social/health_indicators.htm, from the Ministry of Health and *1999 Census* – Vanuatu National Statistics Office, http://www.spc.int/prism/Country/VU/stats/Social/Demography/Population.htm