

**DISEASES OF AFFLUENCE NO LONGER:
NON-COMMUNICABLE DISEASE MORTALITY AS A
POLICY PRIORITY IN SOUTH ASIA**

by

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ABSTRACT

Non-communicable diseases (NCD), historically considered to be associated with affluent regions, now comprise the greatest burden of disease in nearly every region of the world. Cardiovascular disease (CVD) mortality is foremost among these with approximately 80% of CVD deaths occurring in the developing world. Disease burden comparisons are infrequent in developing regions since the respective health infrastructures often lack the capacity to collect comprehensive mortality data. Sri Lanka and Maldives are two South Asian countries with such capacity and have recently begun keeping mortality data with electronic records. This descriptive study is the first to have made use of the data in order to gauge these nations' NCD burdens relative to selected developed nations and identify priority areas for further investigation and policy discussion. Results show that Sri Lanka and Maldives display the highest age-standardized mortality rates for overall NCDs, CVD, hypertension and COPD.

Keywords: Sri Lanka; Maldives; non-communicable disease; cardiovascular disease; mortality trends

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1: INTRODUCTION

1.1 The current burden of cardiovascular disease in developing and developed countries

Non-communicable diseases (NCD) have been historically regarded as diseases of affluence, primarily affecting developed regions. The current statistics, however, are beginning to tell a much different story. It is expected that as many as 70% of all deaths in the world will be caused by NCDs within developing nations by the year 2020 (Boutayeb & Boutayeb 2005).

Foremost in prevalence among the NCDs is cardiovascular disease (CVD), which is now considered to be the number one cause of death in the developing world (WHO 2008). In addition, CVD tends to manifest at younger ages in developing regions as opposed to developed ones (Gaziano 2007). As a result, increasing numbers of individuals are affected during their prime working years which compounds the associated socioeconomic burden of disease. The trends in CVD burdens also differ between developing and developed regions due to differences in resources as well as prevention & treatment policies. In developed countries, the overall CVD burden is increasing. However, this rise is a result of ageing populations and increasing longevity. Age-adjusted CVD mortality rates show that CVD mortality is actually declining among developed nations such as Australia and the United States. This suggests that the CVD burden is being curbed among the population under 60 years of age. In contrast,

similar interventions in developing countries are generally lacking while risk factor prevalence rises, contributing to the increasing number of deaths among those of prime working ages (Gaziano 2007). These trends among developing regions are based on the available data. Unfortunately, such information is often incomplete since the majority of developing nations lack the capacity for the comprehensive collection of mortality, morbidity and risk factor data. As a result, the opportunity for extensive and valid comparative analysis between developing and developed regions is limited.

1.2 The availability of comprehensive registered mortality data in South Asia

In the developing region of South Asia, Sri Lanka and Maldives are the two countries with the most comprehensive health infrastructures. Registered death certificates are collected for over 90% of mortality and can be used to illustrate the distribution of disease burden. This data had not yet been released or analyzed for the Republic of Maldives and remains unpublished for Sri Lanka beyond the year 1997. This project is the first to have made use of the most recent mortality data available from each of these two countries in an attempt to gauge the burden of NCDs relative to a number of selected developed nations.

Sri Lanka and Maldives are in the process of completing their epidemiological transitions. The relative burdens of HIV/AIDS, tuberculosis, and malaria are low compared with South Asian averages, primarily influenced by India's population, while the prevalence of chronic disease is increasing.

Notably, Maldives achieved eradication of Malaria in 1984. This country has

experienced rapid growth in recent years due to the success of its tourism industry. The economic progress has fuelled a period of health care financing reform and the Maldivian government has committed to a stepwise introduction of universal health insurance starting in 2008 (WHO Maldives 2008).

Considerable logistical challenges exist given the geographical nature of the country, which consists of 1192 islands grouped into 26 atolls. Of these, approximately 200 islands are inhabited. It contains the smallest population and has the smallest land area of all the South Asian countries. Since independence from Britain in 1968, population has more than tripled and life expectancy has increased by 26 years to 72. Notably, nearly a third of the current population is comprised of foreign employees primarily from neighbouring South Asian countries. Maldives is primarily an Islamic nation and has operated as a presidential republic since its independence.

In Sri Lanka, the performance of the health sector has been impressive despite limited resource allocation due to the ongoing conflict which is primarily in the Northern and Eastern regions of the island. National health expenditures have been consistent since the 1950's, accounting for between 3.3% and 3.7% of the GDP. The efficiency of the current system may be partially a result of the distribution of primarily public health care services which favour the poorer populations with more physician contacts per capita than richer populations. This suggests that the system may be "redistributive in its net fiscal impact", contributing to its progression and sustainability (Hsiao & Li 2000).

1.3 The increasing need for quantitative analysis in evidence-based decision making

Informed and effective policy development is vital to the ongoing progress of the health sectors in both of these countries. It is therefore necessary to evaluate trends in health data and make international comparisons in order to provide evidence for policy prioritization. This project serves to initially describe the available mortality data from these two countries and compares the mortality distributions with those of developed nations. Emphasis was placed on addressing the large burden of NCD mortality, which was evaluated by major classification and major disease for the most recent available year in the selected countries. Additionally, a trend analysis between Australia, the United States and Sri Lanka was performed in order to evaluate any emerging patterns of disease over time. We then conclude with a discussion of the guiding policies that may be contributing to the identified trends.

2: METHODS

2.1 Data Sources

Mortality data for Sri Lanka and Maldives was provided by the respective governments to the Institute for Health Policy in Colombo, Sri Lanka. The datasets contain information on year of death, age, sex, cause of death, ethnicity, location of death, and area of usual residence. It was unclear, albeit unlikely, that the data included mortality among the Tamil-controlled Northeast populations of Sri Lanka.

Comparable data from other countries was acquired from the WHO mortality database, which contains registered mortality data presented to the WHO by its member states. All causes of death were coded by the WHO International Classification of Disease (ICD) system in versions 9, 9-BTL or 10.

2.2 Statistical Analysis

The statistical software used to manage the Sri Lankan and Maldivian databases was Stata version 9.0. Data was arranged into tables using age, sex and cause-specific mortality rates. Management of comparable health data from other countries, standardizations, and graphing were subsequently completed in Microsoft Excel 2003 spreadsheet software. To allow for comparisons, all Sri Lankan and Maldivian data was organized into the same age categories as the

WHO mortality database. In addition, all standardizations were made using the 2001 Sri Lankan population structure as a reference.

2.3 Study Objectives

Comparisons in this project can be categorized into four successive steps. Firstly, mortality data was standardized and compared between Sri Lanka and Maldives. Five NCDs were identified as major causes of mortality and subsequent breakdowns took these causes into consideration. Secondly, the Sri Lankan and Maldivian data was compared to the WHO South-East Asia Region (WHO-SEAR) mortality data. Thirdly, mortality data from a number of selected developed countries was acquired for the most recent available years. Standardized comparisons to the Sri Lankan and Maldivian populations were made by major causes of mortality (group comparisons), by selected major ICD classification (block comparisons) and by the mortality rates of the five identified non-communicable diseases of interest. Lastly, a mortality trend analysis using the same categories was performed for all available years of data from Australia, the United States, and Sri Lanka. Maldives was excluded from the trend analysis since only a single year of mortality data was available electronically. Australia and the United States were chosen as comparisons for Sri Lanka due to their long-established policies for secondary prevention and treatment of CVD.

Step 1: Comparison of mortality profiles between Sri Lanka and Maldives

- Datasets containing the registered death data for all years available in electronic format in Sri Lanka (1991-2001) and Maldives (2005 only) were organized into Stata.
- Breakdowns of mortality data for the most recent available years in Sri Lanka (2001) and Maldives (2005) were made using age-cause-specific mortality rates. All rates were standardized to the 2001 Sri Lankan population structure.

Step 2: Comparison of Sri Lankan and Maldivian mortality data to the South-East Asian region

- Breakdowns of mortality by major category (groups) were compared to the available WHO-SEAR figures. Additional comparisons were made to the group mortality of the European region and World averages.

Step 3: Comparison of Sri Lankan and Maldivian mortality data to selected developed nations

- Sri Lankan and Maldivian mortality data were compared with the most recent available data from selected developed nations using the three sets of mortality breakdown. All mortality rates were age-standardized to the 2001 Sri Lankan population structure.

Mortality breakdowns were as follows:

1. Communicable, Non-communicable disease, & Injury groups

2. Major ICD block categories (including Circulatory, Neoplasm, Infectious, Respiratory, Maternal & Child)
3. Non-communicable diseases of interest (including cardiovascular, diabetes mellitus, and chronic obstructive pulmonary disease inclusive of asthma)

Step 4: Trend analysis of mortality rates between Australia, the United States, and Sri Lanka for all available years of data

- All available Sri Lankan (1991-2001), U.S. (1979-2000) and Australian mortality data (1979-2001) was compared using the three mortality breakdowns outlined above in Step 3. All rates were standardized to the 2001 Sri Lankan population.

3: RESULTS

3.1 Mortality profile comparisons between Sri Lanka and Maldives

Mortality distribution is relatively similar between Sri Lanka and Maldives. The most notable differences include higher rates of injury in Sri Lanka causing 18% of overall mortality versus only 6% in Maldives. This high rate in Sri Lanka can be largely attributed to the ongoing Sinhala-Tamil conflict. Among the most significant burdens of death, there are higher levels of chronic obstructive pulmonary disorder (COPD) in Maldives than in Sri Lanka, at 6% and 1% of all NCD mortality, respectively. Conversely, Sri Lanka has a higher rate of asthma-related deaths which comprise 6% of all NCD mortality as compared to Maldives which reports at 1%. This may be due to classification issues between the two respiratory diseases. Regardless, the largest burden of death in both countries is caused by cardiovascular disease with approximately 75% of mortality among the five identified NCDs of interest being attributable to ischemic heart disease (IHD) and hypertension.

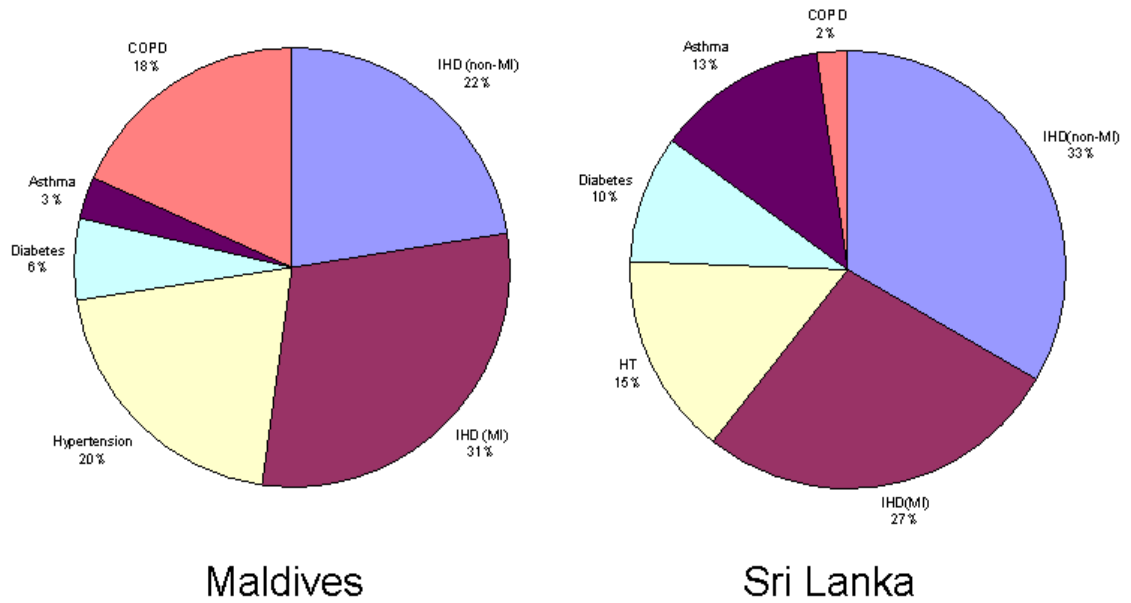


Figure 1. Mortality among the five identified NCDs of interest, Maldives (2005) and Sri Lanka (2001)

3.2 Mortality profile comparisons to South-East Asian & European regions

Compared to the overall distribution of mortality in the South-East Asian region, Sri Lanka and Maldives have low rates of communicable disease at 11% and 15%, respectively, compared to the regional average of 40%.

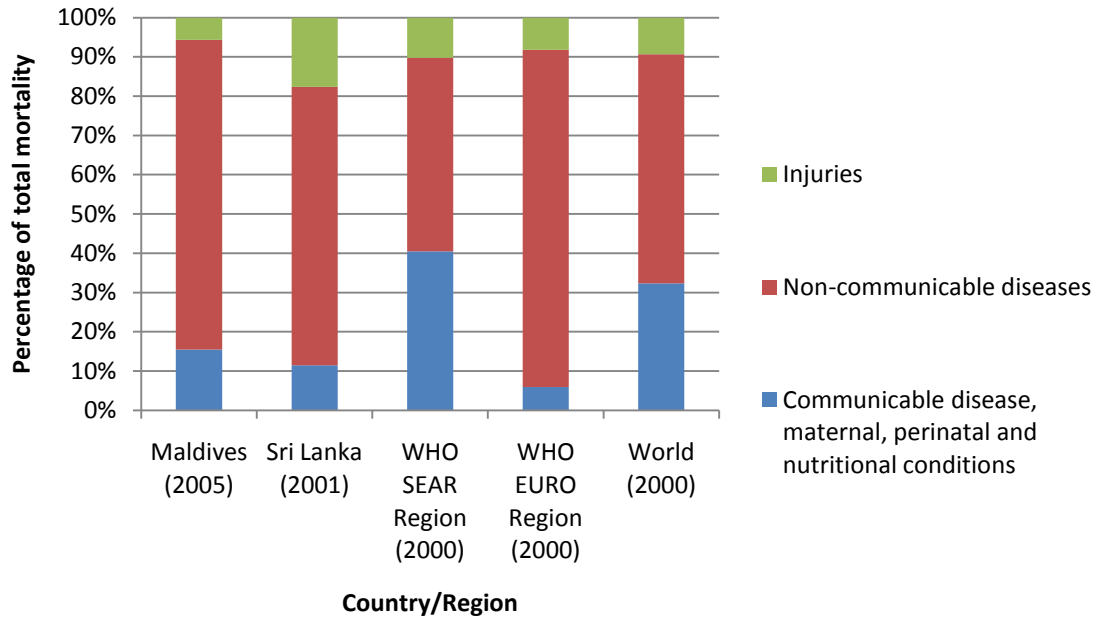


Figure 2. Burden of mortality by major cause in Maldives, Sri Lanka, SEAR, EURO, & World

Accordingly, the rates of non-communicable diseases are much higher in these two countries, at 71% and 79%, compared to the SEAR average of 49%. The Sri Lankan and Maldivian figures resemble those of the European region, and serve to illustrate that Sri Lanka and Maldives are at the forefront of epidemiological transitions in the developing world.

3.3 Among the World: Comparing the latest mortality data from Sri Lanka, Maldives, and selected developed countries

Mortality is compared according to several categorizations or breakdowns, which begin at the most macro-level and successively narrow to focus on specific diseases. The first breakdown uses the three major mortality groups of communicable disease (CD), non-communicable disease (NCD) and injuries. Sri

Lanka and Maldives show the two highest rates of NCD mortality when compared using age-standardized mortality rates to the developed nations of Australia, Canada, Germany, Portugal, the United Kingdom and the United States. The NCD mortality rates are highest of all in Sri Lanka at 920 deaths per 100,000 population.

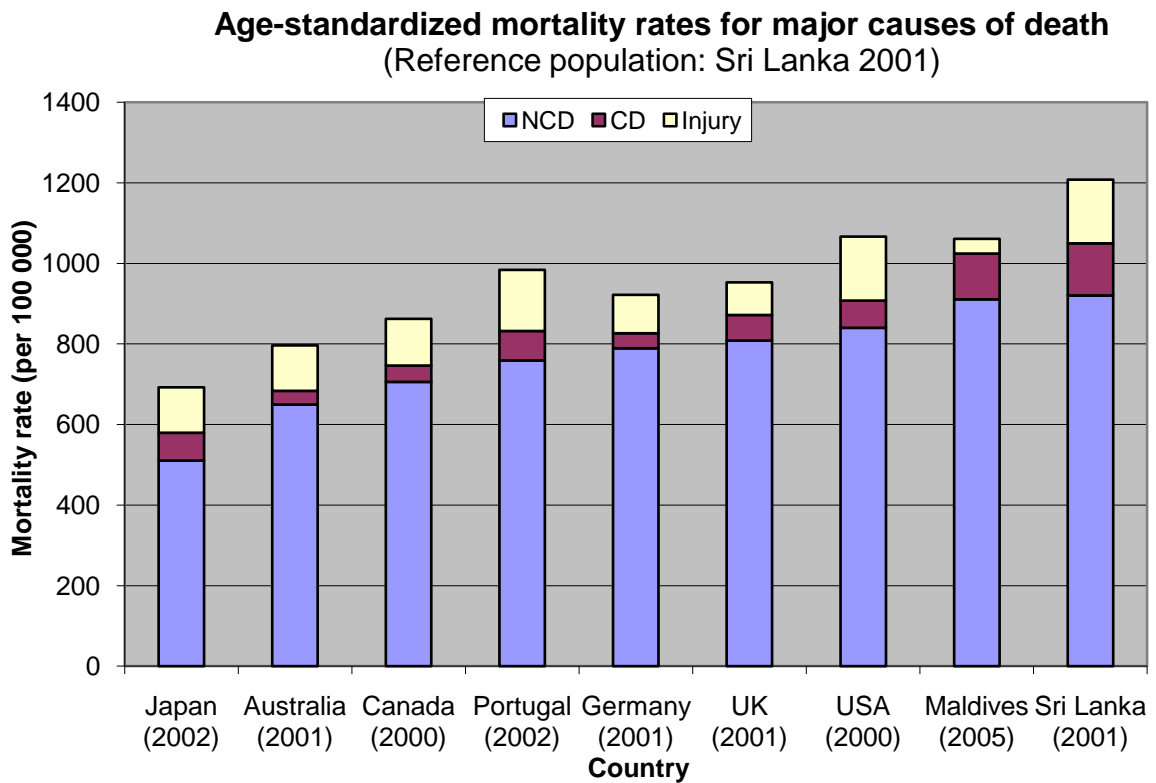


Figure 3. Age-standardized mortality rates for major causes of death by country

The subsequent breakdown is done by major ICD classification (referred to as 'blocks'). ICD-10 classification contains a total of 22 blocks. Of these, five blocks illustrating NCD and CD burdens are used in the analysis. These include circulatory disease, neoplasms, respiratory disease, infectious disease and

maternal & child conditions. Circulatory disease mortality rates are shown to be highest in Maldives at nearly 495 deaths per 100,000. Sri Lanka has the second-highest CVD mortality at 379 deaths per 100,000, just slightly more than Germany. Subsequent investigation regarding the age of CVD mortality reveals that in Sri Lanka, 19% of circulatory deaths are occurring before the age of 55 compared with only 8% in Germany, 9% in Australia and Canada, 10% in the UK and 13% in the USA. In addition, maternal and child mortality rates are also highest in the two South Asian countries of interest. Another notable difference is that neoplasm mortality rates are more than twice as high in the developed countries than in Sri Lanka and Maldives. Due to the availability of data, South Korea is used in lieu of Portugal for this analysis.

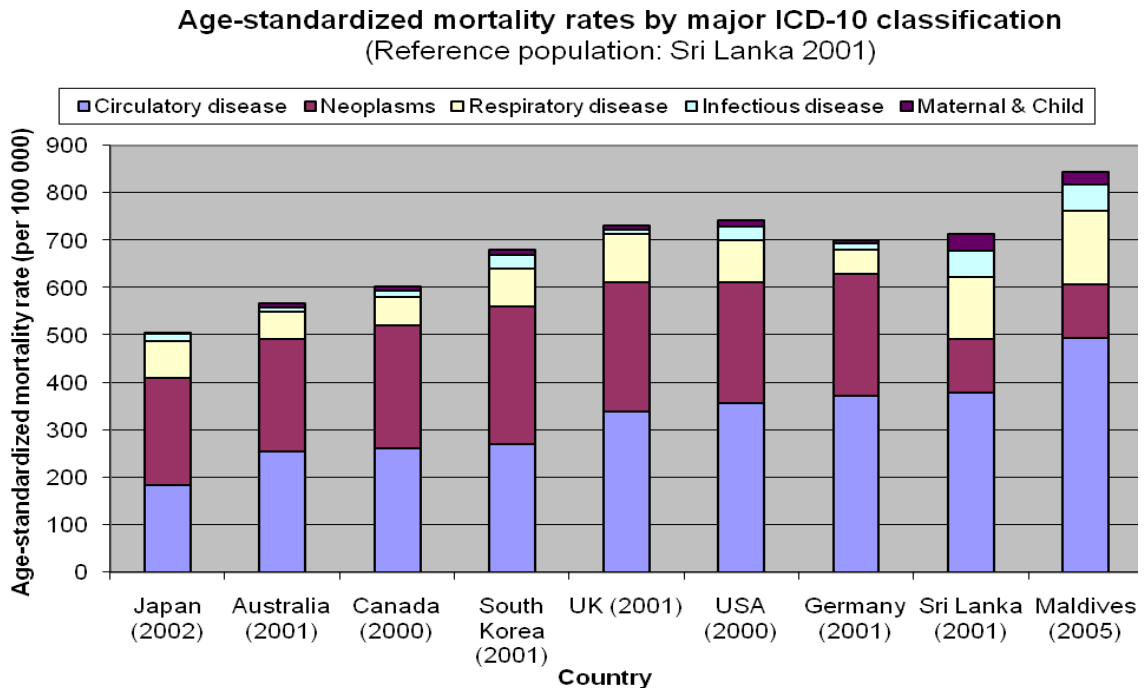


Figure 4. Age-standardized mortality rates by major ICD-10 classification

The final mortality breakdown is done by comparing rates among the five identified NCDs of interest. Maldives and Sri Lanka are shown to have the highest rates of pulmonary heart disease. The Maldivian rate is approximately twice that of Sri Lanka. However, this large disparity may be a result of small sample size. Hypertensive disease and COPD mortality are highest in Sri Lanka and second highest in Maldives. Hypertensive deaths are particularly high in both South Asian countries, being several times the rates of the others. Diabetes mortality is also notably high in Sri Lanka with only the rate in South Korea exceeding it. Arterial disease mortality, prevalent in the developed nations, is very low in South Korea, nearly non-existent in Sri Lanka, and absent in Maldives.

Table 1. Age-standardized NCD-specific mortality rates by country

Country	Age-standardized NCD-specific mortality rates (per 100,000)						
	Ischaemic heart disease	Pulmonary heart disease	Cerebro-vascular disease	Hyper-tensive disease	Arterial disease	Diabetes mellitus	COPD (incl. asthma)
Japan (2002)	45.4	48.8	77.8	2.9	7.4	8.3	10.9
Australia (2001)	139.9	33.9	58.7	5.9	13.4	17.5	32.7
Canada (2000)	149.7	38.9	49.8	5.2	14.8	24.2	33.7
South Korea (2001)	49.2	26.6	166.0	22.1	4.5	52.4	46.2
UK (2001)	181.4	37.3	85.1	5.4	20.9	10.5	42.5
Germany (2001)	164.8	91.4	72.1	17.8	20.7	20.7	26.5
USA (2000)	198.5	62.9	59.1	17.1	15.0	29.3	47.8
Sri Lanka (2001)	142.0	107.0	55.6	68.6	0.6	42.0	68.1
Maldives (2005)	153.4	200.5	83.2	57.7	0.0	20.8	60.5

3.4 Mortality Trend Analysis: Comparing mortality over time in Australia, the United States and Sri Lanka

A final set of analyses looks at the mortality distributions over all available years of data for Australia (1979-2001), the United States (1979-2000) and Sri Lanka (1991-2001).

Group trends (CD/NCD/Injury) in both Australia and the USA show relatively low and steady mortality rates from communicable disease and injury. Of the three, Sri Lanka displays the highest rates of communicable disease and injury-related deaths. NCD mortality rates in both Australia and the USA are shown to be gradually dropping from 1979 onwards. In comparison, the NCD mortality rates of Sri Lanka remain consistently higher than the other two countries from 1996 onwards.

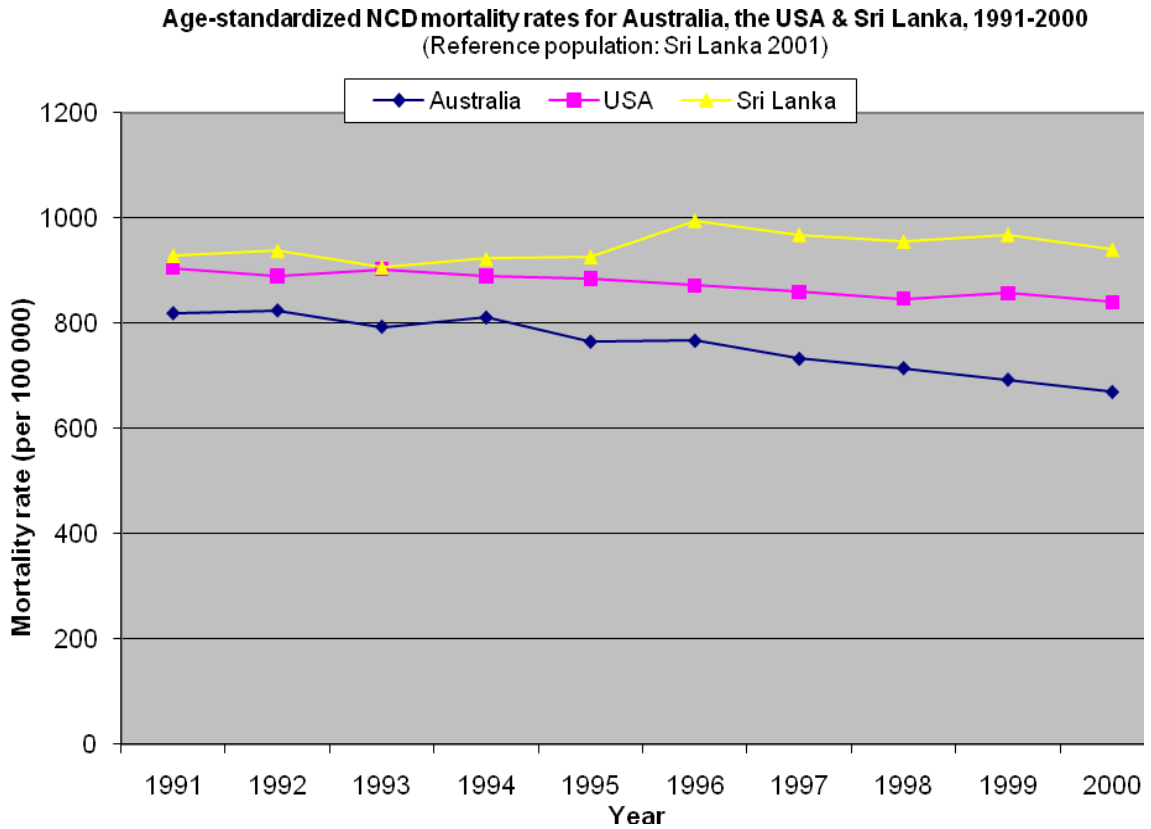


Figure 5. Age-standardized NCD mortality rates for Australia, the USA, & Sri Lanka, 1991-2000

By major ICD classification, Australia and the USA show steady mortality rates for all except circulatory disease, which is falling every year. CVD mortality in Sri Lanka shows a minor decrease over the eleven years of data yet remains higher than the other two countries for all years. Neoplasm mortality is consistently lower in Sri Lanka while infectious, respiratory, and maternal & child mortality is higher for all years.

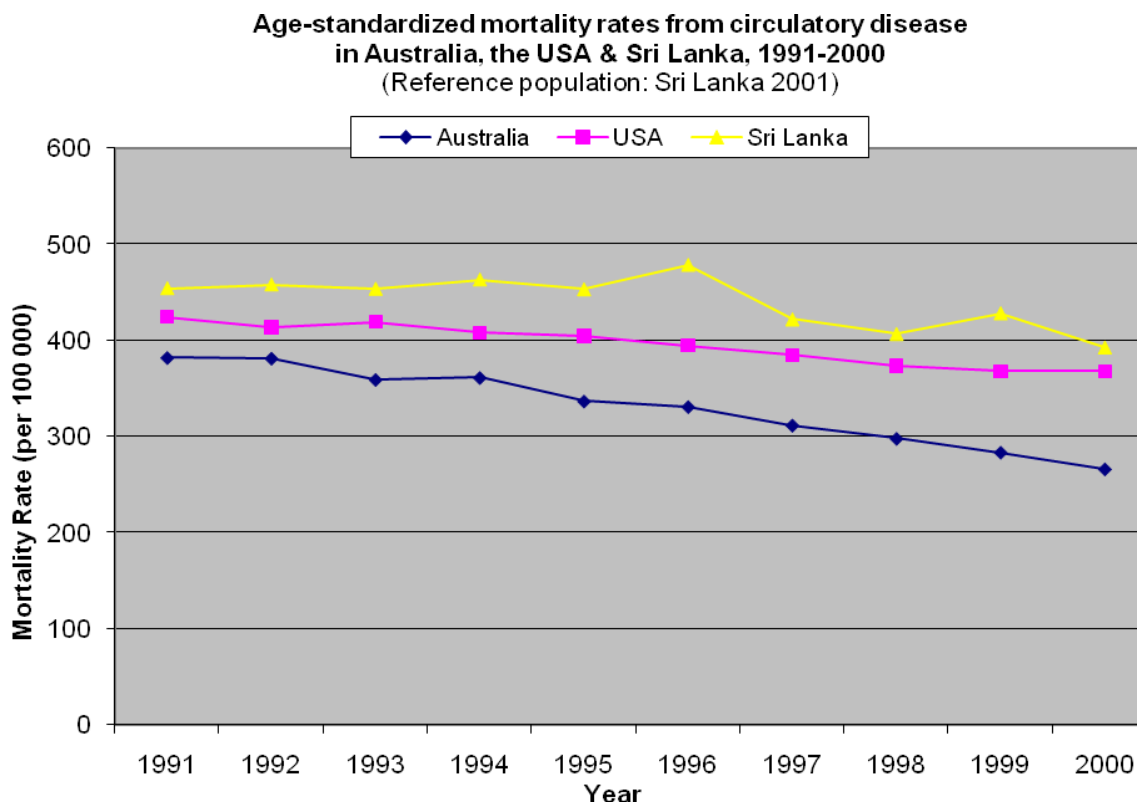


Figure 6. Age-standardized mortality rates from circulatory disease in Australia, the USA, & Sri Lanka, 1991-2000

Among the identified NCDs of interest, ischemic heart disease (IHD), which is dropping in Australia and the USA, remains steady in Sri Lanka. IHD appears to be lower in Sri Lanka for all years. However, a classification bias was revealed in the 1997 transition from ICD version 9 to 10, showing that a large number of IHD deaths were being improperly classified as ‘heart failure’ and ‘ill-defined heart disease’. In addition, a large number of Sri Lankan deaths are ambiguously classified as ‘other heart disease’, while in Australia and the USA, the ‘other heart disease’ category is virtually negligible. This disparity continues even after the switch to ICD-10 in Sri Lanka which suggests that a large portion

of deaths being classified as 'other heart disease' in Sri Lanka are actually IHD deaths (See Figures 7 & 8). Provided that this misclassification is occurring, the rates of IHD mortality in Sri Lanka may very well be higher than that of Australia and the USA.

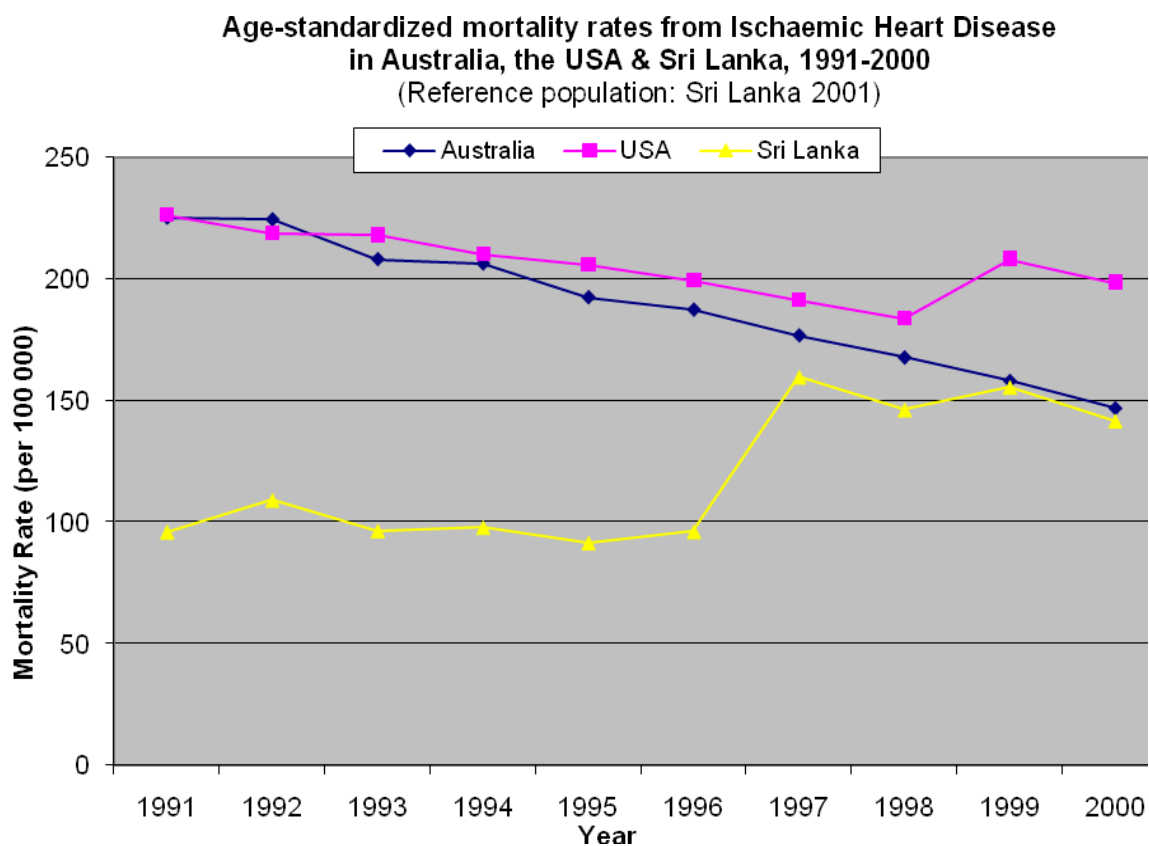


Figure 7. Age-standardized mortality rates from IHD in Australia, the USA, & Sri Lanka, 1991-2000

Age-standardized mortality rates for cardiovascular diseases, diabetes and COPD, Sri Lanka, 1991-2001
 (Reference population: Sri Lanka 2001)

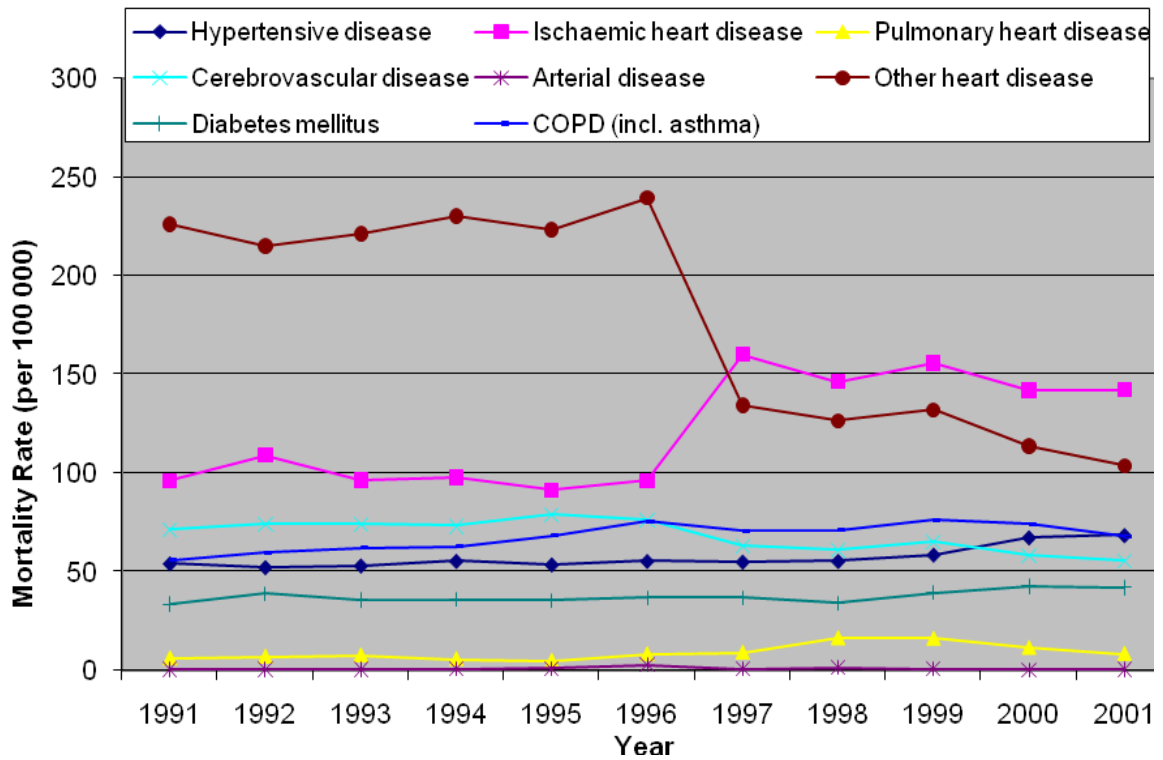


Figure 8. Age-standardized mortality rates for CVD, diabetes, and COPD in Australia, the USA, & Sri Lanka, 1991-2000

4: DISCUSSION

4.1 Findings

When compared to developed nations in this study, Sri Lanka and Maldives are shown to have the two highest rates of NCD mortality, primarily driven by circulatory disease-related deaths. In the trend analysis, NCD mortality rates are higher in Sri Lanka for all years. There is an indication that overall NCD mortality is dropping in Australia and the United States while remaining relatively constant in Sri Lanka at nearly 1000 deaths per 100,000 population. Looking more specifically at ICD blocks, we see that CVD drives approximately half of Sri Lanka's NCD mortality, which is similar to Australia and the US. Regardless, CVD mortality rates remain highest in Sri Lanka for all years.

It is important to note that while these overall rates warrant concern, there is an additional disparity among ages of onset. As discussed above, the number of CVD deaths occurring before age 55 in Sri Lanka is twice that of several developed nations in this study. This results in an indirect economic effect, impacting more individuals during their prime working years. While this study reviews data solely on mortality, the additional economic burden resulting from CVD-associated morbidity should also be considered in any cost-benefit analysis of treatment.

Compared to Australia and the US over time, neoplasm mortality rates are consistently lowest in Sri Lanka, while communicable disease mortality is

consistently highest. These trends fit the continuum of an epidemiological transition and places Sri Lanka at the late 3rd to early 4th stages. Since life expectancy in Sri Lanka is still less than that of Australia and the US, delayed degenerative diseases, namely cancer, are less prevalent. According to the WHO (2008), life expectancy in Sri Lanka & Maldives is approximately 72.5 years as opposed to Australia at 81.5 and the US at 77.5 years. Therefore, if Sri Lanka and Maldives are successful in eventually curbing their current epidemics of heart disease, as many developed nations have been, their populations will continue to age and neoplasm mortality would be expected to increase.

In terms of prevention, Australia and the United States approach the CVD burden both through primary and secondary strategies. In the US, half of the decline in coronary heart disease mortality has been attributed to reductions in major risk factors (primary) while the other half has resulted from evidence-based medical therapies (secondary) (Ford et al. 2007). These medical therapies are mediated using established treatment protocols and involve the use of antihypertensive medications. It is our understanding that such protocols are not yet in place in Sri Lanka and are currently being developed for Maldives.

Since the increasing burden of CVD in Sri Lanka and Maldives is so great, it will be necessary to expand current strategies to address major risk factors. Hypertension is known as a major risk factor for CVD and is the most common in the development of heart failure (Black 2003). Aggressive attempts at lowering blood pressure, which often require the use of multiple antihypertensive agents, have been identified as critical in reducing the risk of CVD (Black 2003). As seen

earlier in Table 1, hypertensive mortality rates in Sri Lanka are more than five times those of the US and over 11 times those of Australia. These mortality rates are indicative of morbidity, suggesting that hypertension is currently not well-controlled in Sri Lanka.

4.2 Limitations

Completeness of the registered mortality databases in each country may vary. For the majority of developed countries, completeness is estimated to be 100%. In comparison, Sri Lankan and Maldivian data is estimated to be 91-95% complete and may therefore include some degree of representation bias. Underreporting in certain regions is also possible given the conflict situation in the Northern and Eastern regions of Sri Lanka. Data is believed to include the majority of registered death certificates from Sri Lankan health infrastructure. However, it is unlikely to contain any data from Tamil-controlled territories which reportedly run an independent health system. Data are further limited by an unknown degree of physician misclassification of deaths and the systemic limitation of only being able to report a single cause of death per individual (registered death certificates in Sri Lanka currently do not accommodate the reporting of multiple causes of death). Additionally, mortality data from various countries and years are coded in different versions of ICD and therefore present an unknown degree of misclassification bias. Finally, the relatively small population of Maldives (300,000), results in relatively few deaths per year (approximately 1000). The small sample size limits the validity of mortality breakdowns, most notably at the micro-level of specific diseases.

4.3 Recommendations for further investigation and public health policy

This project is primarily descriptive and serves to gauge the current burden of CVD in Sri Lanka and Maldives as they compare to the developed world. However, it is limited in that it only answers the question of *what* the current issues are while providing some relative measure of their gravity. The next step is to explore the question of *why* these mortality distributions exist by using a risk factor analysis. Due to the long-term nature of chronic disease manifestation, the risk factors mainly affecting these mortality data occurred previous to the 1990s. To our knowledge, such risk factor data are unavailable and since many of the major risk factors, such as sedentary behaviour, may very well have continued to increase in prevalence, a current analysis would be prudent in serving to predict future mortality patterns as well as to highlight areas from which the burden may be most effectively and efficiently curbed.

Several studies have noted higher rates of CVD occurring at relatively younger ages among South Asian populations and have made comparisons of risk factors and mortality/morbidity between native South Asians and South Asian Diaspora. There is debate surrounding the susceptibility of South Asian populations to CVD which may be insufficiently explained by traditional risk factors and possibly include a degree of genetic predisposition. In a study based in Singapore, which contained Chinese, Malay, and Indian populations, excess CVD mortality was noted among Indians (Relative Risk of 3.8 compared to the Chinese population and 1.9 to Malay population). This disparity in mortality decreased with age, showing the greatest excess at younger ages (Hughes et al.

1990). More recently, an extensive case-control study by Joshi et al (2007) evaluated major risk factors for myocardial infarction (MI) among nearly 30,000 South Asians living throughout the developed world and within South Asia, including Sri Lanka. It was concluded that higher levels of risk factors among younger ages are contributing to the earlier onset of cardiovascular disease in South Asia. Hypertension, abdominal obesity, and psychosocial factors showed some of the greatest associated risk for MI among native South Asians compared to those living in other regions. Such factors may partially explain the results of our current study which shows high levels of CVD mortality occurring at younger ages in Sri Lanka than in developed nations. The identification of hypertension as a major risk factor among South Asians also aligns with the findings, showing mortality associated with hypertensive to be several fold higher in Sri Lanka than in Australia and the US. Possible reasons for increasing risk factor prevalence may include the continued economic progress of Sri Lanka which has led to increased 'white collar' jobs within urban centres that involve less physical labour. Changes in diet may also be occurring with increasing disposable incomes and the availability of high-fat food services. Joshi et al (2007) noted that the consumption of fruits and vegetables, a preventative factor for MI, is approximately half the rate among native South Asians as opposed to those living in other regions. Similarly, moderate- or high-intensity exercise is less than a third prevalent among South Asians residents when compared to their Diaspora.

The Sri Lankan and Maldivian datasets contain additional information that was not available for comparison from the WHO mortality database for the developed countries. Information on residency, birthplace, ethnicity, and sex in the Sri Lankan and Maldivian datasets could be used to identify further trends in CVD mortality. Lastly, information on morbidity was not available for analysis. However, CVD often manifests as a chronic condition and knowledge of the onset age along with some measure of disability and its related economic impact would be vital to a policy discussion.

Once sufficient analyses of data on mortality, morbidity, and risk factors are made available, a review of current treatment guidelines would be in order. Sri Lanka and Maldives are facing comparably higher rates of NCD mortality while having less spending available for the health sector than in the developed world. Therefore, the development of cost-efficient strategies addressing primary and secondary prevention is paramount. Current universal guidelines for the medical management of hypertension are not in place. The employment of antihypertensive medications targeting high-risk individuals should be well-established in addition to current primary prevention strategies. While the costs of hypertension management may be greater than that of general health promotion, the benefits of improved quality of life, increased longevity, and decreased need for interventional procedures may greatly outweigh the additional public expense. Strategies involving the use of secondary prevention measures have been in place in both Australia and the US for decades. The resulting benefit of which, may serve as an explanation of the patterns observed

in the CVD mortality trend analysis of this study. IHD rates continue to drop in Australia and the US while remaining greatest in Sri Lanka for all available years of data.

Lastly, it should be noted that the advent of cardiovascular disease in Sri Lanka and Maldives and the subsequent approaches to its management may provide a model for future policy in other South Asian countries which are likely to follow similar patterns in their own epidemiological transitions. Further research into effective prevention and treatment in Sri Lanka and Maldives could well serve as precedent for future practice throughout the region.

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