Mortality data in the Kingdom of Tonga: a review of changing trends over the ten years since 1996

Sione Hufanga and Vicki Bennett

Keywords (MeSH):
Tonga; Trends; Mortality; Death Rate; Infant Mortality; Maternal Mortality

Introduction
The Kingdom of Tonga, which consists of 175 islands in the South Pacific, has a population of a little over 100,000 living on only 36 of these islands, with about two thirds of the population living on the main island of Tongatapu. The Ministry of Health (MOH) in Tonga provides health services to this population through four hospitals, 14 Health Centres and 34 Maternal and Child Health Clinics.

To understand the patterns of morbidity and mortality in Tonga, the MOH collects data regarding deaths through the death notification process, which has been used as the basis for the information presented in this paper. Death data is also collected from death certificates by the Registrar General; however this has not been used as a source for this paper.

Data collection method
It is estimated that the MOH currently records approximately 85% of all deaths occurring in Tonga annually. Thirty percent of the total annual deaths received by the MOH come from the inpatient health settings of the four main hospitals. The remaining deaths notified occur in the community, in Health Centres, and as ‘dead on arrival’.

Although not complete, it has been determined that the MOH’s death notification data is currently the most reliable source of mortality data when compared with other sources. This dataset can be validated against other sources including ward registers, death certificates, mortuary registers and outpatient registers.

Missing data
The current registration process has some gaps that cause under-reporting of deaths for certain groups within the population. The first group that is likely to be missed in the current death notification process consists of people who live in the geographically remote islands of Tonga where no MOH personnel are permanently located.

The second group of deaths that are under-reported consists of people who do not have a significant estate that may be inherited by the deceased’s family. In Tonga, the property of deceased persons (especially land resources) is inherited by the next of kin, according to cultural requirements. For community deaths, a death certificate is usually only issued at the request of the family, and the most common reason for this request is for inheritance purposes. Infants who die in the community comprise a large portion of this category where death certification is not completed due to lack of estate.

There are some other circumstances where deaths are not reported, but the majority of the under-reporting is deemed to be directly or indirectly related to the above two reasons.

Improvements in data collection
Over the last five years the MOH, with the assistance of donor organisations such as AusAID and the World Bank, has begun to invest significant resources to bring about improvements to the current birth and death notification processes. Prior to this, the death notification process within the MOH had not been revised for over 30 years. There had been some minor changes in business processes over time but these had not completely addressed the inability of the current system to capture those deaths likely to be missed from the collection system, as explained above. This has led to current work to update the policies and procedures for death notification being under-
taken, implementation of monitoring indicators and consideration of the introduction of legislative requirements as enforcement tools.

None of these changes, however, has been fully integrated into current reporting practices, and thus they will not have created any significant variation in data used in this report; that is, there is no change that will have created a series break in the data.

The Ministry of Health has now made several changes to the mortality data collection system, starting with the hospital settings, as described below.

- In the previous reporting system, death certificates were only issued upon request from the family. Death Certificates are now issued as soon as possible after the time of death for hospital deaths, irrespective of family requests.
- The Death Certificate Books are kept in the Medical Records Department of the hospitals. The Medical Records staff now provide these books to the doctors in the wards for them to complete as soon as they become aware of a death or when requested.
- Monitoring indicators have been established to ensure all deaths are reported from the hospital setting. Medical Records staff collect the daily bed census from the wards with the duplicate copies of the death certificates. If there are any deaths identified where the death certificate has not been completed, these are taken to the Medical Superintendent for them to ensure completion.

The above changes have only been in place in the main hospital over the last 12 months, and early review of these changes has noted that the completion rate of deaths certificates in the hospital increased to >95% in 2006.

The changes have been successful due to the good relationship between the Health Information and Medical Records staff and the clinicians. Clinicians at the main hospital involve the staff of the Health Information Section in the monthly mortality meeting and the Health Information staff assist the clinicians by providing data when requested by clinicians and Ministry staff for work or research purposes.

The MOH also anticipates implementing new procedures for community deaths in the next few months, as follows:

- Public Health Nurses will be authorised to use a new form, the Notice of Death form, for notifying deaths. This new form will be used to notify all community deaths to the Medical Superintendent of the main hospital, who can then issue a death certificate.
- This form will also be completed by the Public Health Nurse irrespective of the family request.
- Whenever there is a community death, the Public Health Nurse completes this form and forwards the duplicate copies to the MOH.
- The original copy of the certificate is given to the family and they are required to take this to the Town Officer for countersigning prior to submission to the Medical Superintendent of the main hospital for the issue of the death certificate.
- All duplicates of Notice of Death forms are now sent with the monthly reports submitted by the Public Health Nurse. These are then matched with the number of reported community deaths in their respective locations. These changes will help to strengthen the mortality data collection and the system will no longer depend on family requests. Both

Figure 1: Crude Death Rate, Infant Mortality Rate and Perinatal Mortality Rate, 1996–2005:
the changes in the hospital and community settings have inbuilt monitoring indicators to detect under-reporting for further investigation.

Over the last two years the Ministry introduced a similar methodology for birth notifications, and the under-reporting rate has been reduced from 14% to less than 1% in 2006.

**Demographic analysis of mortality**

Over the last decade, the number of deaths in Tonga has increased at a faster pace than the projected annual population growth rate of 0.3 per 100,000 population. The lowest crude death rate occurred in 1996 with less than 0.4 deaths per 100,000, then increased significantly up to over 0.6 deaths per 100,000 in 1999. Rates have fluctuated above and below 0.6 in all subsequent years. (See Figure 1).

When examining the maternal and child health related mortality indicators in conjunction with the Crude Death Rate, it can be seen that they have very little impact on the overall death rate, due to the extremely low actual numbers. The trend in the Crude Death Rate, as shown in the above graph, does not correlate with the Infant Mortality Rate, Maternal Mortality Rate or the Perinatal Mortality Rate.

**Factors affecting mortality**

**Non-communicable diseases**

The results of a specialised health survey, the STEP Survey, has shown that the prevalence of diabetes in 1973 increased from 4.4% and 5.5% (in rural and urban males respectively) and 10.0% and 9.7% (in rural and urban females) to an overall standardised prevalence for the age group 30-64 years of 15.1% and 17.6% for males and females in 1998-2000. In addition, the cancer registry in Tonga also demonstrates an exponential increase in the number of registered cancer cases in 1998.

Even though there is a lack of scientific evidence to show a direct link between these findings and the fluctuations in the pattern of the Crude Death Rate, we can postulate that the increase in the prevalence of non-communicable diseases (NCDs), specifically diabetes and cancer, has been responsible for the elevated Crude Death Rate in the last decade.

Tonga has experienced high mortality rates due to NCDs in the last five years. The diseases of the circulatory system, neoplasms, endocrine, nutritional and metabolic, diseases of respiratory system are the most common causes of death. These diseases are usually included in the five leading causes of mortality and are responsible for more than 50% of the total annual deaths.

It is also important to acknowledge the limitations of studying routinely collected information retrospectively as the variation in mortality patterns may partly due to the data collection system. This issue is further discussed below.

**Age and gender**

Figure 2 graphically displays the differences in the number of deaths for males and females. Over the last five years, the mortality statistics reveal that the occurrence of deaths among men and women are disproportionate. This is a significant difference and the probable reasons will be discussed below.

Even though the MOH’s mortality registrations have been refined and strengthened over time, there is a small number of death notifications that give no indication of the decedent’s age. These are represented as NA (not available) in the table above. This information partially represents the
additional effort made by the MOH to capture
data on unreported deaths from other sources,
such as private and public mortuaries. In this case
it is sometimes possible to obtain the names of
the deceased without being able to confirm the age.

**Infant and child deaths**
Children under 14 years of age more commonly
died from communicable diseases such as septi-
caemia and gastroenteritis over the period under
study. Death rates attributable to the effects of
communicable diseases are comparably higher in
children compared to the adult age groups.

**Seasonal variation**
In Tonga it is almost impossible to correlate the
pattern of mortality with seasons or weather
patterns because there are no significant varia-
tions between seasonal temperatures and climate.
The variation in weather is sometimes correlated
with patterns of morbidity, such as epidemics of
fish poisoning in hurricane seasons rather than
from influenza-like illness. Given the fact that the
main causes of deaths are lifestyle diseases, the
pattern of mortality is more likely to be associated
with cultural events, such as stroke and cardio-
vascular disease during feasting season.

**Hospital deaths**
The most reliable source of demographic and
clinical information about the deceased is the
admission and discharge database of the main
hospital. The main hospital, Vaiola, serves approx-
imately 70% of the total population. It is also the
referral hospital for the outer island hospitals and
Health Centres.

In order to be able to identify similarities
and differences in deaths over time, the hospital
admission and discharge statistics of Vaiola
Hospital for the years 2001 - 2005 have been
analysed to generalise findings that may be appli-
cable to other hospitals. During the same period,
the three smaller hospitals had bed occupancies
of less than 30%, and less than 50 deaths in each
hospital, thus analysis of these small data sets
was not felt to be reliable.

Descriptive statistics from the admission and
discharge data sets of Vaiola Hospital from 2001
-2005 reported that about 41% of the patients
who died in hospital over the last five years were
admitted with cardiovascular diseases (26%),
cancer (12%) and respiratory diseases (11%).

**Data strengths**
The total current projected population from the
last available Census conducted by the Statistics
Department in 1996 is approximately 103,000. In
a small population group such as this, the collec-
tion of vital statistics is manageable and there is a
great opportunity to capture greater than 95% of
all events.

Provided that numbers of deaths are less than
1,000 annually, the Ministry has more than one
source of information to validate its statistics
(such as private and public mortuaries, and the
Government Justice Department) in a reasonable
time (less than 2 months) for all the islands of
Tonga.

**Limitations of the data**
The total population of Tonga is very small and
this allows significant changes in some mortality
indicators, specifically Infant and Maternal
Mortality Rates, as a result of small changes in
the numerator. In 2005, there were 31 Infant
Deaths and 2634 live births, which means the
Infant Mortality Rate was 11.8 per 1,000 live
births. An increase of even one additional infant
death would subsequently increase the rate from
11.8 to 12.1 if the number of live births remains
constant. Conversely, to offset the effect of one
additional infant death and to maintain the Infant
Mortality Rate at 11.8, it would require at least
78 additional live births.

The second indicator that is very sensitive due
to small numbers in the numerator is Maternal
Mortality Rate. A single maternal death trans-
lates to a rate of approximately 40 per 100,000
live births. In 2005, the Maternal Mortality Rate
was 227 per 100,000, which represented only six
maternal deaths occurring in the whole country.
The impact in small populations of large variation
in rates is a very important factor to be taken
into account by users of the statistics of small
countries like Tonga. A small underreport in
either one of these two indicators can also make a
significant difference in the rates.

In the Kingdom of Tonga legislation supports
the traditional cultural arrangements and require-
The head of the family, usually the father, possesses the ultimate authority in the family to inherit the family property from the legitimate cultural next of kin. Women never directly inherit property. Given that a death certificate was usually only issued at the request of the family, and the most common reason for this request is for inheritance purposes, it is suspected that there is a higher rate of death notifications for males compared to females. Thus unique cultural arrangements regarding the role of the head of family to inherit family property may be creating a selection bias in death notification.

**Comparison with other Pacific countries**

It is acknowledged that all countries have slight differences in their methods of collecting mortality data. The importance of these differences relates to the quality of mortality data, and its suitability for use in international comparisons. In comparing the mortality data of these countries it is acknowledged that these limitations exist, however the overall usefulness of this exercise at a macro level is validated.

Using the simple definitions of Crude Death and Infant Mortality Rate, in the comparison between Countries provided in Figure 3, Tonga has the closest rate among the Small Pacific Islands to New Zealand, Australia and Japan. These statistics have been taken from the Western Pacific Country Health Information Profiles 2006. As is shown, the data was reported over a number of years. Figure 3 also demonstrates that the Infant Mortality Rate of Tonga is double the average rate of Australia and the Crude Death Rate is lower than New Zealand, Australia and Japan.

Australia reported that since 1900, it has experienced significant improvements in health as a result of improvements in immunization, medical treatment, and a better awareness of the positive impact of lifestyle and socioeconomic factors on health. These factors lead to an increase in life expectancy at birth of over 20 years and a significant reduction in perinatal mortality and deaths from infectious diseases. The above information shows how a developed country obtains improvement in the health of its population over time.

In contrast, Tonga experiences diverse health stages. The Tongan population had extremely low life expectancy according to the findings of 1939 Population Census, where both male and female live births were expected to live for only 40 years. In addition, infant mortality was 180 per 1000 live births, which reduced to 89 per live births in the 1950s.

The findings of the Population Census of 1986 reported that the Infant Mortality Rate had decreased to 26.0 per 1000 live births and the life expectancy were significantly improved to 70.7 years for female and 67.6 years for males. The

![Figure 3: Crude Death (per 1000 population) and Infant Mortality Rate (per 1000 live births)](image-url)
Crude Death Rate was reported as 5.6 per 1000 population.

In the Population Census of 1996, Infant Mortality Rate again decreased to 19 per 1000 live births while the Crude Death Rate increased to 7.5 per 1000 population. Life expectancy further increased to 70 years for males and 72 years for females. It can be seen from the most recent two Censuses that Mortality rates and life expectancy varied only slightly over this 10-year period. In 2005, the Ministry of Health reported that the Infant Mortality Rate had again decreased to 11.8 per 1000 live births while the Crude Death Rate also decreased to 6.1 per 1000 population.

Conclusion
To summarise, a significant improvement in the health of the Tongan population has been achieved during the 20th Century, as demonstrated by the significant increase in life expectancy. It is acknowledged that there are limitations with the data; the above statistics are derived from the Government census, which is most likely the best source of information at that particular time, and from the death notification process. Some other data is available from the Ministry of Health’s Annual Reports, which were reviewed from 1956 up to 2005.

It is currently felt that Tonga will experience a steady mortality rate for the next few years. However, with the prevalence of non-communicable diseases increasing exponentially, it is vital that Tonga improves its strategies to combat the effects of these diseases. If these so called ‘life-style’ diseases are not addressed, Tonga will probably see a decrease in life expectancy over the following few decades.

In addition, Pacific Island countries are vulnerable to being severely affected by serious communicable disease outbreaks, such as SARS (Severe Acute Respiratory Syndrome) due to the resource constraints of their small economies. It would also be difficult to estimate the impact on the mortality data if Tonga were to experience a natural disaster like a tsunami. These types of extraneous factors could have catastrophic impacts of unknown proportions on the mortality patterns in Tonga, due to Tonga’s limited resources to guarantee the safety of the population under such conditions.