A critical assessment of mortality statistics in Thailand: potential for improvements

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Abstract This study evaluates the collection and flow of mortality and cause-of-death (COD) data in Thailand, identifying areas of weakness and presenting potential approaches to improve these statistics. Methods include systems analysis, literature review, and the application of the Health Metrics Network (HMN) self-assessment tool by key stakeholders. We identified two weaknesses underlying incompleteness of death registration and inaccuracy of COD attribution: problems in recording events or certifying deaths, and problems in transferring information from death certificates to death registers. Deaths occurring outside health facilities, representing 65% of all deaths in Thailand, contribute to the inaccuracy of cause-of-death data because they must be certified by village heads with limited knowledge and expertise in cause-of-death attribution. However, problems also exist with in-hospital cause-of-death certification by physicians. Priority should be given to training medical personnel in death certification, review of medical records by health personnel in district hospitals, and use of verbal autopsy techniques for assessing internal consistency. This should be coupled with stronger collaboration with district registrars for the 65% of deaths that occur outside hospitals. Training of physicians and data coders and harmonization of death certificates and registries would improve COD data for the 35% of deaths that take place in hospital. Public awareness of the importance of registering all deaths and the application of registration requirements prior to funerals would also improve coverage, though enforcement would be difficult.

Keywords Mortality/statistics; Data collection/methods; Death certificates; Cause of death; Autopsy/methods; Interviews/methods; Thailand (source: MeSH, NLM).

Mots clés Mortalité/statistique; Collecte données/méthodes; Certificat décès; Cause décès; Autopsie/méthodes; Entretien/méthodes; Thaïlande (source: MeSH, INSERM).

Palabras clave Mortalidad/estadística; Recolección de datos/métodos; Certificado de defunción; Causa de muerte; Autopsia/métodos; Entrevistas/métodos; Tailandia (fuente: DeCS, BIREME).

Introduction

Sound statistics on deaths and their causes are vital for decision-makers because they provide information on the current health situation and allow for monitoring of trends in the overall burden of diseases (BOD). Both the magnitude and distribution of disease burden are crucial to inform policies, enable resource allocation to better address health needs, and monitor the impact of health interventions on health outcomes.

Thailand has a long history of registering deaths and is generally acknowledged as having relatively good data. However, Mathers et al. recently classified mortality statistics in Thailand as of low quality, with over 30% of deaths unregistered and more than 20% of those registered classified as due to ill-defined cause.¹

Incomplete registration of deaths and unreliable attribution of causes of death are major policy concerns. High rates of unregistered deaths imply underreporting of mortality and a likely overestimation of life expectancy. Large proportions of ill-defined causes of death distort estimates on the distribution of causes and overall BOD patterns, thus hindering effective resource allocation. The Royal Thai Government has affirmed its strong commitment to reducing both problems in order to permit better allocation of its resources and maintain its commitment to the Thai people regarding its health goals.

This study was undertaken as a response to the findings of the analysis by Mathers et al.¹ and presents a critical self-assessment of current mortality statistics in Thailand, in particular the completeness of death registration and the quality of cause-of-death (COD) attribution. The aim of the study was to assess the current status of mortality statistics in Thailand and to identify gaps and present

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options for improvement. The findings are specific to Thailand, though the problems encountered and the approaches considered are likely to be of use to other low- and middle-income countries interested in strengthening their health information systems to generate better data for decision-making.

Methods

We carried out both a detailed literature review (published and unpublished research reports and legal documentation on death registration) of current systems of reporting mortality statistics in Thailand and a critical assessment of existing guidelines and practices that impact the flow of death information from the local reporting level to national level collateral.

Thailand is one of the countries that has agreed to run pilot tests of the Health Metrics Network (HMN) framework and its tools. Applying these tools provided us with an opportunity to assess the status of mortality statistics. We conducted in-depth interviews with informed respondents, and applied the situation analysis tool developed by the HMN.²

The HMN tool

The HMN tool is designed to enable countries to assess the functioning of their health information system and its various sub-components (vital statistics, household surveys, health accounts, etc.) in a standardized way, against explicit standards for health information systems described in the HMN Framework.¹ The tool consists of a series of questions designed to elicit the strengths and weaknesses of the inputs, processes, outputs and outcomes of the health information systems. The purpose of the tool is to help countries identify critical barriers and gaps and develop options for improvement that can be incorporated into a long-term plan for health information system strengthening.

We examined vital events monitoring in Thailand, with the section of the tool designed for this purpose, excluding questions on sample registration systems and Demographic Surveillance Sites, which are not relevant in the Thai context.

The HMN tool rates the vital statistics system against dimensions of:

- capacity to collect the data, and manage and analyse the results;
- application of agreed standards for data collection and availability of relevant documentation;
- dissemination and analysis of results, including microdata and metadata; and
- linkages to other sources of data.

Each question is scored, to the degree possible, on objective criteria, but subjective rating is used where objective assessment cannot be made. Scores range from 3 (highly adequate) to 0 (non-functional). The total score for each series of questions, when compared to the total maximum, provides a per cent rating. Performance is compared against the HMN standard — highly adequate (81–100%), adequate (61–80%), present but not adequate (41–60%), not adequate (21–40%) and not functioning (0–20%).

Self-assessment using the HMN tool was done by 15 key stakeholders, including producers and users of mortality statistics (including several Departments of the Ministry of Public Health, the National Statistical Office, the Ministry of the Interior, academic and other experts) during a two-day workshop. Discussion and exchange of experiences took place prior to the independent assessments made by each individual stakeholder.

Results

Overview of mortality reporting system

Overall, among the total 0.4 million reported deaths in Thailand in 2004, 65% took place outside hospitals and 35% in hospital settings. This represents an increase in the proportion of deaths that occur in hospitals; from 30% in 2003, a result of improved access to health facilities. Of this total, 25% were classified as unnatural death, thus warranting autopsy.

Attending physicians use the WHO International statistical classification of diseases and related health problems, tenth revision, (ICD-10), to classify cause of death, although there is evidence that a substantial proportion of doctors are unable to accurately determine cause of death.³

Death certificates are the basis for registration at District or Municipality Offices, and Thai legislation requires that cause of death be reported in every instance. Physicians indicate the cause of death — in English — according to ICD-10 codes. The cause of death is entered — in Thai — into the death registry by district officers. The translation from English into Thai often results in discrepancies in cause of death classification between the death certificate (English ICD-10) and the Thai death registration system.

According to the 1991 Civil Registration Act, a person who discovers a death is required to notify to local registrar within 24 hours (or 7 days in remote areas); failure to do so results in a fine of up to 1000 baht (US$ 25), which is equivalent to six times the daily minimum wage. Reporting of deaths gradually improved after the implementation of the Act.

Despite a declining trend in non-hospital deaths, these still account for 65% of all deaths in Thailand. In such cases, the village head is required by law to issue a death certificate which is then used for registration purposes. Cause of death is recorded according to symptomatic descriptions provided by relatives or the village head's own interpretation. This results in the recording of a wide diversity of signs, symptoms and ill-defined causes, such as senility, as the cause of most non-hospital deaths (Table 1).

As required by law, all “unnatural” deaths are subject to forensic investigation by a physician. In such cases, cause of death is usually described in terms of symptoms rather than being attributed to an underlying cause because physicians are reluctant to provide specifics, and risk involvement in legal proceedings. Unnatural deaths (including external causes, accident and injuries, self-inflicted, and criminal injuries), as defined by Thai Criminal Law 2478 (AD 1935) Article 148, are reported to comprise 25% of total deaths.³

Death registries from both sources are compiled electronically and forwarded to the Bureau of Registration Administration. The Ministry of Public Health has full access to this national database. Despite statutory death registration since 1991,⁴ document review and systems analysis indicates a number of weaknesses resulting in incomplete and inaccurate COD reporting.

Completeness of death registration

The Survey of Population Change (SPC), a nationally representative household survey

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conducted by the National Statistical Office every 10 years, generates a direct estimate of the incompleteness of death registration by requesting the registration document for each death that a household reports. According to the SPC, the completeness of death registration improved significantly from 59% to 75% to 95% between 1975–76, 1985–86 and 1995–96, respectively. Deaths occurring outside hospital settings are more likely not to be registered, with underreporting of about 8% compared with about 2% of hospital deaths.

The Kanchanaburi Demographic Sentinel Site, maintained by Mahidol University since 1999, reported that 12.5% of deaths were unregistered in 2004 in the province of Kanchanaburi, much higher than the national figure reported by SPC. The highest percentage of unregistered deaths, 20%, was of children less than five years old.

Two routine sources and one study produce maternal mortality statistics: vital registration and the Ministry of Public Health Safe Motherhood Program, and the Reproductive Age Mortality Study (RAMOS). These three sources generate three different values for maternal mortality ratios. A study in 10 sample provinces to verify the accuracy and validity of maternal death reporting through these sources found that the routine vital registration system captured 32% of maternal deaths and the Safe Motherhood Program 25%. The RAMOS approach was the most successful, identifying 82% of maternal deaths. The Safe Motherhood Program was the least effective because it compiles data only on hospital-based maternal deaths. Only 7% of total deaths were identified by all three sources.

### Quality of cause-of-death assignment

The high proportion of ill-defined causes and the strong likelihood of misclassification are symptomatic of poor quality COD registration. Thailand has used verbal autopsy (VA) to verify causes of death in death registries, with analysis of medical records and reviews by panels of physicians to assess internal consistency.

Using this approach in 15 sample provinces in 1997–99, the overall agreement between cause of death using VA and death registration was 29%. Table 1 shows the discrepancies. In 1999, VA methods identified human immunodeficiency virus/acquired immune deficiency virus (HIV/AIDS) as a major cause of death, contributing 10% of total deaths, whereas the vital registration system identified it as contributing only 2% of total deaths.

Using VA as a reference standard, deaths resulting from road traffic accidents had the highest sensitivity (47%), followed by cancer of the digestive system (42%) and renal failure (42%). The lowest sensitivity was for ischemic heart disease (19%) and cerebrovascular accidents (20%). While it is generally difficult to assess noncommunicable diseases accurately through VA, causes with distinctive features such as injuries can be easily identified. Thus, the low sensitivity of death registration is alarming. As expected, the most problematic data on cause of death occurs among deaths in the elderly that take place at home. Specificity was very high for all conditions.

More surprisingly, COD attribution is also problematic in in-hospital deaths. A study to verify hospital death certificates and causes of death noted in the registers compared these with review of medical records by a panel of physicians in 8 sample hospitals in 2003. Only 30% of the causes of death described in the registers matched the causes determined by the medical panel review. Death certificates matched the medical panel conclusions in 48% of cases. The physician’s translation of cause of death from English (in the certificate) into Thai (in the death registry) is a major source of error.
Application of HMN tool
The results of the application of the HMN tool to the Thai vital statistics system found that while the system performs relatively well in terms of overall coverage of events, problems arise due to the infrequency of efforts to verify both completeness (which is assessed using the SPC every 10 years) and accuracy of COD attribution (which is assessed using VA every 5 years). There is also a high proportion of ill-defined causes of death (Table 2).

In-depth interviews with informed respondents confirm similar weaknesses as those identified with the HMN tool. The strengths of mortality statistics in Thailand are the sound legal framework for vital registration, the strong institutional capacity to produce death registry data and the regular transmission of timely information to the national level. However, disaggregation of mortality statistics by socioeconomic status, as well as their use in monitoring development, need significant improvement.

Discussion
The Thai experience demonstrates that, while a strong legislative framework for vital registration is an essential step in generating good mortality data, problems may still arise at the implementation stage due to the necessary involvement of relatives of the deceased, village heads and district officers.

Two gaps contribute to incomplete registration: the gap between the death event and its certification, and the gap between death certification and registration. In Thailand, the deceased may be brought to burial without death certificate nor registration (especially in very remote areas), or the certificate may be available but the death has not been registered. To facilitate religious and funeral arrangements (which usually take place within 3–5 days of death), death registration is not required; the death certificate alone being sufficient. This contributes to the incompleteness of registration.

Increased public awareness of the importance of death registration and the requirement of death registration for funeral management would improve completeness in the long term, but, despite the existence of a strong legal framework, enforcement may still pose a problem. The decennial Survey of Population Change, under the responsibility of the National Statistical Office, should remain the main avenue for the assessment of completeness. More frequent assessment, perhaps every five years, would be more useful, but also more costly.

To improve the coverage of infant mortality, especially when death occurs before registration, it may be possible to use hospital death reports rather than the vital registration system as more than 95% of total births in Thailand now occur in a hospital. It is also important to find ways to improve the completeness of maternal mortality reporting. Adding regular case finding methods (RAMOS study) and triangulation between data sources is recommended.12

In the context of the mature HIV epidemic in Thailand, our findings indicate that a desire to avoid stigma in identifying HIV as a cause of death in death certificates and registration is one of the most common sources of distortion and misclassification. In addition, another common problem is the use of signs and symptoms, such as respiratory or heart failure, in the certificate and registry (Table 1).

Training in the accurate certification of death is an essential step towards better

<p>| Table 2. Assessment for death registration systems using Health Metrics Network tool, 2005 |
|---------------------------------|---------------------------------|---------------------------------|</p>
<table>
<thead>
<tr>
<th><strong>Items</strong></th>
<th><strong>Result</strong></th>
<th><strong>Rationale</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Content</td>
<td>Highly Adequate</td>
<td>Nationwide system with full coverage</td>
</tr>
<tr>
<td>Availability of VR system</td>
<td>3</td>
<td>Available in death registry but not accurate</td>
</tr>
<tr>
<td>Availability of cause of death data</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2. Capacity</td>
<td>Highly Adequate</td>
<td>Sustainable management by Ministry of Interior</td>
</tr>
<tr>
<td>Capacity in operating VR</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3. Practice</td>
<td>Adequate</td>
<td>Coverage 95% (assessed by SPC)</td>
</tr>
<tr>
<td>Coverage of VR of death</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Frequency of the assessment of completeness of VR</td>
<td>1</td>
<td>Completeness of VR has been assessed by SPC every 10 years</td>
</tr>
<tr>
<td>Frequency of the assessment of quality of cause of death and coding</td>
<td>1</td>
<td>Cause-of-death validation has been assessed by verbal autopsy every 5 years</td>
</tr>
<tr>
<td>Application of ICD</td>
<td>3</td>
<td>ICD-10 has been completely applied</td>
</tr>
<tr>
<td>Number of years of applying current ICD</td>
<td>3</td>
<td>More than 5 years</td>
</tr>
<tr>
<td>Application of WHO international form</td>
<td>3</td>
<td>International form has been adopted</td>
</tr>
<tr>
<td>Proportion of ill-defined causes</td>
<td>0</td>
<td>Approximately 40%</td>
</tr>
<tr>
<td>4. Dissemination</td>
<td>Highly Adequate</td>
<td>National report is available within a year</td>
</tr>
<tr>
<td>Availability and timeliness of results</td>
<td>3</td>
<td>Disaggregated by gender, age, geographical region or urban-rural</td>
</tr>
<tr>
<td>Disaggregation of results from VR</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5. Integration</td>
<td>Adequate</td>
<td>Partially used for demographic and health monitoring</td>
</tr>
<tr>
<td>Utilization for demographic, health and poverty monitoring</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Utilization for estimating need and coverage for health service delivery</td>
<td>2</td>
<td>Partially used for estimating health need</td>
</tr>
<tr>
<td>Overall result of data collection method</td>
<td>Highly adequate</td>
<td></td>
</tr>
</tbody>
</table>

a VR = vital registration. 
b SPC = Survey of Population Change.
COD statistics.\textsuperscript{13} In Thailand, the people who usually issue death certificates are physicians and village heads. Additional areas for improvement (see Fig. 1 web version only, available at: http://www. who.int/bulletin) of mortality statistics include continuous training of, and specific qualifications for, physicians and data coders in public and private hospitals.\textsuperscript{13} The Ministry of Public Health could also choose to make direct use of the COD from death certificates, rather than relying on the registry data.

In the past three years, attempts have been made to improve COD reporting using reviews of medical records certified by physicians for all non-hospital deaths. Strong resistance to doing this on the part of medical profession may reflect doctors’ avoidance of medico-legal issues. Another way to improve reporting on non-hospital deaths would be very costly; training more than 70,000 village heads throughout the country.

Mathers et al. classified mortality statistics in Thailand as low quality, with over 30% of deaths not registered and more than 20% of those registered classified as ill-defined.\textsuperscript{1} On the other hand, our assessment of mortality statistics indicates a medium (86%)\textsuperscript{1} to high completeness of registry (95%),\textsuperscript{4} but low accuracy of COD (40% ill-defined category). The HMN tool was found to be useful for the assessment of mortality statistics, particularly in relation to key issues such as child and maternal mortality.\textsuperscript{2} The tool validated findings from external reviews and from internal assessments, but adds another dimension involving multiple stakeholders that helps generate consensus around priority areas for improvement. The HMN tool can also permit comparisons over time and between countries.

Conclusions

In Thailand, priority for strengthening mortality statistics should be given to improving COD attribution. The verification of COD using the VA algorithm and reviews of medical records (if available) by health personnel for home deaths, in collaboration with the district registrar, seem feasible and are likely to be effective. Issuance of standard practice guidelines, regular training of physicians and data coders, particularly in light of rapid staff turnover, improves the accuracy of COD attribution for in-hospital death certificates. Certification and the registry data should match, and this could be achieved by improving translations from English to Thai. Educating the public to reduce the gaps between death event, certification and registration would improve completeness, but enforcement would be difficult. Requirement of death registration for funeral management would also improve completeness. Regular monitoring and evaluation of data obtained by routine methods are necessary to improve the quality of mortality statistics.

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Special Theme – Estimating Mortality

Mortality statistics in Thailand

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References


Fig. 1. *Ways to improve mortality statistics*

- **Attending physicians**
- **Training of physicians**
- **Death certificates**
- **Reduce underreporting**
- **Mandatory requirement of death registration**
- **District Office Municipal Office**
- **Forensic investigation and death certificates**
- **Verification of COD\(^c\) with medical records, algorithm and interviews with household members, by health personnel from district hospitals**
- **Death Registry**
- **Funeral**

- **Hospital deaths, 35%**
- **Unnatural deaths**
- **Home deaths, 65%**

\(^a\) To improve coding practices. \(^b\) To improve completeness of registration. \(^c\) COD = cause of death.