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

Viroj Tangcharoensathien,[a] Pinij Faramnuayphol,[b] Waranya Teokul,[c] Kanitta Bundhamcharoen,[a] & Suwit Wibulpholprasert[d]

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*).

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Voir page 237 le résumé en français. En la página 237 figura un resumen en español.

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 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

[a] International Health Policy Program, Ministry of Public Health, Nonthaburi, Thailand. Correspondence to Dr Viroj Tangcharoensathien (viroj@ihpp.thaigov.net).
[b] Health Information System Development Office, Health Systems Research Institute, Nonthaburi, Thailand.
[c] National Economic and Social Development Board, Office of the Prime Minister, Bangkok, Thailand.
[d] Office of the Permanent Secretary, Ministry of Public Health, Nonthaburi, Thailand.
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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 collation.

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.[2] 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:

- content, including cost efficiency and effectiveness;
- 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,[4] 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.[5]

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

Table 1. **Proportion and rank of leading cause of death (COD) from verbal autopsy (VA) study 1999**[3]

Rank	COD from death registration	% total deaths	COD from VA and physician panel	% total deaths
1	Senility	27.1	Senility	11.0
2	Heart failure	9.9	Human immunodeficiency virus	10.0
3	No diagnosis	7.1	Stroke	9.3
4	Other chronic respiratory	5.5	Road traffic accident	5.5
5	Other infections	3.3	Diabetes	5.3
6	Ill-defined cancer	3.0	Liver cancer	5.3
7	Collapse	2.6	Chronic obstructive pulmonary disease	4.4
8	Road traffic accident	2.4	Ischaemic heart disease	4.1
9	Liver cancer	2.2	Trachea, bronchus and lung cancer	2.6
10	Shock	2.2	Tuberculosis	2.3
11	Stroke	2.1	No diagnosis	2.3
12	Human immunodeficiency virus	2.1	Cirrhosis	2.2
13	Nephritis and nephrosis	1.8	Suicide	1.9
14	Diabetes	1.7	Nephritis and nephrosis	1.9
15	Lower respiratory infections	1.7	Other infections	1.8
16	Other neurological diseases	1.7	Lower respiratory infections	1.8
17	Other digestive diseases	1.7	Violence/homicide	1.6
18	Other unintentional injuries	1.6	Drowning	1.4
19	Tuberculosis	1.3	Colorectal cancer	1.3
20	Suicide	1.3	Hypertension	1.3

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.[6–8] Deaths occurring outside hospital settings are more likely not to be registered, with underreporting of about 8% compared with about 2% of hospital deaths.[8]

The Kanchanaburi Demographical 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.[9] 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%.[10] 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.[3]

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,[3] 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%).[3] 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 for 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.[11] 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,[4] 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 with neither 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

Table 2. **Assessment for death registration systems using Health Metrics Network tool, 2005**

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

[a] VR = vital registration. [b] SPC = Survey of Population Change.

COD statistics.[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.[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.[1] On the other hand, our assessment of mortality statistics indicates a medium (86%)[1] to high completeness of registry (95%),[8] 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.[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. ■

Competing interests: none declared.

Résumé

Évaluation critique des statistiques de mortalité en Thaïlande : potentiel d'amélioration

La présente étude évalue la collecte et les flux de données relatives à la mortalité et aux causes de décès en Thaïlande en identifiant les points faibles et en proposant des approches pour améliorer ces statistiques. Elle a utilisé notamment les méthodes suivantes : analyse des systèmes, revue de la littérature et application de l'outil d'évaluation du Réseau de métrique sanitaire (HMN) par des partenaires clés. Deux types d'insuffisances ont été identifiés comme à l'origine de la non exhaustivité de l'enregistrement des décès et de l'imprécision de l'affectation des causes de décès : des problèmes dans l'enregistrement des événements ou dans la délivrance des certificats de décès, d'une part, et dans le transfert d'informations des certificats de décès aux registres des décès, d'autre part. Les décès survenant à l'extérieur des installations de soins, qui représentent 65 % de la mortalité totale en Thaïlande, contribuent à l'imprécision des donneés car le certificat de décès doit être établi par des chefs de village qui disposent de connaissances et de compétences limitées pour attribuer une cause au décès. Néanmoins, l'établissement de certificats par les médecins hospitaliers pose aussi des problèmes. La priorité doit être donnée à la formation du personnel médical à la certification des causes de décès, à l'analyse des registres médicaux par le personnel des hôpitaux de district et à l'utilisation des techniques d'autopsie verbale pour évaluer la cohérence interne. Les efforts dans cette direction doivent s'accompagner d'une collaboration accrue avec les responsables des registres de district dans l'enregistrement des décès (65 %) intervenant à l'extérieur des hôpitaux. La formation des médecins et des personnes effectuant le codage des données devrait permettre d'améliorer la qualité des données relatives aux causes de décès pour les 35 % de décès hospitaliers. La sensibilisation de la population à l'importance d'enregistrer la totalité des décès et le respect des exigences relatives à l'établissement du certificat de décès avant les funérailles, même si ces objectifs semblent difficiles à atteindre, devraient également aboutir à une meilleure couverture de l'enregistrement.

Resumen

Evaluación crítica de las estadísticas de mortalidad en Tailandia: posibilidades de mejora

En este estudio se evalúan la recopilación y el flujo de datos sobre la mortalidad y las causas de defunción en Tailandia, identificando puntos débiles y sugiriendo posibles tácticas para mejorar esas estadísticas. Entre los métodos empleados cabe citar el análisis de sistemas, la revisión de las publicaciones y la aplicación del instrumento de autoevaluación de la Red de Sanimetría por parte de interesados directos clave. Detectamos dos puntos débiles relacionados con la incompletud de los registros de defunción y las inexactitudes en la atribución de causas de defunción: fallos del registro de los eventos o de la certificación de las defunciones, y problemas de transferencia de información de los certificados de defunción a los registros de defunción. Las muertes sobrevenidas fuera de los centros de salud, que representan un 65% de todas las defunciones en Tailandia, son uno de los factores que explican la inexactitud de los datos sobre las causas de defunción, pues deben ser certificadas por jefes de aldea que poseen unos conocimientos teóricos y prácticos limitados en lo referente a la atribución de causas de muerte. Sin embargo, también se dan problemas en la certificación de las causas de defunción que hacen los médicos en los hospitales. Habría que dar prioridad a la formación del

personal médico en materia de certificados de defunción, el examen de los registros médicos por el personal sanitario en los hospitales de distrito y el uso de las técnicas de autopsia verbal para evaluar la coherencia interna. Ello debe combinarse con una colaboración más estrecha con los funcionarios encargados de los registros de distrito en lo tocante al 65% de defunciones que se producen fuera de los hospitales. La capacitación de los médicos y los codificadores de datos y la armonización de los certificados de defunción y los registros permitirían mejorar los datos sobre las causas de defunción correspondientes al 35% de muertes ocurridas en entornos hospitalarios. La sensibilización de la población acerca de la importancia de registrar todas las defunciones y la aplicación de los requisitos de registro antes de los funerales también mejorarían la cobertura, pero no es fácil obligar a cumplir esas medidas.

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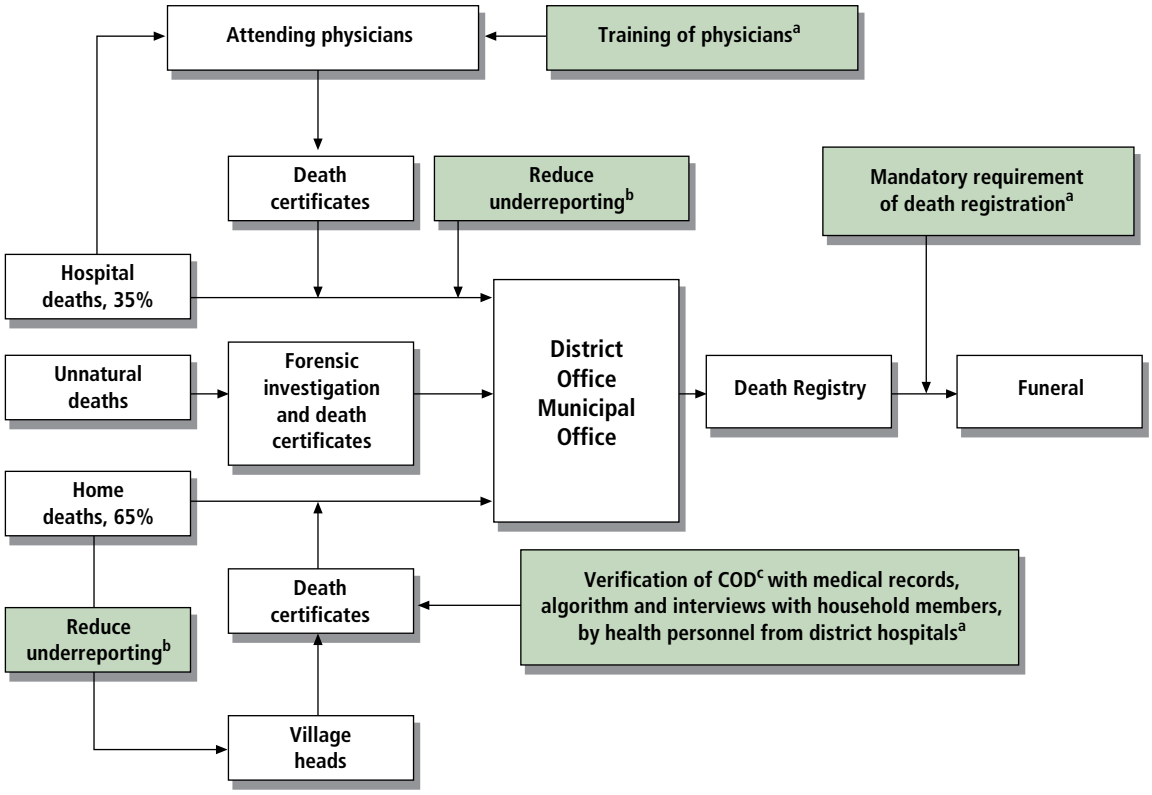
Fig. 1. **Ways to improve mortality statistics**



[a] To improve coding practices. [b] To improve completeness of registration. [c] COD = cause of death.

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