

Relationship Between Physicians' Knowledge and Skills in Medical Cause-of-Death Certification According to WHO Standards at Adam Malik Hospital

Hubungan Tingkat Pengetahuan dengan Keterampilan Dokter dalam Pencatatan Penyebab Kematian Medis Menurut Standar WHO di RSUP H. Adam Malik

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Abstrak

Latar Belakang: Pentingnya pencatatan penyebab kematian yang akurat untuk menghasilkan data mortalitas nasional yang akurat. *World Health Organization* (WHO) telah menetapkan standar internasional mengenai pencatatan penyebab kematian medis. Salah satu faktor yang mempengaruhi ketepatan pencatatan penyebab kematian medis adalah keterampilan dokter yang dipengaruhi umur, tingkat pendidikan dan pengalamannya. Sebagai rumah sakit rujukan tersier, Rumah Sakit Umum Pusat Haji Adam Malik memiliki peran penting dalam penyediaan data mortalitas yang akurat. **Tujuan:** Menganalisis hubungan tingkat pengetahuan dengan keterampilan dokter dalam pencatatan penyebab kematian medis menurut standar WHO di RSUP H. Adam Malik. **Metode:** Penelitian analitik observasional dengan desain potong lintang (*cross-sectional*) ini melibatkan 155 dokter peserta Program Pendidikan Dokter Spesialis (PPDS). Data dikumpulkan menggunakan kuesioner pengetahuan dan kuesioner keterampilan berbasis kasus melalui *Google Form*. Analisis bivariat dilakukan menggunakan uji *Chi-square* dengan tingkat kemaknaan $p < 0,05$. **Hasil:** Sebagian besar responden memiliki tingkat pengetahuan kurang (54,8%), sedangkan 47,7% memiliki keterampilan yang baik dalam pencatatan penyebab kematian medis. Terdapat hubungan yang bermakna antara tingkat pengetahuan dengan keterampilan dokter ($p < 0,001$). Selain itu, program studi PPDS dan pengalaman mengikuti pelatihan sertifikat kematian berhubungan bermakna dengan keterampilan dokter ($p < 0,05$), sedangkan umur, tahun lulus profesi dokter, dan level kompetensi PPDS tidak menunjukkan hubungan yang bermakna. **Kesimpulan:** Tingkat pengetahuan, program studi PPDS, dan pengalaman mengikuti pelatihan sertifikat kematian berhubungan dengan keterampilan dokter dalam pencatatan penyebab kematian medis menurut standar WHO. Pelatihan berkelanjutan dan penguatan kurikulum diperlukan untuk meningkatkan kualitas pencatatan penyebab kematian medis.

Kata kunci: pencatatan penyebab kematian medis; RS Adam Malik; PPDS; pelatihan sertifikat kematian; WHO.

Abstract

Background: Accurate medical cause-of-death certification is essential for producing reliable national mortality statistics. The *World Health Organization* (WHO) has established international standards for recording medical causes of death. One of the factors influencing the accuracy of death certification is physicians' skills, which may be affected by age, educational background, and professional experience. As a tertiary referral hospital, H. Adam Malik General Hospital plays a crucial role in providing accurate mortality data. **Objective:** To analyze the relationship between physicians' knowledge and skills in recording medical causes of death according to WHO standards at H. Adam Malik General Hospital, Medan. **Methods:** This analytical observational study employed a cross-sectional design involving 155 resident physicians enrolled in medical specialty residency programs. Data were collected using a structured knowledge questionnaire and a case-based skills questionnaire administered through *Google Forms*. Bivariate analysis was performed using the *Chi-square* test with a significance level of $p < 0.05$. **Results:** Most participants had poor knowledge of medical cause-of-death certification (54.8%), while 47.7% demonstrated good certification skills. A significant association was found between physicians' knowledge and their skills in recording medical causes of death ($p < 0.001$). In addition, medical specialty residency program and previous participation in death certification training were significantly associated with physicians' skills ($p < 0.05$), whereas age, year

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of medical graduation, and residency competency level showed no significant association. **Conclusion:** Physicians' knowledge, medical specialty residency program, and previous participation in death certification training were significantly associated with skills in recording medical causes of death according to WHO standards. Continuous training and curriculum enhancement are recommended to improve the quality of medical cause-of-death certification.

Keywords: Medical Cause-Of-Death; Adam Malik Hospital; Resident Physician; Death Certification Training; WHO.

1. INTRODUCTION

Accurate medical cause-of-death certification is fundamental for generating reliable mortality statistics and supporting evidence-based public health policies. Medical certificates of cause of death serve not only as legal documents for administrative purposes but also as the primary source of mortality data used to monitor disease trends, determine health priorities, allocate healthcare resources, and evaluate national health programs. Therefore, physicians are expected to complete death certificates accurately, completely, and in accordance with the standards established by the World Health Organization (WHO).^{[1],[2],[3],[4]}

Despite the availability of international guidelines, errors in medical cause-of-death certification remain common worldwide. Previous studies have demonstrated that physicians frequently record terminal mechanisms of death instead of the underlying cause of death, arrange causal sequences incorrectly, or provide nonspecific diagnoses, resulting in inaccurate mortality statistics.^{[5],[6]} These errors reduce the validity of mortality data and may adversely affect epidemiological surveillance, healthcare planning, and medicolegal documentation.^{[5],[6],[7]} Several studies have shown that structured education and continuous training significantly improve the quality of death certification. Schuppener et al. reported that many certification errors are preventable through competency-based education, audit, and regular feedback.^[6] El-Gibaly et al. demonstrated that formal training significantly increased physicians' compliance with WHO recommendations for death certification.^[7] Likewise, Aziz and Dous identified inadequate training as one of the principal causes of poor-quality death certification among physicians.^[8]

In Indonesia, accurate death certification has become increasingly important following the implementation of national mortality reporting systems. The Joint Regulation of the Ministry of Home Affairs and the Ministry of Health requires healthcare facilities to report deaths and their medical causes regularly to local health authorities. Accurate completion of the Medical Certificate of Cause of Death (MCCD) according to the WHO International Classification of Diseases (ICD) framework is therefore essential to produce valid national mortality statistics and improve healthcare policy formulation.^{[9],[10]}

However, studies conducted in Indonesian hospitals continue to demonstrate considerable deficiencies in death certification practices. An evaluation at Dr. Soetomo Hospital reported that nearly half of medical death certificates were incomplete and more than half contained inaccurate underlying causes of death, emphasizing the need for additional physician training.^[11] Similar findings from another Indonesian hospital identified insufficient training, lack of standardized procedures, and incomplete documentation as major contributors to poor certification quality.^[12]

Resident physicians play an essential role in completing death certificates because they are directly involved in patient care within emergency departments, inpatient wards, and intensive care units. Nevertheless, their competence in medical cause-of-death certification may vary according to educational background, clinical experience, specialty training, and previous exposure to death certification education. Although several international studies have investigated physicians' knowledge and practices regarding death certification, evidence from Indonesian teaching hospitals remains limited.^[13]

Adam Malik Hospital is the largest tertiary referral and teaching hospital in North Sumatra, providing specialist training across numerous residency programs.^{[14],[15],[16]} Because of its high patient volume and complex disease spectrum, accurate certification of medical causes of death is particularly important for ensuring high-quality mortality data. To date, no study has specifically evaluated the relationship between physicians' knowledge and skills in medical cause-of-death certification according to WHO standards at this institution. Therefore, this study aimed to determine the relationship between physicians' knowledge and skills in medical cause-of-death certification according to WHO standards among resident physicians at Haji Adam Malik Central General

Hospital, Medan. The findings are expected to provide evidence for strengthening residency curricula, improving continuing medical education, and enhancing the quality of mortality reporting in Indonesia.

2. METHODS

Study Design and Setting

This analytical observational study employed a cross-sectional design to investigate the relationship between physicians' knowledge and skills in medical cause-of-death certification according to World Health Organization (WHO) standards. The study was conducted at Haji Adam Malik Central General Hospital, Medan, Indonesia, a tertiary referral and teaching hospital, from March to May 2026.

Participants

The study population consisted of resident physicians (Program Pendidikan Dokter Spesialis/PPDS) undergoing specialty training at Adam Malik Hospital. Eligible participants were resident physicians actively enrolled during the study period who agreed to participate by providing informed consent. Physicians who did not complete the questionnaire or submitted incomplete responses were excluded from the analysis. A total of **155 resident physicians** were included in the study using a consecutive sampling technique. The minimum sample size was determined before data collection based on the expected correlation, significance level, and statistical power as described in the study protocol.

Data Collection

Data were collected using a structured online questionnaire distributed through Google Forms. The questionnaire consisted of two sections. The first section collected respondents' demographic and educational characteristics, including age, year of medical graduation, residency program, residency competency level, and previous participation in death certification training. The second section assessed physicians' knowledge regarding medical cause-of-death certification according to WHO standards using a structured multiple-choice questionnaire. Physicians' certification skills were evaluated using case-based clinical scenarios requiring respondents to determine and record the appropriate medical cause of death according to WHO recommendations.

Study Variables

The independent variable was physicians' knowledge regarding medical cause-of-death certification according to WHO standards. The dependent variable was physicians' skills in completing medical cause-of-death certification. Additional independent variables included age, year of medical graduation, residency specialty program, residency competency level, and previous participation in death certification training. Operational definitions of all study variables were established before data collection.

Measurement of Knowledge and Skills

Knowledge scores were categorized into three levels: **good, moderate, and poor** according to predetermined scoring criteria.

Skills in medical cause-of-death certification were also categorized as **good, moderate, and poor** based on respondents' accuracy in identifying the underlying cause of death, arranging the causal sequence appropriately, avoiding the use of terminal mechanisms of death, and applying WHO certification principles in the clinical cases.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 32. Descriptive statistics were used to summarize participants' characteristics. Categorical variables were presented as frequencies and percentages. Associations between knowledge level and physicians' certification skills were analyzed using the Chi-square test. The relationships between physicians' characteristics and certification skills were also examined using the Chi-square test. Statistical significance was established at $p < 0.05$ with a **95% confidence interval**.

Ethical Considerations

The study protocol was reviewed and approved by the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sumatera Utara. Written informed consent was obtained electronically from all participants

before completion of the questionnaire. Participation was voluntary, and confidentiality of respondents' identities and study data was strictly maintained throughout the research process.

3. RESULTS

A total of **155 resident physicians** participated in this study. Participants represented various residency programs at Haji Adam Malik Central General Hospital. Most participants were at the intermediate residency competency level (56.8%), while only 13.5% had previously attended death certification training.

Characteristics of participants

The majority of participants were aged 31–35 years (53.55%), reflecting the typical age distribution of resident physicians in specialist training programs. This age group is generally considered to have optimal cognitive ability and learning capacity, facilitating the acquisition of new knowledge and professional competencies. Nevertheless, accurate medical cause-of-death certification requires not only cognitive ability but also adequate clinical experience, structured training, and repeated exposure to death certification practices. Therefore, age alone may not be sufficient to determine physicians' competency in completing medical certificates of cause of death. Participants graduated from medical school between 2009 and 2025, with the largest proportion graduating in 2022, indicating that most respondents had relatively recent professional experience prior to residency training. Participants represented 16 residency specialty programs, with the highest proportion from Anesthesiology and Intensive Care, followed by Internal Medicine and Surgery, reflecting a diverse distribution across clinical specialties. Most participants were at the intermediate residency competency level (semester 3–5), followed by the early level (semester 1–2), while only a small proportion had reached the independent level (semester ≥6). Only 13.5% of participants had previously attended training on medical cause-of-death certification, whereas the majority had never received formal training, indicating limited educational exposure to death certification practices among resident physicians.

Knowledge of medical cause-of-death certification

More than half of the respondents (**54.8%**) demonstrated poor knowledge regarding medical cause-of-death certification according to WHO standards, while the remaining participants were categorized as having moderate or good knowledge.

Table 1. Knowledge level of participants

Knowledge Level	n	Percentage
Good	57	36,77 %
Moderate	13	8,39 %
Poor	85	54,84 %

Skills in medical cause-of-death certification

Regarding certification skills, **47.7%** of respondents demonstrated good performance in completing the medical cause-of-death certificate according to WHO standards, whereas the remainder showed moderate or poor performance.

Table 2. Skills in medical cause-of-death certification

Skill Level	n	Percentage
Good	74	47,74 %
Moderate	29	18,71 %
Poor	52	33,55 %

Association between knowledge and certification skills

A statistically significant association was found between physicians' knowledge and certification skills ($p < 0.001$). Participants with higher knowledge levels were more likely to demonstrate good medical cause-of-death certification skills.

Table 3. Association between knowledge and certification skills

Knowledge Level	Skill Level			p-value
	Poor	Moderate	Good	
Poor	46 (54,1%)	23 (27,1%)	16 (18,8%)	<0,001
Moderate	3 (23,1%)	4 (30,8%)	6 (46,2%)	
Good	3 (5,3%)	2 (3,5%)	52 (91,2%)	

Association between characteristics of participants and certification skills

Age ($p = 0.181$), year of medical graduation ($p = 0.152$), and residency competency level ($p = 0.283$) were not significantly associated with certification skills. However, residency specialty program ($p < 0.001$) and previous participation in death certification training ($p = 0.030$) were significantly associated with physicians' certification skills.

4. DISCUSSION

This study demonstrated a significant relationship between physicians' knowledge and their skills in medical cause-of-death certification according to WHO standards. Resident physicians with better knowledge were more likely to demonstrate accurate certification skills, suggesting that cognitive understanding of death certification principles is closely associated with practical competence. These findings support the concept that adequate theoretical knowledge forms the foundation for accurate clinical documentation and decision-making.^{[19],[20]} More than half of the participants exhibited poor knowledge regarding medical cause-of-death certification, although nearly half demonstrated good certification skills. This discrepancy may indicate that some physicians rely on clinical experience or supervision during residency rather than formal knowledge of WHO certification principles. Nevertheless, insufficient theoretical knowledge may increase the likelihood of errors when physicians encounter unfamiliar or complex clinical situations requiring independent certification.

The present findings are consistent with previous studies. Schuppener et al. reported that certification errors commonly arise from inadequate physician education and can be substantially reduced through structured training, regular audit, and constructive feedback.^[6] Similarly, El-Gibaly et al. demonstrated that educational interventions significantly improved physicians' ability to complete medical certificates of cause of death in accordance with WHO recommendations.^[7] Aziz and Dous also identified inadequate formal training as one of the major contributors to poor certification quality among physicians.^[8] Collectively, these studies emphasize that continuous education remains one of the most effective strategies for improving the quality of mortality reporting.

This study also demonstrated that residency specialty program was significantly associated with certification skills. Differences among specialty programs may reflect variations in exposure to critically ill patients, mortality cases, and opportunities to complete death certificates during clinical training. Residents in specialties that frequently manage critically ill patients are likely to gain greater practical experience in determining the underlying cause of death and completing death certificates according to WHO standards. These findings suggest that competency in death certification develops not only through theoretical instruction but also through repeated clinical practice.

Previous participation in death certification training was another factor significantly associated with physicians' certification skills. This finding is consistent with intervention studies showing that structured educational programs improve physicians' understanding of causal sequencing, identification of the underlying cause of death, and avoidance of recording terminal mechanisms instead of etiological diagnoses.^{[7],[17],[20]} Therefore, periodic refresher courses and competency-based workshops should become integral components of residency education.

In contrast, age, year of medical graduation, and residency competency level were not significantly associated with certification skills. These findings suggest that professional experience alone does not necessarily improve competence in medical cause-of-death certification. Without formal education and continuous reinforcement, physicians may continue to repeat common certification errors regardless of their years of clinical practice. Similar observations have been reported in previous international studies evaluating physician performance in death certification.^{[21],[22],[23]}

Accurate medical cause-of-death certification has implications extending beyond individual patient care. Mortality statistics derived from death certificates serve as essential sources of epidemiological information for disease surveillance, health policy development, healthcare resource allocation, and evaluation of public health interventions. Consequently, inaccurate certification may lead to biased mortality statistics and inappropriate health policy decisions. WHO therefore recommends continuous education, standardized certification procedures, and routine quality assurance to improve the reliability of national mortality data.^{[1],[2]}

Several practical implications emerge from the present findings. First, structured education on WHO death certification principles should be incorporated into undergraduate and residency medical curricula. Second, hospitals should conduct regular audits of completed death certificates accompanied by individualized feedback for physicians. Third, continuing professional development programs focusing on medical cause-of-death certification should be implemented periodically to maintain physicians' competency. These strategies are expected to improve the quality of mortality data while strengthening hospital accreditation and national health information systems.

This study has several limitations. First, it was conducted in a single tertiary teaching hospital, limiting the generalizability of the findings to other healthcare settings. Second, the cross-sectional design precludes conclusions regarding causal relationships. Third, physicians' skills were evaluated using case-based questionnaires rather than direct observation during routine clinical practice. Future multicenter studies involving different levels of healthcare facilities and prospective educational interventions are recommended to further evaluate strategies for improving physicians' competency in medical cause-of-death certification.

5. CONCLUSION

This study demonstrated a significant association between physicians' knowledge and their skills in medical cause-of-death certification according to World Health Organization (WHO) standards. Resident physicians with higher levels of knowledge were more likely to demonstrate better certification skills. In addition, residency specialty program and previous participation in death certification training were significantly associated with physicians' competency in completing medical certificates of cause of death, whereas age, year of medical graduation, and residency competency level were not significantly associated with certification skills.

These findings highlight the importance of strengthening competency-based education and continuous professional training on WHO death certification within residency programs. Regular educational interventions and institutional quality assurance initiatives are recommended to improve the accuracy of medical cause-of-death certification, thereby enhancing the quality of mortality statistics and supporting evidence-based health policy development.

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