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DYNAMICS OF PRACTICES AND CHALLENGES IN THE DOCUMENTATION OF WORK-RELATED MORTALITY: A QUALITATIVE STUDY IN HOSPITALS IN AGROINDUSTRIAL REGIONS OF JEMBER

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ABSTRACT

Background: The quality of death certificates has been widely studied; however, work-related mortality remains underexplored, particularly in high-risk agroindustrial regions. Globally, nearly 2 million people die annually from occupational factors, with Asia accounting for about 65%. In Indonesia, occupational accidents and diseases increased to 234,370 cases in 2021, including 6,552 deaths. Inaccurate documentation hinders evidence-based policymaking and equitable compensation. This study assessed gaps in the quality of work-related mortality documentation by describing recording practices, data management, and case determination dynamics in hospitals located in agroindustrial areas. **Method:** This exploratory qualitative study was conducted in 2024 across nine hospitals in Jember's agroindustrial region. Data sources included 36 case documents of work-related deaths, 10 in-depth interviews with key informants, and one focus group discussion (FGD) with five participants. Thematic analysis was applied to examine documentation patterns across four workflow stages: identification, recording, processing, and reporting. **Result:** The study found dynamic variations at each stage of documentation. Accuracy was shaped by both enabling and inhibiting factors, which were categorised into four critical domains: (1) procedures, (2) infrastructure, (3) personnel, and (4) institutional environment and policies. These domains influenced how mortality data were identified, managed, and reported, revealing significant gaps between practice and policy expectations. **Conclusion:** The quality of work-related mortality documentation results from the interaction of multiple factors throughout the workflow. Strengthening procedures, infrastructure, and institutional support is essential to enhance reporting reliability. Recommendations include developing adaptive technical guidelines and reinforcing national policies to ensure accuracy and responsiveness in documenting occupational mortality.

Keywords: Agro-Industrial Sector, Death certificate, Occupational death

INTRODUCTION

Accurate reporting of causes of death is a vital component of health information systems, particularly in supporting occupational safety policies and the protection of workers. The International Labour Organization (ILO) emphasizes that occupational diseases often act as a silent killer that remain unreported, requiring global action to strengthen systems of recording and reporting (Massari et al., 2022; ILO, 2021). Globally, nearly 2 million people die each year from work-related causes, including both occupational accidents and diseases (WHO, 2021; Reuters, 2021). Approximately 81% of these deaths are caused by non-communicable diseases such as chronic respiratory conditions (450,000 deaths), stroke (400,000), and ischemic heart disease (350,000) (Hart et al., 2020; Gamage et al., 2021; Hoyert, 2020). Asia accounts for about 65% of all work-related deaths, making the region highly relevant as a focus of research (UN Global Compact, 2021).

At the national level, similar challenges are evident. According to the 2022 National Occupational Health and Safety (OHS) Profile, the number of occupational accidents and diseases increased from 210,789 cases in 2019 to 234,370 in 2021, with 6,552 fatalities recorded in the same year (Kemnaker RI, 2022). These figures highlight the significant burden of occupational mortality in Indonesia, particularly in high-risk sectors such as agriculture and agroindustry.

The agricultural and agroindustrial sectors are recognized as high-risk industries for both occupational accidents (OA) and occupational diseases (OD), comparable to construction and mining. It is estimated that more than 1.3 billion agricultural workers worldwide die or suffer from occupational diseases each year, primarily due to pesticide exposure, hazardous chemicals, and accidents involving machinery or equipment (Lermen et al., 2023; Gizlenci & Aybek, 2021). This situation reinforces the urgency of strengthening death recording and reporting systems for work-related causes, ensuring they are not overlooked within national health systems (Junkes et al., 2024).

In Indonesia, the recording of occupational causes of death still faces structural and technical challenges, particularly in agroindustrial regions such as Jember District. Many deaths that are in fact linked to occupational exposures are recorded merely as general causes of death, without identifying work-related factors as the underlying cause. This leads to statistical bias, hampers the development of work-related risk-based intervention programs, and undermines workers' rights to compensation (Brian, 2021).

Moreover, death certificates in developing countries generally do not meet international standards. Most only state immediate causes such as cardiac failure or respiratory arrest, without identifying the underlying cause of death (UCoD). This gap is driven by the absence of standardized formats, insufficient training of physicians in completing the Medical Certificate of Cause of Death (MCCD), and limited understanding of the importance of occupational factors as underlying causes (Zaki & Sobh, 2023; Gamage et al., 2021; Hart et al., 2020).

Several factors influence the quality of occupational mortality records, including the limited number of physicians trained in occupational medicine and forensic science, the lack of national regulations governing occupational death reporting, low utilization of information technology in recording UCoD, and weak systems of audit and supervision (Vargas-Herrera et al., 2023; Alipour et al., 2021). In agroindustrial sectors with high risks such as pesticide exposure, heavy machinery use, and extreme working environments, accurate cause-of-death reporting becomes a critical foundation for evidence-based safety policies (Singh et al., 2024; Hart et al., 2020).

Strategies to improve the quality of death records include standardization of certificate completion, physician training, regular medical audits, and the use of historical data for verification. Previous studies have also explored the potential of artificial intelligence (AI) to improve recording accuracy, though its application remains limited to facilities with adequate infrastructure (Kim et al., 2020; Hoffman et al., 2018; Falissard et al., 2020). Therefore, more contextualized approaches remain necessary to address the challenges of occupational mortality reporting in agroindustrial regions.

Based on these considerations, this study aims to explore practices, challenges, and opportunities for improving the recording and reporting of occupational mortality in hospitals within the agroindustrial area of Jember District.

METHOD

Research Design and Setting

This study employed a qualitative approach with an exploratory design. The research was conducted in nine hospitals located in Jember Regency, East Java, an agroindustrial region with high occupational risks for work-related accidents and diseases. These hospitals were selected because of their role as referral centers for workers in agriculture, plantations, and agro-processing sectors, who are frequently exposed to pesticides, hazardous chemicals, and the use of heavy machinery and equipment. The study focused on exploring the practices of recording work-related deaths, identifying barriers encountered, and examining institutional factors that support mortality documentation in health facilities.

Participants and Sampling Technique

The participants included ten key informants, consisting of physicians and medical record and health information officers (PMIK) directly involved in completing death certificates and managing mortality data. In addition, a single focus group discussion (FGD) was conducted with five supplementary participants to enrich perspectives on organizational dynamics in death reporting. Informants were selected through purposive sampling based on their direct involvement and experience in the death registration system. All participants provided informed consent after being briefed about the objectives of the study. Furthermore, document observation was carried out on 36 death certificates selected randomly to complement and triangulate the interview and FGD data.

Data Collection

Data collection took place between June and August 2025. Semi-structured, face-to-face in-depth interviews were conducted using an interview guide covering four main stages of mortality documentation: (1) case identification, (2) recording on the death certificate, (3) data processing, and (4) reporting into the health information system. The FGD was utilized to capture collective perspectives on procedural factors, infrastructure limitations, and hospital organizational culture related to work-related death reporting. All interviews and FGDs were audio-recorded with participants' permission, transcribed verbatim, and anonymized. Supporting documents, including death certificates, hospital mortality reports, and internal guidelines, were also reviewed to strengthen data triangulation.

Data Analysis

Data were analyzed thematically using an inductive approach. Three researchers independently performed initial coding on the first two transcripts to identify preliminary categories. A coding framework was then agreed upon collaboratively and applied to all transcripts. Emerging codes were organized into broader themes, which were ultimately

synthesized into four main domains: (1) procedures, (2) infrastructure and facilities, (3) personnel, and (4) work environment and institutional policies. The analysis was carried out iteratively, with discussions among the research team until data saturation was achieved.

Trustworthiness

The data were analyzed using an inductive thematic analysis approach. Open coding of interview transcripts was conducted manually to identify recurring and meaningful themes. Data validity was strengthened through source triangulation (physicians and PMIK), methodological triangulation (interviews and FGD), and peer debriefing among the research team members. The criteria of credibility, dependability, and transferability in qualitative reporting were ensured by following the Standards for Reporting Qualitative Research (SRQR) guidelines (O'Brien et al., 2014).

Ethical Considerations

This study obtained ethical approval from the Health Research Ethics Committee of the Faculty of Dentistry, University of Jember, under document number 3359/UN25.8/KEPK/DL/2025. All participants provided informed consent after receiving explanations regarding the purpose, benefits, and procedures of the study. Confidentiality was maintained by removing personal identifiers from transcripts, and participants retained the right to withdraw at any time without consequences.

RESULT

Cause of Death Identification

Inductive analysis at the identification stage generated various insights into the initial process of determining the cause of death by medical personnel in hospitals. Most informants stated that this process begins with the final physical examination by the attending physician, particularly in the emergency department (ED) or inpatient ward.

The identification of causes of death in hospitals is generally divided into several categories. First, patients who arrive in a dead-on-arrival (DOA) condition, where the determination of cause of death is conducted through external physical examination and verbal autopsy with the family to obtain medical history or events preceding death. Second, patients who received initial assessment in the emergency department, in which the cause of death can be traced from recorded medical examinations. Third, patients who die during hospitalization, where medical records during the treatment period become the main source for determining the cause of death.

However, overall, clinical autopsies are never performed in these hospitals, except in cases mandated for legal (forensic) purposes. Consequently, the recorded causes of death are limited to the results of verbal autopsies, external examinations, and medical records for inpatients or those who had at least been examined at the hospital. This limitation undermines the validity of mortality data, as the underlying cause of death (UCoD) often cannot be determined accurately without the support of a clinical autopsy.

In the context of work-related mortality, the identification process faces significant challenges. Several physicians reported that the information required to establish whether a death was directly related to occupational exposure was often unavailable in sufficient detail. This situation frequently occurred when patients arrived unconscious, occupational information was not documented in the medical record, or families were unaware of the patient's occupational risk exposures. In many cases, the patient's occupation was not explicitly recorded in the hospital information system.

This uncertainty created professional dilemmas for physicians in making decisions, as documenting a work-related UCoD without sufficient evidence could result in legal or ethical consequences. As one physician noted: "The exact cause of death might be clarified with an autopsy, but here clinical autopsy is difficult; unless requested by the police, it might be done, but it is rare, and in Jember there is only one forensic doctor." Physicians emphasized that autopsy is often the only way to confirm a causal link between occupation and death, particularly in cases such as toxic exposures, sudden respiratory failure, or unwitnessed workplace accidents. Nevertheless, autopsy procedures remain extremely limited in general hospitals due to inadequate forensic facilities, a shortage of forensic specialists, and resistance from families.

Informants also highlighted the absence of systematic pathways or specific instruments in hospitals to support physicians in identifying potential work-related deaths. For example, there are no triage forms or initial assessment tools that routinely inquire about the patient's occupation and occupational hazard exposure history. As a result, potential work-related deaths are frequently overlooked from the outset of the identification process.

Some physicians suggested that if hospitals had a systematic mechanism to document patients' occupational histories upon admission, the likelihood of identifying work-related deaths would increase. At present, however, this process relies entirely on individual initiative and the availability of information.

These findings indicate that the process of identifying work-related deaths is highly dependent on the completeness of contextual information, the presence of clear guidelines, and physicians' capacity to evaluate causal relationships between occupation and death. Without systemic and procedural support, physicians remain in a weak position to accurately classify work-related mortality.

Cause of Death Documentation

The documentation stage represents a crucial component in the process of mortality reporting, during which physicians are required to record the cause of death in the death certificate. Based on interviews with physicians from nine hospitals, it was found that practices of cause-of-death documentation varied considerably across facilities, yet overallstill revealed limitations in data accuracy and completeness, particularly in writing the sequence of causes of death.

Most hospitals continue to rely on conventional paper-based forms for death certification, although some facilities have begun integrating the process into Electronic Medical Record (EMR) systems. Nevertheless, the transition to EMR has not guaranteed substantive improvements in the quality of cause-of-death documentation. Whether using paper forms or EMRs, physicians generally recorded only a single diagnosis as the cause of death, without constructing a sequence of causes as recommended by WHO guidelines, which should include (a) the immediate cause, (b) intermediate causes, and (c) the underlying cause of death (UCoD). An observation of 36 randomly selected death certificates further highlighted this pattern: 20 documents recorded only a single cause of death, while the remaining showed an attempt to construct a sequence of causes but did not fully adhere to WHO standards. Notably, only 10 certificates complied with the MMDS requirements for documenting the underlying cause of death.

This inaccuracy reflects both the absence of clear technical guidelines and the lack of structured training in completing death certificates according to ICD-10 standards. Informants noted that no dedicated training on death certification had ever been provided,

although some physicians reported attending emergency care training sessions where identification and documentation of causes of death were briefly mentioned. However, these trainings did not extend to the discussion of the MMDS framework for sequencing causes of death.

In the context of work-related mortality, such practices become particularly problematic. The absence of systematic tracing of medical history and chronological events prior to death often results in overlooking underlying causes that may be linked to occupational exposures. For instance, a patient who died from acute respiratory failure might, in fact, have had a history of prolonged exposure to pesticides or industrial dust in agroindustrial areas. Yet, this information was neither conveyed nor documented as part of the causal chain. In most cases, only basic social information of the patient was available, leaving potential occupational determinants unrecorded.

Mortality Data Processing

The mortality data processing stage in hospitals is carried out by the Health Information Management and Reporting (PMIK) unit, which is responsible for translating physicians' entries in the death certificate into reportable statistical data. This process involves coding causes of death using the ICD-10 classification system and reselection through the MMDS framework.

Interviews with seven PMIK officers across nine hospitals revealed that coding practices in health facilities remain limited to translating a single diagnosis—namely, the diagnosis written by physicians in the cause-of-death column. In other words, PMIK staff only conduct linear coding of that single diagnosis without performing reselection or reclassification to determine the underlying cause of death (UCoD) in line with WHO standards.

This practice has a direct impact on the accuracy of mortality data. Secondary diagnoses recorded in patient medical summaries—which should be re-examined to assess their role as intermediate or underlying causes—are instead documented merely as "contributing conditions." In theory, however, secondary diagnoses are not always equivalent to comorbidities; in many cases, they may represent an essential part of the causal chain leading to death and thus hold strong relevance as the UCoD.

The absence of technology-based support systems further exacerbates this issue. Current Electronic Medical Record (EMR) systems in several hospitals lack algorithm-based automated ICD coding features. As a result, the entire coding process is performed manually, which is not only time-consuming but also vulnerable to interpretive bias and mismatches between clinical narratives and assigned codes. In hospitals still using conventional paper forms, these challenges are even greater due to incomplete and often illegible clinical information. Moreover, the format of the death certificate itself remains inconsistent with international standards.

The coded single-diagnosis data are then compiled and reported as hospital mortality statistics. Without verification of the causal sequence, the data reported to District Health Offices and the Ministry of Health may not accurately represent the true UCoD. This particularly contributes to the underreporting of work-related deaths, which require more complex tracing of occupational histories and clinical sequences compared with infectious diseases or emergency cases.

Mortality Data Reporting

The final stage in documenting deaths in hospitals is the reporting of data to external parties through the RL (Hospital Report) format. Findings indicate that the reported data are taken directly from the single diagnosis recorded in the death certificate and coded by PMIK officers, without undergoing validation or further tracing of the more complex causal chain of death.

Interviews with several informants from PMIK and physicians revealed that this limitation is perceived as part of the existing reporting system. One PMIK officer explained: *"As long as the RL report only requires one diagnosis, that is what we take from the death certificate. There is no obligation to provide a sequence based on ICD and MMDS."* This illustrates that the current reporting system implicitly designates the single diagnosis written on the certificate as the UCoD, even though theoretically that diagnosis may only represent the immediate cause or even a terminal condition, rather than the underlying cause.

Some physicians stated that they were aware of the WHO death certification structure, which includes immediate cause, intermediate causes, and the underlying cause. However, since the national reporting system only requires one diagnosis, they prefer to record a single cause without providing a chronological sequence. As one emergency physician put it: *"If only one cause is required, then we write just one. Not all deaths can be traced in sequence, especially without an autopsy."*

These findings highlight a mismatch between ideal practices based on international standards such as ICD and MMDS and the actual practices in the field, which rely on a simplified national reporting system. This situation increases the risk of misclassification of causes of death, including the neglect of work-related deaths that often remain unidentified in single-diagnosis records, thereby hindering the provision of accurate mortality statistics sensitive to social and occupational determinants. The absence of validation mechanisms and the limited reporting format reinforce the status quo, underscoring the need for a shift toward a sequential structure based on ICD-MMDS to improve data quality and responsiveness to work-related mortality.

Interviews further revealed diverse dynamics and issues affecting the quality of documentation and reporting of work-related deaths in health facilities within agroindustrial regions. Through an FGD, five informants identified the most dominant issues, which were subsequently represented visually as follows:

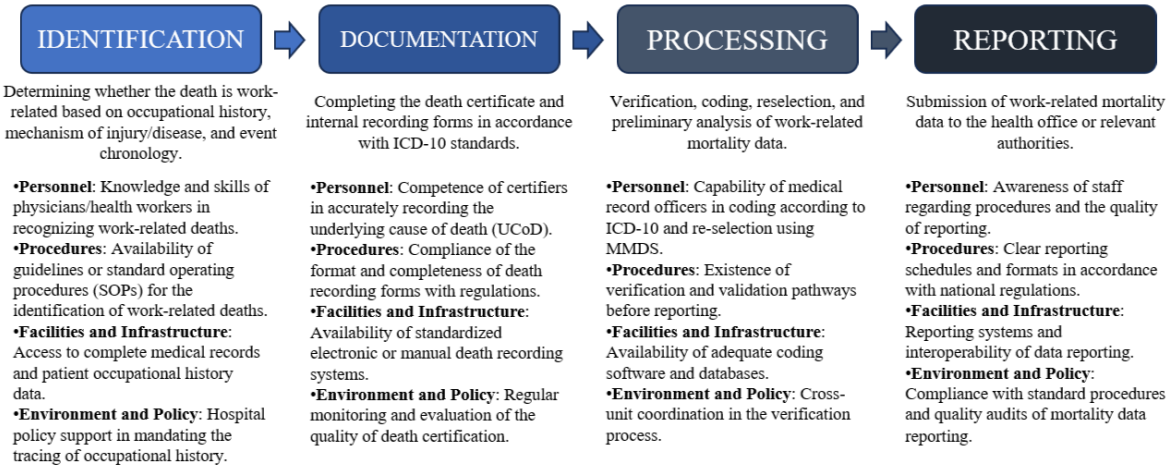

Figure 1. Stages of Work-Related Mortality Documentation in Agroindustrial Hospitals

DISCUSSION

The implementation of innovations in health care systems does not always proceed smoothly, including in the documentation and reporting of work-related causes of death in hospitals. This study explored the experiences of nine hospitals in agroindustrial regions in documenting work-related causes of death through four main stages: identification, documentation, processing, and reporting. Analysis of in-depth interviews with physicians and medical record and health information officers (PMIK), as well as focus group discussions (FGDs), revealed various barriers affecting the quality of work-related death documentation.

At the identification stage, determining the underlying cause of death was often hindered by limited medical information available at the time of death, difficulties in obtaining occupational information from patients or families, and restricted access to autopsy as a method of confirmation. Consequently, deaths that were potentially work-related could not be accurately identified. These findings are consistent with previous studies showing that incomplete social and occupational information in death identification can bias the recording of the underlying cause of death (Agrawal, 2017; AlYazidi et al., 2024). Furthermore, other research emphasized that variations in death declaration practices at the pre-hospital level, such as in dead-on-arrival (DOA) cases, often create inconsistencies in mortality reporting and affect the accuracy of cause-of-death data (Kumala et al., 2022; Petersen et al., 2023). Verification of death also requires sensitive yet standardized procedures, while the limited capacity of health workers to conduct comprehensive verification was an additional barrier to ensuring accurate death documentation (Churcher & Dowie, 2020).

At the documentation stage, although some hospitals had adopted electronic medical records (EMR), the documentation of causes of death largely remained conventional and limited to a single diagnosis. Physicians often recorded the cause of death briefly, thereby reducing the accuracy of mortality data (Petersen et al., 2023; Haque et al., 2013). This aligns with findings that common errors in the Medical Certificate of Cause of Death (MCCD)—such as incorrect causal sequence, use of abbreviations, or illegible handwriting—are still prevalent (Alam et al., 2022; Agrawal, 2017). Indeed, approximately 80% of death certificates were reported to contain inaccurate underlying causes due to inadequate physician training (Al Busaidi et al., 2023). Attempts at improvement through electronic systems, such as electronic death certificates, have been shown to enhance completeness and accuracy, although technical and regulatory challenges remain (Meilia et al., 2024).

At the processing stage, PMIK played a central role in translating physicians' medical diagnoses into statistical data using ICD-10 coding. However, this process remained highly dependent on the single diagnosis recorded by physicians, with no reselection of the underlying cause of death (UCoD), which meant that the proper sequence of events was often omitted (Alam et al., 2022). Secondary diagnoses in medical records were frequently conflated with immediate causes, thereby further reducing accuracy (Agrawal, 2017). This situation was compounded by the lack of automation within EMR systems, leaving most coding tasks manual—time-consuming, error-prone, and increasing the risk of misclassification (Meilia et al., 2024). Other studies also emphasized that inaccuracies in UCoD processing were largely influenced by insufficient training and supervision in the coding process (Al Busaidi et al., 2023). Thus, PMIK's role extended beyond coding, making them frontline actors in safeguarding mortality data quality before national submission (Massari et al., 2022).

Finally, at the reporting stage, hospital RL (Laporan Rumah Sakit) systems required only a single diagnosis, which was automatically considered the underlying cause of death. As a result, the complexity of causes was often overlooked, leading to underreporting. This finding aligns with WHO and ILO reports, which noted that single-cause reporting without chronological sequencing reduces sensitivity to work-related deaths (WHO, 2021; ILO, 2020). Other studies have likewise highlighted that the implementation of reporting policies at regional levels remains suboptimal (Siraj et al., 2022), technical errors in MCCD completion remain common (Alam et al., 2022), and weak validation mechanisms can bias mortality reporting, particularly for UCoD (Kumala et al., 2022; Petersen et al., 2023).

Overall, this study demonstrates that while hospitals have reached the implementation stage of mortality documentation, the quality of mortality data continues to be influenced by procedural limitations, technical competencies, and reporting pressures. Strengthening cause-of-death documentation through sequential reporting, enhanced training for physicians and PMIK on UCoD recording standards, and policy updates aligned with the WHO-MMDS framework are strategic steps that must be prioritized. This study makes a tangible contribution by identifying contextual barriers in documenting work-related deaths while also offering policy implications to improve mortality reporting systems in agroindustrial hospitals. By understanding local dynamics, hospitals can design more targeted strategies to improve the accuracy of cause-of-death documentation and reporting, particularly in relation to occupational factors.

CONCLUSION

This study reveals that the documentation of work-related causes of death in hospitals within agroindustrial regions continues to face obstacles at every stage. Identification is often hampered by limited information on patients' occupational histories and the low likelihood of autopsy being performed. At the documentation stage, most physicians record only a single cause of death without arranging the sequence in accordance with WHO standards. During the processing stage, medical record officers (PMIK) code based on a single diagnosis without reselection to determine the underlying cause of death (UCoD). The lack of integration within hospital information systems and limited automation further increase the risk of coding errors and place an additional burden on PMIK staff.

As a consequence, the reported mortality data often reflect only a single diagnosis, which may not be valid, as the UCoD, particularly in cases of work-related deaths. These findings underscore the urgent need for reform in medical documentation, capacity strengthening of health personnel, and updated reporting policies to ensure mortality data are more accurate and relevant for occupational health planning. This study contributes empirically by highlighting real barriers at the facility level and recommending priority agendas for strengthening national mortality governance.

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