



## A Three-Year Investigation on Corpses Referred to Legal Medicine Organization from An Iranian General Hospital: A Cross-Sectional Study

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### Abstract

**Background:** A Medical Certificate of Cause of Death (MCCD) is a legal and enforceable document issued by the attending physician. However, according to the instructions, in many cases such as sudden, unexplained, and extraordinary deaths, along with some uncommon causes, such as cases suspicious of murder, the deceased patient must be referred to the Iranian Legal Medicine Organization (ILMO). Moreover, the unnecessary referral of corpses to ILMO can increase the workload of the staff, finally confronting the family of the deceased with high emotional and financial costs.

**Methods:** In this cross-sectional study, the medical records of all deceased patients referred from Hazrat Rasool Hospital to the ILMO (565 cases) in a three-year period from April 2016 to March 2019 were investigated and analyzed using SPSS22 software with chi-squared and T-test.

**Results:** Among all the patients who passed away during this time (4,239 patients), 565 were referred to ILMO, accounting for 13.3% of deaths. The most common causes of referral were car and motorcycle accidents, with a total prevalence of 27.1%, dead-on-arrival (DOA) prevalence of 21.3%, and death with an unknown cause prevalence of 15.3%. Significant correlation was also detected between causes of referral with gender, time of death, and age. For example, Car accidents and lawsuits against medical staff were more common in men and women, respectively.

**Conclusion:** Car and motorcycle accidents, DOA, and unknown causes were the most prevalent causes of referral in this study. In general, few studies have been conducted regarding the causes of referral of the deceased to the Legal Medicine Organization. In this study, we collected relevant variables to investigate this issue thoroughly.

**Keywords:** Forensic medicine, Legal Medicine Organization, Cause of referral

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### Introduction

One of the duties of the attending physician is to issue a death certificate for deceased patients (1). Medical Certificate of Cause of Death (MCCD) is a legal and enforceable document that is written in the format published by the World Health Organization (2, 3). This certificate is the main source of official public health-related mortality

statistics (2, 4). Mortality statistics are used to estimate the abundance of diseases, take preventive measures, understand the mortality pattern changes, and evaluate the efficiency of preventive programs (2).

Nevertheless, according to the instructions of the Iranian Legal Medicine Organization (ILMO), in many cases,

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#### ↑What is “already known” in this topic:

Medical guidelines require the attending physician to refer a deceased patient to ILMO under certain conditions. However, unnecessary referral of corpses poses an unwanted financial burden on the health system.

#### →What this article adds:

Despite its importance, few studies have previously investigated the causes of the referral of corpses to the ILMO. This study embarks on the causes of referral as a novel source of information to reduce costs and workforce burnout, paving the path for future investigations.

such as sudden and unexplained deaths, deaths with unclear causes, accidents, work accidents, natural disasters, deaths caused by fights and beatings, injuries, stabbings and gunshots, suicide, burns, rape, etc., the attending physician is not allowed to issue a death certificate and should refer such deceased patients to ILMO. However, the unnecessary referral of corpses to ILMO can increase the workload of the staff, which finally results in imposing excessive economic costs on the country. This condition may also deepen the grief of the relatives of the deceased (5).

Investigating the reasons for referral of the deceased to ILMO, as well as determining the cause of death in referred cases, is of great importance while monitoring public health. Based on these data, one can plan for public health and treatment aspects, which leads to improved perspectives on social and legal issues as well. Considering the role of these statistics in determining the main indicators of health patterns, the smallest mistake in reporting relevant data may have serious consequences for policymaking and health management (2).

Saravani et al. investigated the causes of deaths of subjects under 18 years old who were referred to the forensic autopsy room of Tehran province. The findings of this study on 495 cases referred in 2014 and 508 cases referred in 2015 indicated that the most common causes of death among referred cases were accidents, suspicious deaths and suicides (6).

In 2012, Ugiagbe and Ugiagbe reviewed 626 sudden natural death cases referred to the coroner in an African referral center over a 7-year period. In this study, the ratio of male to female was 1.7 to 1, and in 39.3% of cases, which accounted for most of the referrals, the cause of death was related to the cardiovascular system (hypertension complications) (7).

In 2005, a similar study investigated the causes of death of children and teenagers who were referred to the autopsy room of the ILMO. 65.4% of deaths in this age group were among boys. Trauma (various causes) accounted for 58.4% of all deaths (the most common cause). After that, miscellaneous causes, poisoning, and asphyxia were the most common causes of death respectively (8).

Considering the cases above, there is a certain need to identify the exact causes of the referral of the deceased to a Legal Medicine Organization. Studies investigating this matter are scarce in various countries. Therefore, we decided to determine the reasons for the referral of the de-

ceased to ILMO from Hazrat Rasool Hospital from April 2016 to March 2019. It should be noted that Hazrat Rasool Hospital is a general university hospital in Tehran with all specialized and sub-specialized departments where forensic medicine specialists are stationed as academic faculty members.

## Methods

### Study design and ethics

This study, in a cross-sectional manner, examined the medical records of all deceased patients referred from Hazrat Rasool Hospital to the ILMO in a three-year period from April 2016 to March 2019. The statistical population included 565 deceased patients who were referred to ILMO after death. Demographic variables such as age, sex, and inpatient department were collected from the patients' electronic records. Other required variables, including the causes of hospital admittance, cause of death from the physician's point of view, and the reason for referral to ILMO, were also extracted. The study was conducted following the approval of the project by the Research Council and obtaining the permission of the Ethics Committee of Iran University of Medical Sciences (ethics code: IR.IUMS.REC.1401.290). Also, the research was performed with the approval of the hospital authorities, and all the ethical principles included in the Helsinki Declaration were complied with.

### Statistical analysis

The information was analyzed with SPSS22 software using chi-squared and T-test. In order to prevent selection bias, patients with incomplete information in medical records were not excluded from this study and their background variables were compared with other patients to reveal possible differences.

## Results

### Demographic characteristics of referred patients

From the beginning of April 2016 to the end of March 2019, 4,239 patients died in Tehran's Hazrat Rasool Hospital, of which 565 (13.3%) were referred to ILMO. The average age of the subjects was  $46.00 \pm 21.69$ . 423 cases (74.8%) were male and the rest (142 people, 25.1%) were female. The average age was 45.7 and 46.8 in men and women, respectively, which had no significant statistical difference ( $P = 0.433$ ).

In the case of the time interval between entering the

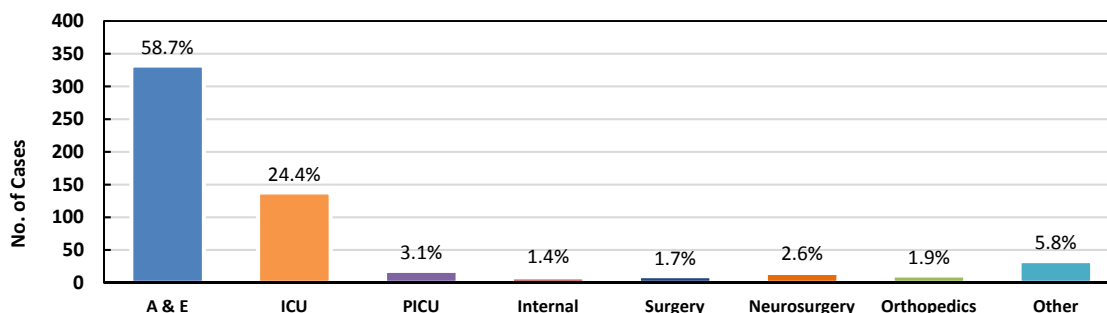


Figure 1. Distribution of referred patients regarding their inpatient departments

hospital and death, 311 people (55.04%) died before 24 hours of hospitalization, and the rest, constituting 254 people (44.96%), died after 24 hours.

Regarding ward distribution of patients who died in the inpatient departments, most cases were related to the emergency department-A & E (58.7%), followed by the intensive care unit-ICU (24.4%) and pediatric intensive care unit-PICU (3.1%). The distribution of patients in inpatient departments is shown in **Error! Reference source not found.**

#### Causes of hospital admittance

Regarding causes of hospital admittance, car and motorcycle accidents were the most common cause with 26.9%, followed by traumas at 17.8% and cardiorespiratory arrest at the time of entering the hospital at 16.6% of cases.

Accidents, cardiorespiratory arrest, and falls were significantly more in men ( $P = 0.040$ ). It should be noted that cardiorespiratory arrest refers to a state following which the patient dies, which is actually neither the cause of death nor a sign of death. The distribution of referred patients regarding the cause of hospital admittance is shown

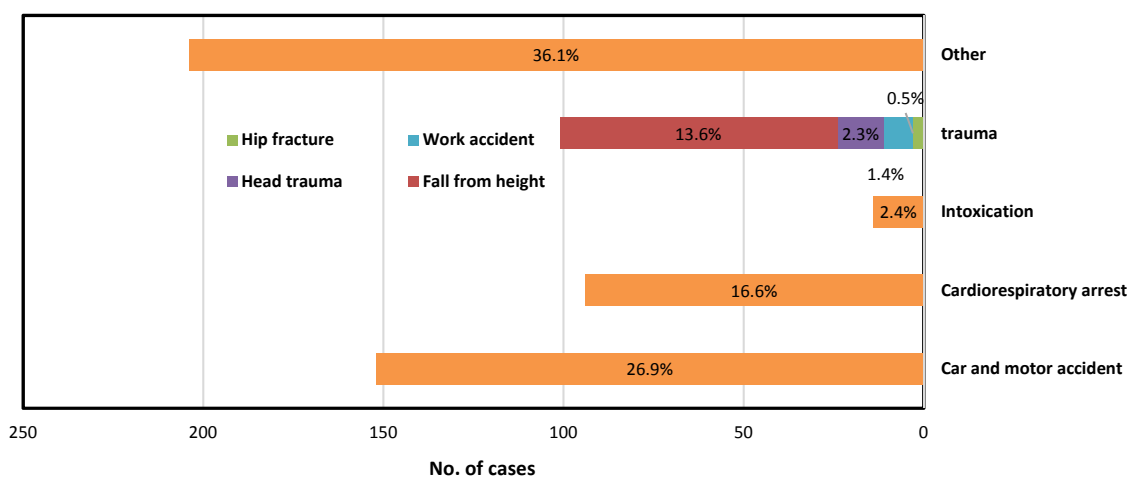


Figure 2. Distribution of referred patients regarding the cause of hospital admittance ("Other" refers to the patient being admitted with a symptom, such as a decreased level of consciousness, or a disease, such as diabetes.)

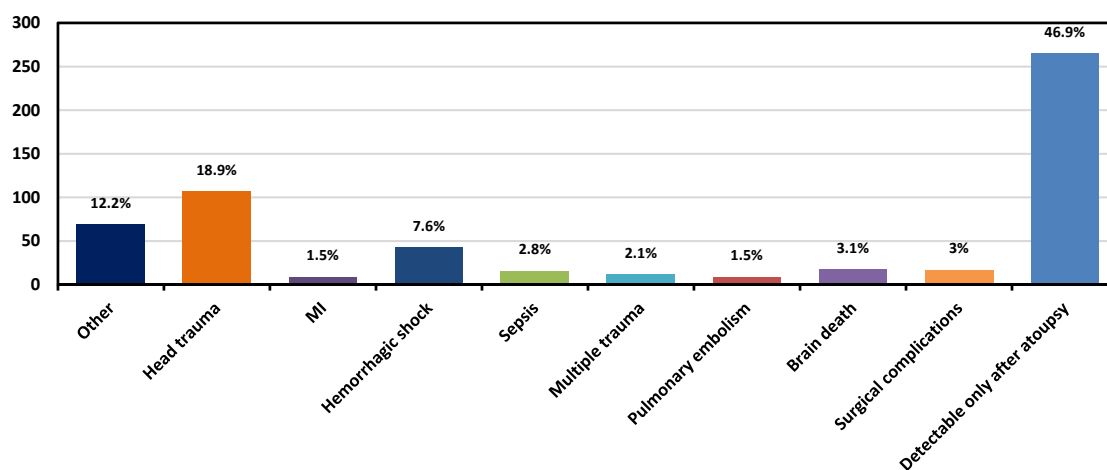


Figure 3. Cause of death in the opinion of the physician; MI: myocardial infarction

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#### Causes of death from the physician's point of view

After unknown cases (determining the cause of death only after autopsy), the most common cause of death, according to the attending physician, was head trauma. The causes of death according to the attending physician, are shown in **Error! Reference source not found.**

#### Causes of referral

The most common cause for referring the deceased to ILMO was car accident with a prevalence of 27.1%, DOA with a prevalence of 21.3%, and death with an unknown cause with a prevalence of 15.3%. **Error! Reference source not found.** shows the causes of referral to the ILMO. It should be noted that DOA is referred to deaths that occurred before or following admittance to the hospital where determining the cause of death was not possible due to imminent passing, and unknown cause refers to a state in which the patient died despite hospitalization and medical examinations, where the cause of death could not be determined at the time of passing.

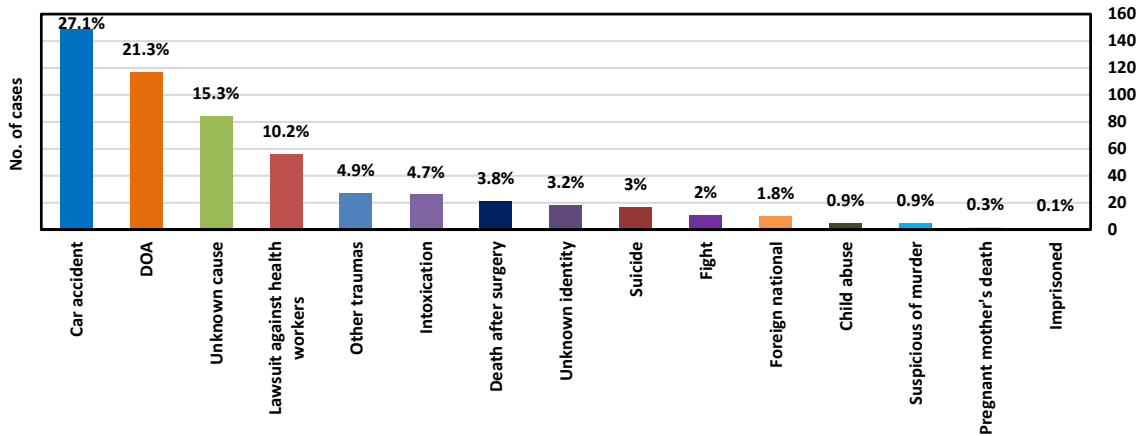


Figure 5. Cause of referral to ILMO

**Causes of referral stratified by gender**

Car accidents, other traumas and intoxication were detected more in men, and lawsuits against medical staff and death following surgery were more in women ( $P < 0.001$ ). The aforementioned results are shown in **Error! Reference source not found.**

**Causes of referral stratified by time of death**

DOA, unknown cause of death, and suicide were the most important causes of referral of deaths occurring within 24 hours of admission to the hospital. Lawsuits against health workers and death after surgery were more common in deaths after 24 hours of admission ( $P < 0.001$ ). The aforementioned results are shown in **Error! Reference source not found.**

**Causes of referral stratified by age**

A significant difference was detected in the case of reasons of referral and age. Death after surgery, unknown cause, and lawsuits against health workers were more common in older patients ( $P < 0.001$ ) (Figure 7).

**Discussion**

Examining the cause of death in referred cases to the ILMO can be useful for monitoring the health status of society. In fact, based on the resulting data, appropriate plans can be administered to improve the level of medical system services, road safety, etc. The present study was conducted in order to investigate the reasons for the referral of the deceased to the ILMO in Hazrat Rasool Hospital, Tehran, from April 1, 2016, to the end of March 2019. In this period of time, 4239 patients died in Hazrat Rasool Hospital of Tehran, of which 564 people (13.3%) were referred to ILMO.

The average age of the deceased was about 46 years, and most of the deceased were men (75%). In a previous study conducted by Ghadipasha et al. on bodies referred to the ILMO of Tehran province, 73.85% of the cases were male, and 26.15% were female (9). More male deaths than female were also observed in the study of Saravani et al., who investigated the causes of death due to accidents in people under 18 in 2013 and 2014, and also in the study of Hashemi et al., who investigated the causes of death in

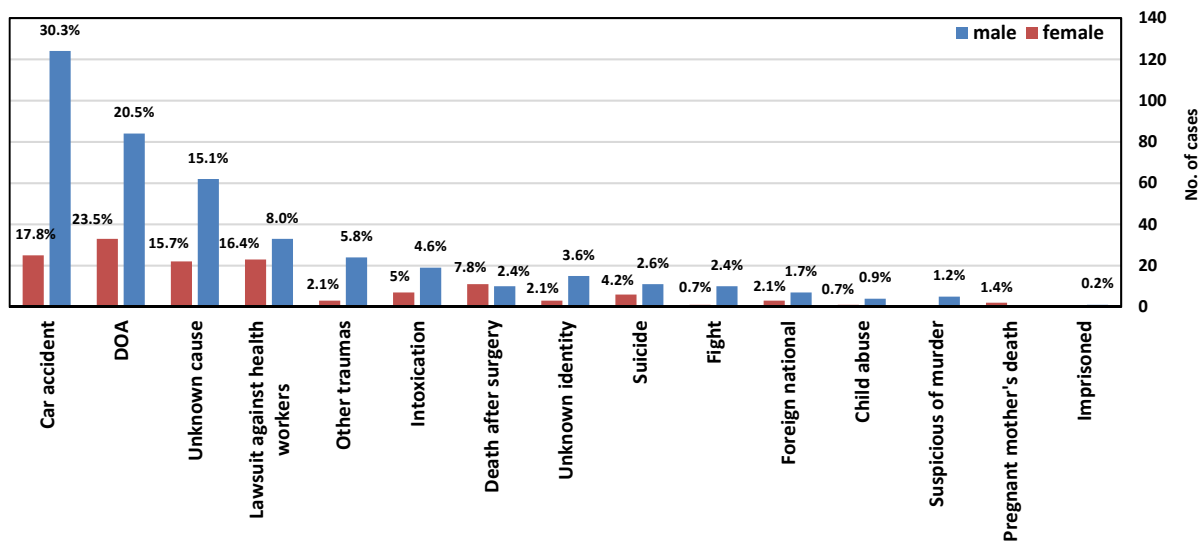


Figure 4. Cause of referral to ILMO stratified by sex

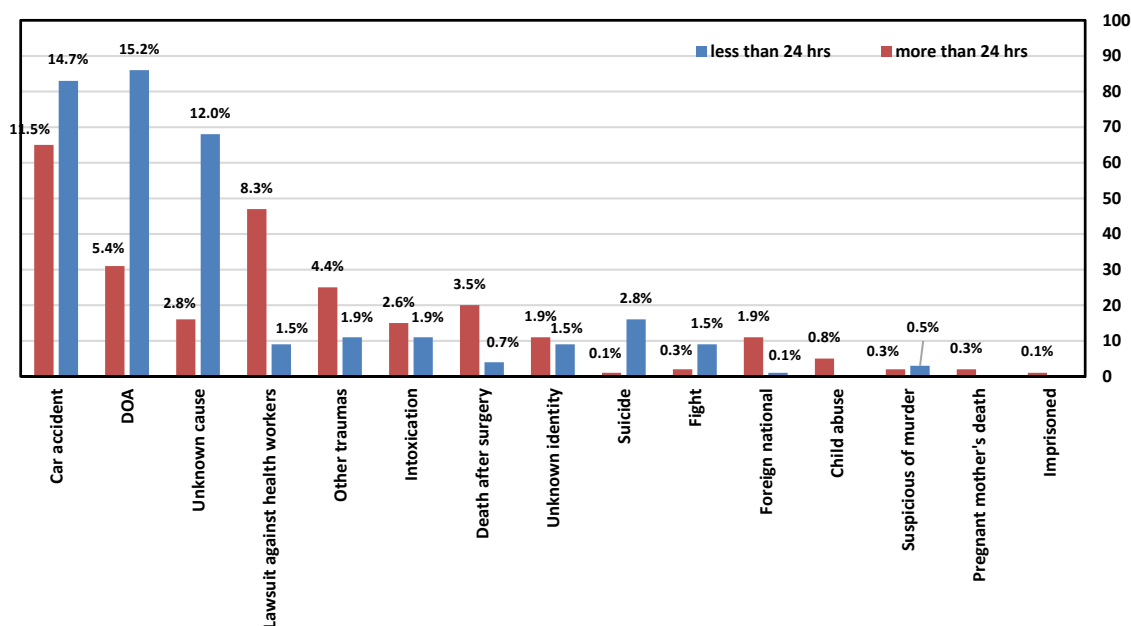


Figure 6. Cause of referral to ILMO stratified by time of death

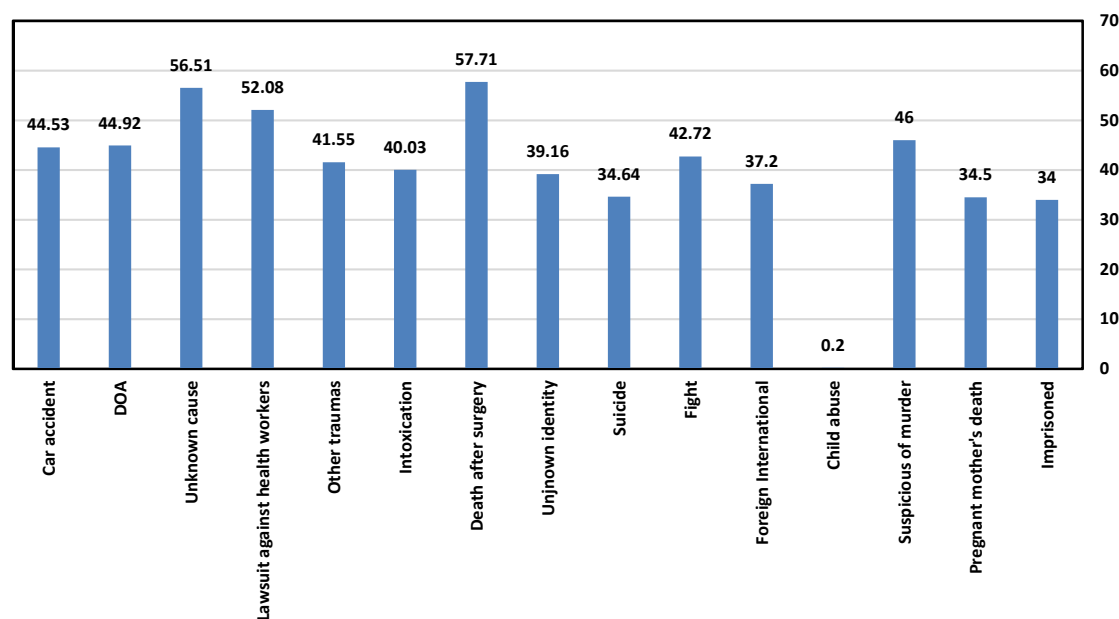


Figure 7. Cause of referral to ILMO stratified by age

children and adolescents in 2004. This issue was also observed in the study of Ugiagbe and Ugiagbe, who investigated the autopsy report of 626 cases referred to the coroner in an African referral center (7). The cause of this gender difference can be social issues or participation in risky behaviors, as well as experiencing more accidents during work in men (6, 8).

In the present study, nearly two-thirds of referrals were from the emergency department (58.7%). It should be kept in mind that Hazrat Rasool Hospital is a referral general hospital, which is visited by more accidental and critically ill patients than other hospitals. On the other hand, emergency patients referred to Hazrat Rasool Hospital are ad-

mitted to the emergency medicine department; therefore, unlike some other hospitals, emergency cases of other specialties are also visited by the emergency service. This issue can explain the high percentage of referrals from the emergency department of this hospital.

The most common reasons for referral were car and motorcycle accidents, followed by cardiorespiratory arrest, trauma, and poisoning. In the study of Ghadipasha et al. in 2012, the most common reasons for referral included decreased level of consciousness, internal problems, surgical problems, and poisoning. The discrepancy is due to the difference in the classification criteria of the cause of referral; for instance, an accident or trauma can cause loss of

consciousness, or internal problems can lead to cardiorespiratory arrest (9).

The majority of referrals from Hazrat Rasool Hospital to the ILMO were related to car and motorcycle accidents, which, as mentioned, is due to the authority of this hospital in the field of accidents and trauma. The second most common cause is dead-on-arrival, which means that the death occurred before or after entering the hospital, and due to imminent death, it was not possible to determine the cause of death; these cases have been referred to ILMO in order to ensure that no crime has occurred. Unknown reasons were the third most common cause of referral. The lawsuit against medical staff is the fourth most common reason for referring a deceased patient to ILMO in this study. This referral is made to provide clarification for the plaintiff's family and to handle their complaint, as well as support the healthcare staff; because if an autopsy is not performed and a complaint is filed against the hospital, the medical staff may be wrongly convicted due to the lack of scientific evidence.

In the present study, it was found that gender had a significant relationship with the reasons for referral, so car accidents, other traumas, and intoxication were significantly more in men than in women, and lawsuits against the medical staff and death following surgery were also significantly more in women ( $P < 0.001$ ). This issue is probably due to the greater participation of men in risky activities and jobs. Also, more lawsuits against medical staff among women can be due to the emotional dependence of family members and relatives on the role of women and mothers in Iranian society. The study findings are summarized in **Error! Reference source not found.**

It should be kept in mind that the present study has some limitations; this study examined the deceased patients referred to ILMO from only one hospital in Tehran.

Although Hazrat Rasool Hospital has all specialized and sub-specialized departments, in order to generalize the findings of this study, future research needs to include a wider statistical population. Another practical limitation of this project was the incompleteness of the medical record information of some patients. In order to avoid bias in data collection, patients with incomplete information were not excluded from this study, and their background variables were compared with other patients to reveal possible differences.

### Conclusion

Investigating the causes of the referral of the deceased to ILMO is an important issue that can play a definitive role in improving the accuracy of mortality statistics of the population. Few studies have been conducted regarding the causes of referral of the deceased to Legal Medicine Organization in Iran. The present study showed that the most prevalent reasons for patient referral were car and motorcycle accidents, death on arrival and death due to unknown causes. Also, the reason for referral had a significant relationship with gender and time of death. Most referred cases were men, and they were hospitalized in the emergency department. To generalize the findings of this study, further studies need to be conducted.

### Ethical Considerations

This research followed the principles of the Declaration of Helsinki and was approved by the Ethics Committee of the Iran University of Medical Sciences (ethical Code: IR.IUMS.REC.1401.290).

### Authors' contributions

Conceptualization and study design, data acquisition and interpretation: All authors; Drafting the article and

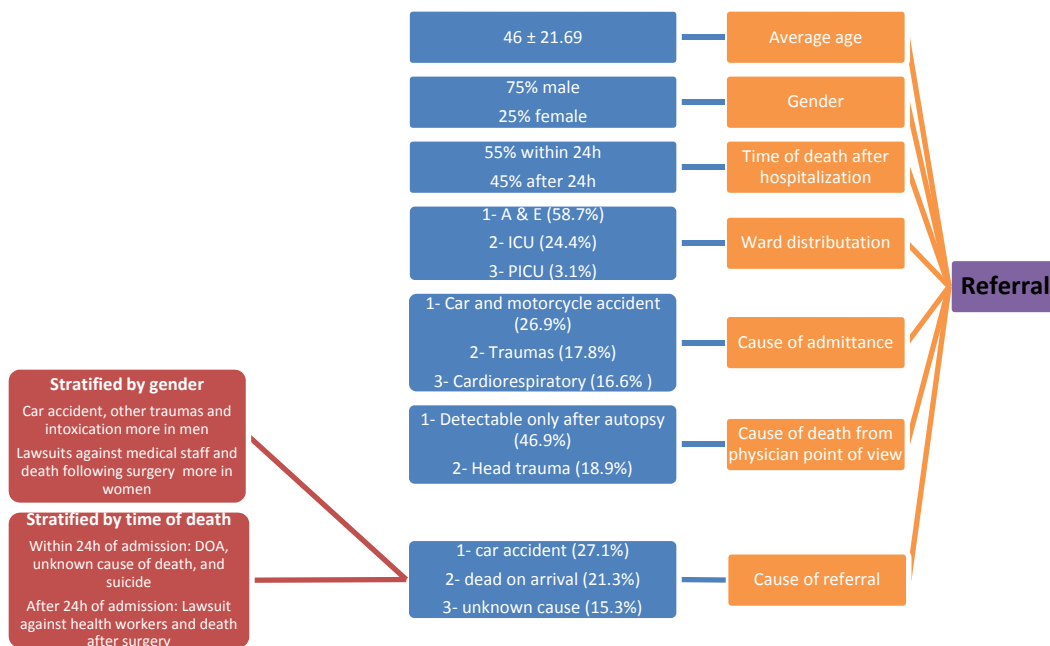


Figure 8. Summary of the study findings

revising it critically for crucial intellectual content: A.A, S.D; Discussing the results and approving the final version: All authors

#### **Conflict of Interests**

The authors declare that they have no competing interests.

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