

## ORIGINAL RESEARCH

# Discrepancy between emergency department diagnoses and discharge diagnoses in a tertiary center in KSA

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**Abstract**

Accurate diagnosis in the Emergency Department (ED) is critical for appropriate, timely treatment. Discrepancies between admission diagnosis by the ED team and discharge diagnosis by the admission team may lead to suboptimal care and have important implications on patient outcomes, resource utilization and hospital quality measures. This study aimed to explore the extent of such discrepancies in a tertiary center in Saudi Arabia and their impact on patient outcomes. This retrospective study at a tertiary medical center in Riyadh, Saudi Arabia (July–August 2019), using electronic medical record (EMR) review, included patients aged  $\geq 14$  years old admitted through the adult emergency department. Patients admitted to the intensive care unit (ICU) or cardiac care unit (CCU), or triaged to the obstetrics and gynaecology (OBGYN) or psychiatric areas of the emergency department were excluded from the study. ED and discharge diagnoses were checked by three physicians and classified into three categories: full, partial and mismatch. A partial match was defined when the ED diagnosis correlated with the final diagnosis to a certain extent and the final diagnosis could not be revealed in the ED setting. Of 771 patients, 692 (89.8%) had matched initial and final diagnoses, 52 (6.7%) had a partially matched diagnosis, and 27 (3.5%) had a complete mismatch between their ED diagnosis and discharge diagnosis. Among partial matches ( $n = 52$ ), the most frequently observed reason was Magnetic Resonance Imaging (MRI) performed during admission (48.08%) and endoscopy/colonoscopy (15.39%). Duration of hospital stay was not significantly associated with diagnosis mismatch. Although the discrepancy between admission and discharge diagnoses was relatively low, careful evaluation of patient complaints, medical history and laboratory and imaging results is critical for accurate diagnosis and management. Future research is needed to explore the impact of discrepancies in diagnosis on patient outcomes and to identify strategies to minimize them.

**Keywords**

Emergency; Diagnosis; Match; Mismatch; Partial match; Saudi Arabia

## 1. Introduction

The Emergency Department (ED) is often the first point of contact for patients seeking urgent medical attention [1]. The ED provides critical care to patients with a wide range of medical emergencies, ranging from life-threatening conditions to minor injuries [1]. The accurate diagnosis of patients in the ED is critical for appropriate and timely treatment. However, discrepancies may occur between the admission diagnosis by the ED team and the discharge diagnosis by the admitting team [2]. Such discrepancies may lead to suboptimal care and have important implications for patient outcomes, resource utilization and hospital quality measures [2].

The discrepancy between the ED admission diagnosis and

admitting team discharge diagnosis is not a new phenomenon. Previous studies have reported conflicting results regarding the frequency and cause of such discrepancies. A retrospective study conducted in the United States found a discrepancy between ED admission diagnosis and admission team discharge diagnosis in 29% of cases, and the most common reasons were inadequate history and physical examination, insufficient diagnostic testing and incorrect interpretation of test results [3].

Discrepancies between admission and discharge diagnoses in the ED may vary and can be related to patient, physician, or system factors [4, 5]. Patient factors such as lack of information about medical history, inability to communicate effectively, and presence of comorbidities may contribute to discrepancies. Physician factors, such as lack of experience

or knowledge, poor communication and incomplete documentation, may also play a role. System factors, such as ED overcrowding, inadequate staffing and limited resources, may also contribute to these discrepancies [2, 4].

In this study, we aimed to explore the extent of the discrepancy between the admission diagnoses made by the ED team and the discharge diagnoses made by the admitting team in a tertiary center in the Kingdom of Saudi Arabia (KSA). We also examined the factors associated with these discrepancies and their impact on patient outcomes.

## 2. Methods

### 2.1 Study design and setting

This retrospective study was conducted at a tertiary medical center in Saudi Arabia between July–August 2019. This study aimed to assess the accuracy of emergency department (ED) admission diagnoses by comparing the degree of matching between ED and final discharge diagnoses and the impact of diagnosis matching on hospital length of stay. We also aimed to evaluate the influence of patient factors, complaint type, medical specialty and investigation type on diagnostic accuracy.

### 2.2 Study population and sample size

The study included all patients aged  $\geq 14$  years who were admitted to the adult emergency department of King Saud University Medical City (KSUMC) between July–August 2019. Patients admitted to the intensive care unit (ICU) or cardiac care unit (CCU) and triaged to the obstetrics and gynaecology (OBGYN) emergency or psychiatric area of the emergency departments were excluded from the study.

### 2.3 Data collection and variables

The electronic medical records (EMRs) of all patients who met the inclusion and exclusion criteria were retrospectively reviewed. Three physicians reviewed ED and discharge diagnoses, classifying them into three categories: full, partial and mismatch. A diagnosis was considered a full match if the ED diagnosis was the same as the final diagnosis in the patient file. A partial match was defined when the ED diagnosis correlated to a certain extent with the final diagnosis but the final diagnosis could not be revealed in the ED setting. A mismatch was defined when the admission and discharge diagnoses were unrelated even though the final diagnosis could be revealed in the ED setting (missed diagnosis). The 3 authors discussed all potential “partial match” cases and made the final decision on a case-by-case basis following our definition of a partial match diagnosis. Certain patients were not included in our sample size or data analysis because they had no clear admission and/or discharge diagnosis for the following reasons: incomplete documentation in the patient file, patients instructed to visit the ED for direct admission by their primary treating physician without a full assessment by an ED physician, death during admission, patients who left against medical advice and did not complete their inpatient investigations, and patients discharged to complete their workup in the outpatient setting.

All documents in EMR were done by the physicians who covered the adult emergency department (ED) of King Saud University Medical City (KSUMC). The ED at KSUMC has two main areas; a resuscitation unit and an adult acute care unit. Each area was covered by at least one emergency consultant, 1 senior resident, and 1 or more junior residents or rotator residents from other (non-emergency medicine) specialties.

The study variables collected from the EMR included patient age, sex, type of presenting complaint, admitting team, type of investigation performed in the ED (blood test/urine test/X-ray/CT), type of investigation or procedure (including operative interventions) performed during admission, length of hospital stay, and for partially matched diagnoses, the intervention or investigation that caused the diagnostic difference between the ED and discharge diagnosis. We evaluated the influence of age, sex, medical specialty and type of investigation in the ED on the accuracy and degree of diagnosis matching.

### 2.4 Statistical analysis

Data were analyzed using SPSS (Statistical Package for the Social Sciences) software version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including means, standard deviations and frequencies, were used to summarize the data. The degree of agreement between the ED diagnoses and final discharge diagnoses was assessed using Cohen’s kappa coefficient. A multivariate logistic regression analysis was performed to evaluate the influence of patient factors, complaint type, medical specialty and investigation type on the accuracy of the diagnosis. *p* value was used to assess the statistical significance.

## 3. Results

Table 1, which involved 771 individuals, summarizes the characteristics of the included population in our study and the type of complaint the patient presented with to the ED and the admission team. The sex distribution was relatively equal, with 49% female and 51% male participants. The mean age was 49 years old, with a standard deviation of 21. Most patients were admitted for medical complaints (74.2%), followed by surgical complaints (19.8%). A smaller proportion of patients were admitted for trauma involving either one system or multiple systems, or due to device malfunction.

Regarding the admission team, Internal Medicine accounted for the largest proportion (38.9%), followed by General Surgery (17.6%) and neurology (14.8%). Other specialties made up smaller proportions of admitting services, with some having only one representative, such as otolaryngology, infectious diseases and oral/maxillofacial surgery.

Table 2 shows the frequency of different tests performed in the ED before admission and the duration of hospital stay of the patients included in the study. The results indicated that blood tests were the most frequently conducted investigations before consultation and subsequent admission, with 95.1% of patients receiving these tests. Additional tests included in the study are shown in Table 2, including urine analysis, radiography imaging (X-ray), departmental ultrasound (US) performed by a radiologist, and computerized tomography (CT). The mean

**TABLE 1. Characters of the included population (n = 771).**

Parameter	Frequency (%)/ Mean ± SD
Gender	
Female	378 (49.0%)
Male	393 (51.0%)
Age, yr	49 ± 21
Type of complaint	
Medical	572 (74.2%)
Surgical	153 (19.8%)
Trauma involving one system	31 (4.0%)
Multi-system trauma	8 (1.0%)
Device malfunction	7 (0.9%)
Admission team	
Internal medicine	300 (38.9%)
General surgery	136 (17.6%)
Orthopedics	26 (3.4%)
Cardiology	61 (7.9%)
Otolaryngology	1 (0.1%)
Neurology	114 (14.8%)
Neurosurgery	6 (0.8%)
Oncology	8 (1.0%)
Rheumatology	8 (1.0%)
Plastics	12 (1.6%)
Vascular Surgery	3 (0.4%)
Urology	21 (2.7%)
Gastrointestinal	31 (4.0%)
Nephrology	15 (1.9%)
Hematology	5 (0.6%)
Pulmonology	11 (1.4%)
Obstetrics and Gynaecology	2 (0.3%)
Endocrinology	1 (0.1%)
Thoracic surgery	5 (0.6%)
Colorectal surgery	3 (0.4%)
Infectious Disease	1 (0.1%)
Oral maxillofacial	1 (0.1%)

*SD: Standard Deviation.*

length of hospital stay was found to be 7 ± 10 days.

Table 3 provides information about diagnosis matching and the reasons for partial mismatches among the included population. Of the 771 patients included in the analysis, 692 (89.8%) had matching initial and final diagnoses, indicating relatively high levels of agreement. However, it is worth noting that 52 patients (6.7%) had a partial match, and 27 (3.5%) had a complete mismatch.

**TABLE 2. Type of investigations in ED n and duration of stay (n = 771).**

Parameter	Frequency (%) / Mean ± SD
Blood	
Done	733 (95.1%)
Not done	38 (4.9%)
Urine analysis	
Done	405 (52.5%)
Not done	366 (47.5%)
X-Ray	
Done	424 (55%)
Not done	347 (45%)
US	
Done	45 (5.8%)
Not done	726 (94.2%)
CT	
Done	308 (39.9%)
Not done	463 (60.1%)
Length of hospital stay (d)	7 ± 10

*SD: Standard Deviation; CT: computed tomography; US: ultrasound.*

**TABLE 3. Degree of matching, and investigations that contribute partial match (n = 771).**

Parameter	Frequency (%) / Mean ± SD
Initial and final diagnoses matching	
Match	692 (89.80%)
Partial mismatch	52 (6.70%)
Mismatch	27 (3.50%)
Factors affecting partial match (n = 52)	
Barium swallow	1 (1.93%)
Biopsy	2 (3.85%)
Blood cultures	1 (1.93%)
Cardiac catheterization	1 (1.93%)
CT	2 (3.85%)
ECG	1 (1.93%)
EEG	1 (1.93%)
Endoscopy/Colonoscopy	8 (15.39%)
MRCP	2 (3.85%)
MRI	25 (48.08%)
Negative investigations	2 (3.85%)
Repeat labs	2 (3.85%)
Repeat US	1 (1.93%)
Stool culture	1 (1.93%)
Symptom resolution	2 (3.85%)

*SD: Standard Deviation; ECG: electrocardiogram; EEG: electroencephalogram; MRCP: Magnetic resonance cholangiopancreatography; MRI: Magnetic Resonance Imaging; US: ultrasound; CT: computerized tomography.*

The reasons for these discrepancies varied among patients with partial mismatches ( $n = 52$ ). The most frequently observed reason was MRI, which accounted for 48.08% of cases. This suggests that MRI findings may have contributed to differences in the final diagnosis. Endoscopy/colonoscopy was another significant reason for partial mismatch, observed in 15.39% of the cases, followed by biopsy (3.85%), CT (3.85%) and Magnetic Resonance cholangiopancreatography (MRCP) (3.85%). Other factors, such as negative investigations, repeat labs, symptom resolution and repeat ultrasound, also contributed to the partial mismatch in a smaller number of cases.

Table 4 presents the percentages of our study patients (771) with a match, partial match or mismatch for various parameters, along with the  $p$ -values.

For sex, the results showed that 90.2% of females and 89.3% of males had a match between the initial and final diagnoses, with no significant difference between the two groups ( $p = 0.906$ ).

Regarding age, patients aged 21 or less had the highest percentage of matching diagnoses (95.1%), followed by those aged 62 or more (90.2%), while patients aged 22–41 and 42–61 had lower percentages of matching diagnoses (88.7% and 88.4%, respectively). However, the difference was not statistically significant ( $p = 0.461$ ).

As shown in Fig. 1, When reviewing the results for the type of complaint, patients with surgical complaints had the highest percentage of matching diagnoses (94.8%), followed by those with medical complaints and multisystem trauma (87.9%). Patients with trauma involving one system and device malfunction complaints had even higher percentages of matching diagnoses (96.8% and 100%, respectively); however, the number of patients in these categories was relatively small. The difference between the groups was not statistically significant ( $p = 0.157$ ).

Patients admitted to the Internal Medicine departments had a high percentage of matched diagnoses (92%), General Surgery (93.4%), cardiology (90.2%) and neurology (78.9%). The difference between the groups was statistically significant ( $p = 0.002$ ).

Fig. 2 depicts the factors that led to diagnosis mismatching (misdiagnosis) in the ED. Causes for misdiagnoses were categorized into three broad categories: The first is inadequate assessment by the ED team, this category made up the majority of cases ( $n = 11$ ). An example of this is missing the diagnosis of an obstructed stoma as insufficient history taking failed to reveal the decrease in stoma output. The Second category is misinterpretation of results ( $n = 9$ ), that being misinterpretation of electrocardiograms (ECGs), laboratory or imaging results. In this category, the appropriate investigation modality was conducted in the ED but the ED team failed to reach the correct diagnosis given the results provided. The third and last category is lack of consideration for the appropriate imaging modality required to reveal the pathology and hence the correct diagnosis ( $n = 7$ ). In this category, the patient's presentation provided adequate clues to trigger consideration for a particular imaging study, however, the ED team failed to request the appropriate imaging modality which would have been available in the ED setting.

Finally, no significant difference in the percentage of match-

ing diagnoses was observed between patients who had blood tests done and those who did not ( $p = 0.306$ ). The duration of hospital stay was not significantly associated with the diagnosis mismatch.

## 4. Discussion

Diagnosis is a critical component of healthcare that influences the quality of patient care and patient outcomes [6]. Inappropriate diagnoses can lead to treatment delays, unnecessary investigations and hospitalizations and can have negative implications for patient safety [7]. Accurate diagnosis is a critical step towards providing effective treatment and improving patients' outcomes [8]. The Emergency Department (ED) plays a vital role in healthcare systems by providing urgent care to patients who require immediate medical attention [9]. The ED is the gateway to hospitalization, and patients admitted to the hospital are typically evaluated by a team of specialists to determine the most appropriate treatment [9]. However, a discrepancy often exists between the initial diagnosis made by ED physicians and the final discharge diagnosis made by the admitting team [2]. This discrepancy may have significant implications for patient outcome [4, 5].

This study aimed to assess the extent of discrepancies between admission and discharge diagnoses in a tertiary center in the KSA, explore the factors associated with these discrepancies, and investigate their impact on patient outcomes. The study found a relatively low rate of discrepancy between initial and final diagnoses. Most patients had matching initial and final diagnoses, whereas only a small percentage had a partial or complete mismatch. This finding suggests that ED doctors are generally more accurate in their diagnoses. However, this study identified several factors associated with these discrepancies. In our study which was conducted in KSUMC, all patients underwent the history and physical examination and were seen by at least the triage physician, then seen by at least 2 physicians from different experience levels in the ED area (resident and consultant/attending). We believe all of these, as well as the type of complaint, play a role in the accuracy of diagnosis-matching. However, as mentioned in the results, blood tests, urine tests, US and CT were helpful in reaching the diagnosis in the ED, but they did not affect the accuracy.

Inconsistencies in diagnostic discrepancy rates have been reported in various studies, depending on the study design [10–13]. Some studies have measured only the discrepancy rate between the documented International Classification of Diseases (ICD) code at admission and discharge without actual chart review and have shown high diagnostic discrepancy rates ranging from 52.8% to 75.6% [10, 14, 15]. However, a retrospective chart review from Malaysia that included 180 patients from a university hospital reported a diagnostic discrepancy rate of 13.3% [11], which was still higher than the percentage of mismatches we found (both complete and partial combined). Similarly, a retrospective chart review from Singapore, which included 361 patients admitted to a tertiary hospital with specific criteria for concordant and discordant diagnoses, also documented a rate of 13.3% [16]. Our mismatch percentage was lower than that reported in previous studies [10, 11, 14–16]. However, the reason for such low rates is unclear and

**TABLE 4. Degree of matching in association with patient parameters (n = 771).**

Parameter	Initial and final diagnoses matching			p-value
	Match	Partial match	Mismatch	
<b>Gender</b>				
Female	341 (90.2%)	24 (6.3%)	13 (3.4%)	0.906
Male	351 (89.3%)	28 (7.1%)	14 (3.6%)	
<b>Age, yr</b>				
21 or less	78 (95.1%)	3 (3.7%)	1 (1.2%)	0.461
22–41	204 (88.7%)	15 (6.5%)	11 (4.8%)	
42–61	190 (88.4%)	19 (8.8%)	6 (2.8%)	
62 or more	220 (90.2%)	15 (6.1%)	9 (3.7%)	
<b>Type of complaint</b>				
Medical	503 (87.9%)	46 (8.1%)	23 (4.0%)	0.157
Surgical	145 (94.8%)	6 (3.9%)	2 (1.3%)	
Trauma 1 system	30 (96.8%)	0 (0.0%)	1 (3.2%)	
Multi-system trauma	7 (87.5%)	0 (0.0%)	1 (12.5%)	
Device malfunction	7 (100%)	0 (0%)	0 (0%)	
<b>Admission team</b>				
Internal medicine	276 (92.0%)	11 (3.7%)	13 (4.3%)	0.002
General surgery	127 (93.4%)	7 (5.1%)	2 (1.5%)	
Orthopaedics	25 (96.2%)	0 (0.0%)	1 (3.8%)	
Cardiology	55 (90.2%)	3 (4.9%)	3 (4.9%)	
Ear, Nose and Throat	0 (0.0%)	1 (100.0%)	0 (0.0%)	
Neurology	90 (78.9%)	22 (19.3%)	2 (1.8%)	
Neurosurgery	5 (83.3%)	1 (16.7%)	0 (0.0%)	
Oncology	7 (87.5%)	0 (0.0%)	1 (12.5%)	
Rheumatology	8 (100%)	0 (0%)	0 (0%)	
Plastics	11 (91.7%)	0 (0.0%)	1 (8.3%)	
Vascular Surgery	3 (100%)	0 (0%)	0 (0%)	
Urology	19 (90.5%)	1 (4.8%)	1 (4.8%)	
Gastrointestinal	25 (80.6%)	5 (16.1%)	1 (3.2%)	
Nephrology	13 (86.7%)	0 (0.0%)	2 (13.3%)	
Hematology	4 (80%)	1 (20%)	0 (0%)	
Pulmonology	11 (100%)	0 (0%)	0 (0%)	
Obstetrics and Gynaecology	2 (100%)	0 (0%)	0 (0%)	
Endocrinology	1 (100%)	0 (0%)	0 (0%)	
Thoracic surgery	5 (100%)	0 (0%)	0 (0%)	
Colorectal surgery	3 (100%)	0 (0%)	0 (0%)	
Infectious Disease	1 (100%)	0 (0%)	0 (0%)	
Oral maxillofacial	1 (100%)	0 (0%)	0 (0%)	
<b>Blood</b>				
Done	659 (89.9%)	50 (6.8%)	24 (3.3%)	0.306
Not done	33 (86.8%)	2 (5.3%)	3 (7.9%)	

TABLE 4. Continued.

Parameter	Initial and final diagnoses matching			p-value
	Match	Partial match	Mismatch	
Urine				
Done	367 (90.6%)	21 (5.2%)	17 (4.2%)	0.115
Not done	325 (88.8%)	31 (8.5%)	10 (2.7%)	
X-Ray				
Done	387 (91.3%)	22 (5.2%)	15 (3.5%)	0.163
Not done	305 (87.9%)	30 (8.6%)	12 (3.5%)	
US				
Done	41 (91.1%)	4 (8.9%)	0 (0%)	0.366
Not done	651 (89.7%)	48 (6.6%)	27 (3.7%)	
CT				
Done	270 (87.7%)	27 (8.8%)	11 (3.6%)	0.186
Not done	422 (91.1%)	25 (5.4%)	16 (3.5%)	
Duration of hospital stay (d)				
1 to 7	484 (90.5%)	33 (6.2%)	18 (3.4%)	0.330
8 to 28	187 (89.5%)	15 (7.2%)	7 (3.3%)	
29 or more	21 (77.8%)	4 (14.8%)	2 (7.4%)	

US: ultrasound; CT: computerized tomography.

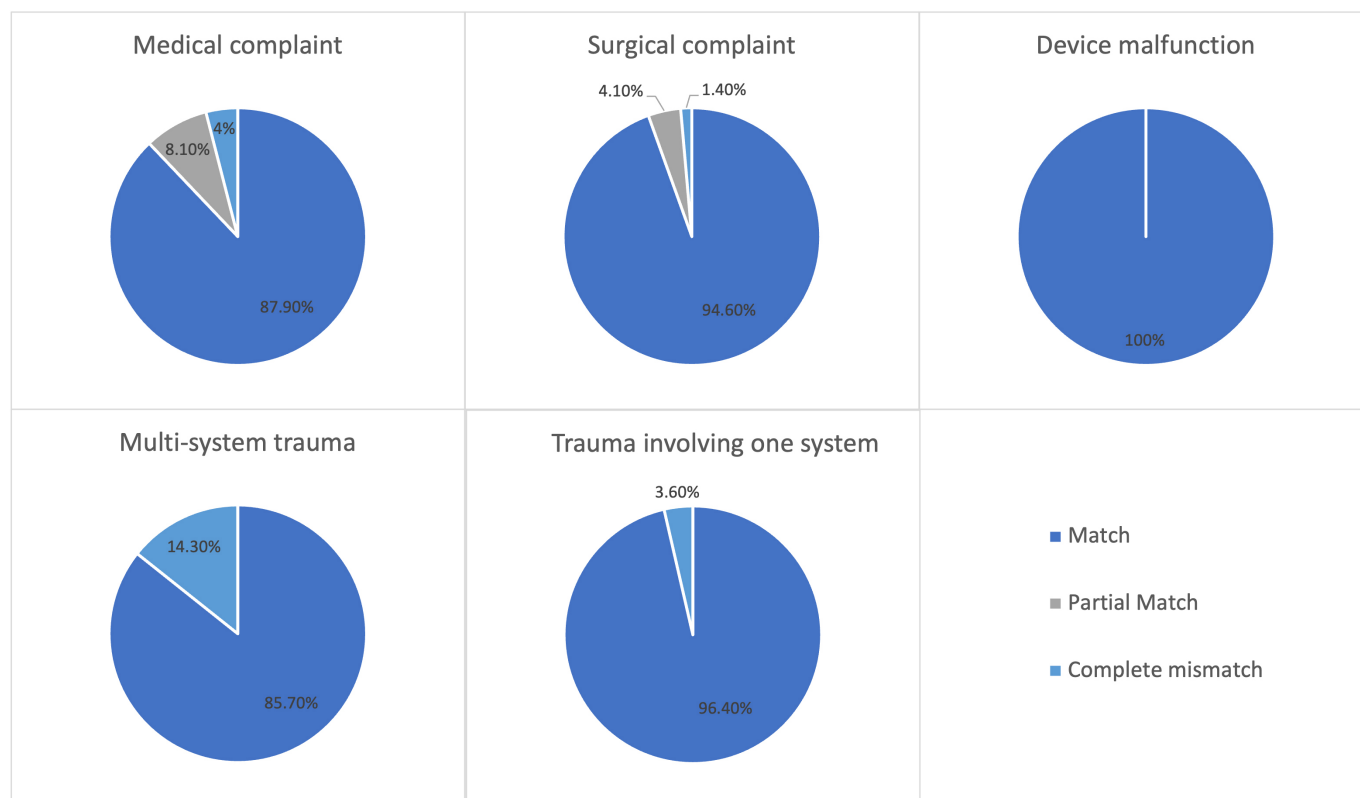
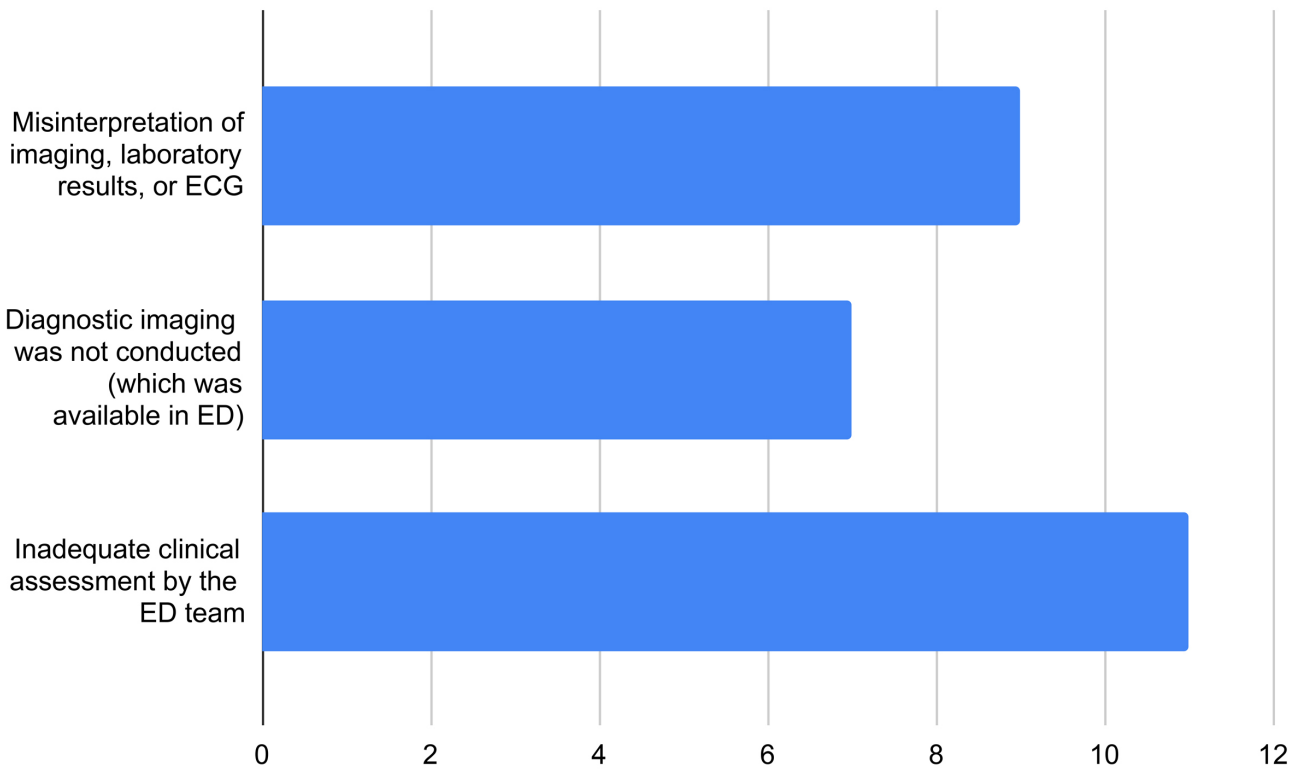


FIGURE 1. Degree of matching, for each type of complaint.



**FIGURE 2. Factors contributing to mismatch between ED diagnosis and discharge diagnosis.** ED: Emergency Department; ECG: electrocardiogram.

could be attributed to accurate diagnosis in the ED or anchoring bias during admission.

Our study found that patients with surgical complaints had a higher percentage of matched diagnoses than those with medical complaints. This finding may be because surgical complaints are typically more acute and less vague than medical complaints. Patients presenting with trauma and device malfunction complaints had an even higher percentage of matched diagnoses, which may have been due to the more straightforward nature of these complaints. Regarding admission services, neurology had the lowest percentage of complete matching compared to other medical services (78%), which may be due to the requirement of an MRI to reach an accurate final diagnosis. This difference between admitting services was statistically significant, indicating that the specialty of the admitting team may affect the accuracy of diagnoses. Our study showed no statistical difference among groups with different hospital stay durations, which not only shows that diagnosis mismatch had no association with an increased length of stay but also shows that patients with prolonged admission duration were not more likely to have a mismatched diagnosis after extensive investigations.

It is worth noting that symptom diagnosis, which describes symptoms without pathological diagnoses, represented more than half of ED discharge diagnoses for specific complaints such as abdominal and chest pain in a national study [17]. Wen *et al.* [17] showed that ED physicians choose symptom diagnoses over pathological diagnoses for various reasons,

including not wanting to commit to a specific diagnosis and risk-causing anchoring bias. Some may argue that obtaining a pathological diagnosis is often impossible in an ED setting. They believed that the goal of the ED should always be to rule out life-threatening diagnoses and avoid making a pathological diagnosis [17]. Symptom diagnoses were not presented in our study or any of the diagnostic discrepancy studies included in the literature review.

Our study also considered the factors that affect matching, resulting in a partial match. Most of these factors are related to investigations that are not available in the ED, at least at our hospital. The highest rates of diagnostic change during admission were due to MRI performed in the inpatient setting, followed by endoscopies/colonoscopies, CT scans, and biopsy histopathology. Thus, the number of cases requiring advanced investigations not available in the ED was relatively low compared to the overall number of patients enrolled.

## 5. Limitations

This study has limitations. It was conducted at a single tertiary center in the KSA, which may limit the generalizability of the findings to other settings. Furthermore, the retrospective nature and reliance on medical records introduce the possibility of errors and missing data. We excluded some patients due to incomplete documentation for the reasons mentioned in the methods section. Additionally, the study did not investigate the impact of discrepancies in diagnosis on factors other than

hospital length of stay, such as morbidity and mortality.

## 6. Conclusions

Although the discrepancy between admission and discharge diagnoses was relatively low, careful evaluation of patient complaints, medical history and laboratory and imaging results are critical for accurate diagnosis and appropriate management. Future research is needed to explore the impact of discrepancies in diagnosis on patient outcomes and to identify strategies to minimize these discrepancies.

## AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

## AUTHOR CONTRIBUTIONS

FAb, YA and LA—designed the research study; performed the research. FAb, YA, LA, BA, AA and TAS—analyzed the data. MA and FAI—wrote the manuscript. All authors read and approved the final manuscript.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of King Saud University Medical City (KSUMC), Saudi Arabia (No. E-20-5297). The need for written informed consent was waived due to the retrospective nature of the study and the use of de-identified data. Patient confidentiality was maintained throughout the study, and all data were handled in a secure and confidential manner.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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