A STUDY OF DIAGNOSIS DISCREPANCY BETWEEN ADMISSION AND DISCHARGE IN HOSPITAL UNIVERSITI SAINS MALAYSIA.

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In the name of Allah, the Most Gracious and the Most Merciful

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The dissertation that you may read after this, is a result of multiple failures, multiple corrections, extensions and hard work. The results is what you see as presented by this book, but the strive of many people will remain the greatest memory towards completion of this dissertation.

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ABSTRAK

KAJIAN KETEPATAN DIAGNOSIS PESAKIT DI HOSPITAL UNIVERSITI SAINS MALAYSIA.

Pengenalan: Ketepatan Jabatan Kecemasan Dan Trauma (ED) dalam membuat diagnosis semasa kemasukan pesakit ke hospital merupakan satu perkara yang penting dalam meningkatkan mutu penjagaan, meningkatkan tahap keselamatan, mengurangkan tempoh kemasukan pesakit dan mengurangkan beban hospital. Kajian ini bertujuan mengkaji ketepatan diagnosis yang dibuat oleh ED Hospital Universiti Sains Malaysia (USM) dan faktor-faktor yang menyumbang ketidaktepatan diagnosis yang dibuat oleh ED hospital USM.

Metodologi: Ini adalah kajian "retrospective cross-sectional" dimana fail-fail pesakit yang dimasukkan ke dalam hospital USM melalui ED dari Mei 2016 until Disember 2017 dipilih secara rawak. Data berkenaan pesakit-pesakit ini kemudiannya dikategorikan mengikut ketepatan diagnosis yang dibuat mengikut klasifikasi ICD-10. Sebanyak 180 kes dikaji dan diagnosis yang dibuat dikategorikan kedalam dua diagnosis utama iaitu diagnosis tepat dan diagnosis tidak tepat. Faktor-faktor yang mempengaruhi ketidaktepatan diagnosis kemudannya dikaji menggunakan kaedah "multiple logistic regression".

Keputusan: Jabatan kecemasan hospital USM mempunyai ketepatan diagnosis sebanyak 84.4 peratus dan ketidaktepatan diagnosis sebanyak 15.56 peratus. Pesakit – pesakit di zon hijau mempunyai kebarangkalian tinggi sebanyak 4.2 kali ganda untuk diklassifikasikan ke dalam ketidaktepatan diagnosis berbanding dengan zon merah.

Kesimpulan: Jabatan Kecemasan hospital USM mempunyai kadar ketepatan diagnosis yang tinggi.

ABSTRACT

A STUDY OF DIAGNOSIS DISCREPANCY BETWEEN ADMISSION AND DISCHARGE IN HOSPITAL UNIVERSITI SAINS MALAYSIA.

Background: The accuracy of Emergency Department (ED) doctors in making a provisional diagnosis is crucial as it has direct impact on the patient treatment, safety, length of stay and cost of treatment. The study of the accuracy of the provisional diagnosis made by ED to compare with the discharge diagnosis is scarce in its availability and most results vary with different continents. This study was conducted to evaluate the accuracy of the diagnosis made by ED doctors in Hospital Universiti Sains Malaysia (HUSM) and the factors contributed to the discrepancy.

Methods: This was a retrospective cross-sectional study in which medical records of patient admitted to hospital USM within Mei 2016 until December 2017 were selected using simple random sampling methods. The folders were then reviewed and the association within the categorized diagnosis accuracy was analysed using the ICD-10 classification. The sample size was 180 cases and cases was divided into two main categories. The factors associated with the unmatched diagnosis from both, patients and provider were then measured using multiple logistic regressions.

Results: Hospital USM Emergency department had 84.4 percent of matched diagnosis with 15.56 percent of unmatched diagnosis. The odds of having unmatched diagnosis in patients from green zone are 4.2 times higher compared to the red zone.

Conclusions: Hospital USM Emergency department had high diagnostic accuracy as compared to the unmatched diagnosis.

Chapter 1: Introduction

The perception of other specialty towards Emergency Medicine in Malaysia was complex as it started way back in 1980's. The Emergency Medicine specialty in Malaysia started around 1990's and prior to that the Emergency Department was managed by medical officers and had no dedicated attending specialist. It was considered as a "dumping site" to medical officers that were problematic and those who had no clear pathway to further their study in any specialities [1].

As the specialities in Emergency Medicine sets in the 1990's, it has made great changes in the management and training for the medical officers in the Emergency Department. Though many changes have been made, it is always perceived as the department that is not able to be relied on. As the years progress, the speciality of Emergency Medicine has been expanding and at the current moment this paper is written, it is one of the most medical post graduate applicants in Malaysia.

One of the important debate within the inter-specialities in a hospital around Malaysia is about the competency of the Emergency Department to make a correct diagnosis prior to admission of the patients and further management by the primary team [2]. There are two types of admission that are being practise in the country. In most of the hospitals in Malaysia, the receiving team has to vet the admission, either by reviewing the patient at the emergency department or through phone call and at some centre the admissions to hospital are done directly by the emergency department.

In the setting where every cases need to be vet by the receiving team, the management of patient in emergency department is affected in various ways. The main drawback of this is prolonged stay in emergency department that will lead to backlog in the emergency department. This will also lead to the overload of patients and reduce the quality of their care in ED [3].

The question raised is whether there is a difference between diagnoses made by the emergency department doctors compared to the admission diagnosis by the primary team who review the patient in the Emergency Department [2].

Multiple studies show variation of results. High diagnostic accuracy has been seen in multiple studies [2-4]. However El-Mahhali et al.[5] recorded that accuracy of Emergency Department that is made during admission is only around 65.3%. This discrepancy in results may be due to the availability of medical staffs, investigations and the medical practice itself. The workload difference in different centre and the pressure of time on making diagnosis may as well contribute to this result variation [6].

The need for a high diagnostic accuracy is important to be done at the doorstep as it may have clinical, financial, legal implications, reducing the burden to health sector, to provide high level of satisfaction for the patients and reducing the revisit to emergency department or any other health centre [7-10].

Hospital Universiti Sains Malaysia is a tertiary hospital in the state of Kelantan, Malaysia. It caters most of the cases especially medical, surgical, paediatric surgery, cardiothoracic surgery, neurosurgery, neuromedical, obstetrics and gynaecology, paediatrics, psychiatric, and orthopaedic. It is the only referral centre for all neurosurgery and neuromedical cases throughout the state and the northern part of Terengganu.

The objective of this study is to evaluate the accuracy of diagnosis made by emergency department doctors and factors that contribute to the diagnosis discrepancy.

Chapter 2 : Objectives

2.1 General Objective

To determine the accuracy of admission diagnosis made by emergency department doctors and the factors associated with diagnosis discrepancy among patients admitted via emergency Department Hospital Universiti Sains Malaysia from Mei 2016 until August 2017

2.2 Specific Objective

2.2.1 To determine the patient associated factors **(age, gender, numbers of co-morbidity, time of presentation)** that may lead to unmatched diagnosis to those who admitted to Hospital Universiti Sains Malaysia from Mei 2016 until August 2017.

2.2.2 To determine the provider associated factors **(triage, numbers of investigations, numbers of referral, length of stay)** that may lead to unmatched diagnosis to those who admitted to Hospital Universiti Sains Malaysia from Mei 2016 until August 2017.

Chapter 3: Manuscript

3.1 TITLE: A STUDY OF DIAGNOSIS DISCREPANCY BETWEEN ADMISSION AND DISCHARGE IN HOSPITAL UNIVERSITI SAINS MALAYSIA.

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3.2 Abstract

A STUDY OF DIAGNOSIS DISCREPANCY BETWEEN ADMISSION AND DISCHARGE IN HOSPITAL UNIVERSITI SAINS MALAYSIA.

Background: The accuracy of Emergency Department (ED) in making a provisional diagnosis is crucial as it has direct impact on the patient treatment, safety, length of stay and cost of treatment. The study of the accuracy of the provisional diagnosis made by ED to compare with the discharge diagnosis is scarce in its availability and most results vary with different continents. This study was conducted to evaluate the accuracy of the diagnosis made by ED in Hospital Universiti Sains Malaysia (HUSM) and the factors contributed to the discrepancy.

Methods: This was a retrospective cross-sectional study in which medical records of patient admitted to hospital USM within Mei 2016 until December 2017 were selected using simple random sampling methods. The folders were then reviewed and the association within the categorized diagnosis accuracy was analysed using the ICD-10 classification. The sample size was 180 cases and the accuracy of the diagnosis was divided into two main categories. The factors associated with the unmatched diagnosis from both, patients and provider were then measured using multiple logistic regressions.

Results: Hospital USM Emergency department had 84.4 percent of matched diagnosis with 15.56 percent of unmatched diagnosis. The odds of having unmatched diagnosis in patients from green zone are 4.2 times higher compared to the red zone.

Conclusions: Hospital USM Emergency department had a high diagnosis accuracy as compared to the unmatched diagnosis.

3.3 Introduction

The perception of other specialties toward Emergency Medicine were complex as it started way back in 1979 as a 23rd specialties [1]. The Emergency Medicine specialty in Malaysia started in 1998 and prior to that the Emergency Department (ED) was managed by medical officers (MO) and had no dedicated attending specialist. It was considered as a "dumping site" to MOs that were problematic and those who had no clear pathway to further their study in any specialities [2].

Since the inception of a new specialty sets in the late 1990's, it has made great changes in the management of undifferentiated patients and training for the MOs in the ED. Though many changes have been made, it is always perceived as the department that is not able to be relied on. As the years progress, the speciality of Emergency Medicine has been expanding and to date, it is among the most applied specialty for post graduate training in Malaysia.

One of the important debate within the inter-specialities in a hospital around Malaysia is about the competency of the ED to make a correct diagnosis prior to admission of the patients and further management by the primary team [3]. There are two types of admission that are being practise in the country. In most of the hospitals in Malaysia, the receiving team has to vet the admission, either by reviewing the patient at the ED or through phone call. However, in some hospitals, direct admissions from the EDs are practiced.

In the setting where every case needs to be vetted by the receiving team, the management and flow of the patient in the ED is affected in various ways. The main drawback of this is prolong stay in ED that will lead to access block. This will also lead to the overload of patients and reduce the quality of care in ED [4].

The question raised is whether there is a difference between the diagnoses made by the ED MOs compared to the admission diagnosis by the primary team who reviews the patient in the ED [2].

Multiple studies show variation of the results. High diagnostic accuracy has been seen in multiple studies, ranging from 43.3% to 93.5% [2-4]. However El-Mahhali et al. [5] from Hospital King Saudi Arabia, Egypt recorded that the accuracy of diagnosis during admission from the ED is only around 65.3%. This discrepancy may be due to the availability of medical staffs, investigations, the medical practice itself and robustness of the medical training. The workload difference in different centres and the pressure of time on making diagnosis may as well contribute to this variation [6].

The need for a high diagnostic accuracy in ED is very important as it affects patients' care, prognosis of the patients, financial and legal implications. This also lead to high level of satisfaction and indirectly reducing the revisit to ED and burden to the health sectors [7-10].

Hospital Universiti Sains Malaysia (USM) is a tertiary hospital in the state of Kelantan, Malaysia. It caters most of the cases especially medical, surgical, paediatric surgery, cardiothoracic surgery, neurosurgery, neuromedical, obstetrics and gynaecology, paediatrics, psychiatric, and orthopaedic. It is the only referral centre for all neurosurgery and neuromedical cases throughout the state and the northern part of Terengganu.

The aim of this study is to compare the accuracy of the ED diagnosis during admission to the discharge diagnosis by the primary team. Patients associated factors and providers associate factors that contribute to the discrepancy of the diagnoses are also determined.

3.4 Materials and methods.

A retrospective cross-sectional study was conducted in ED Hospital USM from June 2016 to August 2017. Patients who were admitted to Hospital USM from ED were included in the study. In 2016, the numbers of patient presented to ED was 65,908 patients throughout the year [12]. All the cases presented in ED were documented in the ED cencus book which was kept on monthly basis. From the total of 14 months, we randomly chose 15 cases per month through ED cencus book by using random number generator [13]. The first 15 cases that were admitted from the ED using the sequence number that was generated were traced from the Record Unit and were enrolled into the study provided there was no exclusion criteria. The exclusion criteria for the cases are terminally ill and palliative patients, referral cases from other tertiary hospital for continuation of care, out-of-hospital cardiac arrest, incomplete data and any direct admission from district hospitals or clinics that went through ED.

From the total of 210 folders traced, 180 cases were selected. 30 folders were excluded because of incomplete data from the ED clerking sheet like no proper investigations written.

These folders were reviewed and the final diagnosis made from the ED prior to the referral was taken and compared to the final discharge diagnosis. Patients' demographic data, triage, time of arrival, numbers of co-morbidities, numbers of investigations done, numbers of referral done and the length of stay, the diagnosis of emergency department prior to referral and the discharge diagnosis were collected.

These data were categorized into two major groups that was modified based on the previous study done by El-Mahalli et al. [5] that are matched diagnosis and unmatched diagnosis.

1. Matched Diagnosis includes:

    a. “Fully matched" diagnosis: if the ED diagnosis was the same as the final discharge diagnosis based on the ICD-10-CM coding.

    b. “Partially matched" diagnosis: if the ED diagnosis and final discharge diagnosis belonged to the same broad diagnostic grouping according to the ICD-10-CM , three digits classification.

2. Unmatched Diagnosis includes:

    a. "Unmatched" diagnosis: if admission diagnosis and final discharge diagnosis were different and unrelated.

    b. "Missed" diagnosis: if there was no specific diagnosis in the ED sheet but only the symptoms were documented e.g. giddiness, chest pain, vomiting etc.

Statistical analysis was done using Statistical Packages for Social Science (SPSS) version 22.0. Descriptive analysis was expressed in frequencies and percentage for categorical variables. Means and standard deviation are expressed in numerical variables. For primary objective the analysis was presented as descriptive analysis and the rest of the objectives were analysed using multiple logistic regression.

3.5 Results

From 180 cases that were admitted through ED Hospital USM, 152 out of 180 cases (84.4%) had matched diagnosis and 28 cases (15.6 %) had unmatched diagnosis. Based on the table 1, the gender is almost equally distributed with male cases of 47.8 % and the female cases are 52.2 %. Among the unmatched diagnosis cases, female has higher percentage compare to male. However there is almost equal distribution of male and female gender in matched diagnosis cases. The mean age of the cases are 38 (SD±25.7) years old. The minimum age is 1 month old and the maximum age is 80 years old.

More than fifty percent of the cases already have medical illness. Those who have one, two and three or more underlying medical illness are 23.9%, 11.1%, and 19.4% respectively. Only 45.6% of the patients have no medical illness during the presentation. Both matched and unmatched diagnosis have the highest number in those who had no previous medical illness.

Majority of the cases presented during evening (PM) shift (3pm until 10pm) that accounts for 43.3% of the cases and both the morning (AM) shift (8.00am until 3pm) and night shift (ON) have similar percentage. Nearly half of the cases that are unmatched diagnosis presented during PM shifts, however among the matched diagnosis there were also higher percentages in the PM shift.

Among the cases presented, 48.9% triaged into the yellow zone while patients triaged into red and green zone are 37.2% and 13.9% respectively. Patient presented to yellow zone shows high degree of unmatched diagnosis which accounts for 75% of the total unmatched diagnosis and among the matched diagnosis, it also shows to be the highest percentage which is 44.1% followed by red zone which contributed by 41.4% of the matched cases.

Among the number of referral unit that were involved, most of the cases had only one referral unit which accounts for 93.3%. Only 2.8% of the cases had three or more referral unit and

3.9% had two referral units that were involved in reviewing the cases in ED. Only 11.1% of the cases had to be refered to critical care unit. The mean numbers of investigations is 5.5 with a standard deviation of 2.3.

Table 1 : Sociodemographic data

	Matched diagnosis	Unmatched diagnosis	Total Cases
	n (%)	n (%)	n(%)
Gender			
Male	77(50.7)	9(32.1)	86 (47.8)
Female	75(49.3)	19(67.9)	94 (52.2)
Age	39.1(26.0)*	29.0(22.5)*	38 (25.7)*
Minumum			1 month
Maximum			80 years
Underlying Medical Condition			
NKMI	70(46.1)	12(42.9)	82 (45.6)
1	33(21.7)	10(35.7)	43 (23.9)
2	19(12.5)	1(3.6)	20 (11.1)
>3	30(19.7)	5(27.9)	35 (19.4)
Time of Presentation			
AM	44(28.9)	7(25)	51 (28.3)
PM	65(42.8)	13(46.4)	78 (43.3)
ON	43(28.3)	8(28.6)	51 (28.3)
Triage zone			
Green	22(14.5)	3(10.7)	25 (13.9)
Yellow	67(44.1)	21(75.0)	88 (48.9)
Red	63(41.4)	4(14.3)	67 (37.2)
Numbers of Referrals			
1	141(92.8)	27(96.4)	168 (93.3)
2	7(4.6)		7 (3.9)
3	3(2.0)		3 (1.7)
4	1(0.7)	1(3.6)	2(1.1)
Critical Care Referrals			
Yes	17(11.2)	3(10.7)	20 (11.1)
No	135(88.8)	25(89.3)	
Investigations	5.51(2.3)*	5.46(2.28)*	
Total	152(84.44%)	28(15.56)	180(100%)

* Mean (SD)

**No known medical illness (NKMI)

Table 2 : Admission and discharge diagnosis difference in Unmatched diagnosis category.

ADMISSION DIAGNOSIS	DISCHARGE DIAGNOSIS
Acute coronary syndrome	Electrical storm in aicd with brugada syndrome
Acute coronary syndrome	Uncontrolled hypertension unlikely acs/nstemi
Acute fever for investigations	Parainfluenza croup with secondary bacterial infection
Acute SLE flare	Seborrheic dermatitis and fungal infections
AGE	Constipation colic
AGE with mild dehydration	Acute tonsillopharyngitis
AGE with poor oral intake	Urinary tract infection
Alleged fall with cerebral oedema	Cerebral concussion, no cerebral oedema
Cerebral concussion, unlikely intraabdominal injury	Liver injury grade 2
Dengue fever with warning signs	Atypical pneumonia with clinical leptospirosis
Ectopic pregnancy	Uterine pregnancy with threatened miscarriage
Fluid overload secondary acute coronary syndrome	HAP
Fluid overload secondary CCF	Complex cyanotic heart disease
HAP	Labile mood secondary SLE
Intraabdominal sepsis	Clinical typhoid fever
Left renal colic	Twisted left ovarian cyst
No diagnosis	MVA with severe head injury
Open fracture left tibia fibula	Deep laceration wound left leg
Prolonged fever with pleural effusion	PTB smear negative with pleural tuberculosis
Reduced urine output for investigations	UTI with AUR due to neurogenic bladder 2 myelomeningocele
Schizophrenia	Bipolar 1 disorder
Spondylolisthesis	L4/L5 pars interarticularis fracture
Symptomatic hypoglycaemia	Treat as meningitis with electrolyte imbalance
Threatened miscarriage	Early intrauterine pregnancy
To rule out occult sepsis	Right lung abscess
Urinary tract infection	E coli bacteraemia secondary cap
Urinary tract infection	Unstable angina
Viral fever with recurrent vomiting	Acute tonsillopharyngitis

AGE- Acute gastroenteritis, SLE – Systemic lupus erythematous, HAP – Hospital Acquired Pneumonia, CCF- congestive cardiac failure, ACS –Acute coronary syndrome.

Table 2 shows the list of unmatched diagnosis that shows 46.4% of the cases are infection-related while coronary and trauma-related cases had 14.2% each. The rest of the cases which account for 25.2% of the unmatched diagnosis includes gynaecology, immunology, urology, orthopaedics, endocrine and psychiatric cases.

Table 3 shows significant relationship in unmatched diagnosis which are age, gender and triage zone. However, based on multiple logistic regression analysis, only triage zone shows significant variable. The odds of getting unmatched diagnosis in green zone is 4.2 times higher compared to the red zone.

Table 3: Simple logistic regression for factors associated with unmatched diagnosis

Simple logistic regression			
Variables	B	Crude OR (95% CI)	p-value
Age	-0.16	0.984 (0.968,1.001)	0.059
Gender			
Male		1.00	
Female	-0.774	0.076 (0.196,1.084)	0.076
No. of Co - morbidity			
NKMI		1.00	
1	0.028	1.029 (0.333,3.176)	0.961
2	0.598	1.818 (0.558,5.928)	0.321
≥ 3	-1.153	0.316 (0.034,2.915)	0.309
Time of presentation			
AM		1.00	
PM	-0.157	0.855 (0.285,2.564)	0.780
ON	0.072	0.883 (0.411,2.811)	1.075
Triage			
Green Zone		1.00	
Yellow Zone	0.832	2.299 (0.625,8.451)	0.210
Red Zone	-0.764	0.466 (0.097,2.246)	0.341
Investigations	-0.009	0.991 (0.8321.180)	0.918
No of referrals	0.010	1.010 (0.407,2.503)	
Length of stay	-0.029	0.971 (0.910,1.036)	0.371

Table 4: Multiple logistic regression for factors associated with unmatched diagnosis

	Multiple logistic regression		
Variables	B	Adjusted OR (95%CI)	p-value
Gender			
Male		1.00	
Female	0.678	0.986(0.809,4.798)	0.113
Age	-0.014	0.986(0.969,1.003)	0.136
Triage			
Red		1.00	
Yellow	0.685	1.983(0.399,9.856)	0.403
Green	1.435	4.201(1.345,13.121)	0.013

Classification table 84.4% correctly classified

Interaction term checked – no interaction found

Hosmer Lemeshow test, p-value = 0.955

Area under Receiver Operating Characteristic (ROC) curve was 0.722

.

3.6 Discussions

Diagnosing undifferentiated patients in ED is always challenging[14]. The importance of making an accurate diagnosis is crucial for the treatment of a patient. A wrong diagnosis at start, especially in ED can cause devastating failure to the patient's management, causing more harm to the current patient's state. In our study we found that the ED in Hospital USM had a relatively high diagnosis accuracy of 84.4%. In comparison with previous study, Chattopadhyay et al. [7] documented 43.3% diagnostic accuracy in a study that held in Kalkutta, India. In Egypt, El-Mahalli et al. [5] showed 62.3% diagnostic accuracy made by ED. A study in Singapore showed diagnostic accuracy of 86.7% while the highest accuracy documented was from Turkey by Hassan Amiri et al. [3] that showed 97.2% accurate diagnosis made in ED setting [2].

The ED of Hospital USM is well established training centre and started its postgraduate training since 1998. Before enrollment into the postgraduate training, most of the MOs in ED Hospital USM have served other Ministry of Health hospital for three to 5 years. Upon reaching registrar position, they usually have seven to ten years of experiences. Other than that, being the teaching and tertiary centre, ED of Hospital USM is well-equip with bedside investigations and good facilities. These may contribute towards the high diagnostic accuracy made at the ED [13].

The only significant finding in this study is that the odds of getting unmatched diagnosis in green zone in 4.2 times higher compared to red zone. The previous study did not compare the different between the zone of the patients. However, study done by El-Mahalli et al. had compared either the patient being assessed at triage or not. In that study they noted that more than half (52.8%) of the patient who passed through triage had fully matched diagnosis, compared to those who did not passed through the triage counter [5].

In our settings, the green zone is where the non– critical patients are seen. There are four rooms and this zone are mostly taken care by the junior MOs or the first year postgraduate students

in Emergency Medicine. There are no dedicated registrar or specialist that will be on the floor all the time covering green zone. The MOs will consult the registrar or specialist if they have difficulty in diagnosis, investigation, treatment or admissions. This zone has higher turnover patient compared to other zones. Due to this high turnover rate, the time for each patient is limited and numbers of investigations in this zone are relatively less compared to other zones. A study done in 1984 by Trautlein et al. claims that misdiagnosis in ED are mostly contributed by failure to examine properly, failure to order proper diagnostic studies, failure to interpret x-rays and other diagnostic studies[15]. In Netherland, most of the claims made from ED are for the minor injuries such as ankle injuries [16].This may reflect the condition that happen in green zone.

Atypical presentation is another challenge in any EDs. It has been recognized that elderly, female, underlying diabetes mellitus and physically or mentally challenged patients may have higher atypical presentation in some diseases [14]. Our study shows that female gender does not contribute towards the unmatched diagnosis, that may be reflected by the atypical presentation. This finding is comparable with two other studies that showed no significant findings of gender in making accurate diagnosis [5,7]. One study by Chiu et al. shows that significant higher accuracy in male gender and non-geriatric patients (<65 years) on which 77.4% accuracy compared to geriatric patient which had 67.1% ($p < 0.001$) diagnosis accuracy [17].

El-Mahalli et al. [5] showed unmatched diagnosis was higher during the night shift (18.9%) comparatively to the morning (8.1%) and evening (8.6%). However our study shows no significance in the time of presentation of the patients to ED of Hospital USM. Other factors include triage zone, the number of investigations, number of referral and length of stay also show no significant results. Mean numbers of investigations done was 5.51 with standard deviation of 2.3. Study in Kalkutta, India by Amitbha Chattopadhayay noted that the mean number of investigations done at the centre was 7 including biochemistry, radiological, cardiology and others [7]. Another study found that there are no statistically significance between the number of

investigations towards the accuracy of the diagnosis [5]. In Hospital USM, the most frequent investigations done in ED was full blood count (FBC), renal profile (RP), liver function test (LFT), electrocardiogram (ECG) and capillary blood sugar (CBS). Chiu et al. noted that patient with chest x-ray and ECG done in ED shows higher accuracy among those admitted into medical ward while among admission to paediatric department, those who had blood investigations done in ED shows significantly associated with matched diagnosis [17]. Other associated factors involving the providers also show no significant results in this study. However, another study in Calcultta showed that increase numbers of stay (>7days) was associated with unmatched diagnosis which accounts 75.9% of total number of unmatched diagnosis cases [7].

Among the unmatched diagnosis, majority of the cases were among patients with underlying infections. Out of 23 unmatched diagnosis, thirteen cases were infections related. Some of the unmatched diagnosis had no proper diagnosis in the emergency clerking sheets like prolonged fever or reduce urine output. Most of acute coronary syndrome (ACS) cases were diagnosed correctly. However only two cases in which were diagnosed as ACS in ED but turned out to be different diagnoses. Other diagnosis that had high diagnostic accuracy include those in the neurosurgical, neuromedical and orthopaedics team in which most of this diagnosis was supported by the radiological findings. Comparatively, Hassan Amiri et al. shows 100% accuracy in neurosurgery cases, 93.3% accuracy in internal medicine and 88.6% of diagnosis accuracy in infectious disease [3]. In North General Hospital from Hong Kong, showed among numbers of unmatched diagnosis, general medicine had higher number of cases followed by surgery and neurosurgery cases [17]. El Mahalli et al. noted higher percentages of accuracy in paediatric and obstetric and gynaecology department, while medical department have the lowest accuracy rate which accounts for 53.9 percents [5].

3.7 Conclusion

ED Hospital USM has high diagnosis accuracy. However green zone had 4.2 higher odds of making unmatched diagnosis compared to red zone. Placing a senior medical officer in green zone is recommended to guide other doctors in establishing

3.8 Referrence

1. Stevens, R., American Medicine and the Public Interest: Updated Edition with a New Introduction. 1998: Univ of California Press.

3. Rahman, N. and C. Holliman, Emergency medicine in Malaysia. Hong Kong J Emerg Med, 2005. **12**(4): p. 246-251.
4.
3. Lim, G., et al., Study on the discrepancies between the admitting diagnoses from the emergency department and the discharge diagnoses. Hong Kong J Emerg Med, 2002. **9**: p. 5.
4. Amiri, H., et al., Comparison of Presumptive Diagnoses in the Emergency Department and the Final Diagnoses in the Wards. Turk J Emerg Med, 2010. **10**: p. 5.

5. Goh, S.H. and B.Y. Low, Accident & emergency department diagnosis--how accurate are we? Singapore Med J, 1996. **37**(1): p. 24-30.

6. El-Mahalli, A.A. and S.A. Mokhtar, Miss and missed diagnosed cases at the emergency department of king fahd hospital of the university in khobar, king saudi arabia. The Journal of the Egyptian Public Health Association, 2008. **84**(5-6): p. 501-516.

7. Wogan, J.M., ED follow-up: A comparison of admission and discharge diagnoses. The American Journal of Emergency Medicine, 2001. **19**(3): p. 249-251.

8. Chattopadhyay, A., et al., Gap Analysis between Provisional Diagnosis on Admission and Final Diagnosis during Discharge-A Comparative Study.

9. Wu, C.-L., et al., Unplanned Emergency Department Revisits within 24 Hours in a Referral Hospital, 2008. **19**(4): p. 146-154.

10. Goh, S.H., et al., Unplanned returns to the accident and emergency department--why do they come back? Ann Acad Med Singapore, 1996. **25**(4): p. 541-6.

11. Lo, S.M., et al., Effectiveness of Emergency Medicine Wards in reducing length of stay and overcrowding in emergency departments. International Emergency Nursing, 2014. **22**(2): p. 116-120.

12. (HUSM), H.U.S.M. Audit Kemasukan Pesakit 2016. 2016; Available from: http://h.usm.my/urp/index.php/statistik-hospital.

13. Research Randomizer 2018; Available from: www.randomizer.org.

14. McPhee, S.J., M.A. Papadakis, and M.W. Rabow, Current medical diagnosis & treatment 2010. 2010: McGraw-Hill Medical New York:.

15. Trautlein, J.J., R.L. Lambert, and J. Miller, Malpractice in the emergency department—review of 200 cases. Annals of emergency medicine, 1984. **13**(9): p. 709-711.

16. Elshove-Bolk, J., et al., A description of emergency department-related malpractice claims in the Netherlands: closed claims study 1993–2001. European Journal of Emergency Medicine, 2004. **11**(5): p. 247-250.

17. Chiu, H., et al., A comparison of emergency department admission diagnoses and discharge diagnoses: retrospective study. Hong Kong J Emerg Med, 2003. **10**(2): p. 70-5.

18. Wong JD, Bajear JM, Wong GG, Alibhai SM, Huh J-H, Cesta A, et al. Medication reconciliation at hospital discharge: evaluating discrepancies. Annals of Pharmacotherapy. 2008;42(10):1373-9.

19. Wogan JM. Emergency department follow-up of hospitalized patients. The American Journal of Emergency Medicine. 2000;18(4):510-1.

20. Willis BH, Sur SD. How good are emergency department senior house officers at interpreting X-rays following radiographers' triage? European Journal of Emergency Medicine. 2007;14(1):6-13.

21. Weatherburn G, Bryan S, Nicholas A, Cocks R. The effect of a Picture Archiving and Communications System (PACS) on diagnostic performance in the accident and emergency department. Journal of Accident and Emergency Medicine. 2000;17(3):180-4.

22. Urrutia A, Bechini J, Tor J, Olazábal A, Rey-Joly C. Evaluation of chest X-ray readings by emergency room physicians of a universitary hospital. Medicina Clinica. 2001;117(9):332-3.

23. Tudor GR, Finlay D, Taub N. An assessment of inter-observer agreement and accuracy when reporting plain radiographs. Brain and Language. 1997;52(3):235-8.

24. Ting HH, Lee TH, Soukup JR, Cook EF, Angelos Tosteson AN, Brand DA, et al. Impact of physician experience on triage of emergency room patients with acute chest pain at three teaching hospitals. The American Journal of Medicine. 1991;91(4):401-8.

25. Snaith B, Hardy M. Emergency department image interpretation accuracy: The influence of immediate reporting by radiology. International Emergency Nursing. 2014;22(2):63-8.

26. Rizoli SB, Boulanger BR, McLellan BA, Sharkey PW. Injuries missed during initial assessment of blunt trauma patients. Accident Analysis and Prevention. 1994;26(5):681-6.

27. Rickett AB, Finlay DBL, Jagger C. The importance of clinical details when reporting accident and emergency radiographs. Injury. 1992;23(7):458-60.

28. Regel G, Bayeff-Filloff M. Emergency room management of the multiply-injured patient with limb injuries: A systematic review of the literature. Unfallchirurg. 2004;107(10):919-26.

29. Quirke M, Boland F, Fahey T, O'Sullivan R, Hill A, Stiell I, et al. Prevalence and predictors of initial oral antibiotic treatment failure in adult emergency department patients with cellulitis: A pilot study. BMJ Open. 2015;5(6).

30. Pickrell L, Duggan C, Dhillon S. From hospital admission to discharge: an exploratory study to evaluate seamless care. Pharmaceutical Journal. 2001.

31. Petinaux B, Bhat R, Boniface K, Aristizabal J. Accuracy of radiographic readings in the emergency department. American Journal of Emergency Medicine. 2011;29(1):18-25.

32. O'Connor PM, Dowey KE, Bell PM, Irwin ST, Dearden CH. Unnecessary delays in accident and emergency departments: do medical and surgical senior house officers need to vet admissions? Journal of accident & emergency medicine. 1995;12(4):251-4.

33. O'Connor P, Dowey K, Bell P, Irwin S, Dearden C. Unnecessary delays in accident and emergency departments: do medical and surgical senior house officers need to vet admissions? Emergency Medicine Journal. 1995;12(4):251-4.

34. Morton RJ. Fracture clinic referrals: the need for self audit. Injury. 1988;19(2):77-8.

35. McLauchlan CAJ, Jones K, Guly HR. Interpretation of trauma radiographs by junior doctors in accident and emergency departments: A cause for concern? Emergency Medicine Journal. 1997;14(5):295-8.

36. McDonald KM, Matesic B, Contopoulos-Ioannidis DG, Lonhart J, Schmidt E, Pineda N, et al. Patient safety strategies targeted at diagnostic errors: A systematic review. Annals of Internal Medicine. 2013;158(5 PART 2):381-9.

37. Lu TC, Tsai CL, Lee CC, Ko PCI, Yen ZS, Yuan A, et al. Preventable deaths in patients admitted from emergency department. Emergency Medicine Journal : EMJ. 2006;23(6):452-5.

38. Lo SM, Choi KTY, Wong EML, Lee LLY, Yeung RSD, Chan JTS, et al. Effectiveness of Emergency Medicine Wards in reducing length of stay and overcrowding in emergency departments. International Emergency Nursing. 2014;22(2):116-20.

39. Letts M, Davidson D, Lapner P. Multiple trauma in children: Predicting outcome and long-term results. Canadian Journal of Surgery. 2002;45(2):126-31.

40. Lee C, Bleetman A. Commonly missed injuries in the accident and emergency department. Trauma. 2004;6(1):41-51.

41. Lawrence S, Spencer LM, Sinnott M, Eley R. It takes two to tango: Improving patient referrals from the emergency department to inpatient clinicians. Ochsner Journal. 2015;15(2):149-53.

42. Lane DC, Monefeldt C, Rosenhead JV. Looking in the Wrong Place for Healthcare Improvements: A System Dynamics Study of an Accident and Emergency Department. The Journal of the Operational Research Society. 2000;51(5):518-31.

43. Krüger W, Ludman AJ. Core knowledge in critical care medicine2014. 1-422 p.

44. Kremli MK. Missed musculoskeletal injuries in a University Hospital in Riyadh: Types of missed injuries and responsible factors. Injury. 1996;27(7):503-6.

45. Katz DA, Aufderheide TP, Bogner M, Rahko PS, Hillis SL, Selker HP. Do Emergency Department Patients With Possible Acute Coronary Syndrome Have Better Outcomes When Admitted to Cardiology Versus Other Services? Annals of Emergency Medicine. 2008;51(5):561-70.e1.

46. Kansagara D, Ramsay RS, Labby D, Saha S. Post-discharge intervention in vulnerable, chronically ill patients. Journal of Hospital Medicine. 2012;7(2):124-30.

47. Hulbert DC, Riddle WL, Longstaff PM, Belstead JS, Beckett MW. An audit of litigation costs in four accident and emergency departments. Emergency Medicine Journal. 1996;13(6):400-1.

48. Hardy M, Snaith B, Scally A. The impact of immediate reporting on interpretive discrepancies and patient referral pathways within the emergency department: A randomised controlled trial. British Journal of Radiology. 2013;86(1021).

49. Gwynne A, Barber P, Tavener F. A review of 105 negligence claims against accident and emergency departments. Emergency Medicine Journal. 1997;14(4):243-5.

50. Guly HR. Diagnostic errors in an accident and emergency department. Emergency Medicine Journal. 2001;18(4):263-9.

51. Guly HR. A scale for measuring the severity of diagnostic errors in accident and emergency departments. Emergency Medicine Journal. 1997;14(5):290-2.

52. Furnival RA, Woodward GA, Schunk JE. Delayed diagnosis of injury in pediatric trauma. Pediatrics. 1996;98(1):56-62.

53. Frost SA, Alexandrou E, Bogdanovski T, Salamonson Y, Parr MJ, Hillman KM. Unplanned admission to intensive care after emergency hospitalisation: Risk factors and development of a nomogram for individualising risk. Resuscitation. 2009;80(2):224-30.

54. Friedman SM, Merman E, Chopra A. Clinical impact of diagnostic imaging discrepancy by radiology trainees in an urban teaching hospital emergency department. International Journal of Emergency Medicine. 2013;6(1).

55. Evans R. Trauma misdiagnosis in the emergency unit. Clinical Risk. 2003;9(5):175-8.

56. Cohen RI, Eichorn A, Motschwiller C, Laktikova V, La Torre G, Ginsberg N, et al. Medical intensive care unit consults occurring within 48 hours of admission: A prospective study. Journal of Critical Care. 2015;30(2):363-8.

57. Chiu H, Chan K, Chung C, Ma K, Au K. A comparison of emergency department admission diagnoses and discharge diagnoses: retrospective study. Hong Kong J Emerg Med. 2003;10(2):70-5.