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An audit of chest pain and the factors affecting it in private emergency department

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CHANGES		
LITERATURE REVIEW	OLD REPORT	CHANGES
Definition of lethal diagnoses not part of objectives	These diagnoses are defined as follows: Acute coronary syndrome[14]: Acute coronary syndromes result from acute obstruction of a coronary artery. Consequences depend on the degree and location of the obstruction and range from unstable angina to non–ST-segment elevation myocardial infarction, ST-segment elevation myocardial infarction, and sudden cardiac death. Symptoms are similar in each of these syndromes (except sudden death) and include chest discomfort with or without dyspnoea (difficulty breathing), nausea, and diaphoresis (sweating). As part of acute coronary syndromes, myocardial (cardiac) infarction refers to myocardial necrosis (cell death) resulting from abrupt reduction in coronary blood flow to part of the myocardium (heart muscle)[14]. Unstable angina[14] (chest discomfort caused by cardiac ischaemia) also forms part of acute coronary syndrome and is defined as: • Rest angina that is prolonged (usually > 20 min) • New-onset angina • Increasing angina, i.e. previously diagnosed angina that has become distinctly more frequent, more severe, longer in duration, or lower	*These definitions were removed and the following summarised paragraph remained:* In Opolots[19] article entitled Chest pain: An approach for Family Practice, the following life-threatening causes of chest pain are listed: Acute coronary syndromes (acute myocardial infarction, unstable angina), pulmonary embolism, aortic dissection, tension pneumothorax and ruptured aortic aneurysm. The American Heart Association lists similar causes in the advanced cardiac life support experienced provider[20] manual: acute coronary syndrome, aortic dissection, pulmonary embolism, pericardial effusion with acute tamponade and tension pneumothorax[20]. Inci et al[21] in their case study also discuss the addition of oesophageal rupture as a life-threatening cause of chest pain.

	in threshold. Pulmonary embolism[14]: Pulmonary embolism (PE) is the occlusion of ≥ 1 pulmonary arteries by thrombi that originate elsewhere, typically in the large veins of the lower extremities or pelvis. Risk factors are conditions that impair venous return, conditions that cause endothelial injury or dysfunction, and underlying hypercoagulable states[14]. Aortic dissection[14,15:] Aortic dissection is the surging of blood through a tear in the aortic intima with separation of the intima and media and creation of a false lumen. The intimal tear may be a primary event or secondary to hemorrhage within the media. The dissection may occur anywhere along the aorta and extend proximally or distally into other arteries. Hypertension is an important contributor. This condition carries a mortality rate as high as 1% per hour over the first several hours[15]. Pericarditis with acute tamponade[14]: Pericarditis is inflammation of the pericardium, often with fluid accumulation. Pericarditis may be caused by many disorders (e.g. infection, myocardial infarction, trauma, tumors, metabolic disorders) but is often idiopathic (with unknown cause). Cardiac tamponade occurs when a large pericardial effusion impairs cardiac filling, leading to low cardiac output and sometimes shock and death.	

	Tension Pneumothorax[12]: An injury to the lung or lung parenchyma or a bronchus that produces an air leak can cause a tension pneumothorax, where air accumulates in the pleural space and causes high pressures, compression of the lung on the involved side and pushes the heart and mediastinum to the opposite side. Oesophageal rupture[13]: Spontaneous perforation involving the entire thickness of the oesophageal wall usually associated with forceful or prolonged emesis (vomiting). Factors involved are: increased intraluminal pressure, pre-existing oesophageal diseases and neurogenic causes of perforation. This may rapidly progress to severe mediastinitis, sepsis, and multiple organ failure.	
Discuss disposition and age in literature review	*Disposition and age were not discussed.*	*Under section 2.2 of the Literature review, the following was added:* Age of patient presentation Age of presentation in chest pain is important as age is a well-known risk factor for acute myocardial infarction[14] amongst other causes. Zucker et al[14] evaluated patient presentations of chest pain and other symptoms suggestive of acute cardiac ischaemia in ten ED's across the United States. In their patient population they found that in the age group 30-44, there was a prevalence of acute myocardial infarction in 3% of males and 1% of

		females. In contrast, in the age group 65-74, there was a prevalence of acute myocardial infarction of 15% in males and 7% in females. Ekelund et al[8] looked at the likelihood of acute coronary syndrome in ED patients with chest pain and linked this to time of presentation and demographics. In their study, they noticed the following age distributions in terms of chest pain presentations[8]: 18-39: 15%, 40-48: 13%, 50-59: 17%, 60-69: 22%, 70-79: 18%, over 80: 15%. They also correlated for acute coronary syndrome and found that in patients over the age of 65 years a higher prevalence of 11% was found as compared to patients under the age of 65 with a prevalence of 4.5%. *Under Section 2.7 of the Literature review the following was added.* Patient disposition Luke et al[9] had looked at admission rates in their chest pain audit done in 1990 and found an admission rate of 22%. The study looked at 400 consecutive ED patients in a United Kingdom ED. Of note, is that their study was done on a population that was 35 years of age or younger. Verdont et al[5] had an admission rate of 5% in their primary care practice and this likely relates to the variation in diagnostic mix in primary care versus ED cases, as detailed by Buntinx et al[24].

<table>
<tr><td></td><td></td><td>In summary, the various studies and information in this literature review highlight a variety of important facets related to chest pain presentations. One the most important of these, is the wide aetiology in relation to a diagnosis and the difficulties faced by the ED doctor in evaluating these patients.
This study was conducted in the private South African context so as to better understand these facets in this specific context.</td></tr>
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<tr><td>METHODOLOGY</td><td></td><td></td></tr>
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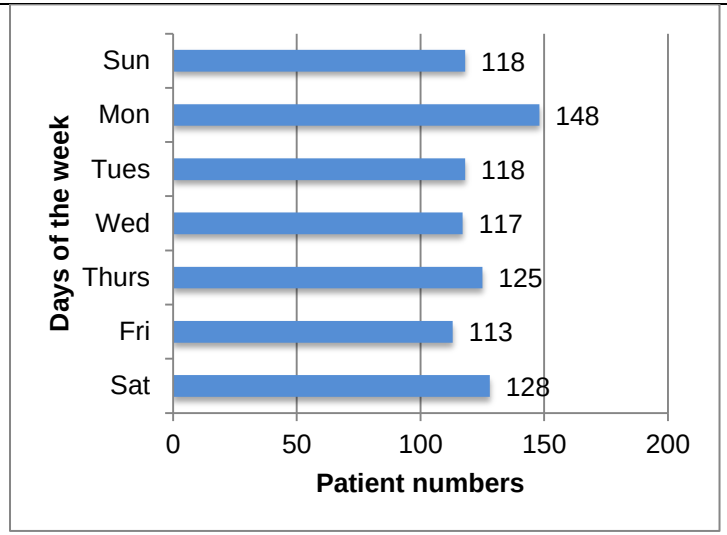
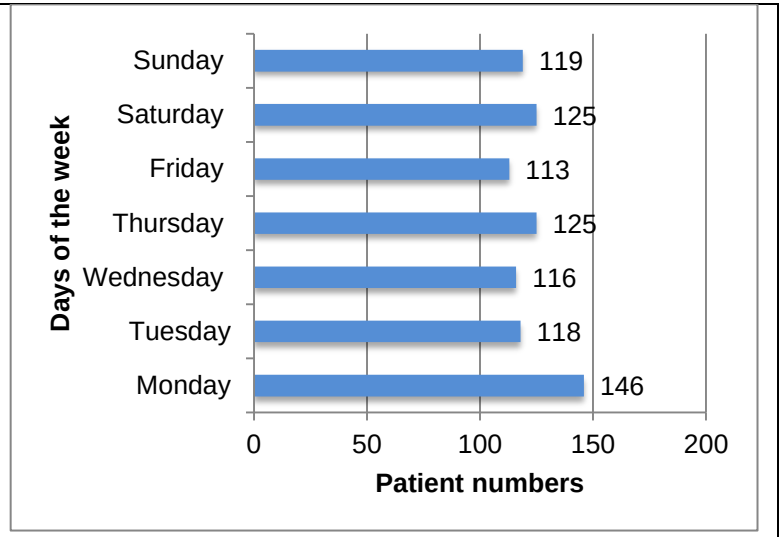
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	Private		Private	
	Triage time		Triage time	
	Nursing Notes time		Nursing Notes time	
	Triage colour		Triage colour	
	Ambulance or non ambulance transportation		Ambulance or non-ambulance transportation	
	Trauma related		Trauma related	
	Patient ethnicity (if recorded)		Patient ethnicity (if recorded)	
	Asian		*Asian*	
	Coloured		*Coloured*	
	White		*White*	
	Black		*Black*	
	Indian		*Indian*	
	ECG done?		ECG done?	
	Laboratory blood tests done?		Sent for and angiogram from the ED?	
	Bloods tests repeated in ED?		Final ED diagnosis	
	Chest X-ray done?		Patient died in ED?	
	Blood gas done?		Admitted?	
	Intravenous line inserted? ED/Ambulance?		Transferred out?	
	Computed tomographic scan of the chest done?		Referred to specialist on admission?	
	Required		Any data concerns	
			Other relevant information	

	cardiopulmonary resuscitation?		
	Sent for and angiogram from the ED?		
	Final ED diagnosis		
	Patient died in ED?		
	Admitted?		
	Transferred out?		
	Referred to specialist on admission?		
	Any data concerns		
	Other relevant information		
Explain why 77 patients were excluded	After review of the new and resuscitation registers, a total of 939 patients were identified. From there, exclusion criteria were applied and a total of 862 files were evaluated and statistically analysed.		After review of the new and resuscitation registers, a total of 939 patients were identified. From there, exclusion criteria were applied, which excluded 77 files. These files were excluded for the following reasons: • Patients < 18 yr: 22 files • Trauma patients: 54 files (of which two were also under 18 years) • Patients for whom there was no data: two files • Patients who were sent to the ED for evaluation from the ward i.e. in-hospital patients: one file. A total of 862 files were evaluated and statistically analysed.

29 follows up patients omitted	*Follow ups were not mentioned in the Methodology.*	*The following paragraph was added to the Methodology:* The follow up patients were identified as 29 patients, but these were excluded from the study as they represented a double count of existing patients already attributed to the new and resuscitation categories. In addition, the number was small and the factors influencing a repeat presentation were numerous. It was decided that this should be further evaluated in a future study
RESULTS		
939 vs 862 calculation	In the year 2013, 30 090 chest pain patient presentations were recorded. Of these, 939 chest pain presentations were identified, demonstrating a 3.12% incidence of chest pain patients for the year.	In the year 2013, 30 090 chest pain patient presentations were recorded. Of these, 862 chest pain presentations were included, demonstrating a 2.86% incidence of chest pain patients for the year.

Graph 4.5 added up to 867		
Discuss statistical tests	*No discussion was done.*	*The following paragraphs were added:* In terms of gender distribution, 55.1% of the patients in the study were male, with 44.9% female patients. Resuscitation patients had a higher proportion of males (63.1%) compared to new patients (46.0%) (Fisher's exact test: $p<0.0001$; phi coefficient=0.17; weak association). There was a significant associations between race and patient type (X2 test: $p<0.0001$; Cramer's V=0.27; weak association): There were relatively more White, and fewer Black, resus patients, compared to new patients (Figure 4.3). The median number of chest pain patient

		presentations per day was 2 with a range of 0-8 patients per day. In terms of day versus night, 60.2% of the patients presented during the day, while 39.8% presented during the night. There was no significant difference in this when correlated for months in the year. Chest pain presentations on Mondays were marginally higher than the rest of the week, with 17% of presentations (Figure 4.5). This was not statistically significant. Orange triage made up the largest group of triage colours amongst all patients types (Figure 4.6). To evaluate mode of transport for patients presenting with chest pain. “Fisher’s exact test: p=0.011; phi coefficient=0.09; weak association). A higher proportion of resus cases arrived by ambulance (10.3%) as compared to new patients (4.0%) (Fisher’s exact test: p<0.0001; phi coefficient=0.12; weak association). (Fisher’s exact test: p=0.011; phi coefficient=0.09; weak association). A higher proportion of resus cases arrived by ambulance (10.3%) as compared to new patients (4.0%) (Fisher’s exact test: p<0.0001; phi coefficient=0.12; weak association). There was a significant association between diagnosis and patient type (Fisher’s exact test:

		p<0.0001; phi coefficient=0.38; moderate association): A higher proportion of resuscitation cases received a cardiac diagnosis, while a higher proportion of new cases received a respiratory or musculoskeletal diagnosis (Figure 4.8). There was a significant association between diagnosis and day period (Fisher's exact test: p<0.0001; phi coefficient=0.21; weak association): More patients were given a 'no diagnosis' at night, and fewer a respiratory diagnosis, compared to the daytime results (Figure 4.9). Age category and diagnosis were significantly associated (X2 test: p<0.0001; Cramer's V=0.18; weak association): Cardiac diagnoses increased with increasing age (Figure 4.10). Gender and diagnosis were significantly associated (X2 test: p<0.0001; Cramer's V=0.18; weak association): Cardiac diagnoses were more prevalent amongst males than females, while musculoskeletal diagnoses were more prevalent amongst women than men (Figure 4.11). Of the admissions in Figure 4.12, 17% (34) were admitted under the ED and specialist referrals are differentiated in Figure 4.13 with Cardiology referrals being the highest.

DISCUSSION		
5.1 population 939	Of these, 939 chest pain presentations were identified,	Of these, 862 chest pain presentations were identified,
5.2 Discuss in literature review	*Old 5.2* In terms of patient age, the largest number of chest pain presentations in the study group occurred in the age group 30-39years. Patients in the 30-39 year age group made up 31.44% of total chest pain presentations. The other age groups were as follows: 18-29: 18.10%, 40-49: 15.20%, 50-59: 12.18%, 60-69: 10.56%, over 70: 12.30%. When investigated in terms of when patients presented, the 30-39 year group was the largest group during both day (31.21%) and night (31.96%) presentations. This is younger than the age when compared to the Ekelund et al[8] study whose largest presenting group was in the 60-69 year age group, consisting of 22% of their patients. Other percentages were: 18-39: 15%, 40-48: 13%, 50-59: 17%, 60-69: 22%, 70-79: 18%, over 80: 15%. Ekelund et al[8] had 15% in the age group 18-39, while the current study had 41.44%, which is a major difference. This correlates with the mean age of presentations, which was 60 years for Ekelund et al[8] and 44 years for the current study, indicating a younger population group presenting with chest	*New 5.2 (Changes to Literature review under 2.2 as above)* In terms of patient age, the largest number of chest pain presentations in the study group occurred in the age group 30-39years. Patients in the 30-39 year age group made up 31.44% of total chest pain presentations. The other age groups were as follows: 18-29: 18.10%, 40-49: 15.20%, 50-59: 12.18%, 60-69: 10.56%, over 70: 12.30%. When investigated in terms of when patients presented, the 30-39 year group was the largest group during both day (31.21%) and night (31.96%) presentations. This is younger than the age when compared to the Ekelund et al[8] study whose largest presenting group was in the 60-69 year age group, consisting of 22% of their patients. Other percentages were: 18-39: 15%, 40-48: 13%, 50-59: 17%, 60-69: 22%, 70-79: 18%, over 80: 15%. Ekelund et al[8] had 15% in the age group 18-39, while the current study had 41.44%, which is a major difference. This correlates with the mean age of presentations, which was 60 years for Ekelund et al[8] and 44 years for the current study, indicating a younger population group presenting with chest pain. In addition, the studied

	pain. In addition, the studied population saw the greatest number of patients in the under 50 year group at 64%, while Ekelund et al[8] saw the largest number of patients in the over 50 year age group at 72%. Comparisons are appropriate as inclusion criteria for both studies in terms of age was age greater than or equal to 18 years of age. The large proportion of younger patients is likely related to the area studied, which is established, but expanding at a high rate with young professionals and families moving in as development occurs. In terms of the differing age groups, one of the areas this could affect would be in terms of patient diagnoses. Ekelund et al[8] focused primarily on the diagnosis of acute coronary syndrome in their patient population and found a total of 1 745 cardiac related chest pain diagnoses with an incidence of 15.6%, while the current study identified 196 cardiac related chest pain diagnoses, with an incidence of 22.73%. Of these, 834 patients In Ekelund et al[8] were diagnosed with acute coronary syndrome, which represents a 7.48% incidence. In the current study 99 cases of acute coronary syndrome were recorded which represents an incidence of 11.48%. This finding is surprising as one of the risk factors for cardiac disease and acute coronary syndrome is age greater than 606. Age is also a factor in myocardial infarction decisions rules e.g. The	population saw the greatest number of patients in the under 50 year group at 64%, while Ekelund et al[8] saw the largest number of patients in the over 50 year age group at 72%. Comparisons are appropriate as inclusion criteria for both studies in terms of age was age greater than or equal to 18 years of age. The large proportion of younger patients is likely related to the area studied, which is established, but expanding at a high rate with young professionals and families moving in as development occurs. In terms of the differing age groups, one of the areas this could affect would be in terms of patient diagnoses. Ekelund et al[8] focused primarily on the diagnosis of acute coronary syndrome in their patient population and found a total of 1 745 cardiac related chest pain diagnoses with an incidence of 15.6%, while the current study identified 196 cardiac related chest pain diagnoses, with an incidence of 22.73%. Of these, 834 patients In Ekelund et al[8] were diagnosed with acute coronary syndrome, which represents a 7.48% incidence. In the current study 99 cases of acute coronary syndrome were recorded which represents an incidence of 11.48%. This finding is surprising as one of the risk factors for cardiac disease and acute coronary syndrome is age greater than 606. Age is also a factor in myocardial infarction decisions rules e.g. The Rouan decision rule for myocardial infarction[6] which gives age greater than 60 a full point in their score, which is out

	Rouan decision rule for myocardial infarction6 which gives age greater than 60 a full point in their score, which is out of six maximal points. Thus, in comparing these two studies, the assumption would be that Ekelund[8] would have a higher incidence of chest pain and acute coronary syndromes, due to the largest part of their population being in the age group over 50 years of age at 72%. This surprising result suggests possible other population specific variables which may have reduced this figure. The current study showed a higher rate of cardiac diagnoses (not limited to acute coronary syndrome) over the age of 50 in keeping with older age, with 64% of cases in this age group. A significant portion still occurred under 50 and this suggests that while the younger patient is thought to be less at risk for acute coronary syndrome, that efforts must be taken to look at other risk factors and actively exclude cardiac pathology in the studied population. In evaluating age in other studies, Burman et al[30] investigated the management of chest pain patients in four different ED's (termed casualty clinics in the study) in Norway. They had 100 patients included in their study across these ED's chosen to represent a variety of settings – urban, rural and suburban. In the study, the largest age group for presentation was between 36-50 years of age, at 33% of patients30. To compare this to	of six maximal points. Thus, in comparing these two studies, the assumption would be that Ekelund[8] would have a higher incidence of chest pain and acute coronary syndromes, due to the largest part of their population being in the age group over 50 years of age at 72%. This surprising result suggests possible other population specific variables which may have reduced this figure. The current study showed a higher rate of cardiac diagnoses (not limited to acute coronary syndrome) over the age of 50 in keeping with older age, with 64% of cases in this age group. A significant portion still occurred under 50 and this suggests that while the younger patient is thought to be less at risk for acute coronary syndrome that efforts must be taken to look at other risk factors and actively exclude cardiac pathology in the studied population. In evaluating age in other studies, Burman et al[31] investigated the management of chest pain patients in four different ED's (termed casualty clinics in the study) in Norway. They had 100 patients included in their study across these ED's chosen to represent a variety of settings – urban, rural and suburban. In the study, the largest age group for presentation was between 36-50 years of age, at 33% of patients[31]. To compare this to the current study, all chest pain presentations under the age of 50 were combined. Burman et al30 had 56% of patients in this group, while the current study had 64.74%. Burman et al[32] noted a total of 50 patients with a diagnosis of

	the current study, all chest pain presentations under the age of 50 were combined. Burman et al[30] had 56% of patients in this group, while the current study had 64.74%. Burman et al[30] noted a total of 50 patients with a diagnosis of ischaemic heart disease, with an incidence of 50%. In the current study, 99 patients had acute coronary syndrome with an incidence of 11.48%. While incidence of chest pain presentations under 50 was similar, the high diagnosis of ischaemic chest pain was unusual[30]. The researchers also cite this as being unusual and attributed this to their smaller number of study participants, which may have limited the range of diagnoses. Participants were included in the study on the basis of being the first hundred patients to arrive and patients where the doctor involved could be contacted shortly after the patient consultation was completed[30]. This may have affected the types of presentations seen. While age is an important factor, this demonstrates that a variety of other factors influence patient presentation with chest pain. These may include but not be limited to socio-economic status, study population and inclusion criteria. In comparing age, between the resuscitation (53.1%) and new (46.9%) patient groups in the current study the following was found: patients in the resuscitation group were older than in those in	ischaemic heart disease, with an incidence of 50%. In the current study, 99 patients had acute coronary syndrome with an incidence of 11.48%. While incidence of chest pain presentations under 50 was similar, the high diagnosis of ischaemic chest pain was unusual[30]. The researchers also cite this as being unusual and attributed this to their smaller number of study participants, which may have limited the range of diagnoses. Participants were included in the study on the basis of being the first hundred patients to arrive and patients where the doctor involved could be contacted shortly after the patient consultation was completed[30]. This may have affected the types of presentations seen. While age is an important factor, this demonstrates that a variety of other factors influence patient presentation with chest pain. These may include but not be limited to socio-economic status, study population and inclusion criteria. In comparing age, between the resuscitation (53.1%) and new (46.9%) patient groups in the current study the following was found: patients in the resuscitation group were older than in those in the new group. The resuscitation group of patients had a larger number of patients over the age of 50 years at 228 (49.7%), while the new patient group had 74 (18.3%). The difference was 154 patients. This would indicate that a larger number of older patients were deemed potentially more serious at initial evaluation and triage after presentation. This was likely appropriate

	the new group. The resuscitation group of patients had a larger number of patients over the age of 50 years at 228 (49.7%), while the new patient group had 74 (18,3%). The difference was 154 patients. This would indicate that a larger number of older patients were deemed potentially more serious at initial evaluation and triage after presentation. This was likely appropriate from medical evaluation, but there is the possibility that a selection bias may be employed for older patients presenting with chest pain.	from medical evaluation, but there is the possibility that a selection bias may be employed for older patients presenting with chest pain.
5.7 ED doctor admissions not mentioned elsewhere	*Not mentioned in rest of document*	*Following paragraph added under Data collection in the Methodology section:* For patient disposition, it was evaluated whether patients had been admitted, discharged, transferred to another facility, absconded or refused further care. Under admissions data was collected showing which specialities patients had been admitted under or whether they had been admitted under the ED doctors overnight. Here doctors admit patients to the ward overnight under the care of the ED doctor if their condition is stable, and refer to the specialist the following morning as needed or discharge patients.
CONCLUSION		
Follow up patients not mentioned elsewhere	*Not mentioned in rest of document*	The follow up patients were identified as 29 patients, but these were excluded from the study as they

		represented a double count of existing patients already attributed to the new and resuscitation categories. In addition, the number was small and the factors influencing a repeat presentation were numerous. It was decided that this should be further evaluated in a future study.
GENERAL		
Section breaks do not correlate	*Previous literature review order:* 2.1 Incidence of chest pain 2.2 Aetiology of chest pain and the diagnostic challenge 2.3 When do chest pain patients present? 2.4 Mode of transportation 2.5 Gender variance 2.6 Triage	*Literature review sections adjusted to reflect the same order as in the conclusion. New order:* 2.1 Incidence of chest pain 2.2 Demographics 2.3 When do chest pain patients present? 2.4 Triage 2.5 Mode of transportation 2.6 Aetiology of chest pain and then diagnostic challenge 2.7 Patient disposition