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Executive Summary

In 2012 the Royal Malaysian Police reported that there were more than 400,000 road traffic accidents throughout the country[1]. The high numbers of those injured due to road traffic accidents is a major burden to our health care system. This is alarming and a good Trauma Surgery Service is certainly in order. In 2008, the Ministry of Health, Malaysia recognized this need and formalized Trauma Surgery as a subspecialty of General Surgery.

Trauma Surgery as an additional part of general surgical services in Hospital Sultanah Aminah was established in March 2011. A registry was created two months later. This report describes the first year performance of the Trauma Surgery Service in Hospital Sultanah Aminah, beginning May 2011 to April 2012. This report investigates the data collected, to assess whether the patients received appropriate and efficient care by reviewing their outcomes.

Analysis from the Registry found that:

- There were 687 admissions for a 12 months period and that trauma in HSAJB is a disease, predominantly of young adult males.
- Injury due to road traffic accidents are the most common cause of admission (82.5% of cases).
- Approximately a third of cases required ICU admissions.
- Slightly more than half of the cases sustained injuries with ISS more than 15.
- Overall case fatality was 11.06%, all of them sustained major trauma and the majority were motorcyclists, showing increased rates with higher ISS.
- A wide range of procedures and operations were performed by this unit, reflecting the diversity of surgical treatments required for trauma patients.

There are no historical data of dedicated definitive surgical trauma management in this country to compare with. Some allegories and comparisons were made with registries in the Australasian region.

It is hoped that this report can be used to provide advice and feedback to administrators and caregivers of injured patients. It also forms a basis for monitoring and assessing outcomes of future improvements made to the system.

Introduction

The Trauma Surgery Service was established as a subspecialty under the ambit of the Department of Surgery of Hospital Sultanah Aminah in March 2011. It is currently staffed by three surgeons, two trauma coordinators, a registrar/medical officer and a house officer also both on rotational basis. Besides clinical aspects of patient care, the unit is also heavily involved in other aspects of trauma care, namely, systems development of both pre and in-hospital, training and education of Specialist Fellows, doctors and nurses. There is also an ongoing process of Quality Improvement activity by way of morbidity-mortality audits and setting of performance indices in the hope that any improvements would be reflected in the future outcome measures of this registry. The Trauma Surgery Registry commenced in May 2011. This is the first registry report, for the period of May 2011 ending April 2012.

Data capture and entry

Data from the following were captured for entry into the registry:

a. All adult trauma patients admitted to the Department of Surgery, Hospital Sultanah Aminah, whether directly or as referrals from other hospitals.
b. All other adult trauma patients referred to the Trauma Surgery Service of the Department of Surgery, from other Departments/Services within Hospital Sultanah Aminah.

Data is entered by a dedicated staff member. It is kept, and processed with a computer statistics program configured to the needs of the registry.

Definitions

This registry *EXCLUDES*:

a. Injury resulting from pathological conditions (i.e pathological fractures resulting from malignancy) and injury resulting from degenerative changes or medical illnesses.
b. Hanging, drowning, burns and envenomation.
c. Very late presentations or transfers or referrals from other hospitals for conditions not as a direct result of the initial trauma insult where definitive treatment had been accomplished in the hospital of origin (i.e bowel obstruction following a laparotomy performed for trauma) or sequelae of complications occurring temporally distant from the index injury.
d. Isolated head and/or isolated skeletal fractures.

"Major Trauma"

The only globally accepted definition of "Major Trauma" are injuries with an ISS of more than 15. Subsequent additional criteria vary by institutions and regions.

The criteria used for "major trauma" for Hospital Sultanah Aminah is as below:

a. All adult trauma patients with an Injury Severity Score of more than 15 and/or,
b. All adult trauma patients in the care of the Trauma Surgery Service requiring admission to the Intensive Care Unit (does not include Neurosurgical HDU).
c. Trauma patients who die in the Emergency Department having been brought in with signs of life.
d. All hemodynamically unstable pelvic fractures requiring surgical/radiological hemostatic intervention.

Injury Severity Score (ISS) and New Injury Severity Score (NISS)

ISS is an anatomical score used to quantitatively assign the severity of multiple injury. Each injury is assigned an Abbreviated Injury Score (AIS) and only the highest AIS within a certain body region included in the final calculation. There are five body region divisions and the top 3 scoring injuries are identified. Each of these 3 AIS scores are squared and the sum total constitutes the ISS (Baker et. al., 1974)[2]. In this report, where "ISS" is stated, it was calculated with the NISS principle (Osler, 1997)[3].

Abbreviated Injury Score (AIS)

The AIS is a score weighted on the severity of injury to a given anatomic organ. It is graded 1 to 6 in ascending severity, 6 being unsurvivable. The AIS for solid organs are coded according to AAST (American Association for the Surgery for Trauma) guidelines, 1990. All other AIS scores are clinician subjective. For this registry, the AIS scores were decided and assigned to an injury by cross referencing at least two or preferentially three sources of information, which are, radiological data (X-rays and scans), operative notes and communication with the operating team surgeon/s.

Revised Trauma Score (RTS)

The Revised Trauma Score is a physiologic severity score that can be a useful triage tool and is an accurate predictor for the probability for survival. This score assigns coded values for 3 parameters, namely the first recordings of the Glasgow Coma Scale, systolic blood pressure and respiratory rate as below;

Glasgow Coma Scale (GCS)	Systolic Blood Pressure (SBP)	Respiratory Rate (RR)	Coded Value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

RTS = 0.9368 GCS + 0.7326 SBP + 0.2908 RR

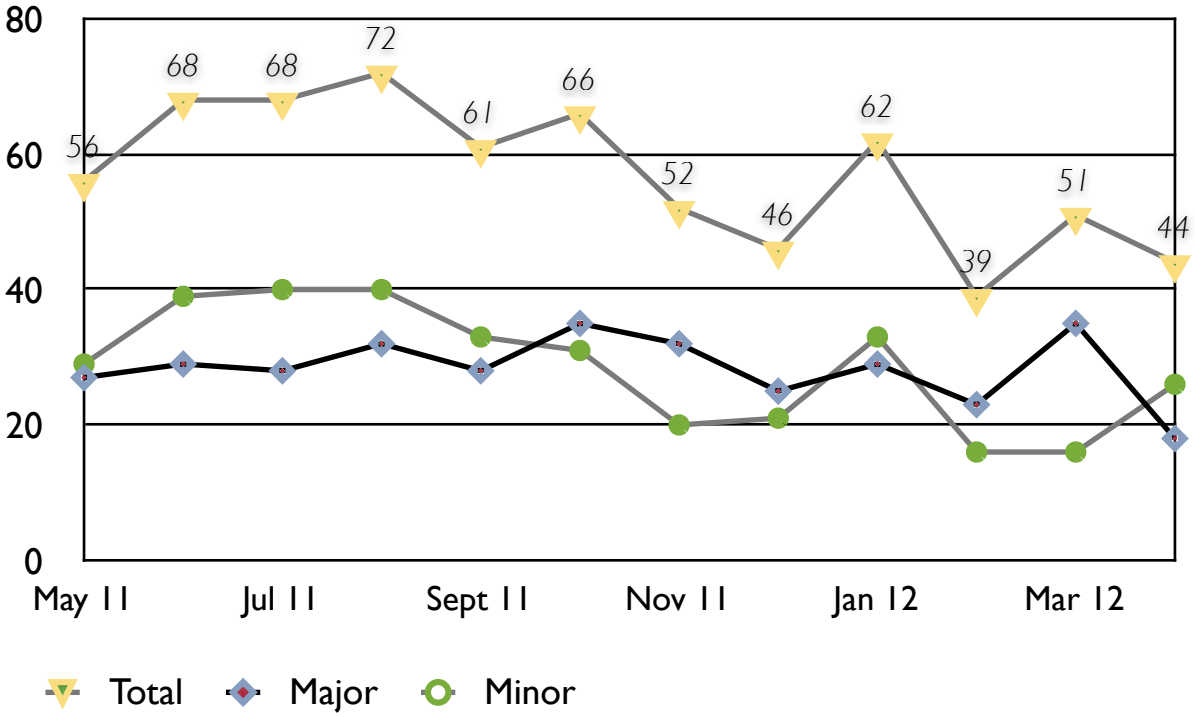
Values range from 0.00 to 7.84. The higher the RTS value, a higher probability for survival is expected. The values used for calculation are that obtained from the first recorded values in the emergency department.

The Functional Independence Measure Score (FIMS)

The FIM score is a functional outcome score that measures the patient in four areas, which are self care, mobility, communication and social cognition. Each of these areas are subdivided into smaller subdivisions and are given 7 score levels, which will subsequently be totaled for each area. Patients are scored by nursing staff just before hospital discharge.

Admissions

Fig. 1- All Trauma Admissions 2011-2012



There were a total of 687 admissions during the 12 month period. There was an average of 57.25 admissions a month and major trauma comprised of approximately half of the admissions.

Demographics

Fig 2- Gender Distribution

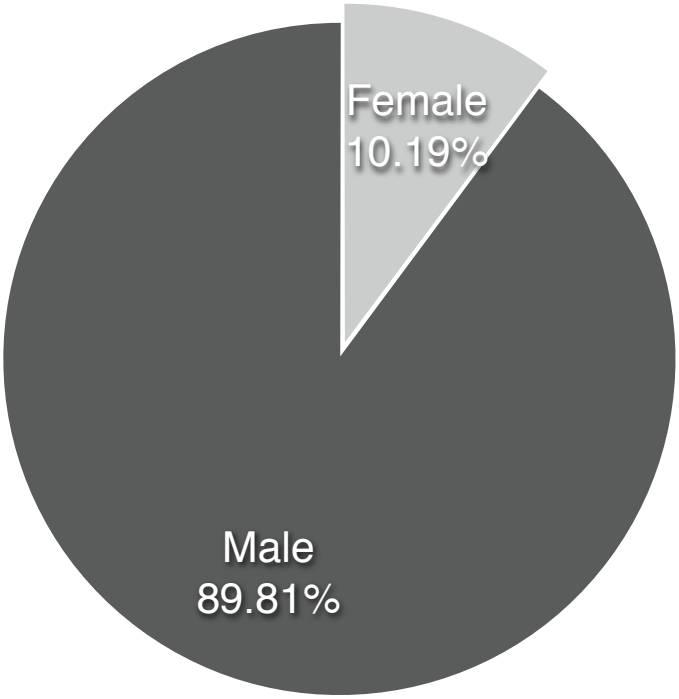


Fig. 3- Ethnic groups

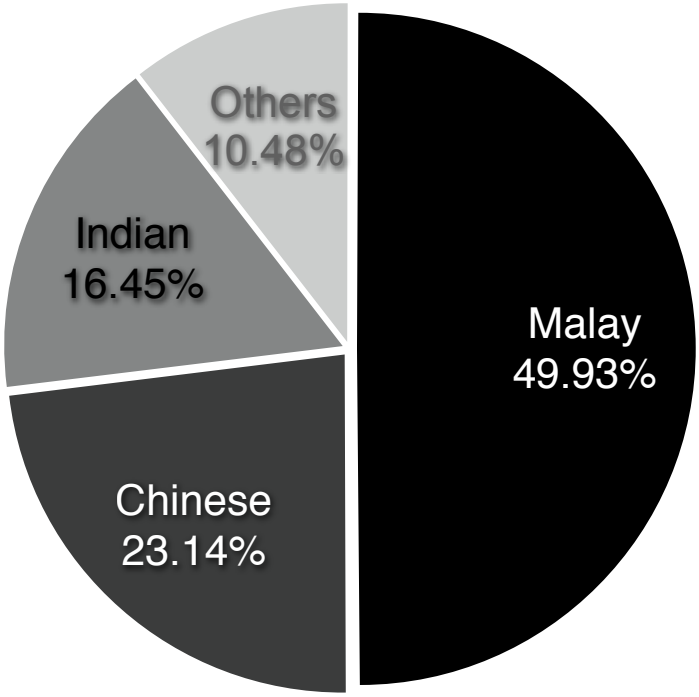
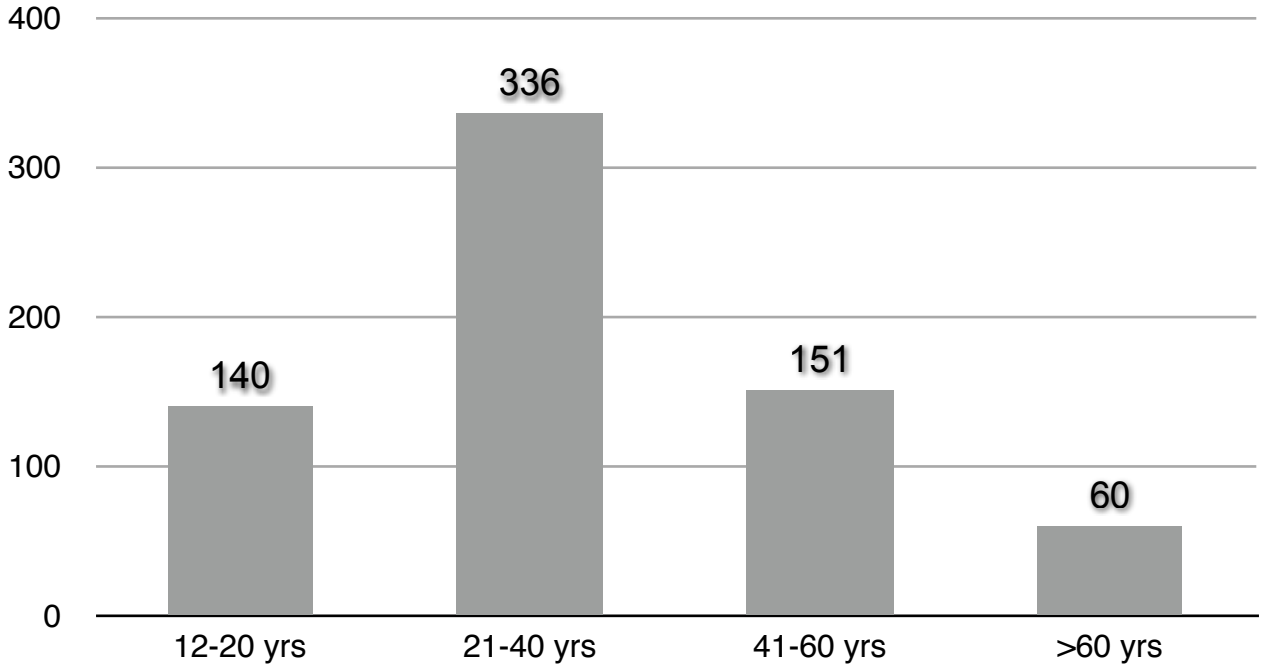


Fig. 4- Age distribution



Young males in the age group 21 to 40 years form the majority of cases. This pattern is similar to that reported by the National Trauma Database, Malaysia[4]. The ethnic distribution is reflective of the local ethnic groups[4].

Mechanism and Causes

Fig. 5- Mechanism of injury

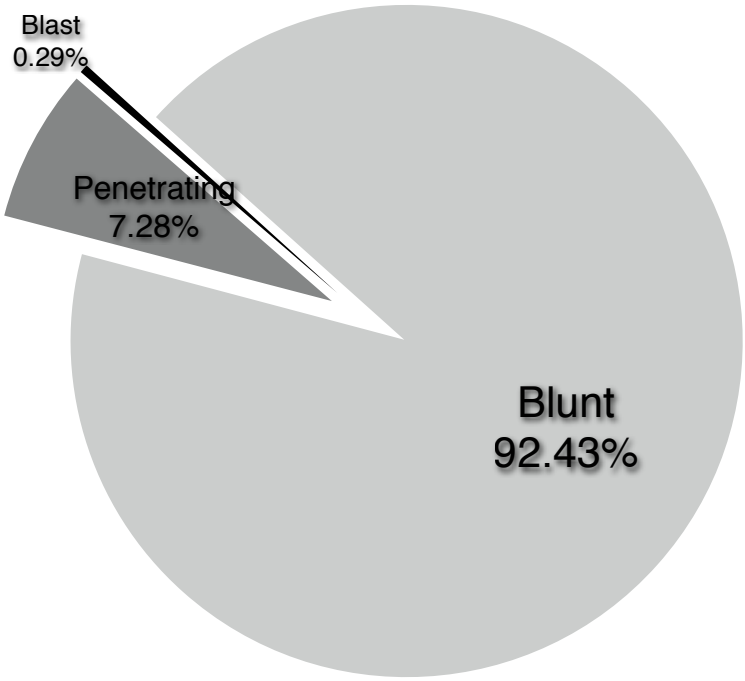


Fig. 6- Trauma by Cause

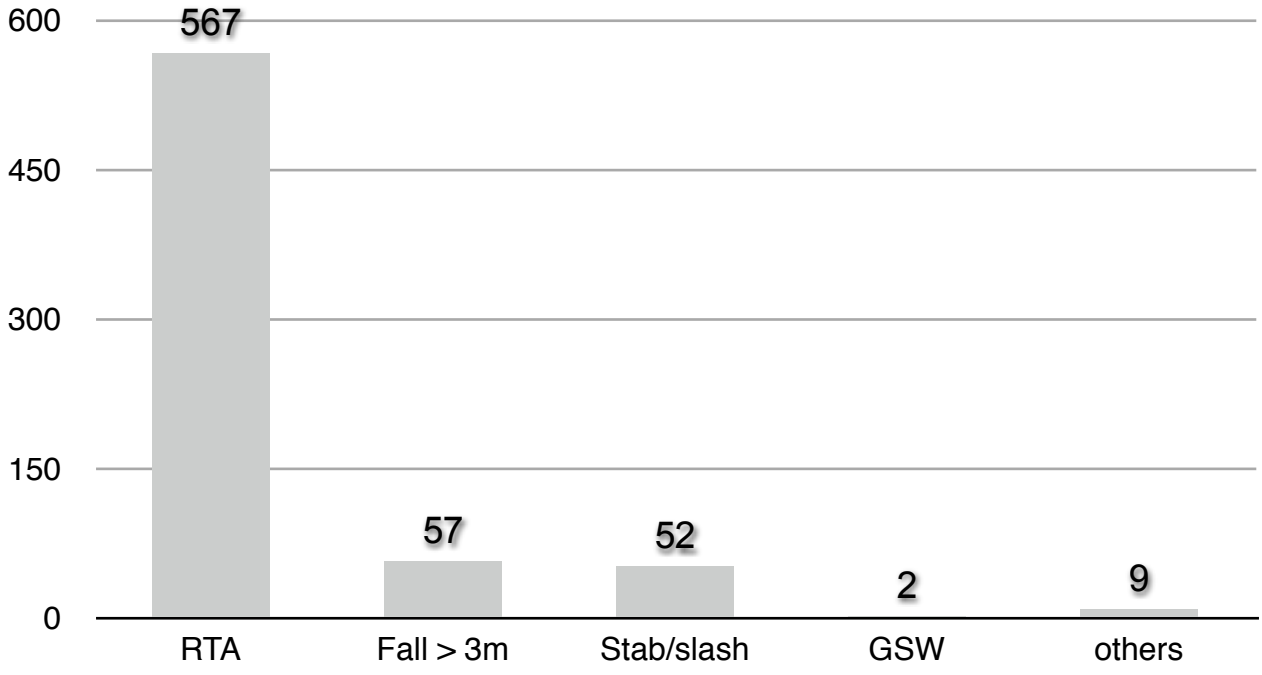
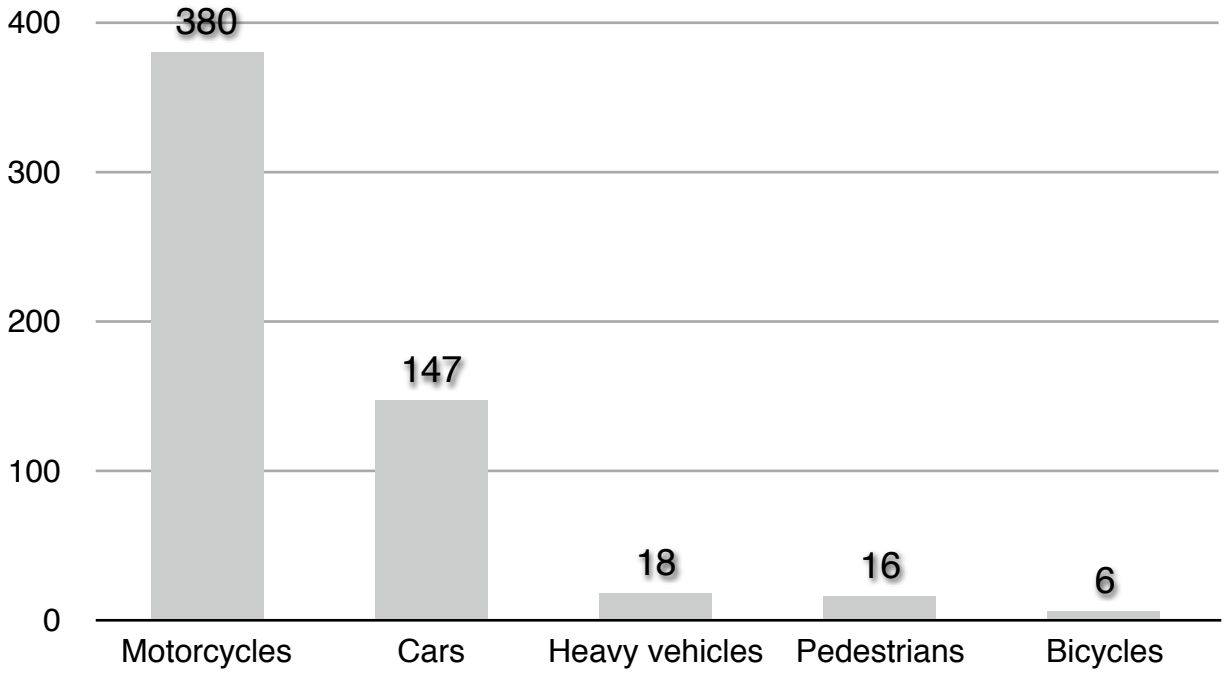


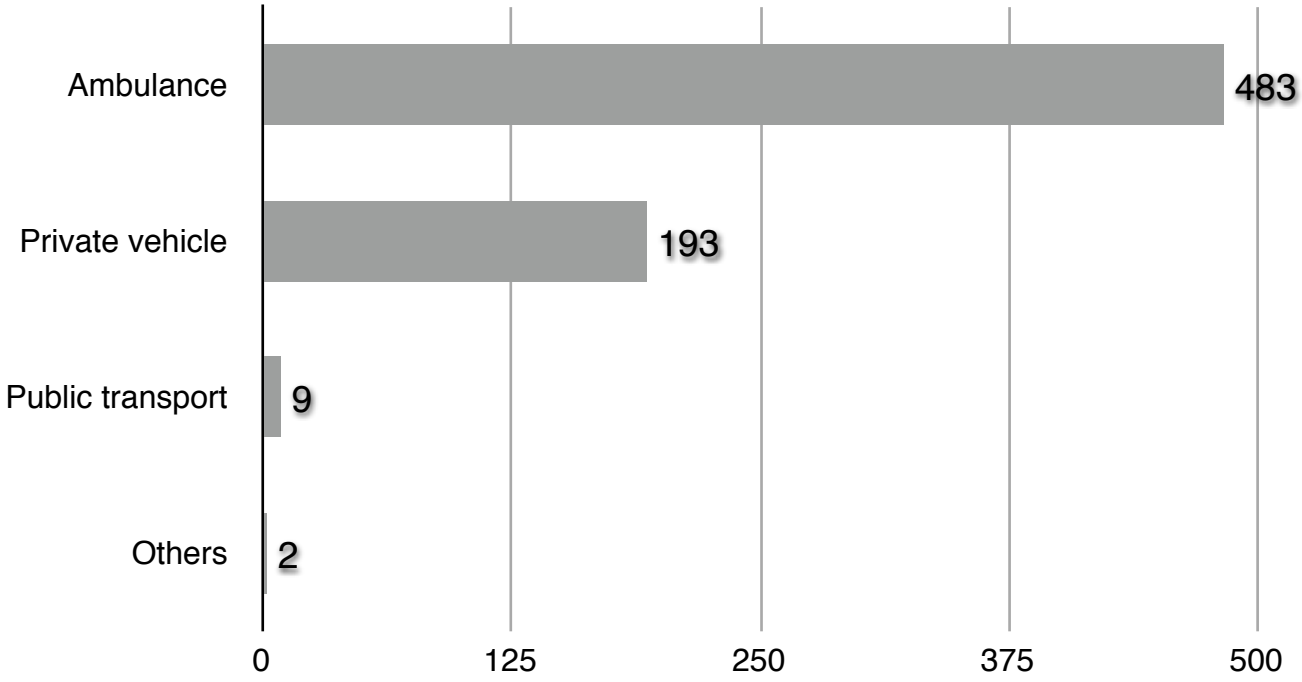
Fig. 7- Breakdown of Road Traffic Acidents



Blunt trauma form the major mechanism of injury accounting for 92.4% of cases. Overwhelmingly, motorcycle crashes form a large number of injuries. Injury prevention campaigns should and have been focused on road safety especially among motorcyclists. Gunshot wounds were less common, Malaysia has tight laws to regulate private gun ownership. Nonetheless small numbers of illegal guns may still be obtained and used for criminal activities.

Pre-hospital services

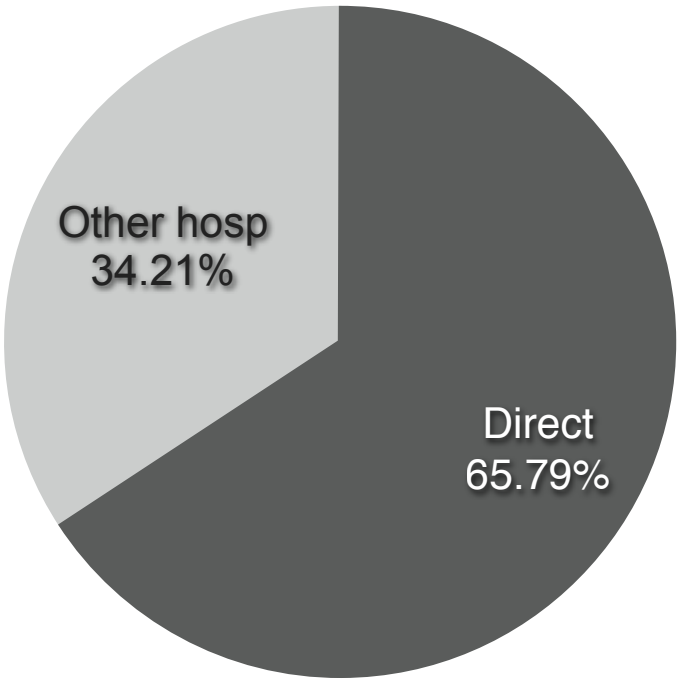
Fig 8- Mode of transport to hospital



The majority of cases (70.3%) arrived by ambulance but there were still a significant number of cases that were sent by private transport. Taking into consideration that about a third of the cases were referred from other hospitals and thus transported by ambulance, the number of cases presenting directly to our hospital by non-ambulance is 204 cases (45.1%). Nonetheless public confidence in pre-hospital services have been rising steadily in the last decade and all levels of care facility in the Ministry of Health are expected to abide by the National Pre-Hospital Policy. HSAJB has translated this into a local policy in 2012 and it appears that this has succeeded somewhat in instilling public confidence in our ambulance/pre-hospital services. There were two stray cases that did not present with any listed transport. These were cases in which the injury occurred within the immediate vicinity of the hospital grounds and the other was brought in by the police.

Treatment and Outcomes

Fig. 9- Admission source



Approximately two thirds of cases were the result of direct admissions with another third of cases as inter-hospital transfers. The fairly large volume of inter-hospital transfers merely reflects HSAJB's position as the apex hospital for the state of Johor.

Table 1- Length of hospital stay

LOS	N (days)
Mean	9.41
Median	6.0
Range	1 - 160

The mean length of stay for all cases was 9.41 days with a median of 6.0 days. These figures includes deaths. The range however shows a few cases with 1 day stay in hospital. These cases constitute 22 minor trauma cases requesting transfer to nearby private facilities and 9 major traumas due to transfers and deaths.

Fig. 11- ICU admission

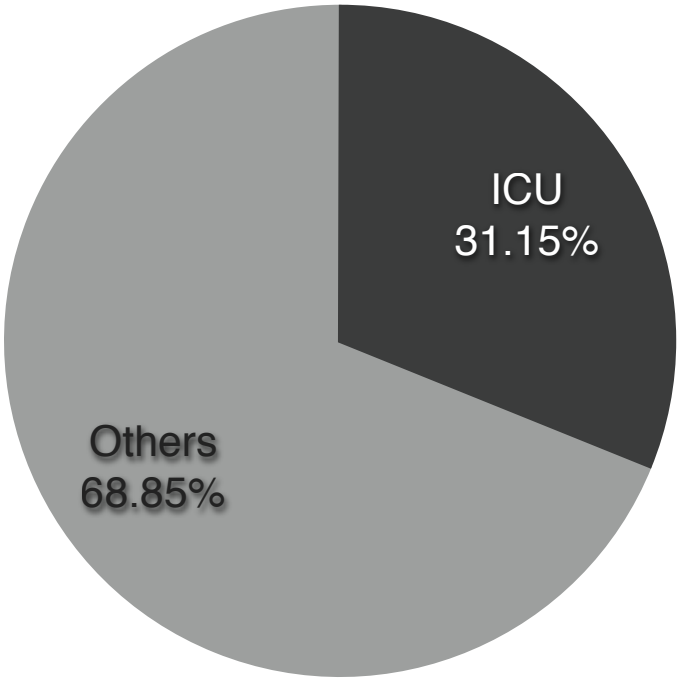


Table 2- ICU admissions

N	%
214	31.15%

Table 3- ICU length of stay

LOS	N (days)
Mean	8.2
Median	6.0
Range	1- 56

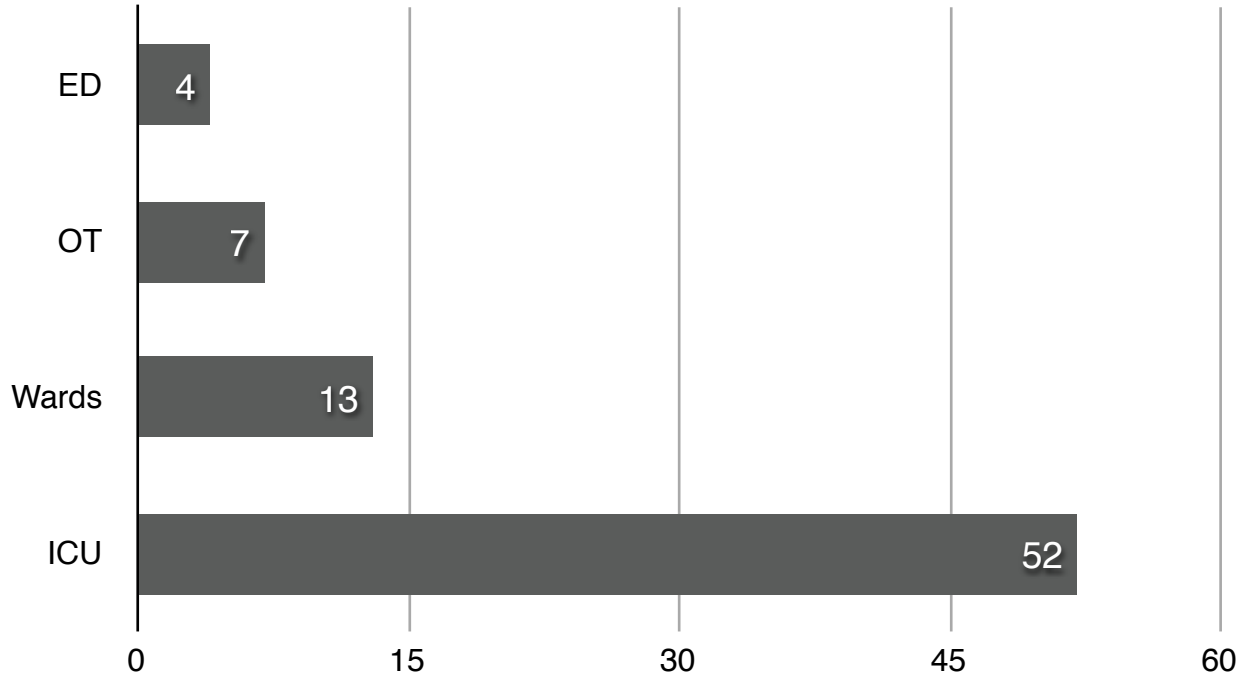
About a third of the cases required admission to the General ICU and this reflects the severity of the cases managed by the unit. The median number of days spent in the ICU was 6 days (range 1 – 56). Future studies can assess the health cost and resource utilization of this subset of major trauma cases. Multi-trauma cases admitted to the Neurosurgical High Dependency Unit were not included as ICU admission.

Table 4- Case fatalities

Outcome	N	%
Dead	76	11.06
Alive at discharge	611	88.94
Total	687	100

The crude mortality was 11.06% which reflected the mortality rate of all trauma cases. It approximates most figures of Australasian Trauma Registry Reports of Case Fatality Rates in the past few years[6, 7, 8]

Fig. 15- Death by location



Overall survival of all trauma cases was 88.9%. Of those that died, majority of the deaths (68.4%) occurred in the ICU. There were 7 deaths in OT and these were cases with massive hemorrhage. Four cases that died in the ED were brought in "in-extremis" with low RTS values. The presenting RTS values and corresponding probability of survival is illustrated in the following two figures. It can be surmised that an injured patient presenting to our ED with normal GCS, SBP and RR has a 94.8% chance of surviving.

Fig 16- RTS and survival probability

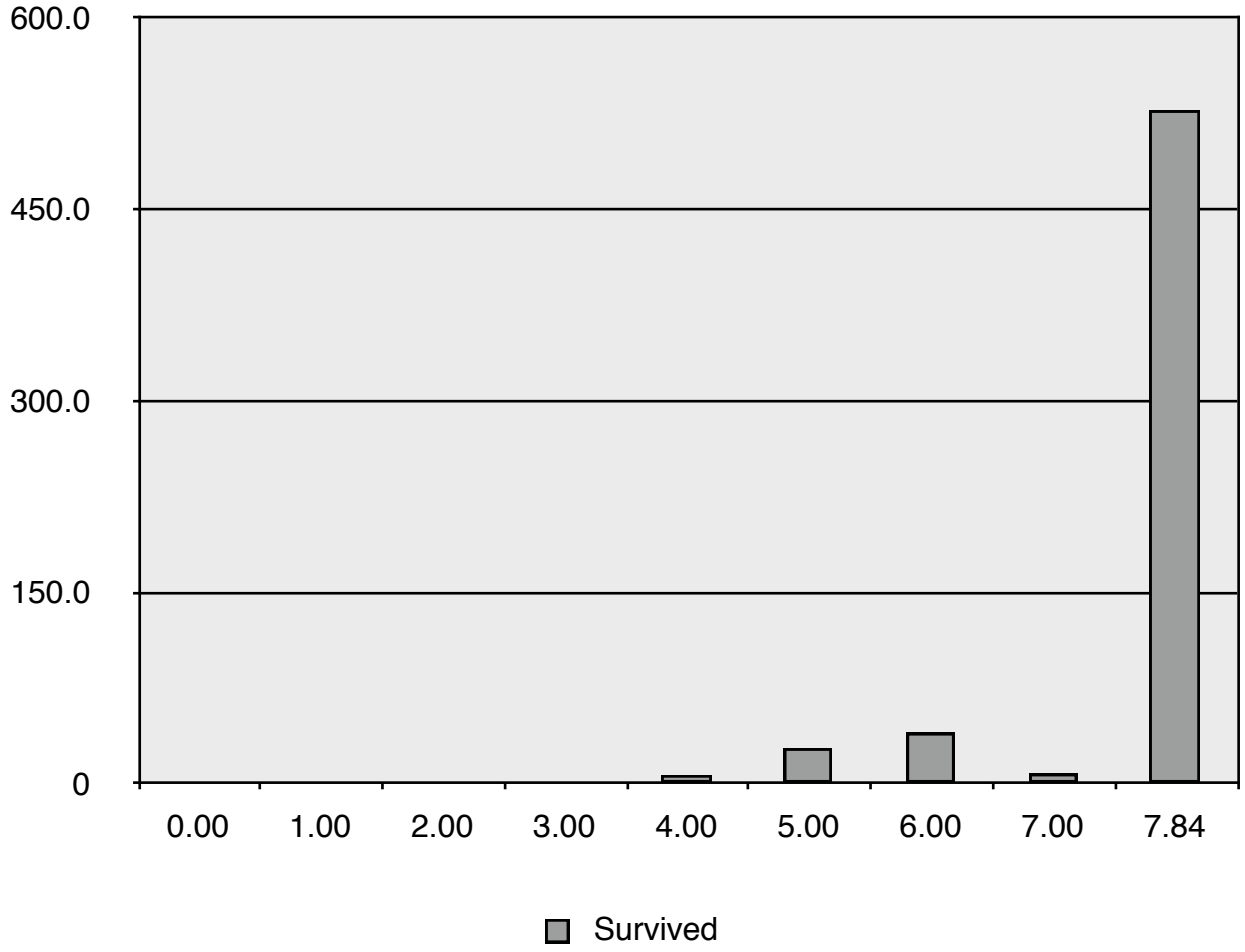


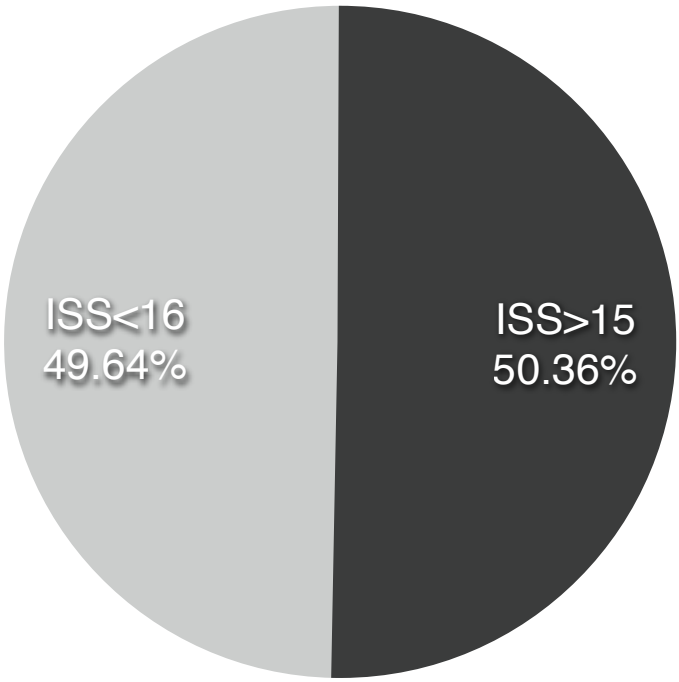
Table 5- Probability of survival by RTS

RTS	Survival	Death	Total	*PS
0.00 - 0.99	0	0	0	-
1.00 - 1.99	0	0	0	-
2.00 - 2.99	0	2	2	0.000
3.00 - 3.99	0	2	2	0.000
4.00 - 4.99	7	16	23	0.304
5.00 - 5.99	28	18	46	0.609
6.00 - 6.99	40	7	47	0.851
7.00 - 7.83	8	1	9	0.841
7.84	528	30	558	0.948

* PS- Probability of survival

Major Trauma

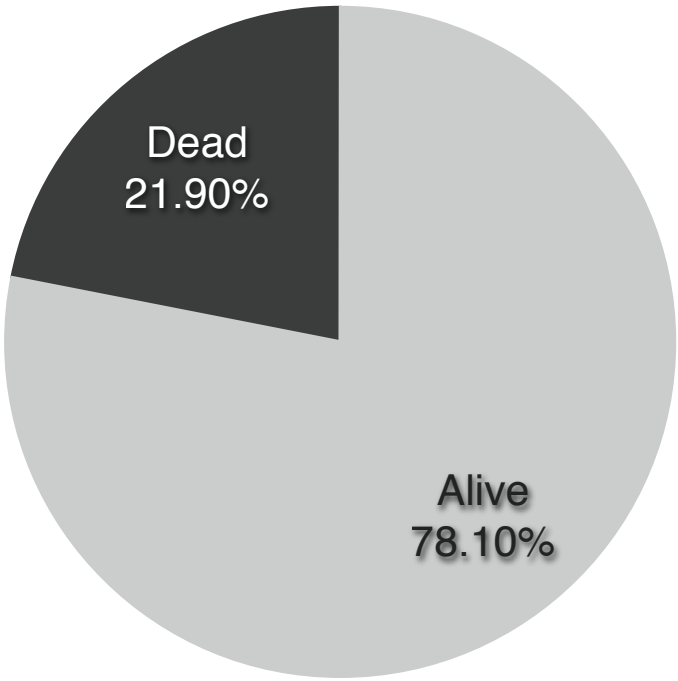
Fig. 17- Severity of Injury



Three hundred forty seven cases (50.51% of all cases admitted) had an ISS of more than 15. This represents a significant burden of care for the unit. Less than half of the remaining were minor trauma as per ISS definition.

Major trauma outcomes

Fig. 18- Mortality rates of major trauma



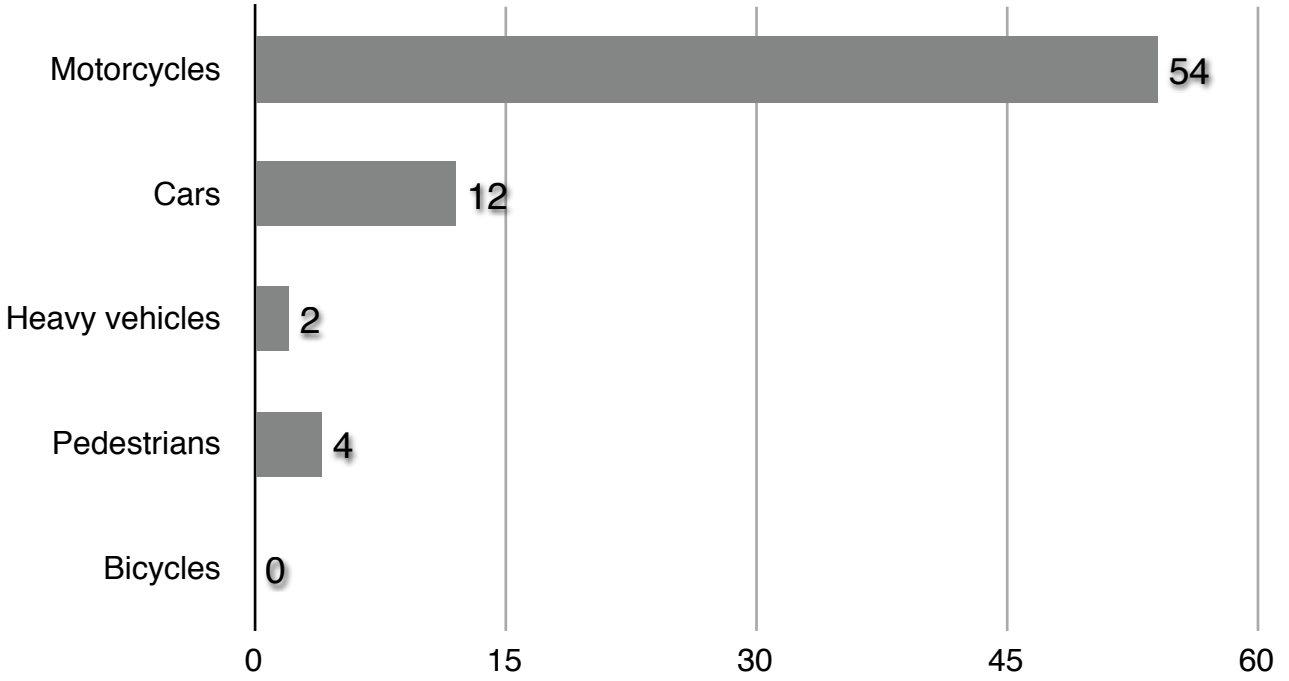
Overall mortality for major trauma stands at 21.90% or seventy six patients. This figure does not stratify the severity of trauma involved. In comparison, the Auckland City Hospital Trauma Registry Report 2012 states a mortality of 11.9% and the New South Wales Regional Registry 2009 reports case fatalities ranging 5.1% to 28.0% in fourteen reporting hospitals.[6]

Table 6- Death by mechanism

Mechanism	Alive	Death	Mortality %
Blunt	635	76	11.97
Penetrating	50	0	0
Blast	2	0	0

All deaths occurred within the blunt trauma subgroup and blunt trauma is a significant and major contributor for all trauma cases in our hospital. In the penetrating injury group, there were no mortalities and this can be explained by the low numbers of gun shot wounds (2 cases in total) as expected, low velocity woundings by stabbing will result in more survivors. The mortality rate quoted is the percentage within the group.

Fig. 20- RTA Deaths



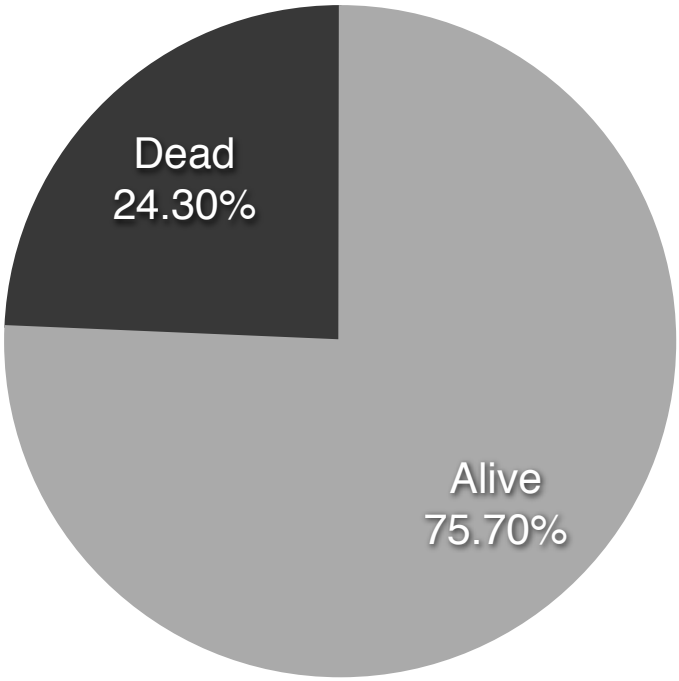
Within the subgroup of road traffic accident deaths, an overwhelming majority of deaths occurred amongst motorcyclists as they constitute the bulk of trauma patients involved in road traffic accidents in Malaysia. This correlates well with figures from the Royal Malaysian Police that in 2010, there were 4036 deaths (58.73%) involving motorcyclist from a total of 6872 RTA deaths.[9]

Table 7- Length of hospital stay and ISS > 15

ISS	Mean LOS (days)	Range (days)
16 - 24	10.50	1 - 50
25 - 40	16.09	1 - 160
41 - 75	16.58	1 - 74

The largest group of patients (135) were within the ISS 16 - 24 range and had the shortest duration of stay and the more severe the injury (the higher the ISS values), the longer the duration of stay in hospital. This also correlates with other outcome measures such as mortality. It seems that the differences in LOS between the ISS 41 - 75 and 16 - 24 was not as large as expected and this may be due to the inclusion of deaths within the calculation.

Fig. 21- In ICU mortality



There were 214 admissions of major trauma to ICU. Of these 52 (24.30%) patients succumbed in ICU. These cases tended to be the most severely injured with high ISS values.

Fig. 22- Mortality rates by ISS

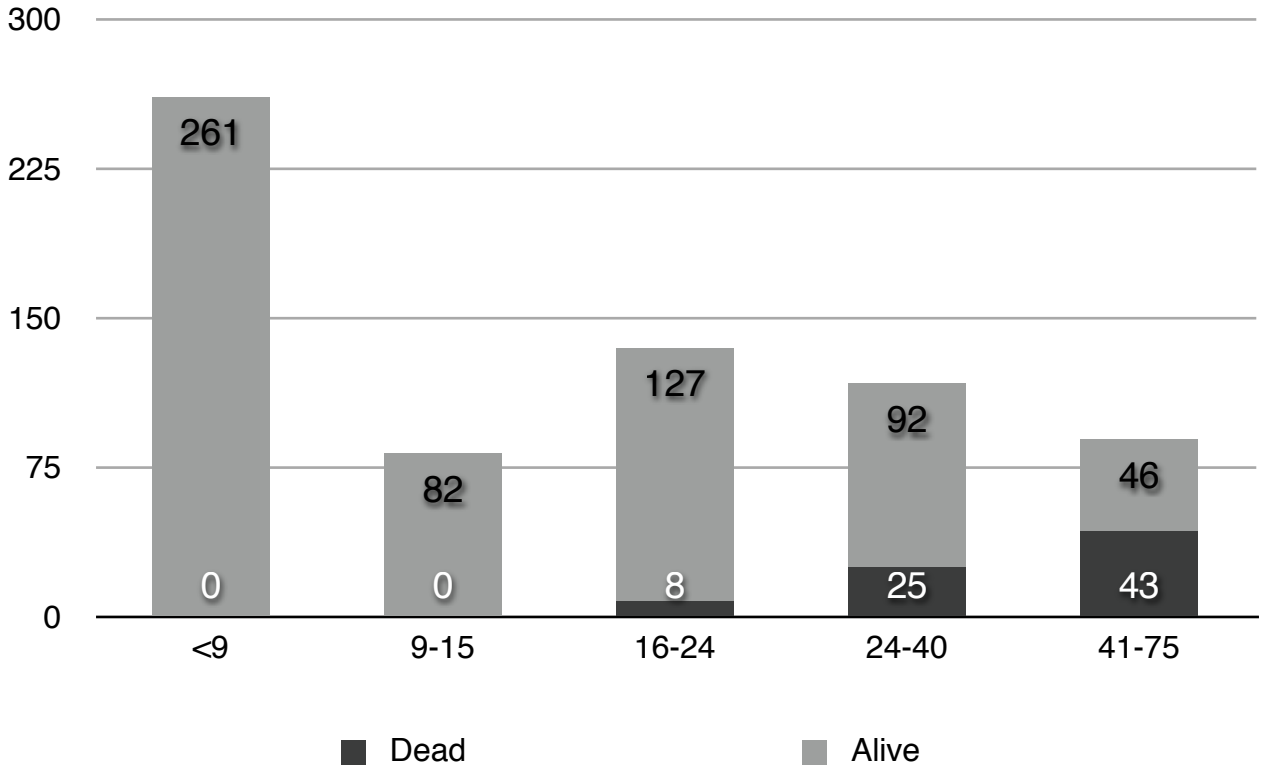


Table 8- ISS stratified mortality

Outcome	ISS				
	< 9	9 - 15	16 - 24	24 - 40	41 - 75
Dead	0	0	8	25	43
Alive at discharge	261	82	127	92	46
Mortality %	0	0	5.93	21.37	48.31

The mortality of those with ISS > 15 was 21.9% . As expected, the mortality rate correlated to the ISS score. The mortality of those with ISS >40 was 48.9%. There was only one patient with ISS score of 75 and did not influence the overall high mortality rate of those with ISS>40. Although we do not have any similar historical data to compare with, a review of registry reports from Autralasia, namely the South West Sydney Regional Trauma Registry 10 year report shows approximately similar mortality for the ISS 24-40 and ISS 41-75 (there were slight variations to the range) groups.[9] More recently the 2012 ACH registry report reported mortalities of 22% and 53.8% for both the above mentioned ISS groups.

Table 9- Functional outcomes

FIMS	Mean	Mode	Range
Self care	50.7	56	8 - 56
Mobility	32.2	35	5 - 35
Communication	13.6	14	2 - 14
Social cognition	20.4	21	3 - 21

FIMS showed good functional outcomes in most areas of assessment. This may be due to the fact that the registry only captures head injuries occurring in conjunction with other organ system injuries, thus excluding isolated head injuries, leading to better functional outcomes.

Operations and Procedures

Table 10- Selected operations and procedures

Operations		N
Abdominal damage control surgery		15
Abdominal definitive surgery (all procedures)		168
	Perihepatic packing (including re-packings)	23
	Liver, resectional debridement	8
	Splenectomy	32
	Splenic repair	4
	Bowel repair/ resection/ anastomosis/stoma	10
	Diaphragm, repair	5
	Distal pancreatectomy	2
	Mesentery, repair	23

Operations		N
	Nephrectomy	6
	Others	55
Thoracotomy (all procedures)		22
Pelvic damage control surgery		11
Revascularization of injured limbs		3
Neck explorations (all procedures)		5
Surgical tracheostomy		26
Percutaneous tracheostomy		57
Tube thoracostomy		164
Bronchoscopy		24

Table 11- Selected non operatively managed intra- abdominal injuries

Organ	N	%
Liver	47	67.14
Spleen	25	40.98
Renal	24	80.00
Pancreas	1	33.33

The majority of surgeries were related to intra-abdominal injuries with the liver being the most common intra-abdominal organ involved. Pelvic damage control surgery consists mainly of extra-peritoneal packings and internal iliac artery ligations. Emergency angioembolization services are not available at this point of time. Non-operative management of intra-abdominal solid organ injuries were successfully practiced in selected cases. The above list is a selected group of data from the registry and does not reflect the entire number of operations/procedures done.

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