Malaysian Registry of Intensive Care

Report for 2014

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Malaysian Registry of Intensive Care

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REPORT SUMMARY

This is the report on all intensive care admissions to the 51 participating centres from 1st January to 31st December 2014.

The following are the main findings:

1. The total number of ICU beds in the 49 MOH participating units was 637 with a median bed occupancy rate of 90.5%.

2. The number of cases analysed was 38,904, an increase of 4% over the previous year.

3. The percentage of patients denied admission due to the unavailability of ICU beds had declined from 37% to 30% in the last five years.

4. The average age of the patients, excluding those below 18 years, was 49.7 years.

5. The average duration of ICU and hospital stay was 4.7 and 14.2 days respectively.

6. In MOH hospitals, 68% of ICU admissions were non-operative patients.

7. Direct admissions to MOH ICUs from the emergency department had increased more than three-fold over the past 10 years from 10% in 2005 to 31% in 2014.

8. Dengue infection, sepsis and head injury were the three most common diagnoses leading to ICU admission in MOH hospitals in 2014. The in-hospital mortality rates for this group of patients were 7.1%, 52.8% and 22.2%respectively.

9. The average SAPS II score was 36.3, which carries a predicted in-hospital mortality of 30.4%.

10. In MOH hospitals, 74% of patients received invasive ventilation with an average duration of 4.9 days.

11. The percentage of patients who received non-invasive ventilation increased more than three-fold from 5.1% in 2005 to 18.6% in 2014.

12. The incidence of ventilator-associated pneumonia in MOH ICUs had decreased by more than half, from 10.1 to 3.6 per 1000 ventilator days, in the last five years.

13. The incidence of central venous catheter-related bloodstream infection in MOH ICUs was 0.8 and 0.7 per 1000 catheter days for 2013 and 2014 respectively

14. The crude in-ICU and in-hospital mortality rates for MOH hospitals were 19.0% and 25.7% respectively.

15. The crude in-ICU and in-hospital mortality rates for UMMC were 18.4% and 25.8% respectively.

16. The mean standardised mortality ratio was 0.69 [95%C.I. 0.48–0.95], 0.65 [95%C.I.0.44 – 0.90] and 0.22 [95%C.I. 0.11–0.59] for MOH, UMMC and SJMC ICUs respectively.

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All site investigators and source data providers

The heads of Department of Anaesthesia and Intensive Care of participating ICUs

Staff of the participating ICUs

Quality of Health Care Unit, Medical Development Division, Ministry of Health

National Clinical Research Centre, Ministry of Health

Health Informatics Centre, Ministry of Health

Malaysian Society of Intensive Care

All who have contributed in one way or another to the MRIC

FOREWORD

It is a privilege for me to be writing this foreword for the MRIC report of 2014.

This registry has been ongoing for more than a decade and the data obtained has been a reference source for the Ministry of Health for the continuous improvement in the delivery of critical care services to patients.

This report highlights all intensive care admissions to the 51 participating centres from 1st January to 31st December 2014. The number of cases analysed was 4% higher over the previous year. Dengue infection, sepsis and head injury were the three most common diagnoses leading to ICU admission in MOH hospitals.

The incidence of ventilator-associated pneumonia in MOH ICUs had decreased by more than half, in the last five years. The incidence of central venous catheter-related bloodstream infection was 0.7 per 1000 catheter days in 2014. This is heartening to note that this rate is within the set standard of the Malaysian Patient Safety Goals indicators.

I see a challenging future ahead for the further development of intensive care services in Malaysia especially with the increased awareness and demand by the public, newer challenges with emerging infectious diseases and increasing antibiotic resistance.

I take this opportunity to thank Dato' Dr Jenny Tong May Geok, Dr Tai Li Ling, Dr Tan Cheng Cheng, Dr As-Niza Abdul Shukor, Dr Lim Chew Har and Dr Laila Kamaliah for working together to produce this report. I want to acknowledge the hard work of all the site investigators and source data collectors who have contributed to the registry. I also want to express my thanks to the National Clinical Research Centre and Medical Development Division, Ministry of Health for their continued guidance and support.

Dr. Sivasakthi V
Head of the Anaesthesia and Intensive Care Services
Ministry of Health Malaysia

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PARTICIPATING HOSPITALS

No.	Name of hospital	Abbreviation
Sites since 2002		
1.	Hospital Sultanah Bahiyah Alor Setar	AS
2.	Hospital Pulau Pinang	PP
3.	Hospital Raja Permaisuri Bainun Ipoh	IPH
4.	Hospital Kuala Lumpur	KL
5.	Hospital Selayang	SLG
6.	Hospital Tengku Ampuan Rahimah Klang	KLG
7.	Hospital Tuanku Ja'afar Seremban	SBN
8.	Hospital Melaka	MLK
9.	Hospital Sultanah Aminah Johor Bahru	JB
10.	Hospital Tengku Ampuan Afzan Kuantan	KTN
11.	Hospital Sultanah Nur Zahirah Kuala Terengganu	KT
12.	Hospital Raja Perempuan Zainab II Kota Bharu	KB
13.	Hospital Umum Sarawak Kuching	KCH
14.	Hospital Queen Elizabeth Kota Kinabalu	KK
Sites since 2005		
15.	Hospital Sultan Abdul Halim Sungai Petani	SP
16.	Hospital Putrajaya	PJY
17.	Hospital Pakar Sultanah Fatimah Muar	MUR
18.	Hospital Teluk Intan	TI
19.	Hospital Taiping	TPG
20.	Hospital Seberang Jaya	SJ
21.	Hospital Kajang	KJG
22.	Hospital Tuanku Fauziah Kangar	KGR
Sites since 2006		
23.	Subang Jaya Medical Centre	SJMC
24.	Hospital Sultan Haji Ahmad Shah Temerloh	TML
25.	Hospital Tuanku Ampuan Najihah Kuala Pilah	KP
26.	Hospital Sri Manjung	SMJ
27.	Hospital Batu Pahat	BP
28.	Hospital Tawau	TW
29.	Hospital Miri	MRI
30.	Hospital Kulim	KLM
31.	Hospital Serdang	SDG

Sites since 2010		
32	Hospital Sibu	SB
33	Hospital Duchess of Kent Sandakan	DKS
34	Hospital Sultan Ismail Johor Bahru	SI
35	Hospital Sungai Buloh	SBL
36	Hospital Ampang	AMP
37	Hospital Wanita dan Kanak-Kanak Sabah	LIK
Sites since 2012		
38	University Malaya Medical Centre	UMMC
39	Langkawi	LKW
40	Bukit Mertajam	BM
41	Slim River	SLR
42	Port Dickson	PD
43	Kuala Krai	KKR
44	Segamat	SGT
45	Tanah Merah	TM
46	Kemaman	KEM
47	Kuala Lipis	KLP
48	Labuan	LAB
49	Keningau	KEN
50	Bintulu	BIN
51	Lahad Datu	LD

CATEGORIES OF ICU

Based on the number of ICU admissions in 2014, for the purpose of MRIC 2014 report

Participating sites		Number of admissions
Participating sites with ≥ 1000 admissions		
1	Hospital Sungai Buloh	2284
2	Hospital Tengku Ampuan Rahimah Klang	2281
3	Hospital Kuala Lumpur	2144
4	Hospital Sultanah Aminah Johor Bharu	1687
5	Hospital Raja Perempuan Zainab II Kota Bharu	1607
6	Hospital Melaka	1432
7	Hospital Selayang	1426
8	Hospital Sultanah Bahiyah Alor Setar	1331
9	Hospital Raja Permaisuri Bainun Ipoh	1217
10	Hospital Taiping	1182
11	Hospital Sultanah Nur Zahirah Kuala Terengganu	1172
12	Hospital Umum Sarawak Kuching	1140
13	Hospital Pulau Pinang	1134
14	Hospital Sultan Ismail Johor Bahru	1131
15	Hospital Tengku Ampuan Afzan Kuantan	1062
Participating sites with 500 - 999 admissions		
16	Hospital Queen Elizabeth Kota Kinabalu	987
17	Hospital Sultan Abdul Halim Sungai Petani	953
18	Hospital Duchess of Kent Sandakan	950
19	Hospital Sultan Haji Ahmad Shah Temerloh	837
20	Hospital Serdang	835
21	Hospital Putrajaya	654
22	Hospital Ampang	634
23	Hospital Pakar Sultanah Fatimah Muar	600
24	Hospital Kulim	555
25	Hospital Tuanku Ja'afar Seremban	541
26	Hospital Tuanku Ampuan Najihah Kuala Pilah	512

Participating sites with < 500 admissions		
27	Hospital Tawau	498
28	Hospital Sultanah Nora Ismail Batu Pahat	459
29	Hospital Sri Manjung	432
30	Hospital Sibu	431
31	Hospital Miri	424
32	Hospital Seberang Jaya	409
33	Hospital Teluk Intan	406
34	Hospital Likas	353
35	Hospital Tuanku Fauziah Kangar	341
36	Hospital Kajang	284
37	Hospital Bintulu	283
38	Hospital Port Dickson	265
39	Hospital Kuala Krai	260
40	Hospital Slim River	223
41	Hospital Lahad Datu	217
42	Hospital Labuan	166
43	Hospital Langkawi	165
44	Hospital Tanah Merah	160
45	Hospital Segamat	150
46	Hospital Keningau	144
47	Hospital Bukit Mertajam	141
48	Hospital Kuala Lipis	96
49	Hospital Kemaman	91
Private hospital		
50	Subang Jaya Medical Centre	870
University hospital		
51	University Malaya Medical Centre	1334

LIST OF SITE INVESTIGATORS AND SOURCE DATA COLLECTORS

January – December 2014

No	Hospital	Site investigator	Source data collectors
1	Sultanah Bahiyah Alor Setar	Dr Ahmad Shaltut Othman	Sr Teoh Shook Lian SN Hafisoh Ahmad SN Haslina Khalid SN Noorazimah Salleh SN Faten Ramiza Ahmad Abdullah
2	Pulau Pinang	Dr Lim Chew Har	SN Siti Hazlina Bidin SN Rosmawati Yusoff SN Emeelia Zuzana Abdul Wahab
3	Raja Permaisuri Bainun Ipoh	Dr Foong Kit Weng	SN Saadiah Bidin SN Ng Pek Yoong
4	Kuala Lumpur	Dr Tai Li Ling	SN Salmi Zawati Serif SN Ismee Jusoh
5	Selayang	Dr Laila Kamariah Kamalul Baharin	SN Nor Zaila Saad@ Senafi SN Noor Azwati Daud
6	Tengku Ampuan Rahimah Klang	Dr Sheliza Wahab	SN Latifah Omar SN Tai Yoke Ching SN Rosenah Abdul Rahman
7	Tuanku Ja'afar Seremban	Dato' Dr Jenny Tong May Geok	Sr Lim Yek Fong SN Farawahida Ahmad (from Oct 2014) SN Normah Abdul Taib (till Oct 2014)
8	Melaka	Dr Nahla Irtiza Ismail	Sr Zaliha Emperan SN Norina Abd Kadir
9	Sultanah Aminah Johor Bahru	Dr Tan Cheng Cheng	Sr Marian Sais ak Sipit SN Aishah Abu Bakar AMO Mohd Zakuan Mohd Nor AMO Hairizam Zulkhifli AMO Mohd Adib Jasni AMO Anand Sivasamy
10	Tengku Ampuan Afzan Kuantan	Dr Muhammad Zihni Abdullah	Sr Gan Soo Heng SN Salina Sulaiman SN Amimah Abd Hamid SN Nur Azura Hamzah (till Oct 2014)
11	Sultanah Nur Zahirah Kuala Terengganu	Dr Mohd Ridhwan Mohd Nor	SN Zauwiah Idris SN Aslinawati Chik
12	Raja Perempuan Zainab II Kota Bharu	Dr Wan Nasrudin Wan Ismail	Sr Azilah Ishak SN Azizum Ismail SN Suzana Yusof
13	Umum Sarawak Kuching	Dr.Jamaidah Jamorek	SN Noreafa Daim (till April 2014) SN Sabia Lew SN Rosnica Jiton SN Sharon Ivy Gombek

14	Queen Elizabeth Kota Kinabalu	Dr Khoo Tien Meng	SN Conny Chong Chiew Fah SN Aslinda Ahmad (till Oct 2014) SN Saihin Maun SN Suzie Tinus SN Winnie Yasin
15	Sultan Abdul Halim Sungai Petani	Dr Rosman Noor Ali	SN Rafizah Md Zuki SN Hamiza Mohd Noor SN Zainun Awang
16	Putrajaya	Dr Fauziah Yusoff	Sr Latifah Mohd Korib SN Maznah Muhamad
17	Pakar Sultanah Fatimah Muar	Dr Suzaliatun Kasbolah	SN Roslina Othman SN Mazlidah Osman SN Nurazlin Jawad SN Fazal Naim Ramli
18	Teluk Intan	Dr Noor Azira Haron	SN Azliza Zakaria SN Rohayu Dalila Yusof
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21	Kajang	Dr Nursuhaila binti Mohd Amin	SN Normaizana Ismail SN Rosnani binti Ab.Latip SN Emiza binti Abdullah Zahid
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23	Subang Jaya Medical Center	Dr Wong Ket Hiung	Ms Navjeet Kaur SN Normazimah Mohamad Nazar
24	Sultan Haji Ahmad Shah Temerloh	Dr Rahimah Haron	Sr Rakiah Mohd Noor SN Norliza Ismail SN Rohayu Yusof SN Joliena Jaafar SN Aida Azlina Ali
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26	Sri Manjung	Dr Khairudin Zainal Abidin	Sr Rohani Ali Sr Hartini Abd Rahman SN Salbiah Abdul Rashid SN Norfaizal Abdul Majid
27	Batu Pahat	Dr Nasrudin Bunasir	SN Rosmawati Saimin SN Norhaezah Jani
28	Tawau	Dr Sein Win	SN Lilybeth Feliciano Ferez SN Sarwah Isa SN Sharifah Maznah Habib Muhammad

29	Miri	Dr Lim Hong Jin (till Aug 2014) Dr Norhuzaimah Binti Julai Abdul Julaihi	SN Noriah Ilai SN Zuriha Achim
30	Kulim	Dr Chua Kok Boon	Sr Mahani binti Hassan SN Mohana Omar SN Bahayah Mohamed Bakari SN Che Asmah Haji Md Isa
31	Serdang	Dr Nazarinna Muhamad	Sr Norain Saad (till Mar 2014) Sr Siti Ainah Binti Buang SN Sarina Jamhari
32	Sibu	Dr Anita Alias	SN Wong Chen Chen SN Yong Suk Moi
33	Duchess of Kent Sandakan	Dr Rusnah Abd Rahman	Sr Noorasmah Hassim SN Norahimah Dulraman SN Sofiah Yampi
34	Sultan Ismail Johor Bahru	Dr Mohd Zaini Laman	Sr Azleena Mohd Yusop SN Huzaimah Jahir (till June 2014) SN Norwati Jamiran SN Norelessa Abd Aziz
35	Sungai Buloh	Dr Shanti Ratnam	Sr Sri Jayanthi Gobalan Sr Noorhaidah Baharuddin SN Siti Salwa binti Mohd Latif
36	Ampang	Dr Rusnah Ab.Latif	Sr Normazlin Md Derus SN Amiza Dyana Abu Amin SN Asilah Fatin
37	Wanita dan Kanak-Kanak Sabah	Dr Lorrain Lim	SN Siti Rajiah bt Muslimin SN Dayang Noreenz Mohd Yusoh SN Yusnita bt Yunus
38	University Malaya Medical Centre	Dr Vineya Rai	Sr Azizah Md Lajis SN Nur Aina Muhamad
39	Langkawi	Dr Suriana binti Mohd Abu Bakar	Sr Hamiza Harun
40	Bukit Mertajam	Dr Nur Sabrina Mohd Sabry (till Sept 2014) Dr Tan Mei Xuan	Sr Thanaletchimi Packirisamy SN Faizah Abdul
41	Slim River	Dr Tin Tin Myint	Sr Khairol Nazimah Musa SN Suliati Baghdadi
42	Port Dickson	Dr Hema Malini Manogharan	Sr Hapisah Mat SN Muhazni Mohammad
43	Kuala Krai	Dr Norhafidza Ghazali	Sr Norlela Ismail SN Salma binti Ismail
44	Segamat	Dr Wirza Feldi Bin Sawir	Sr Hasneyza Bakar Sr Khatijah binti Yusof

45	Tanah Merah	Dr Mohd Azmi Mamat	Sr Norain binti Saad SN Fadilah bt Mohd Nor
46	Kemaman	Dr Ahmad Nizam Ismail	Sr Rosmazariawati Zahari
47	Kuala Lipis	Dr Wan Satifah Wan Ngah (till Feb 2014) Dr Sharihanim bt Hussain	Sr W. Norlizer W.Muda (till Oct 2014) SN Nik Arienti Nik Man Sr Potchaine a/p Ek Kam
48	Labuan	Dr Betty Shee	Sr Roslin Akiu SR Loinsah Sibin
49	Keningau	Dr Fazilawati bt Zakaria (till August 2014) Dr Maswiana Abdul Majid	Sr Haineh Amin Sr Icha Chim
50	Bintulu	Dr Siti Intan Zurhaida bt Mohd Zainol Abidin (till Sept 2014) Dr Hairatun Ida binti Md Hamzah	Sr Jennifer Anak Sahim Sr Raimah Sebli SN Ann Lampung SN Yuhana Dalang
51	Lahad Datu	Dr Norazura Ahmad@Said	Sr Juraini bt Mohd Jaffar SN Noorlaila btDurahman

ABBREVIATIONS

Adm.	Admission
AKI	Acute kidney injury
ALI	Acute lung injury
AMO	Assistant medical officer
AOR	At own risk
APACHE II	Acute Physiologic and Chronic Health Evaluation (Version II)
ARDS	Acute respiratory distress syndrome
BOR	Bed occupancy rate
CRBSI	Catheter related bloodstream infection
CRRT	Continuous renal replacement therapy
CVC	Central venous catheter
CVC-BSI	Central venous catheter-related bloodstream infection
ED	Emergency department
ENT	Otorhinolaryngology
HD	Haemodialysis
HDU	High dependency unit
Hosp	Hospital
Hrs	Hours
ICU	Intensive care unit
MOH	Ministry of Health
MRIC	Malaysian Registry of Intensive Care
MRO	Multi-drug resistant organism
MRSA	Methicillin-resistant Staphylococcus aureus
MSSA	Methicillin-sensitive Staphylococcus aureus
NAICU	National Audit on Adult Intensive Care Units
NIV	Non-invasive ventilation
NHSN	National Healthcare Safety Network
No./n	Number
O&G	Obstetrics & Gynaecology
$PaCO_2$	Partial pressure of arterial carbon dioxide
PaO_2	Partial pressure of arterial oxygen
Refer.	Referred
SAPS II	Simplified Acute Physiologic Scoring System (Version II)
SD	Standard deviation
SIRS	Systemic inflammatory response syndrome
SMR	Standardised mortality ratio
SN	Staff nurse
SOFA	Sequential Organ Failure Assessment
Sr	Sister
SPSS	Statistical Package for Social Sciences
VAP	Ventilator-associated pneumonia
VCB	Ventilator care bundle
Yrs	Years

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INTRODUCTION

The National Audit on Adult Intensive Care Units (NAICU) was established in 2002 as a quality improvement initiative to systematically review the intensive care practices in Malaysia and where possible, to introduce remedial measures to improve outcome. To date, this audit has published eleven yearly reports and introduced several quality measures such as ventilator care bundle, central venous catheter care bundle, early mobility in ICU and the SSKIN bundle.

In 2009, the NAICU was renamed the Malaysian Registry of Intensive Care (MRIC). This report is the seventh for MRIC, but twelfth in the series.

The objectives of this registry are to:

1. Establish a database of patients admitted to the adult ICUs
2. Review the clinical practices of intensive care
3. Determine clinical outcome
4. Determine the resources and delivery of intensive care service
5. Evaluate the impact of quality improvement measures on patient care
6. Provide comparisons of performance of participating centres against national and international standards
7. Conduct healthcare research related to intensive care

In 2002, 14 state hospitals were first recruited into the audit. The number of centres increased to 22 in 2005. In 2006, 9 more centres were added to the list of participating sites, including one private hospital in Selangor. In 2010, 6 more centres were added to the list of 31 participating hospitals. In 2012, the total number of participating centres expanded to 51 with 49 MOH hospitals, 1 private hospital and 1 university hospital.

This report describes the intensive care practices and outcomes in 49 ICUs in MOH, 1 ICU in a private hospital and 1 ICU in a university hospital.

Data Collection and Verification

Data were collected prospectively by trained nurses (source data providers) and specialists (site investigators) based on a written protocol. Data was initially collected on a standard e-case report form for each patient. Since 1st January 2010, data were entered directly in a central depository via a web-based programme by individual centres.

All participating centres were to ensure "accuracy and completeness" of their individual databases.

Merged data were 'cleaned' and verified before being analysed using SPSS version 20.0.0.

This report is based on all admissions into the 51 participating ICUs from 1st January to 31st December 2014. The total number of admissions in 2014 was 41,370 out of which 2368 (5.7%) were readmissions. For patients with multiple ICU admissions, only the first admission was included in the analysis.

Due to missing and inconsistent data, the sum total of some variables shown in the tables may not add up to the actual number of admissions.

Data Limitations

Limitations to the registry data were mainly related to data collection and data entry. Some of the participating ICUs experienced rapid turnover of their site investigators and source data providers resulting in under-reporting and data inconsistencies. Data from several centres with low reporting rates were excluded from some of the analysis of the variables.

Format of Report

The format of this report follows the patient's journey in four sections: demographics, interventions, complications and outcomes. Information is reported on a total of 38,904 ICU admissions.

In this report, information was provided for individual centres. Wherever appropriate, comparisons were made between three categories of hospitals based on the number of ICU admissions. MOH hospitals were divided into three categories: centres with 1000 admissions and more, centres with 500 to 999 admissions and those with less than 500 admissions.

Where relevant, trends of certain variables over the years were reported.

This report also includes ICU admissions for dengue infection, central venous care bundle compliance, central venous catheter-related bloodstream infections and early mobility in ICU compliance in MOH participating centres.

SECTION A:

GENERAL INFORMATION

Table 1 : No. of ICU beds and bed occupancy rate, by MOH hospitals, 2010–2014

Hospital	Number of functional ICU beds (as of 31-12-2014)	Median ICU bed occupancy rate %				
		2010	2011	2012	2013	2014
AS	24	83.2	87.0	96.7	93.3	88.8
PP	22	61.5	89.9	88.7	90.9	90.5
IPH	26	104.0	107.0	106.0	104.0	109.0
KL	30	109.3	107.5	111.7	110.6	114.1
SLG	24	97.7	111.4	99.8	101.8	92.7
KLG	32	91.9	87.8	108.3	105.9	112.9
SBN	8	114.0	118.4	114.6	108.3	111.7
MLK	24	88.1	106.0	107.9	97.5	90.7
JB	29	108.7	106.2	105.6	109.4	109.0
KTN	18	103.0	105.2	106.4	106.5	110.3
KT	21	93.9	102.0	103.6	104.6	94.2
KB	20	88.5	80.8	80.0	96.2	109.2
KCH	16	104.9	116.6	125.9	101.0	107.6
KK	21	100.1	101.7	93.4	95.9	90.9
SP	16	80.9	84.6	84.9	92.5	82.7
PJY	11	89.5	78.2	75.2	71.2	84.7
MUR	8	89.6	82.4	97.5	97.5	94.2
TI	4	91.0	101.3	123.8	105.2	114.0
TPG	20	98.4	103.2	92.7	84.7	81.4
SJ	10	90.7	89.6	99.1	80.2	81.3
KJG	6	75.6	78.9	77.2	77.1	84.2
KGR	5	70.2	63.3	77.3	78.1	80.8
TML	18	110.5	104.0	113.0	127.0	88.8
KP	8	56.2	68.5	61.8	72.4	91.7
SMJ	8	79.0	82.4	92.7	85.5	92.4
BP	7	71.4	69.0	87.0	79.6	74.8
TW	10	82.5	60.6	80.7	70.0	78.2
MRI	8	79.7	72.7	76.1	79.6	101.3
KLM	7	99.2	98.9	100.5	95.4	100.2
SDG	13	87.4	88.2	50.4	84.4	85.7
SB	13	102.6	99.2	60	120.5	144.0
DKS	16	116.2	87.9	87.9	99.1	82.2
SI	21	79.2	87.3	86.2	90.2	85.1
SBL	38	118.2	108.1	94.6	94.0	115.7
AMP	12	89.0	85.5	45.7	82.9	74.4
LIK	9	62.0	76.7	76.9	106.0	103.4
LKW	4	-	-	67.0	67.4	59.1
BM	**6**	-	-	65.6	106.8	100.9

SLR	**5**	**-**	**-**	76.0	71.0	79.3
PD	4	**-**	**-**	85.5	65.6	86.0
KKR	5	**-**	**-**	69.8	85.2	87.1
SGT	4	**-**	**-**	58.1	89.7	75.0
TM	2	**-**	**-**	68.7	74.0	113.2
KEM	2	**-**	**-**	59.6	50.9	-
KLP	3	**-**	**-**	21.8	53.0	54.2
LAB	5	**-**	**-**	30.7	41.2	45.5
KEN	4	**-**	**-**	90.4	78.0	80.3
BIN	6	**-**	**-**	88.3	63.2	59.7
LD	4	**-**	**-**	104.2	101.2	103.1
Total	**637**		**-**	**-**	**-**	**-**
Median	**-**	**90.2**	**88.6**	**86.2**	**90.2**	**90.5**

The total number of ICU beds in the 49 MOH hospitals as of 31st December 2014 was 637 with a median bed occupancy rate (BOR) of 90.5%. There was a 6.1% increase (37 beds) in the number of ICU beds from the previous year.

There was a wide variation in the BOR across the centers. Four hospitals, KL, SBN, JB and KTN continuously had their bed occupancy rate more than 100% for the past 5 years while LAB had a consistently low BOR of approximately 40%.

Bed occupancy is used as a measure to indicate the activity of a unit in terms of its maximum capacity. There are several methods of calculating bed occupancy and the impact of these methodological differences will tend to be greatest in specialised areas such as intensive care units, where the duration of admission is generally short but highly variable, and throughput is high. If it is measured in whole numbers of days, intensive care units can show an occupancy of greater than 100%, as more than one patient may use a particular bed on a given day.

It is believed that some MOH ICUs still use the "midnight count" method to calculate BOR and hence BOR maybe lower than if the throughput method was used.

Table 2 : ICU admissions, by individual hospital 2010 – 2014

Hospital	2010	2011	2012	2013	2014
	n (%)	n (%)	n (%)	n(%)	n (%)
AS	1094 (4.1)	1212 (4.1)	1201 (3.5)	1347 (3.6)	1331 (3.4)
PP	911 (3.4)	1198 (4.0)	1287 (3.8)	1121 (3.0)	1134 (2.9)
IPH	1143 (4.2)	1140 (3.8)	926 (2.7)	1203 (3.2)	1217 (3.1)
KL	1947 (7.2)	1842 (6.2)	1971 (5.8)	1905 (5.1)	2144 (5.5)
SLG	1053 (3.9)	1141 (3.8)	1289 (3.8)	1507 (4.0)	1426 (3.7)
KLG	1215 (4.5)	1608 (5.4)	2136 (6.3)	2065 (5.5)	2281 (5.9)
SBN	542 (2.0)	554 (1.9)	537 (1.6)	471 (1.3)	541 (1.4)
MLK	1636 (6.1)	1593 (5.3)	1694 (5.0)	1673 (4.5)	1432 (3.7)
JB	1443 (5.3)	1685 (5.7)	1752 (5.2)	1931 (5.2)	1687 (4.3)
KTN	744 (2.8)	612 (2.1)	641 (1.9)	837 92.2)	1062 (2.7)
KT	1087 (4.0)	1207 (4.1)	1363 (4.0)	1180 (3.2)	1172 (3.0)
KB	826 (3.1)	1125 (3.8)	1286 (3.8)	1337 (3.6)	1607 (4.1)
KCH	512 (1.9)	643 (2.2)	854 (2.5)	950 (2.5)	1140 (2.9)
KK	808 (3.0)	843 (2.8)	954 (2.8)	1022 (2.7)	987 (2.5)
SP	207 (0.8)	270 (0.9)	159 (0.5)	583 (1.6)	953 (2.4)
PJY	523 (1.9)	537 (1.8)	574 (1.7)	606 (1.6)	654 (1.7)
MUR	759 (2.8)	473 (1.6)	636 (1.9)	675 (1.8)	600 (1.5)
TI	276 (1.0)	308 (1.0)	384 (1.1)	401 (1.1)	406 (1.0)
TPG	834 (3.1)	860 (2.9)	1203 (3.5)	1348 (3.6)	1182 (3.0)
SJ	590 (2.2)	579 (1.9)	644 (1.9)	413 (1.1)	409 (1.1)
KJG	323 (1.2)	341 (1.1)	371 (1.1)	321 (0.9)	284 (0.7)
KGR	294 (1.1)	298 (1.0)	350 (1.1)	322 (0.9)	341 (0.9)
SJMC	1578 (5.8)	2018 (6.8)	1467 (4.3)	1335 (3.6)	870 (2.2)
TML	624 (2.3)	543 (1.8)	436 (1.3)	599 (1.6)	837 (2.2)
KP	234 (0.9)	359 (1.2)	334 (1.0)	394 (1.1)	512 (1.3)
SMJ	314 (1.2)	380 (1.3)	403 (1.2)	376 (1.0)	432 (1.1)
BP	409 (1.5)	454 (1.5)	415 (1.2)	459 (1.2)	459 (1.2)
TW	238 (0.9)	274 (0.9)	433 (1.3)	449 (1.2)	498 (1.3)
MRI	302 (1.1)	385 (1.3)	478 (1.4)	481 (1.3)	428 (1.1)
KLM	474 (1.8)	498 (1.7)	601 (1.8)	561 (1.5)	555 (1.4)
SDG	824 (3.1)	883 (3.0)	875 (2.6)	851 (2.3)	835 (2.1)
SB	471 (1.7)	569 (1.9)	490 (1.4)	506 (1.4)	431 (1.1)
DKS	246 (0.9)	526 (1.8)	526 (1.6)	964 (2.6)	950 (2.4)
SI	568 (2.1)	647 (2.2)	806 (2.4)	970 (2.6)	1131 (2.9)
SBL	1234 (4.6)	1260 (4.2)	1583 (4.7)	1922 (5.1)	2284 (5.9)
AMP	534 (2.0)	553 (1.9)	572 (1.7)	566 (1.5)	634 (1.6)
LIK	160 (0.6)	376 (1.3)	270 (0.8)	517 (1.4)	353 (0.9)
UMMC	-	-	474 (1.4)	883 (2.4)	1344 (3.5)

LKW	-	-	157 (0.5)	180 (0.5)	165 (0.4)
BM	-	-	38 (0.1)	158 (0.4)	141 (0.4)
SLR	-	-	154 (0.5)	225 (0.6)	223 (0.6)
PD	-	-	204 (0.6)	245 (0.7)	265 (0.7)
KKR	-	-	149 (0.4)	240 (0.6)	260 (0.7)
SGT	-	-	127 (0.4)	159 (0.4)	150 (0.4)
TM	-	-	17 (0.1)	127 (0.3)	160 (0.4)
KEM	-	-	94 (0.3)	105 (0.3)	91 (0.2)
KLP	-	-	7 (0.0)	116 (0.3)	96 (0.2)
LAB	-	-	107 (0.3)	165 (0.4)	166 (0.4)
KEN	-	-	82 (0.2)	161 (0.4)	144 (0.4)
BIN	-	-	213 (0.6)	260 (0.7)	283 (0.7)
LD	-	-	168 (0.5)	244 (0.7)	217 (0.6)
Total	**26977 (100)**	**29794 (100)**	**33892 (100)**	**37436 (100)**	**38904 (100)**

Figure 1 : **ICU admissions, 2003 – 2014**

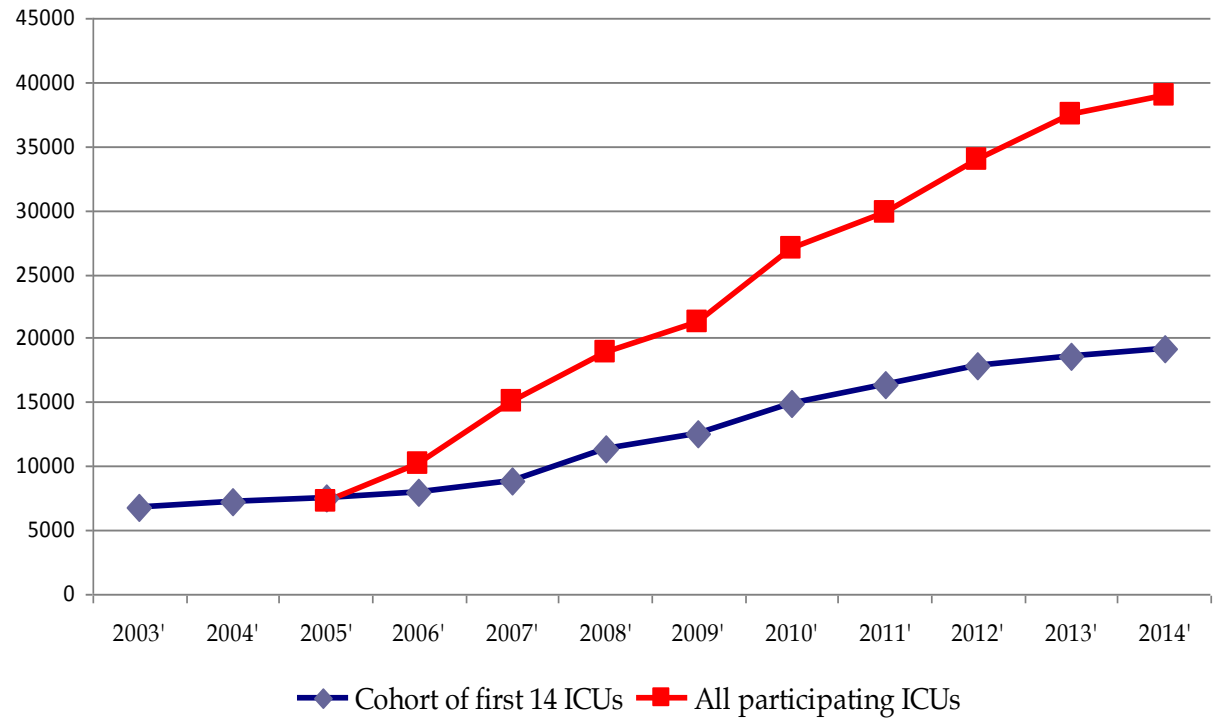
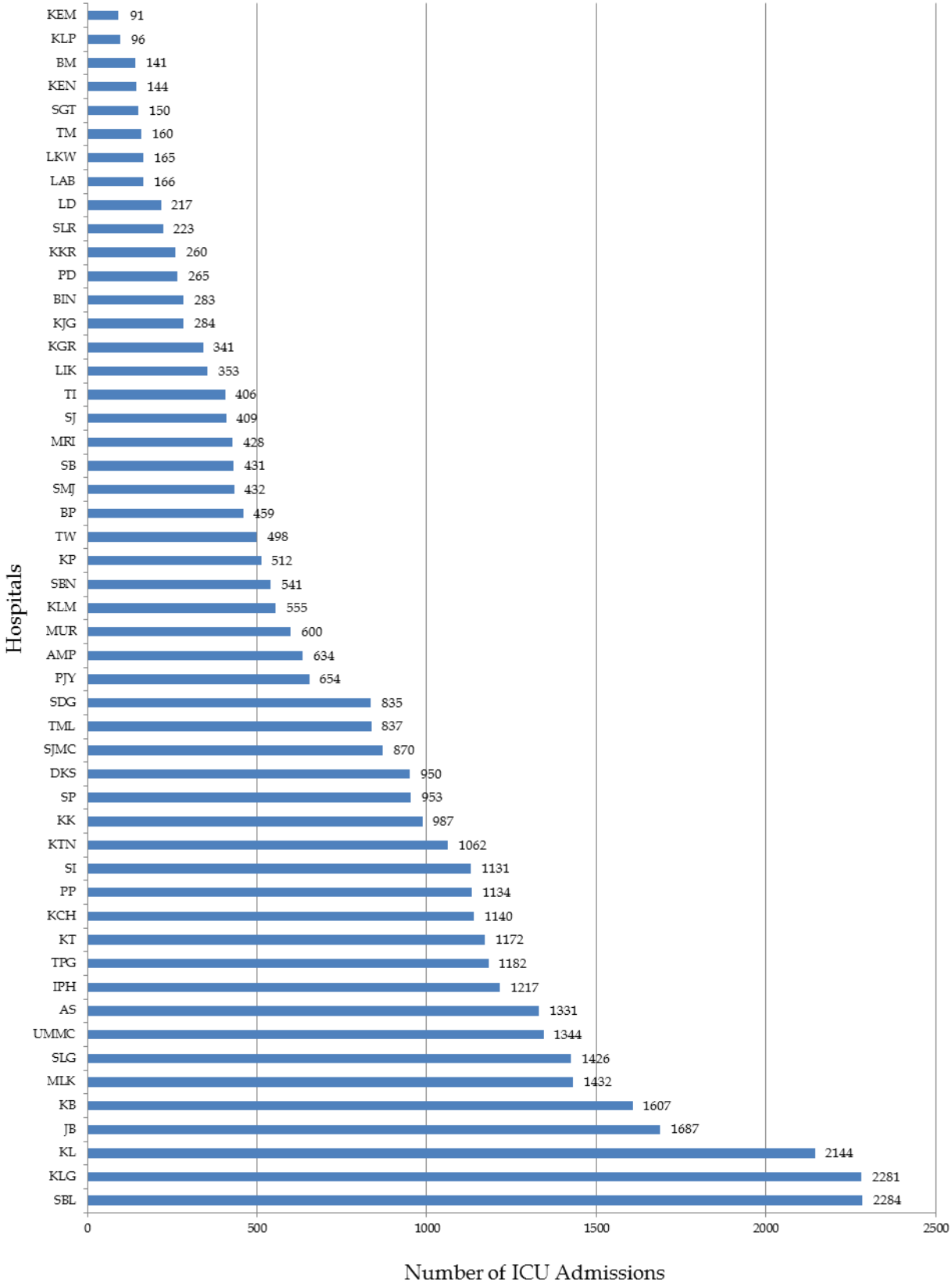


Figure 2 : ICU admissions, by participating centres 2014



The number of admissions had increased over the years in the MOH hospitals. There was an increase of 44% over the past five years from 2010 to 2014. This was attributed to the increase in the number of participating centres, increase in the number of ICU beds in the existing centres and an increase in ICU admissions.

For the initial cohort of 14 hospitals recruited in 2002, the number of admissions increased from 14,961 to 19,161 (an increase of 28%) over the last 5 years. There was an increase of 25% in the number of ICU beds from 251 to 315 over the same period of time for the same cohort.

Readmission within 48 hours is commonly used as an indicator of intensive care patient management, as it might reflect premature ICU discharge or substandard ward care. Although readmission is associated with high mortality, it is unclear whether it reflects substandard practices within a hospital. Low readmission rate may be due to inability to readmit patients due to unavailability of ICU beds.

The readmission rate within the first 48 hours of ICU discharge for the 49 MOH centres was 1.5% in 2014. This rate has varied from 1.3% to 2.1% over the past five years. In a retrospective study done from 2001 to 2007, in 106 ICUs in United States of America, approximately 2% of ICU patients discharged to the ward were readmitted within 48 hours [1].

The Australian Council on Healthcare Standards reported a readmission rate of 1.68% from 2003 to 2010 [2].

Table 3 : Reporting rates, by individual hospital 2010 – 2014

Hospital	2010 %	2011 %	2012 %	2013 %	2014 %
AS	92.2	98.2	93.1	99.6	91.5
PP	87.4	90.1	96.2	92.2	94.1
IPH	96.3	99.2	97.5	95.9	91.0
KL	94.8	98.7	98.5	95.0	94.7
SLG	94.8	95.0	97.6	95.3	92.8
KLG	91.1	86.0	97.3	97.7	95.9
SBN	96.4	99.5	99.3	97.3	96.8
MLK	94.8	99.5	98.8	95.2	94.8
JB	97.4	99.8	97.2	95.7	95.4
KTN	94.8	99.0	97.2	124.4*	88.4
KT	96.1	99.8	99.1	95.0	90.4
KB	95.7	94.4	98.7	83.0	100.7*
KCH	87.5	94.3	95.3	89.6	93.2
KK	89.4	95.4	94.9	95.2	95.3
SP	38.5	53.1	30.8	106.0*	92.7
PJY	96.5	99.1	98.0	92.9	86.6
MUR	63.0	97.4	94.6	98.0	92.0
TI	92.0	98.4	91.2	90.3	94.0
TPG	95.5	94.0	99.3	95.5	94.3
SJ	95.2	98.5	98.3	85.7	73.4
KJG	81.4	95.5	99.7	75.2	57.7
KGR	97.0	98.1	98.6	94.2	95.5
TML	87.4	81.4	62.6	68.3	91.0
KP	98.3	100.0	66.4	51.0	94.6
SMJ	95.4	100.0	99.5	97.9	94.9
BP	95.1	98.5	97.9	106.3*	97.2
TW	78.3	91.7	98.6	95.5	94.0
MRI	94.1	88.5	99.2	97.6	78.0
KLM	95.2	98.9	98.5	94.1	92.2
SDG	66.7	94.9	90.5	108.4*	97.0
SB	74.8	73.1	70.0	46.7	25.7
DKS	54.8	99.6	95.5	92.7	90.3
SI	92.4	86.3	94.6	97.3	95.0
SBL	92.5	100.0	90.7	82.0	89.6
AMP	95.5	85.2	100.0	97.1	119.6*
LIK	27.2	60.9	57.4	80.7	59.9
LKW	-	-	69.8	87.4	82.5
BM	-	-	11.3	39.4	34.7
SLR	-	-	42.5	67.6	67.8

PD	-	-	84.0	93.2	92.7
KKR	-	-	87.1	94.9	102.4*
SGT	-	-	41.2	50.5	20.1
TM	-	-	22.4	104.1*	32.4
KEM	-	-	75.2	82.0	74.6
KLP	-	-	36.8	87.9	43.2
LAB	-	-	96.4	91.2	89.2
KEN	-	-	16.4	59.2	56.5
BIN	-	-	75.5	80.5	84.0
LD	-	-	67.2	92.4	83.5

***** *These hospitals had reporting rates more than 100%.*

The reporting rate is calculated by comparing the number of ICU admissions reported to the MRIC and to the national census, collected by the Head of Anaesthesia service. The total number reported to the MRIC should be equal or slightly less than that of the national census, as patients who were still in hospital on 31st January 2015 were excluded in the analysis.

The following hospitals have consistently contributed high reporting rates of over 90% over the last 5 years: AS, IPH, KL, SLG, SBN, MLK, JB, KT, TI, TPG, KGR, SMJ, BP and KLM.

On the other hand, the following hospitals have been having low reporting rates of less than 50% over the last 5 years: SB, LIK, BM, SLR, SGT and KEN.

Table 4 : Intensive care referrals and refusal of admission, by individual hospital 2010 – 2014

Hosp	2010		2011		2012		2013		2014	
	No. refer.	% denied adm.	No. refer.	% denied adm.	No. refer.	% denied adm.	No. refer.	% denied adm.	No. refer.	% denied adm.
AS	*	*	*	*	*	*	*	*	*	*
PP	1292	83.3	942	70.2	1329	67.8	1365	73.6	1145	66.1
IPH	1275	69.3	1525	66.7	1834	63.4	1639	70.2	1852	62.2
KL	2218	34.6	1971	32.8	2364	30.4	2515	30.1	3393	30.0
SLG	151	40.4	448	27.2	1173	24.2	1537	35.3	1449	28.2
KLG	2155	56.7	2264	33.1	2458	21.2	2576	23.1	31.40	21.2
SBN	1862	59.3	2125	60.8	1929	56.0	1640	51.6	853	49.1
MLK	1035	70.3	919	55.2	993	61.2	1285	73.9	2451	43.0
JB	2065	50.4	2069	39.8	2205	28.8	2634	33.7	2495	40.9
KTN	1092	29.1	791	42.4	455	39.6	608	40.0	241	29.5
KT	264	20.1	150	18.0	544	26.3	183	27.9	443	19.6
KB	1399	63.3	1431	50.1	1417	41.5	1884	46.9	2817	46.8
KCH	326	61.4	477	51.4	1132	57.8	1271	53.1	1474	52.7
KK	992	13.2	1340	16.0	1282	13.0	1619	21.7	1364	17.9
SP	*	*	*	*	254	44.1	562	46.1	74	21.6
PJY	*	*	*	*	36	5.6	486	0.6	*	*
MUR	619	15.8	685	31.4	903	34.3	1223	31.5	1368	28.7
TI	186	21.0	54	40.7	170	42.9	156	49.1	440	49.3
TPG	902	2.0	958	0.5	1498	10.4	2004	12.4	1360	6.5
SJ	758	23.5	625	31.2	592	34.1	813	41.7	657	28.9
KJG	170	5.3	67	19.4	*	*	488	22.1	145	37.9
KGR	230	21.7	201	20.4	405	12.8	390	16.7	397	15.1
TML	800	35.3	921	35.6	875	38.5	836	37.6	834	38.3
KP	372	33.3	412	7.3	412	9.7	587	21.8	684	14.0
SMJ	203	16.3	191	13.1	145	13.8	122	12.3	232	2.6
BP	382	8.6	454	2.6	372	2.2	458	3.7	443	1.1
TW	250	0.0	297	*	505	3.2	591	5.4	844	19.1
MRI	141	16.3	81	18.5	132	4.6	335	22.4	61	13.1
KLM	411	2.9	509	2.9	710	5.2	699	10.7	730	6.6
SDG	581	21.5	712	14.2	506	22.9	1221	10.2	1525	12.0
SB	*	*	*	*	*	*	565	22.5	506	22.7
DKS	130	38.5	10	50.0	214	33.6	81	26.0	246	20.3
SI	478	35.6	635	34.8	547	21.4	734	31.7	484	28.5
SBL	119	40.3	*	*	689	17.4	636	14.8	1607	9.2
AMP	*	*	149	39.6	716	26.7	1333	29.5	1419	21.9
LIK	*	*	*	*	*	*	*	*	*	*
UMMC	-	-	-	-	657	57.5	955	41.8	55	34.6
LKW	-	-	-	-	*	*	171	0.6	*	*

BM	-	-	-	-	*	*	*	*	*	*
SLR	-	-	-	-	55	10.9	166	7.2	277	2.5
PD	-	-	-	-	216	7.4	249	1.6	288	0.7
KKR	-	-	-	-	49	24.5	105	27.6	263	36.5
SGT	-	-	-	-	*	*	*	*	*	*
TM	-	-	-	-	*	*	95	3.2	148	10.1
KEM	-	-	-	-	60	1.7	119	12.6	122	11.5
KLP	-	-	-	-	*	*	100	3.0	99	6.1
LAB	-	-	-	-	*	*	*	*	*	*
KEN	-	-	-	-	46	4.4	*	*	*	*
BIN	-	-	-	-	*	*	*	*	*	*
LD	-	-	-	-	*	*	*	*	67	43.3
Total	**22861**	**36.5**	**25321**	**34.2**	**31341**	**32.0**	**37962**	**29.4**	**39586**	**29.8**

* *Missing data*

The reason for ICU refusal for the purpose of this registry was limited to the unavailability of ICU beds. In 2014, 30% of patients were denied ICU admission. Over the past five years, the percentage of patients denied ICU admission has reduced steadily due to the overall increase in the number of ICU beds in most MOH hospitals.

In an observational prospective study, the ICU refusal rates varied greatly across ICUs in 11 hospitals in France ranging from 7.1 to 63.1%, with reasons for refusal as being too well to benefit, too sick to benefit and unavailability of ICU beds [3].

SECTION B:

PATIENT CHARACTERISTICS

Table 5 : Gender 2010-2014

Gender	2010 n (%)	2011 n (%)	2012 n (%)	2013 n (%)	2014 n (%)
Male	16040 (59.6)	17788 (59.7)	20295 (60.0)	22331 (59.7)	22926 (59.0)
Female	10875 (40.4)	11968 (40.2)	13554 (40.0)	15048 (40.3)	15895 (41.0)

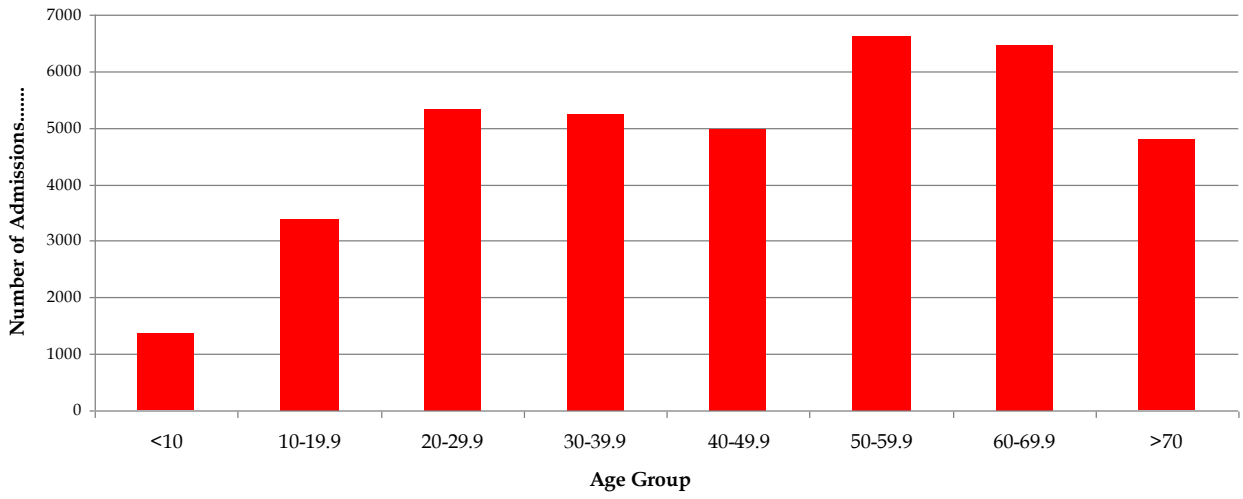
The ratio of male to female patients (3:2) has remained fairly constant over the past five years.

Table 6 : Mean age (years) 2010 – 2014

Age	2010	2011	2012	2013	2014
All ages, Mean ± SD yrs	45.6 ± 20.6	46.5± 20.7	46.6 ± 20.7	46.5 ± 20.6	45.9 ± 20.6
Age ≥ 18 years Mean ± SD yrs	49.4 ± 18.1	50.2± 18.0	50.3 ± 17.8	50.3 ± 17.7	49.7 ± 17.8

The average age for all age groups was 45.9 ± 20.6 years (median 47.7 years). For adult patients, with age exceeding 18 years, the average age was 49.7 ± 17.8 years (median 51.1 years). The average age of patients admitted to ICUs has remained fairly similar over the last five years.

Figure 3 : Age groups, 2014

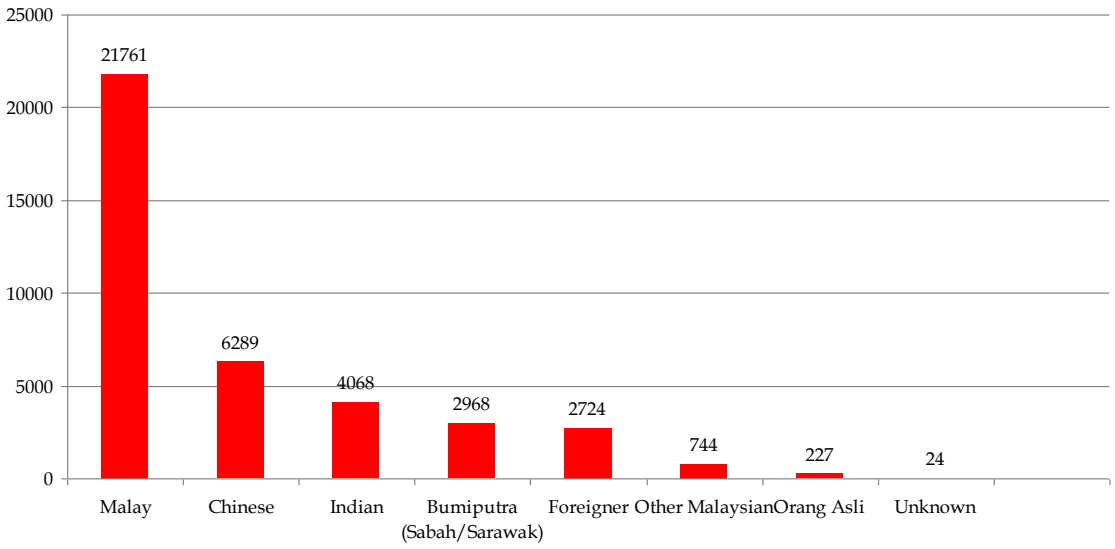


Geriatric patients (age 65 years and above) and paediatric patients (age less than 12 years) accounted for 20.6% and 4.0% of total admissions respectively in 2014.

Table 7 : Ethnic groups 2014

Ethnic group	n	%
Malay	21761	56.1
Chinese	6289	16.2
Indian	4068	10.5
Bumiputra Sabah/Sarawak	2968	7.6
Foreigner	2724	7.0
Other Malaysian	744	1.9
Orang Asli	227	0.6
Unknown	24	0.1
Total	**38, 805**	**100**

Figure 4 : Ethnic groups 2014



The distribution of patients admitted to ICU reflected the distribution of the ethnic groups in the general population in Malaysia. Foreigners contributed 7% to the overall ICU admissions.

Table 8 : Length of ICU stay, by individual hospital 2010 – 2014

Hospital	Mean (Median), days				
	2010	2011	2012	2013	2014
AS	4.1 (2.2)	4.6 (2.8)	5.6 (3.1)	4.9 (2.9)	4.6 (2.8)
PP	5.6 (2.8)	5.1 (2.5)	5.4 (2.6)	5.9 (2.7)	6.2 (2.9)
IPH	5.0 (2.6)	5.3 (2.6)	5.5 (2.9)	5.9 (3.0)	6.1 (3.2)
KL	4.7 (2.5)	4.7 (2.8)	5.1 (2.8)	5.0 (2.7)	4.6 (2.4)
SLG	4.4 (2.1)	4.4 (2.4)	4.5 (2.6)	4.2 (2.0)	4.7 (2.5)
KLG	4.9 (2.7)	3.6 (2.0)	4.1 (2.1)	4.3 (1.9)	4.0 (2.0)
SBN	5.1 (2.8)	4.8 (2.7)	4.9 (2.7)	5.9 (2.9)	5.0 (2.7)
MLK	4.1 (2.1)	4.0 (2.7)	4.1 (2.1)	4.1 (2.1)	4.8 (2.5)
JB	5.0 (2.8)	5.2 (3.0)	5.2 (3.0)	4.7 (2.8)	5.4 (3.1)
KTN	4.4 (2.5)	6.3 (3.4)	6.3 (3.6)	5.6 (3.3)	5.5 (2.8)
KT	4.5 (2.5)	4.0 (2.3)	4.1 (2.2)	4.6 (2.7)	4.1 (2.1)
KB	4.8 (2.0)	4.7 (1.9)	4.7 (2.3)	4.9 (2.3)	4.2 (2.3)
KCH	5.0 (2.7)	5.6 (3.0)	5.2 (2.9)	4.7 (2.6)	3.9 (2.0)
KK	6.2 (3.2)	6.3 (3.7)	6.3 (3.8)	6.2 (3.6)	5.9 (3.6)
SP	4.6 (3.2)	4.0 (2.4)	7.6 (2.2)	4.7 (2.6)	4.8 (2.8)
PJY	3.6 (1.7)	3.2 (1.5)	3.2 (1.5)	3.5 (1.8)	3.9 (1.7)
MUR	3.5 (1.8)	4.8 (2.4)	3.5 (1.8)	3.0 (1.8)	3.7 (1.9)
TI	4.2 (1.8)	4.0 (2.0)	3.5 (2.1)	3.0 (1.8)	3.2 (1.7)
TPG	7.4 (3.5)	7.0 (3.7)	5.1 (2.7)	4.1 (2.7)	4.7 (2.6)
SJ	4.3 (2.3)	4.3 (2.1)	4.2 (2.1)	6.2 (3.1)	6.5 (3.5)
KJG	3.8 (2.1)	4.0 (2.7)	4.6 (2.9)	4.7 (3.2)	4.8 (3.1)
KGR	4.2 (2.2)	3.4 (1.7)	4.3 (2.1)	4.2 (2.6)	4.2 (2.1)
SJMC	2.5 (1.3)	2.4 (1.3)	2.7 (1.6)	2.6 (1.6)	2.5 (1.6)
TML	4.9 (2.8)	5.1 (3.0)	6.4 (3.5)	4.8 (2.6)	4.7 (2.7)
KP	3.5 (2.0)	5.8 (3.1)	5.7 (3.0)	5.5 (2.9)	4.7 (2.7)
SMJ	4.4 (2.2)	3.7 (2.3)	3.9 (2.5)	3.6 (2.2)	3.2 (1.9)
BP	4.8 (2.7)	4.3 (2.2)	5.7 (3.3)	4.5 (2.8)	4.4 (2.7)
TW	4.1 (2.3)	3.5 (2.2)	3.5 (2.4)	3.8 (2.5)	4.2 (2.5)
MRI	5.4 (2.8)	4.4 (2.3)	5.2 (2.5)	4.5 (2.6)	4.9 (3.0)
KLM	3.9 (2.3)	3.6 (2.0)	3.3 (1.9)	3.2 (1.7)	3.3 (1.8)
SDG	4.3 (2.1)	4.8 (2.7)	4.8 (2.8)	4.4 (2.2)	4.4 (2.4)
SB	5.3 (2.9)	4.7 (2.4)	5.1 (2.5)	5.4 (3.3)	6.8 (4.0)
DKS	6.8 (3.2)	6.0 (3.1)	5.1 (3.1)	4.5 (2.5)	3.7 (1.9)
SI	5.2 (2.3)	7.0 (3.7)	6.2 (3.3)	5.4 (2.7)	5.1 (2.6)
SBL	5.7 (2.8)	6.0 (3.2)	5.7 (3.1)	5.5 (3.1)	4.8 (2.7)
AMP	5.3 (2.9)	5.4 (3.2)	5.0 (2.9)	5.4 (2.9)	5.7 (3.0)
LIK	2.4 (1.5)	2.5 (1.6)	3.5 (1.8)	3.5 (1.9)	4.1 (2.6)
UMMC	-	-	7.2 (3.8)	5.6 (3.3)	5.5 (2.6)
LKW	-	-	5.3 (2.0)	4.1 (2.0)	3.7 (2.1)
BM	-	-	-	9.0 (4.3)	8.8 (5.6)
SLR	-	-	6.3 (3.2)	6.3 (3.0)	6.6 (3.0)
PD	-	-	4.0 (2.5)	4.4 (2.8)	3.5 (2.0)

KKR	-	-	5.6 (2.9)	5.7 (3.4)	5.8 (3.2)
SGT	-	-	4.5 (2.8)	3.3 (2.3)	3.7 (2.1)
TM	-	-	3.5 (1.9)	3.8 (2.5)	4.5 (3.3)
KEM	-	-	3.3 (2.6)	4.2 (2.8)	5.0 (2.6)
KLP	-	-	1.3 (0.8)	2.9 (1.5)	3.0 (2.0)
LAB	-	-	4.6 (2.2)	4.4 (1.9)	4.1 (1.8)
KEN	-	-	6.5 (2.9)	5.1 (2.9)	5.4 (3.0)
BIN	-	-	5.4 (2.8)	3.9 (2.1)	3.9 (2.3)
LD	-	-	5.7 (2.7)	4.8 (2.7)	5.1 (3.4)
Total	**4.7 (2.4)**	**4.7 (2.4)**	**4.8 (2.6)**	**4.7 (2.5)**	**4.7 (2.5)**

The average length of ICU stay in 2014 was 4.7 days. This has not changed much over the past 5 years.

The median length of stay was 2.5 days.

SJMC recorded the shortest length of stay (2.5 days).

Among the MOH ICUs, KLP had the shortest average length of stay (3.0 days). BM recorded the longest length of ICU stay (8.8 days).

Table 9 : Length of hospital stay, by individual hospital 2010 – 2014

Hospital	Mean (Median), days				
	2010	2011	2012	2013	2014
AS	13.4 (8.3)	14.5 (9.5)	15.1 (9.2)	14.6 (8.8)	13.1 (7.9)
PP	21.1 (12.0)	19.0 (11.5)	19.5 (12.0)	19.2 (12.0)	20.2 (12.5)
IPH	14.6 (9.4)	15.4 (9.3)	16.0 (10.6)	15.2 (9.8)	15.3 (10.0)
KL	17.8 (10.3)	19.1 (11.0)	17.7 (10.7)	16.5 (10.2)	14.8 (8.6)
SLG	15.3 (9.8)	16.7 (11.0)	17.3 (12.1)	15.2 (10.5)	15.2 (9.9)
KLG	14.1 (9.6)	13.6 (8.4)	12.2 (7.6)	12.5 (7.80	11.5 (7.4)
SBN	16.7 (10.1)	19.9 (11.0)	17.0 (10.6)	18.5 (10.7)	17.5 (10.4)
MLK	13.6 (8.3)	14.2 (9.3)	16.0 (10.0)	14.4 (8.6)	16.2 (9.6)
JB	14.2 (9.8)	14.6 (10.1)	14.7 (9.9)	13.6 (9.3)	14.2 (9.4)
KTN	14.9 (10.0)	17.1 (12.1)	18.0 (12.3)	15.8 (10.8)	16.6 (10.4)
KT	12.7 (8.9)	12.6 (8.3)	14.5 (9.7)	14.6 (9.80	13.5 (8.8)
KB	16.6 (10.1)	14.5 (10.0)	16.5 (10.0)	14.4 (9.6)	12.0 (8.0)
KCH	19.6 (12.8)	20.5 (12.6)	21.4 (13.7)	19.2 (12.1)	19.5 (11.8)
KK	21.0 (13.2)	21.4 (14.1)	19.9 (11.7)	17.7 (11.1)	16.4 (10.9)
SP	12.8 (8.3)	10.8 (7.4)	14.0 (8.2)	12.9 (8.9)	12.6 (8.4)
PJY	11.7 (8.1)	11.6 (8.0)	11.7 (8.6)	13.2 (8.2)	12.4 (7.4)
MUR	13.3 (8.3)	16.3 (10.3)	22.0 (10.5)	13.6 (8.4)	13.6 (9.1)
TI	12.4 (8.0)	12.5 (8.4)	14.2 (9.6)	11.4 (8.2)	11.3 (7.5)
TPG	14.3 (8.7)	15.1 (10.3)	12.6 (8.3)	10.7 (7.8)	11.7 (8.0)
SJ	11.4 (8.4)	12.9 (9.1)	13.0 (8.2)	14.3 (9.7)	15.9 (11.1)
KJG	12.2 (7.6)	11.2 (7.9)	13.5 (8.3)	12.5 (8.6)	13.4 (8.7)
KGR	12.7 (8.1)	12.6 (8.2)	18.3 (10.9)	14.2 (9.7)	13.8 (7.9)
SJMC	7.3 (5.1)	7.7 (5.3)	8.4 (5.1)	7.7 (4.6)	7.7 (4.8)
TML	13.8 (9.0)	14.6 (9.9)	14.5 (10.7)	13.1 (9.3)	11.9 (8.0)
KP	12.1 (6.0)	12.8 (8.7)	15.5 (9.3)	13.6 (8.5)	13.3 (8.0)
SMJ	12.5 (8.0)	12.1 (7.1)	12.0 (7.2)	10.5 (7.1)	8.4 (6.1)
BP	13.1 (8.3)	11.4 (8.0)	13.6 (9.5)	14.0 (9.0)	15.9 (9.7)
TW	14.1 (9.0)	15.3 (9.1)	13.0 (8.4)	14.1 (9.1)	13.5 (8.6)
MRI	16.6 (10.6)	15.0 (9.6)	14.0 (10.8)	12.4 (9.9)	13.1 (10.0)
KLM	10.6 (7.4)	11.4 (7.3)	12.6 (7.8)	11.7 (7.9)	11.6 (7.6)
SDG	14.6 (8.8)	14.7 (9.0)	14.6 (9.4)	14.3 (8.1)	13.2 (7.5)
SB	15.4 (9.0)	13.1 (8.1)	13.1 (8.3)	15.7 (10.5)	15.3 (10.0)
DKS	15.8 (9.0)	13.7 (10.1)	12.4 (8.2)	11.4 (7.6)	11.8 (6.8)
SI	16.6 (10.9)	19.7 (12.2)	16.0 (9.7)	14.6 (9.2)	15.3 (9.3)
SBL	17.1 (9.8)	19.5 (11.2)	19.2 (10.8)	17.0 (9.8)	15.4 (7.9)
AMP	15.6 (9.0)	15.1 (10.2)	15.4 (10.5)	15.1 (10.7)	16.1 (10.5)
LIK	11.8 (8.1)	11.6 (7.6)	18.4 (9.7)	15.3 (10.9)	15.0 (10.6)
UMMC	-	-	25.2 (16.2)	22.0 (12.4)	19.7 (11.4)
LKW	-	-	12.7 (6.4)	12.5 (6.6)	10.5 (5.9)
BM	-	-	20.9 (10.1)	16.3 (10.3)	14.8 (11.5)
SLR	-	-	12.1 (7.9)	12.2 (6.6)	13.3 (8.2)
PD	-	-	10.2 (5.9)	10.9 (7.4)	10.2 (5.9)

KKR	-	-	12.5 (9.6)	13.6 (8.6)	11.4 (7.0)
SGT	-	-	14.8 (8.3)	10.4 (7.1)	10.7 (7.6)
TM	-	-	12.0 (8.2)	9.1 (6.3)	12.5 (7.3)
KEM	-	-	9.6 (7.8)	12.3 (8.0)	11.9 (8.0)
KLP	-	-	6.3 (6.9)	11.4 (6.9)	11.3 (7.5)
LAB	-	-	14.4 (6.4)	10.0 (4.3)	9.4 (5.9)
KEN	-	-	19.2 (10.4)	15.0 (9.6)	15.1 (10.4)
BIN	-	-	21.5 (12.6)	14.2 (10.3)	13.4 (7.9)
LD	-	-	12.8 (7.7)	13.2 (8.3)	14.2 (9.5)
Total	**14.6 (9.0)**	**14.9 (9.3)**	**15.5 (9.5)**	**14.4 (9.0)**	**14.2 (8.7)**

The average length of hospital stay was 14.2 days with a median of 8.7 days.

PP recorded the longest length of hospital stay of 20.2 days. This was followed by UMMC and KCH which had length of hospital stays of 19.7 and 19.5 days respectively.

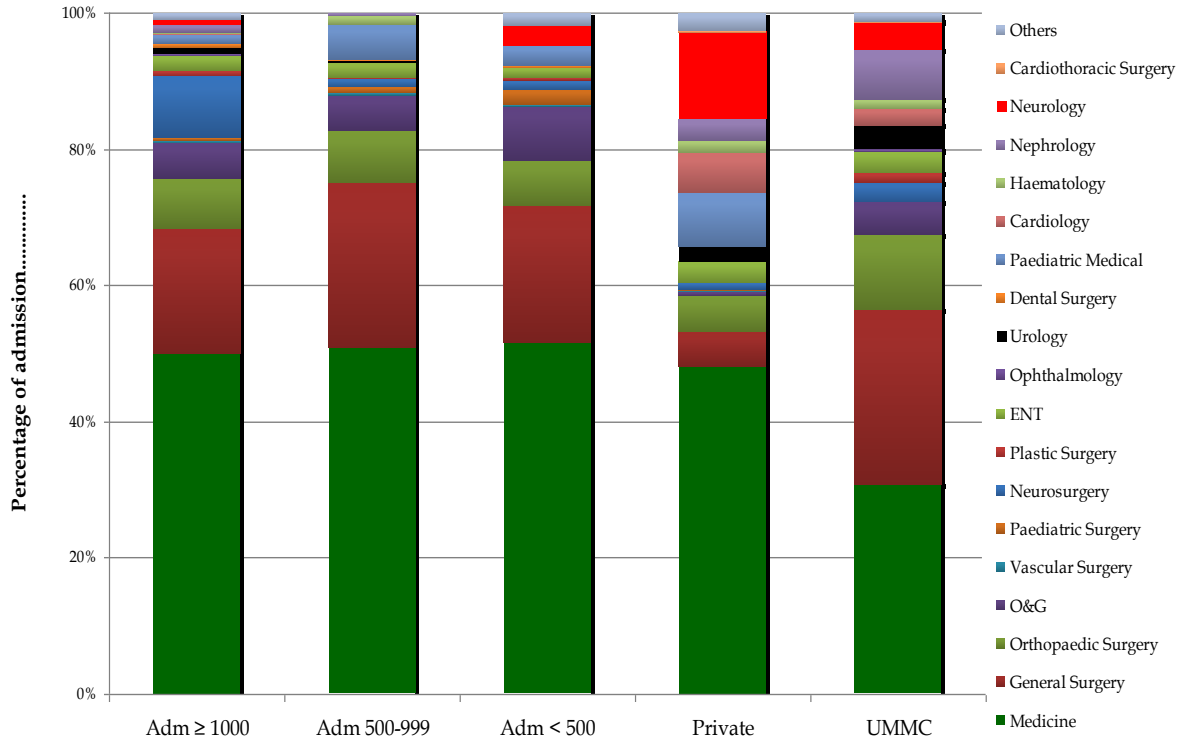
Among MOH hospitals, SMJ recorded the shortest length of hospital stay of 8.4 days.

SJMC recorded a length of hospital stay of 7.7 days.

Table 10 : Referring units, by category of ICU 2014

Referring units	ICUs					
	Adm ≥ 1000 n (%)	Adm 500 - 999 n (%)	Adm < 500 n (%)	Private n (%)	UMMC n (%)	Total n (%)
Medicine	11095 (50.0)	4095 (50.9)	3463 (54.2)	416 (47.8)	397 (30.6)	**19466 (50.2)**
General Surgery	4090 (18.4)	1950 (24.2)	1334 (20.9)	46 (5.3)	335 (25.8)	**7755 (20.0)**
Orthopaedic Surgery	1629 (7.3)	622 (7.7)	452 (7.1)	46 (5.3)	143 (11.0)	**2892 (7.5)**
O&G	1166 (5.3)	419 (5.2)	531 (8.3)	4 (0.5)	61 (4.7)	**2181 (5.6)**
Vascular Surgery	100 (0.5)	29 (0.4)	10 (0.2)	2 (0.2)	0 (0.0)	**141 (0.4)**
Paediatric Surgery	81 (0.4)	59 (0.7)	144 (2.3)	3 (0.3)	0 (0.0)	**287 (0.7)**
Neurosurgery	2005 (9.0)	94 (1.2)	99 (1.5)	8 (0.9)	36 (2.8)	**2242 (5.8)**
Plastic Surgery	173 (0.8)	14 (0.2)	35 (0.5)	1 (0.1)	19 (1.5)	**242 (0.6)**
ENT	479 (2.2)	164 (2.0)	97 (1.5)	26 (3.0)	42 (3.2)	**808 (2.1)**
Ophthalmology	18 (0.1)	6 (0.1)	3 (0.0)	0 (0.0)	2 (0.2)	**29 (0.1)**
Urology	238 (1.1)	25 (0.3)	0 (0.0)	19 (2.2)	47 (3.6)	**329 (0.8)**
Dental Surgery	104 (0.5)	25 (0.3)	17 (0.3)	0 (0.0)	0 (0.0)	**146 (0.4)**
Paediatric Medical	274 (1.2)	414 (5.1)	194 (3.0)	70 (8.0)	1 (0.1)	**953 (2.5)**
Cardiology	52 (0.2)	6 (0.1)	4 (0.1)	50 (5.7)	30 (2.3)	**142 (0.4)**
Haematology	41 (0.2)	86 (1.1)	1 (0.0)	16 (1.8)	20 (1.5)	**164 (0.4)**
Nephrology	232 (1.0%	34 (0.4)	0 (0.0)	26 (3.0)	93 (7.2)	**385 (1.0)**
Neurology	168 (0.8)	0 (0.0)	3 (0.0)	111 (12.8)	52 (4.0)	**334 (0.9)**
Cardiothoracic Surgery	11 (0.0)	2 (0.0)	0 (0.0)	3 (0.3)	3 (0.2)	**19 (0.0)**
Others	242 (1.1)	7 (0.1)	2 (0.0)	23 (2.6)	15 (1.2)	**289 (0.7)**
Total	**22198 (100.0)**	**8051 (100.0)**	**6389 (100.0)**	**870 (100.0)**	**1296 (100.0)**	**38804 (100.0)**

Figure 5 : Referring units, by category of ICU 2014



The percentage of patients admitted from the medical-based disciplines increased from 29.5% in 2003 to 50.2% in 2014.

Table 11 : Category of patients, by category of ICU 2014

	ICUs					
	Adm ≥ 1000 n (%)	**Adm 500 - 999** n (%)	**Adm < 500** n (%)	**Private** n (%)	**UMMC** n (%)	**Total** n (%)
Non-operative	14692 (66.1)	5679 (70.5)	4487 (70.2)	728 (83.7)	740 (61.5)	**26326 (68.0)**
Elective operative	2105 (9.5	776 (9.6)	582 (9.1)	123 (14.1)	194 (16.1)	**3780 (9.8)**
Emergency operative	5415 (24.4)	1600 (19.9)	1326 (20.7)	19 (2.2)	269 (22.4)	**8629 (22.3)**
Total	**22212 (100.0)**	**8055 (100.0)**	**6395 (100.0)**	**870 (100.0)**	**1203 (100.0)**	**38735 (100.0)**

Non-operative — *Refers to patients in whom no surgery was done out within 7 days before ICU admission or during the first 24 hours after ICU admission*

Operative-elective — *Refers to patient in who surgery was done within 7 days before ICU admission or during the first 24 hours after ICU admission on a scheduled basis*

Operative-emergency — *Refers to patient in who surgery was done within 7 days before ICU admission or during the first 24 hours after ICU admission on an unscheduled basis*

Figure 6 : Category of patients, by category of ICU 2014

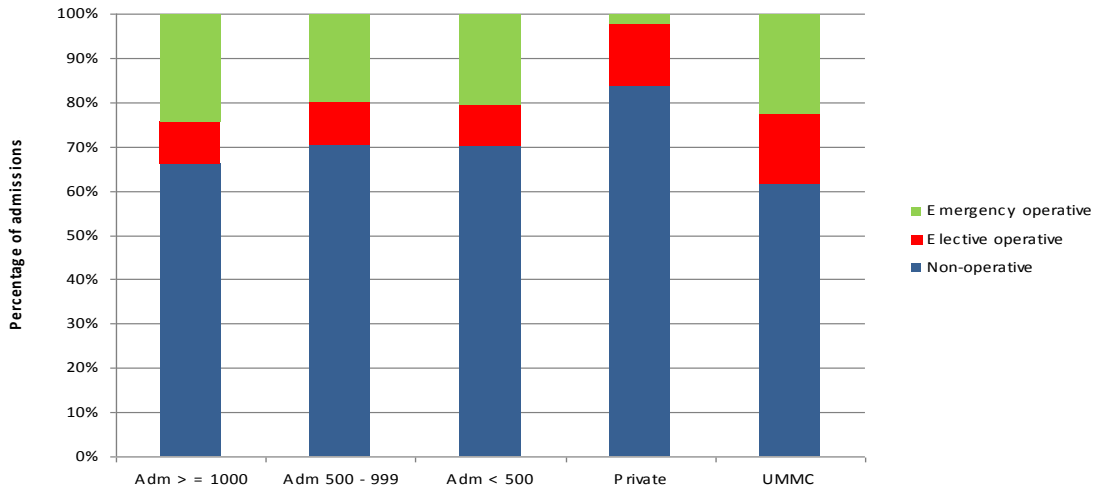
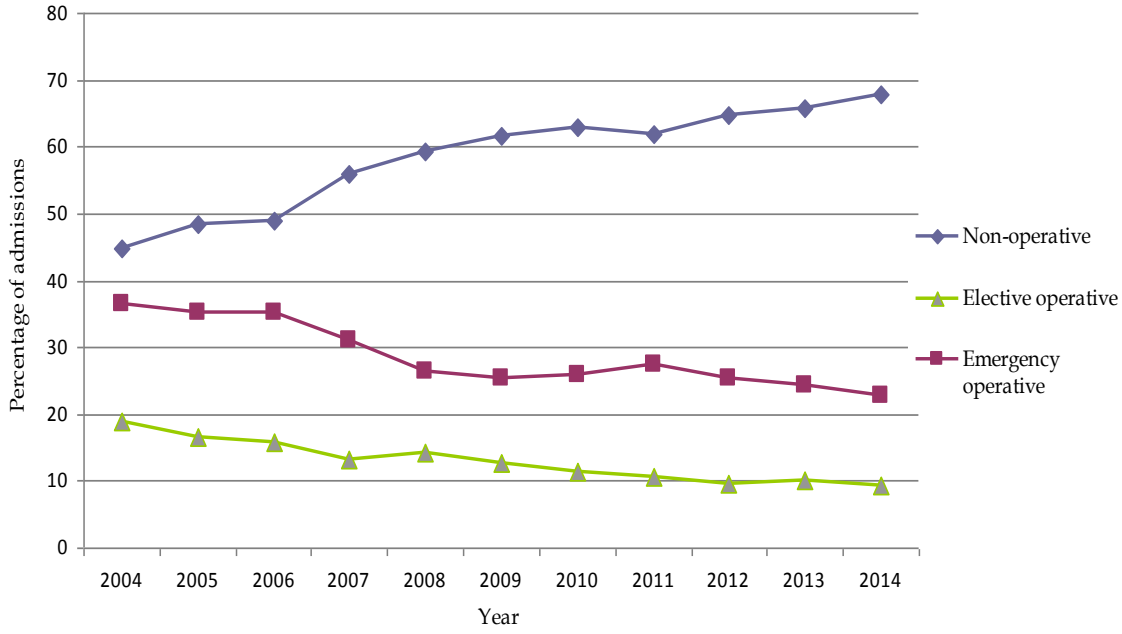


Table 12 : Category of patients in MOH hospitals 2010 - 2014

Category of patients	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)
Non-operative	62.9	62.0	65.1	66.1%	67.8
Elective operative	11.3	10.5	10.3	10.4%	9.4
Emergency operative	25.8	27.5	24.6	23.6%	22.8

Figure 7 : Category of patients in MOH hospitals 2004 – 2014



The categories of patients did not differ much among MOH ICUs.

The proportion of patients admitted into ICU after elective operations was higher in UMMC (16%) and private hospital (14%) compared with that of MOH ICUs (9%).

Emergency operative patients admitted into the private hospital ICU were relatively low (2%) compared with MOH hospitals (23%) and UMMC (23%).

Non-operative admissions accounted for 68%, 62% and 84% of all admissions to MOH, UMMC and SJMC ICUs respectively. There was a steady increase in non-operative patients over the past 10 years with a 21% increase from 2004 to 2014, while the percentage of elective operative and emergency operative patients decreased by 9% and 12% respectively.

Table 13 : Location before ICU admission, by category of ICU 2014

Location	ICUs					
	Adm ≥ 1000 n (%)	Adm 500 - 999 n (%)	Adm < 500 n (%)	Private n (%)	UMMC n (%)	Total n (%)
Ward	7467 33.6%	3092 38.4%	2745 42.9%	221 25.4%	368 29.7%	**13893** **35.8%**
OT	6126 27.6%	1652 20.5%	1238 19.4%	112 12.9%	423 34.2%	**9551** **24.6%**
Emergency department	6697 30.1%	2791 34.7%	2040 31.9%	475 54.6%	410 33.1%	**12413** **32.0%**
Other critical areas	706 3.2%	147 1.8%	74 1.2%	5 0.6%	0 0.1%	**933** **2.4%**
Other locations	235 1.1%	35 0.4%	18 0.3%	49 5.6%	8 0.6%	**345** **0.9%**
Other hospitals	988 4.4%	337 4.2%	278 4.3%	8 0.9%	27 2.2%	**1638** **4.2%**
Total	**22219** **100.0%**	**8054** **100.0%**	**6393** **100.0%**	**870** **100.0%**	**1237** **100.0%**	**38773** **100.0%**

*Location before ICU admission: Refers to the area/location patient was being managed **just before** being admitted into ICU*

Figure 8 : Location before ICU admission, by category of ICU 2014

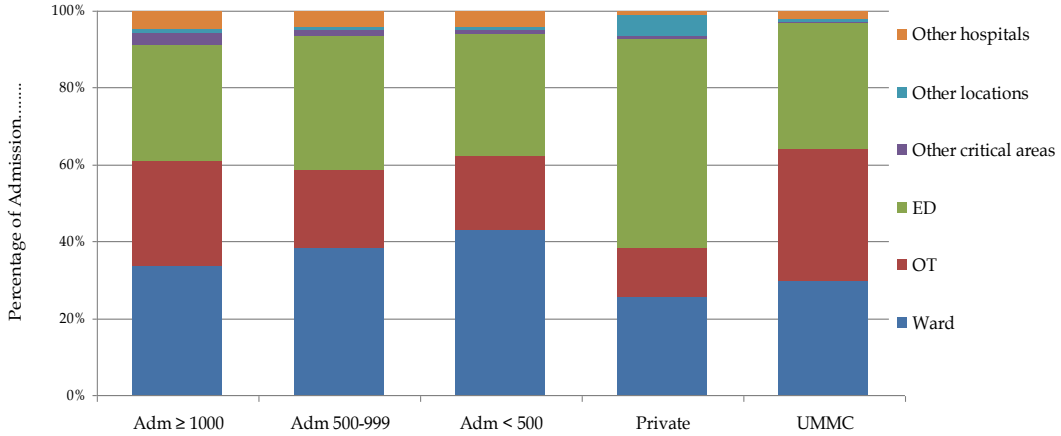
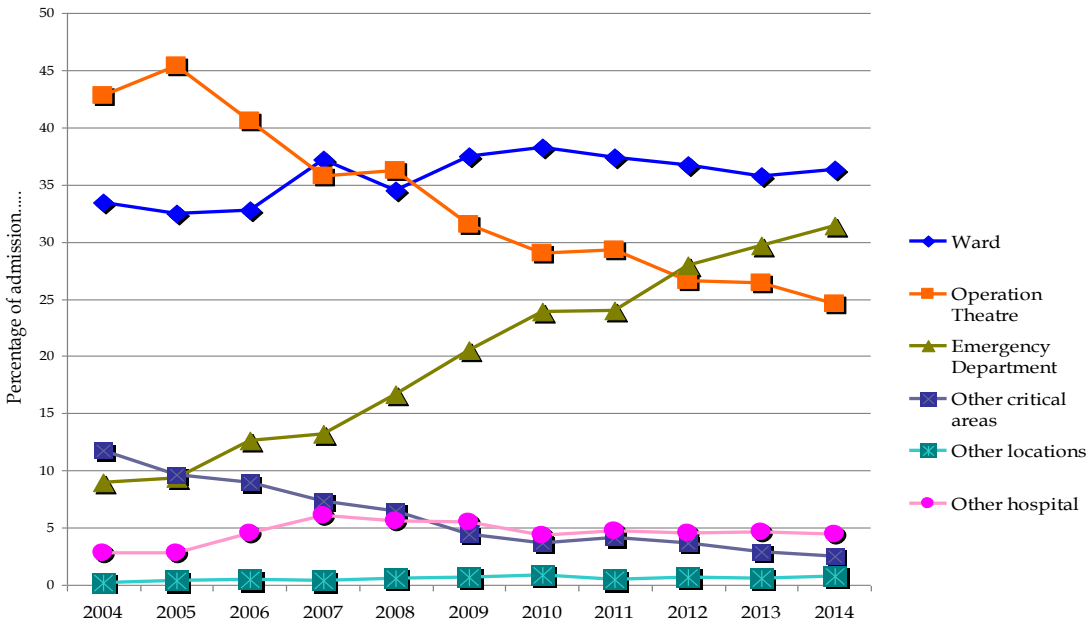


Table 14 : Location before ICU admission in MOH hospitals 2010 – 2014

Location	2010 (%)	2011 (%)	2012 (%)	2013 (%)	2014 (%)
Ward	38.2	37.4	36.7	35.7	36.3
Operation theatre	29.0	29.3	26.6	26.4	24.6
Emergency department	23.9	24.0	27.9	29.7	31.4
Other critical areas	3.7	4.1	3.7	2.9	2.5
Other locations	0.9	0.5	0.7	0.6	0.8
Other hospitals	4.3	4.7	4.5	4.6	4.4

Figure 9 : Location before ICU admission in MOH hospitals 2004 – 2014



The percentage of admissions from the emergency department had increased more than three-fold, while admissions from the operating theatre had decreased by almost half over the past 10 years.

Although the percentage of direct admissions from the operating theatre had decreased, a number of patients from other areas were operative in nature, ranging from 7% of admissions from ED to 16% from other critical care areas (e.g. coronary care unit, cardiothoracic unit, neonatal/paediatric ICU, neurosurgical ICU, urological ICU, haemodialysis unit, high dependency wards, obstetric intensive care ward, ED resuscitation wards).

Table 15: Main organ failure on ICU admission, by category of ICU 2014

Main organ failure	ICUs					
	Adm ≥ 1000 n (%)	Adm 500 - 999 n (%)	Adm < 500 n (%)	Private n (%)	UMMC n (%)	Total n (%)
Without organ failure	6247 31.8%	2177 32.8%	1716 33.4%	556 75.7%	497 38.8%	**11193 33.5%**
Respiratory	3387 17.3%	861 13.0%	1182 23.0%	1 0.1%	105 8.2%	**5536 16.6%**
Cardiovascular	5022 25.6%	1594 24.0%	952 18.5%	2 0.3%	407 31.7%	**7977 23.9%**
Neurological	2212 11.3%	1099 16.6%	674 13.1%	10 1.4%	103 8.0%	**4098 12.3%**
Renal	1296 6.6%	480 7.2%	373 7.3%	43 5.9%	98 7.6%	**2290 6.9%**
Haematological	1303 6.6%	359 5.4%	199 3.9%	118 16.1%	65 5.1%	**2044 6.1%**
Hepatic	148 0.8%	67 1.0%	47 0.9%	4 0.5%	7 0.5%	**273 0.8%**
Total	**19615 (100.0)**	**6637 (100.0)**	**5143 (100.0)**	**734 (100.0)**	**1282 (100.0)**	**33411 (100.0)**

The definition of organ failure is based on the Sequential Organ Failure Assessment (SOFA) [4]
*Main organ failure: Refers to the main or most important organ failure within **24 hours** of ICU admission and management.*

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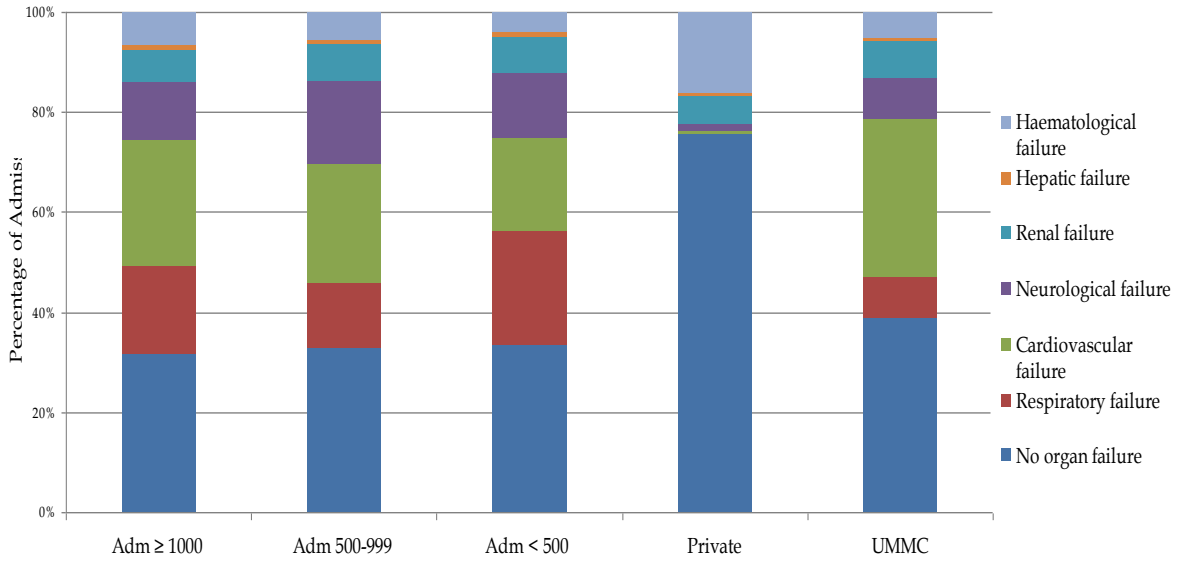
Figure 10 : Main organ failure on ICU admission, by category of ICU 2014

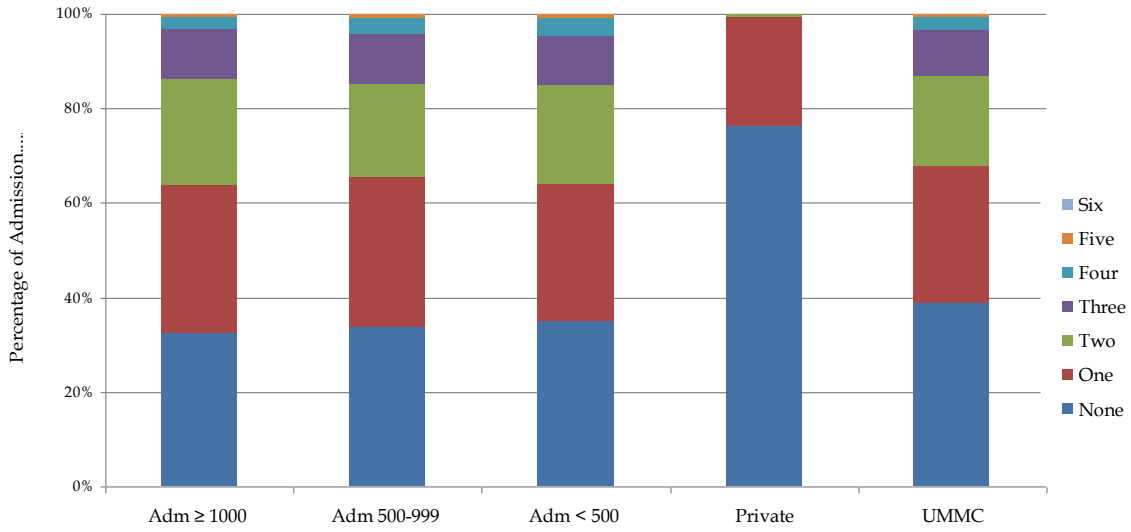


In MOH ICUs, cardiovascular failure (36%) was the most common organ failure during the first 24 hours of ICU admission followed by respiratory (25%), neurological (19%), renal (10%), haematological (9%) and hepatic (1%).

Table 16 : Number of organ failure(s) on ICU admission, by category of ICU 2014

Main organ failure	ICUs					
	Adm ≥ 1000 n (%)	Adm 500 - 999 n (%)	Adm < 500 n (%)	Private n (%)	UMMC n (%)	Total n (%)
Without	6380 (32.5)	2233 (33.6)	1796 (34.9)	559 (76.2)	502 (39.2)	**11470 (34.3)**
Single	6140 (31.3)	2126 (32.0)	1506 (29.3)	172 (23.4)	362 (28.2)	**10306 (30.8)**
Two	4381 (22.3)	1317 (19.8)	1071 (20.8)	3 (0.4)	249 (19.4)	**7021 (21.0)**
Three	2097 (10.7)	694 (10.5)	545 (10.6)	0 (0.0)	126 (9.8)	**3462 (10.4)**
Four	532 (2.7)	216 (3.3)	188 (3.7)	0 (0.0)	38 (3.0)	**974 (2.9)**
Five	79 (0.4)	44 (0.7)	32 (0.6)	0 (0.0)	5 (0.4)	**160 (0.5)**
Six	6 (0.0)	7 (0.1)	5 (0.1)	0 (0.0)	0 (0.0)	**18 (0.1)**
Total	**19615 (100.0)**	**6637 (100.0)**	**5143 (100.0)**	**734 (100.0)**	**1282 (100.0)**	**33411 (100.0)**

Figure 11: Number of organ failure(s) on ICU admission by category of ICU, 2014



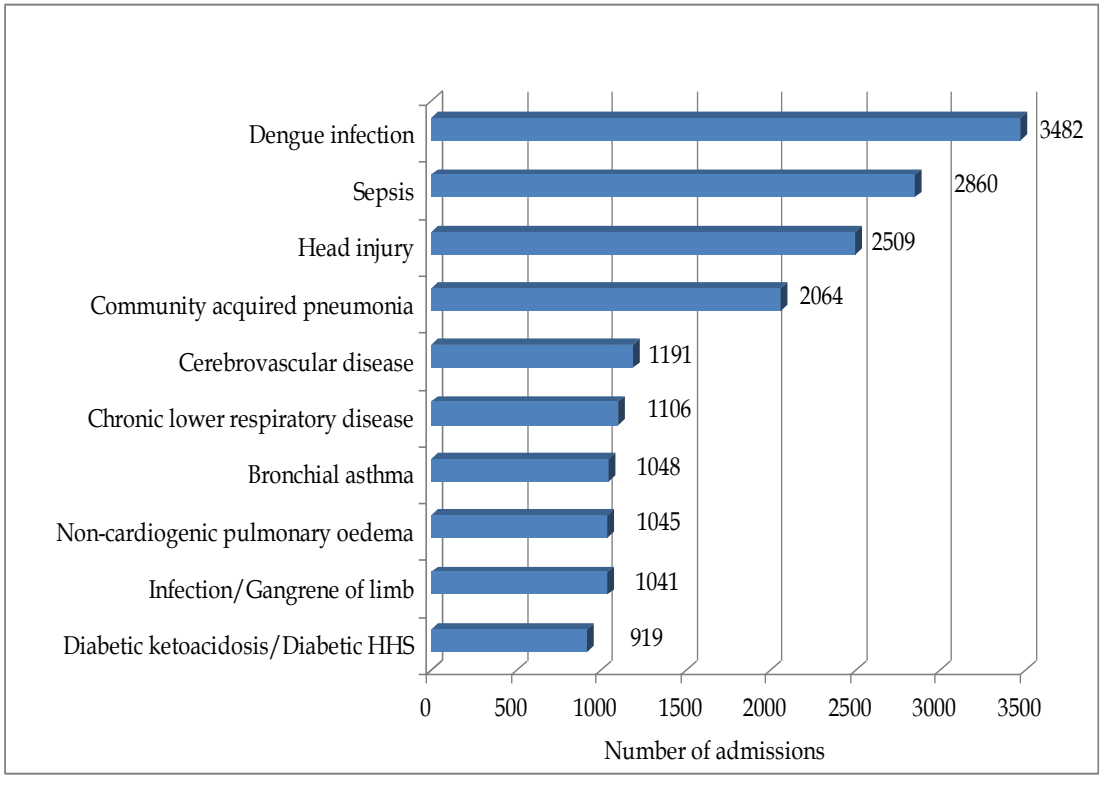
In 2014, about two-thirds (66%) of the patients were admitted with one or more organ failures in MOH ICUs. 47% of these patients had single organ failure. 32%, 16%, 4%, 0.7% and 0.1% had two, three, four, five and six organ failures respectively.

Table 17 : Ten most common diagnoses leading to ICU admission 2014

Diagnosis	Number	Percentage
Hospitals with admission ≥ 1000		
Dengue	2469	11.1
Sepsis	1744	7.9
Head Injury	1570	7.1
Community acquired pneumonia	1119	5.0
Cerebrovascular disease (infarct, thrombosis, haemorrhage)	879	4.0
Bronchial asthma	646	2.9
Non-cardiogenic pulmonary oedema	640	2.9
Infection/gangrene of limb (including osteomyelitis, necrotizing fasciitis)	619	2.8
Diabetic ketoacidosis / diabetic hyperosmolar hyperglycaemic state (HHS)	599	2.7
Chronic lower respiratory disease	563	2.5
Hospitals with admission 500 – 999		
Sepsis	691	8.5
Head injury	538	6.7
Dengue	520	6.5
Community acquired pneumonia	448	5.6
Chronic lower respiratory disease	314	3.9
Bronchial asthma	245	3.0
Non-cardiogenic pulmonary oedema	217	2.7
Infection / gangrene of limb (including osteomyelitis, necrotizing fasciitis)	212	3.1
Gastrointestinal perforation (including anastomotic leak)	194	2.4
Diabetic ketoacidosis / diabetic hyperosmolar hyperglycaemic state (HHS)	191	2.4
Hospitals with admission < 500		
Community acquired pneumonia	497	7.8
Sepsis	425	6.7
Head injury	341	5.3
Dengue	272	4.2
Chronic lower respiratory disease	229	3.6
Infection / gangrene of limb (including osteomyelitis, necrotizing fasciitis)	210	3.3
Ischaemic heart disease / acute coronary syndrome	208	3.2
Non-cardiogenic pulmonary oedema	188	2.9
Bronchial asthma	157	2.5
Gastrointestinal perforation (including anastomotic leak)	157	2.5
Private Hospital		
Dengue	221	25.4
Cerebrovascular disease (infarct, thrombosis, haemorrhage)	84	9.7
Other abdominal / pelvic conditions	55	6.3
Seizures (primary, no structural brain disease)	37	4.3
Gastrointestinal bleeding	35	4.0

Sepsis	34	3.9
Other respiratory conditions	33	3.8
Other cardiovascular conditions	24	2.8
ENT / oral conditions	24	2.8
Bronchial asthma	21	2.4
UMMC		
Sepsis	197	14.7
Dengue	68	5.1
Other renal / genito-urinary conditions (UV prolapse, TURP syndrome)	58	4.3
Diabetic ketoacidosis / diabetic hyperosmolar hyperglycaemic state (HHS)	46	3.4
Community acquired pneumonia	43	3.2
Gastrointestinal malignancy	42	3.1
Bronchial asthma	38	2.8
Hepatobiliary disease	38	2.8
Head injury	33	2.5
Infection / gangrene of limb (including osteomyelitis, necrotizing fasciitis)	33	2.5

Figure 12 : Ten most common diagnoses leading to ICU admission in MOH Hospitals, 2014



For the first time, since the inception of this registry, dengue infection was the most common diagnosis leading to ICU admission in 2014. This was followed by sepsis, head injury and community-acquired pneumonia. The latter three were the three most common diagnoses leading to ICU admission over the last 10 years until 2013.

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Table 18 : Ten most common diagnoses leading to ICU admission using APACHE II diagnostic category 2014

Diagnosis	Number	Percentage
Hospitals with admission ≥ 1000		
Non-operative: Cardiovascular failure from sepsis	2646	11.9
Non-operative: Respiratory failure from Infection	1975	8.9
Non-operative: Respiratory system as principal reason for admission	1574	7.1
Non-operative: Haemorrhagic shock / hypovolemia	1532	6.9
Operative: Respiratory system as principal reason for admission	1117	5.0
Non-operative: Neurologic system as principal reason for admission	801	3.6
Non-operative: Multiple trauma	781	3.5
Non-operative: Metabolic / renal system as principal reason for admission	750	3.4
Operative: Multiple trauma	643	2.9
Non-operative: Pulmonary oedema (non-cardiogenic)	626	2.8
Hospitals with admission 500 – 999		
Non-operative: Cardiovascular failure from sepsis	1076	13.4
Non-operative: Respiratory failure from infection	906	11.2
Non-operative: Respiratory system as principal reason for admission	696	8.6
Non-operative: Metabolic/ renal system as principal reason for admission	379	4.7
Non-operative: Head trauma	329	4.1
Operative: Respiratory insufficiency after surgery	277	3.4
Operative: Respiratory system as principal reason for admission	258	3.2
Non-operative: Haemorrhagic shock / hypovolemia	253	3.1
Operative: Cardiovascular system as principal reason for admission	320	3.7
Operative: Gastrointestinal perforation / obstruction	248	3.5
Non-operative: Neurologic system as principal reason for admission	240	3.1
Hospitals with admission < 500		
Non-operative: Respiratory failure from infection	991	15.5
Non-operative: Cardiovascular failure from sepsis	607	9.5
Non-operative: Respiratory system as principal reason for admission	419	6.5
Operative: Respiratory system as principal reason for admission	236	3.7
Non-operative: Pulmonary oedema (non-cardiogenic)	221	3.5
Operative: Cardiovascular system as principal reason for admission	198	3.1
Non-operative: COPD	177	2.8
Non-operative: Metabolic/ renal system as principal reason for admission	278	3.9
Operative: Respiratory insufficiency after surgery	165	2.6
Non-operative: Head trauma	165	2.6
Private Hospital		
Non-operative: Respiratory failure from infection	223	25.6
Non-operative: Neurologic system as principal reason for admission	104	12.0
Non-operative: Metabolic/ renal system as principal reason for admission	96	11.0
Non-operative: Respiratory system as principal reason for admission	90	10.3
Operative: Cardiovascular system as principal reason for admission	44	5.1

Operative: Gastrointestinal system as principal reason for admission	37	4.3
Non-operative: Gastrointestinal system as principal reason for admission	36	4.1
Non-operative: Gastrointestinal bleeding	33	3.8
Non-operative: Cardiovascular system as principal reason for admission	32	3.7
Non-operative: Cardiovascular failure from sepsis	30	3.4
Non-operative: Seizure disorder	30	3.4
UMMC		
Non-operative: Cardiovascular failure from sepsis	157	11.7
Operative: Respiratory system as principal reason for admission	120	8.9
Operative: Cardiovascular system as principal reason for admission	115	8.6
Non-operative: Respiratory system as principal reason for admission	89	6.6
Non-operative: Cardiovascular system as principal reason for admission	72	6.0
Non-operative: Haemorrhagic shock / hypovolemia	68	5.1
Non-operative: Respiratory failure from infection	66	4.9
Operative: GI surgery for neoplasm	57	4.2
Non-operative: Metabolic/ renal system as principal reason for admission	50	3.7
Non-operative: Neurologic system as principal reason for admission	49	3.6

Table 19 : Severe sepsis, ARDS and AKI within 24hrs of ICU admission 2014

	ICUs					
	Adm ≥ 1000 **n (%)**	**Adm 500 - 999** **n (%)**	**Adm < 500** **n (%)**	**Private** **n (%)**	**UMMC** **n (%)**	**Total** **n (%)**
Severe sepsis*	4847 (21.8)	1405 (17.5)	1031 (16.1)	3 (0.3)	475 (35.4)	**7761 (20.0)**
ARDS#	1964 (8.9)	739 (9.2)	574 (9.0)	3 (0.3)	126 (9.4)	**3406 (8.8)**
AKI^	3443 (15.5)	1288 (16.0)	916 (14.3)	3 (0.3)	270 (20.1)	**5920 (15.2)**

** Sepsis refers to documented infection with 2 out of 4 SIRS criteria:*

1) Temperature >38.3 or < than 36℃
2) Total white cell count > 12000 or < 4000
3) Heart rate > 90/min
4) Respiration rate > 20 breath / minute or PaCO2 < 32mmHg

Severe sepsis is sepsis with one of the following organ dysfunction:

(1) Hypotension: Systolic blood pressure < 90 mmHg or mean arterial pressure < 70 mm Hg
(2) PaO_2/F_IO_2 ≤ 300 mmHg
(3) Acute decrease in platelet count to < 100 000 u/L
(4) Acute increase in total bilirubin to > 70 umol/L
(5) Acute increase in serum creatinine to >170umol/L or urine output < 0.5 mL/kg/hour for > 2 hours
(6) Serum lactate >4 mmol/l

 # ARDS refers to a severe form of acute lung injuryI with a PaO_2/F_IO_2 ratio ≤ 200 mm Hg with diffuse radiologic infiltrates which is not predominantly due to heart failure

^AKI : Serum creatinine x 2 baseline or urine output < 0.5 ml/kg/hr x 12 hours

Table 20 : Severe sepsis, ARDS and AKI within 24hrs of ICU admission, by individual hospital 2012 – 2014

Hospital	2012			2013			2014		
	Severe sepsis n (%)	ARDS n (%)	AKI n (%)	Severe sepsis n (%)	ARDS n (%)	AKI n (%)	Severe sepsis n (%)	ARDS n (%)	AKI n (%)
AS	410 (34.3)	278 (23.2)	213 (17.8)	380 (28.3)	198 (14.7)	227 (16.9)	394 (29.7)	200 (15.1)	290 (21.9)
PP	449 (34.9)	115 (8.9)	397 (30.9)	413 (36.8)	58 (5.2)	377 (33.6)	370 (32.6)	35 (3.1)	293 (25.8)
IPH	60 (6.6)	61 (6.6)	46 (5.0)	149 (12.4)	87 (7.2)	129 (10.8)	148 (12.2)	123 (10.1)	197 (16.2)
KL	1073 (54.5)	192 (9.8)	589 (29.9)	727 (38.2)	46 (2.4)	245 (12.9)	694 (32.4)	26 (1.2)	269 (12.6)
SLG	352 (27.3)	106 (8.2)	228 (17.7)	409 (27.1)	190 (12.6)	259 (17.2)	270 (18.9)	189 (13.3)	232 (16.3)
KLG	208 (9.7)	22 (1.0)	122 (5.7)	491 (23.8)	346 (16.8)	229 (11.1)	925 (40.6)	405 (17.8)	353 (15.5)
SBN	153 (28.5)	141 (26.3)	90 (16.8)	134 (28.5)	133 (28.2)	95 (20.2)	289 (53.6)	130 (24.1)	141 (26.2)
MLK	93 (5.5)	13 (0.8)	125 (7.4)	10 (0.6)	1 (0.1)	30 (1.8)	37 (2.6)	7 (0.5)	26 (1.8)
JB	478 (27.3)	71 (4.1)	364 (20.8)	557 (28.9)	95 (4.9)	465 (24.1)	510 (30.2)	68 (4.0)	391 (23.2)
KTN	117 (18..3)	66 (10.3)	127 (19.8)	201 (24.0)	109 (13.0)	180 (21.5)	254 (23.9)	146 (13.8)	230 (21.7)
KT	7 (0.5)	1 (0.1)	2 (0.1)	11 (0.9)	3 (0.3)	55 (4.7)	7 (0.6)	3 (0.3)	53 (4.5)
KB	155 (12.1)	185 (14.4)	174 (13.5)	168 (12.6)	241 (18.0)	234 (17.5)	92 (5.7)	232 (14.4)	198 (12.3)
KCH	111 (13.0)	14 (1.6)	59 (6.9)	122 (12.8)	9 (0.9)	48 (5.1)	121 (10.6)	8 (0.7)	63 (5.5)
KK	248 (26.0)	390 (40.9)	164 (17.2)	348 (34.1)	293 (28.7)	243 (23.8)	226 (22.9)	139 (14.1)	230 (23.3)
SP	19 (11.9)	1 (0.6)	10 (6.3)	92 (15.8)	20 (3.4)	72 (12.3)	14 (1.5)	6 (0.6)	88 (9.2)
PJY	63 (11.0)	54 (9.4)	57 (8.0)	115 (19.0)	91 (15.0)	91 (15.0)	126 (19.3)	90 (13.8)	112 (17.2)
MUR	7 (1.1)	22 (3.5)	51 (8.0)	16 (2.4)	44 (6.5)	45 (6.7)	10 (1.7)	96 (16.0)	37 (6.2)
TI	65 (17.0)	88 (22.9)	48 (12.5)	24 (6.0)	5 (1.2)	38 (9.5)	68 (16.8)	2 (0.5)	77 (19.0)
TPG	788 (65.5)	18 (1.5)	57 (4.7)	650 (48.2)	18 (1.3)	99 (7.3)	249 (21.1)	37 (3.1)	108 (9.1)
SJ	138 (21.4)	29 (4.5)	113 (17.5)	97 (23.5)	29 (7.0)	72 (17.5)	132 (32.6)	19 (4.7)	73 (18.0)
KJG	14 (3.8)	9 (2.4)	16 (4.3)	8 (2.5)	1 (0.3)	23 (7.2)	16 (5.6)	3 (1.1)	36 (12.7)
KGR	6 (1.7)	-	-	11 (3.4)	0 (0.0)	3 (0.9)	6 (1.8)	2 (0.6)	10 (2.9)
SJMC	7 (0.5)	12 (0.8)	15 (1.0)	12 (0.9)	9 (0.7)	7 (0.5)	3 (0.3)	3 (0.3)	3 (0.3)
TML	48 (11.0)	21 (4.8)	57 (13.1)	56 (9.3)	11 (1.8)	112 (18.8)	62 (7.4)	34 (4.1)	127 (15.2)
KP	110 (32.9)	14 (4.2)	83 (24.9)	142 (36.0)	22 (5.6)	77 (19.6)	208 (40.6)	21 (4.1)	95 (18.6)

SMJ	0 (0.0)	1 (0.2)	2 (0.5)	2 (0.5)	1 0.3)	2 (0.5)	0 (0.0)	0 (0.0)	1 (0.2)
BP	86 (20.7)	57 (13.7)	85 (20.5)	75 (16.4)	8 (1.7)	42 (9.2)	56 (12.2)	15 (3.3)	57 (12.4)
TW	84 (19.4)	55 (12.7)	66 (15.3)	30 (6.7)	45 (10.0)	54 (12.1)	49 (9.8)	32 (6.4)	29 (5.8)
MRI	30 (6.3)	7 (1.5)	5 (1.1)	78 (16.2)	6 (1.2)	35 (7.3)	53 (12.4)	10 (2.3)	66 (15.4)
KLM	94 (15.6)	32 (5.3)	28 (4.7)	70 (12.5)	36 (6.4)	47 (8.4)	96 (17.3)	48 (8.6)	75 (13.5)
SDG	51 (5.8)	260 (29.7)	158 (18.1)	75 (8.8)	117 (13.8)	141 (16.6)	111 (13.3)	24 (2.9)	193 (23.1)
SB	78 (15.9)	38 (7.8)	95 (19.5)	72 (14.3)	47 (9.3)	82 (16.2)	68 (15.8)	33 (7.7)	80 (18.6)
DKS	67 (12.7)	26 (4.9)	53 (10.1)	100 (10.4)	48 (5.0)	65 (6.8)	37 (3.9)	12 (1.3)	45 (4.7)
SI	277 (34.6)	76 (9.5)	156 (19.5)	275 (28.6)	116 (12.1)	156 (16.2)	319 (28.6)	62 (5.6)	219 (19.7)
SBL	199 (12.6)	111 (7.0)	230 (14.6)	160 (8.3)	92 (4.8)	321 (16.8)	457 (20.0)	423 (18.6)	521 (22.9)
AMP	295 (51.6)	187 (32.7)	102 (17.8)	235 (41.5)	120 (21.2)	126 (22.3)	226 (35.7)	139 (22.0)	145 (22.9)
LIK	18 (6.7)	7 (2.6)	10 (3.7)	5 (1.0)	11 (2.1)	8 (1.6)	7 (2.0)	8 (2.3)	4 (1.1)
UMMC	136 (28.8)	75 (15.8)	135 (28.5)	225 (25.9)	99 (11.4)	210 (24.1)	475 (35.4)	126 (9.4)	270 (20.1)
LKW	45 (28.7)	30 (19.1)	40 (25.5)	21 (11.7)	10 (5.6)	17 (9.4)	19 (11.6)	13 (7.9)	31 (18.9)
BM	3 (7.9)	0 (0.0)	7 (18.4)	17 (11.1)	3 (2.0)	6 (4.0)	16 (11.5)	13 (9.4)	21 (15.1)
SLR	43 (27.9)	27 (17.5)	37 (24.0)	40 (17.9)	15 (6.7)	45 (20.2)	80 (35.9)	72 (32.4)	103 (46.2)
PD	40 (19.6)	2 (1.0)	27 (13.2)	16 (6.5)	1 (0.4)	38 (15.5)	1(0.4)	0 (0.0)	5 (1.9)
KKR	6 (4.0)	7 (4.7)	16 (10.7)	64 (26.9)	59 (24.9)	39 (16.3)	82 (31.8)	90 (34.7)	40 (15.6)
SGT	34 (27.0)	10 (7.9)	33 (26.2)	24 (15.1)	16 (10.1)	37 (23.4)	29 (19.3)	20 (13.3)	33 (22.1)
TM	0 (0)	1 (5.9)	1 (5.9)	21 (16.5)	15 (11.8)	16 (12.7)	15 (9.4)	44 (27.5)	17 (10.6)
KEM	7 (7.4)	5 (5.3)	10 (10.6)	12 (11.4)	4 (3.8)	6 (5.8)	5 (5.5)	4 (4.4)	8 (8.9)
KLP	0 (0)	0 (0)	0 (0)	10 (8.6)	3 (2.6)	21 (18.1)	10 (10.5)	2 (2.1)	10 (10.5)
LAB	17(15.9)	15 (1 4.0)	11 (10.3)	28 (17.0)	23 (14.0)	25 (15.2)	46 (27.7)	70 (42.2)	42 (25.3)
KEN	8 (9.9)	7 (8.6)	5 (6.2)	31 (19.3)	6 (3.7)	36 (22.4)	36 (25.0)	5 (3.5)	39 (27.1)
BIN	51 (23.9)	67 (31.6)	29 (13.6)	96 (36.9)	4 2 (16.2)	43 (16.5)	188 (66.7)	68 (24.0)	70 (24.8)
LD	30 (18.0)	24 (14.3)	45 (26.8)	46 (19.2)	37 (15.4)	56 (23.2)	49 (22.7)	49 (22.7)	64 (29.5)
Total	**6878 (20.3)**	**3050 (9.0)**	**4593 (13.6)**	**7171 (19.2)**	**3039 (8.1)**	**5129 (13.7)**	**7761 (20.0)**	**3406 (8.8)**	**5920 (15.2)**

During the first 24 hours of ICU admission, 20.0%, 8.8% and 15.2% of patients had severe sepsis, acute respiratory distress syndrome and acute kidney injury respectively. The rates appear to follow a similar trend over the past three years.

In the Sepsis Occurrence in Acutely Ill Patients (SOAP) study, 24% of patients had sepsis on admission [5]. An Italian study in 2011, demonstrated that 42.7% of patients had AKI within 24 hours of ICU admission [6].

Table 21 : SAPS II score, by individual hospital 2010 – 2014

Hospital	SAPS II score (mean)				
	2010	2011	2012	2013	2014
AS	42.4	39.4	40.1	39.4	41.0
PP	34.9	38.0	36.5	35.8	36.1
IPH	33.7	33.0	32.0	34.0	34.2
KL	34.5	38.3	38.9	40.4	36.8
SLG	33.2	34.5	36.0	35.7	34.2
KLG	34.5	38.2	36.9	35.3	33.1
SBN	38.0	39.2	39.2	37.3	35.0
MLK	31.9	33.4	36.8	31.8	33.5
JB	38.2	39.1	40.7	31.8	40.2
KTN	33.4	34.5	39.8	38.6	37.1
KT	36.2	39.0	41.5	42.0	40.2
KB	30.0	33.4	34.4	34.3	29.6
KCH	32.4	35.0	33.0	33.7	31.4
KK	37.4	36.4	33.2	35.1	40.6
SP	41.0	40.1	43.3	39.7	37.9
PJY	29.6	28.7	28.0	29.5	32.0
MUR	32.1	37.9	37.6	38.4	39.8
TI	42.6	41.7	41.1	43.7	43.0
TPG	43.5	42.2	40.4	39.7	39.4
SJ	40.6	40.3	38.9	41.9	38.3
KJG	34.9	36.0	31.7	32.9	31.7
KGR	36.3	33.9	35.3	36.6	30.9
SJMC	18.3	18.0	18.8	18.6	16.6
TML	38.3	37.3	34.5	31.5	33.7
KP	43.0	40.0	41.2	39.9	37.3
SMJ	39.6	38.8	40.0	40.5	39.8
BP	41.0	43.3	43.4	40.1	41.0
TW	51.4	40.0	41.4	38.8	33.1
MRI	33.5	34.9	35.5	35.6	35.6
KLM	41.0	42.8	42.7	44.6	45.0
SDG	35.5	37.6	41.9	40.8	40.9
SB	39.6	39.2	40.4	43.9	41.7
DKS	51.0	41.3	38.0	39.3	37.7
SI	40.1	38.3	38.1	38.4	33.2
SBL	33.2	37.6	39.1	31.5	34.4
AMP	45.9	46.5	48.6	45.9	45.9
LIK	17.0	21.6	21.1	15.2	15.5
UMMC	-	-	36.5	36.5	37.4
LKW	-	-	41.2	29.3	39.2
BM	-	-	42.8	47.5	54.4
SLR	-	-	47.9	38.8	46.5

PD	-	-	31.3	33.8	28.3
KKR	-	-	36.0	44.0	44.3
SGT	-	-	39.9	43.8	45.1
TM	-	-	25.3	35.9	39.6
KEM	-	-	39.2	38.7	38.3
KLP	-	-	8.4	26.9	29.7
LAB	-	-	40.0	45.7	56.3
KEN	-	-	44.9	34.3	37.3
BIN	-	-	33.5	32.4	36.6
LD	-	-	48.8	43.3	45.1
Total	**35.1**	**36.1**	**37.3**	**36.5**	**36.3**

The average SAPS II score has remained the same over the past five years. The average SAPS II score in MOH hospitals for 2014 was 36.3; which carries predicted in-hospital mortality of 30.4% [8].

Table 22 : Sequential Organ Failure Assessment (SOFA) [4] by individual hospital 2010 – 2014

Hospital	SOFA score Mean (Median)				
	2010	2011	2012	2013	2014
AS	8.0 (8)	7.3 (7)	7.3 (7)	7.1 (7)	7.4 (7)
PP	6.3 (6)	6.2 (5)	6.7 (6)	6.9 (6)	7.1 (7)
IPH	5.9 (5)	5.4 (5)	5.4 (5)	5.9 (5)	6.1 (5)
KL	6.4 (6)	6.5 (6)	7.0 (7)	7.2 (7)	6.9 (6)
SLG	6.3 (5)	6.5 (6)	6.7 (6)	6.8 (6)	6.6 (6)
KLG	6.6 (6)	7.5 (7)	7.4 (7)	7.0 (7)	6.7 (6)
SBN	6.9 (6)	7.1 (7)	7.0 (7)	7.3 (7)	6.7 (6)
MLK	5.6 (5)	5.6 (5)	6.1 (6)	5.1 (4)	4.6 (4)
JB	7.4 (7)	7.2 (7)	7.4 (7)	7.6 (7)	7.3 (7)
KTN	5.7 (5)	5.9 (5)	7.0 (7)	7.0 (6)	6.3 (6)
KT	6.0 (6)	6.1 (6)	6.6 (6)	6.8 (7)	6.6 (6)
KB	4.7 (3)	5.1 (4)	5.3 (4)	5.5 (5)	4.6 (4)
KCH	5.6 (4)	6.0 (5)	5.4 (4)	5.7 (5)	5.0 (4)
KK	6.0 (5)	6.0 (6)	5.7 (5)	6.2 (6)	6.7 (6)
SP	6.8 (6)	6.9 (6)	6.8 (6)	7.0 (6)	7.3 (7)
PJY	4.2 (3)	4.1 (3)	4.2 (3)	5.0 (4)	5.1 (4)
MUR	5.1 (4)	5.9 (6)	5.5 (5)	5.5 (5)	6.0 (5)
TI	8.0 (8)	7.3 (7)	7.4 (7)	7.8 (7)	8.1 (7)
TPG	8.2 (8)	7.6 (8)	7.1 (7)	6.8 (6)	7.0 (7)
SJ	6.3 (6)	6.6 (6)	6.2 (6)	7.3 (7)	6.2 (5)
KJG	6.0 (5)	7.3 (7)	5.6 (5)	6.1 (5)	6.1 (6)
KGR	5.9 (5)	5.5 (4)	5.5 (5)	5.6 (5)	4.7 (4)

SJMC	1.3 (0)	1.4 (0)	1.4 (0)	1.1 (0)	1.4 (1)
TML	6.4 (6)	6.2 (5)	6.1 (5)	5.1 (4)	5.9 (5)
KP	7.6 (7)	7.3 (7)	7.3 (7)	6.6 (6)	6.5 (6)
SMJ	7.3 (7)	6.9 (7)	7.3 (7)	7.1 (7)	7.4 (7)
BP	6.7 (6)	6.9 (6)	7.1 (7)	6.4 (6)	6.4 (6)
TW	8.8 (9)	7.2 (6)	7.2 (6)	7.4 (7)	6.2 (5)
MRI	5.2 (4)	5.5 (5)	5.9 (6)	5.8 (5)	5.0 (4)
KLM	8.4 (8)	8.5 (8)	7.8 (7)	7.3 (7)	7.1 (7)
SDG	6.3 (5)	6.5 (6)	7.2 (7)	7.2 (7)	7.6 (7)
SB	7.8 (7)	7.8(7)	7.6 (7)	7.3 (7)	7.3 (7)
DKS	9.2 (9)	6.5 (6)	5.8 (5)	5.5 (4)	5.2 (4)
SI	6.6 (6)	6.5 (6)	6.8 (6)	6.1 (5)	5.7 (5)
SBL	6.6 (7)	7.0 (8)	7.3 (8)	7.0 (7)	7.7 (7)
AMP	8.6 (9)	8.8 (9)	8.9 (9)	8.5 (8)	8.2 (8)
LIK	1.3 (0)	2.2 (1)	2.6 (1)	1.6 (0)	1.5 (0)
UMMC	-	-	7.6 (7)	7.4 (6)	7.0 (6)
LKW	-	-	5.7 (5)	3.4 (0)	5.0 (3)
BM	-	-	9.5 (10)	6.8 (6)	8.8 (8)
SLR	-	-	7.9 (8)	6.5 (6)	7.6 (8)
PD	-	-	4.7 (4)	4.9 (4)	4.1 (3)
KKR	-	-	6.8 (6)	7.5 (7)	6.6 (6)
SGT	-	-	6.4 (6)	6.6 (6)	7.2 (7)
TM	-	-	3.1 (3)	6.2 (5)	6.6 (6)
KEM	-	-	6.0 (5)	6.5 (6)	5.8 (4)
KLP	-	-	0.8 (1)	3.7 (3)	4.3 (3)
LAB	-	-	4.2 (2)	5.9 (6)	7.9 (8)
KEN	-	-	5.9 (5)	6.1 (6)	6.0 (6)
BIN	-	-	5.7 (5)	4.9 (4)	6.2 (5)
LD	-	-	8.7 (9)	7.5 (7)	8.0 (8)
Overall	**6.2 (5)**	**6.2 (6)**	**6.4 (6)**	**6.4 (6)**	**6.4 (6)**

The average SOFA score in 2014 was 6.4. BM had the highest score of 8.8 while SJMC had the lowest score of 1.4.

SECTION C:

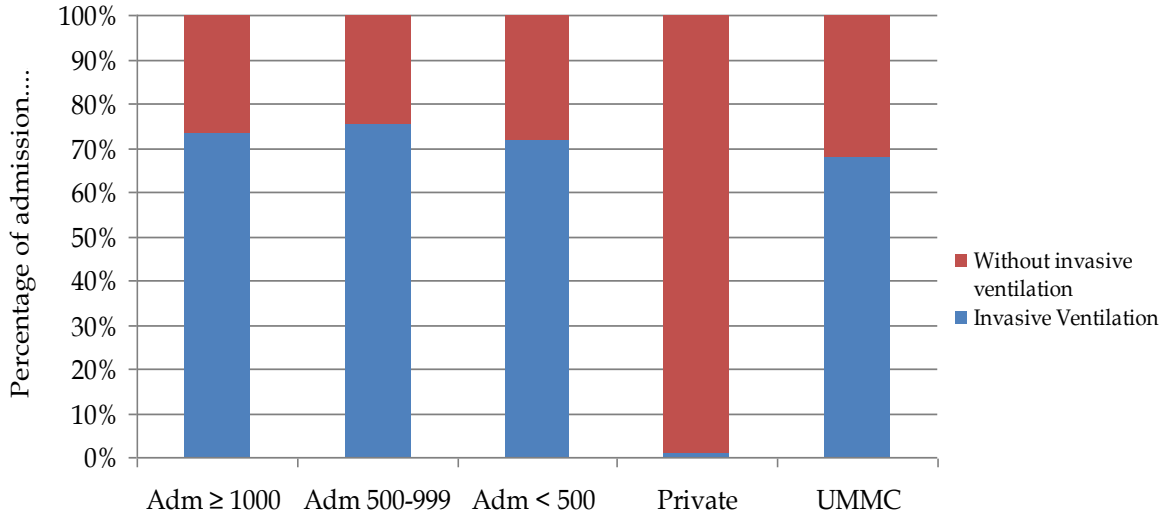
INTERVENTIONS

Table 23 : Invasive ventilation, non-invasive ventilation and reintubation, by category of ICU 2014

	ICUs					
	Adm ≥ 1000 n (%)	**Adm 500 - 999 n (%)**	**Adm < 500 n (%)**	**Private n (%)**	**UMMC n (%)**	**Total n (%)**
Invasive ventilation	16325 (73.4)	6061 (75.2)	4584 (71.6)	5 (0.6)	910 (67.7)	**27885 (71.1)**
Non-invasive ventilation	4273 (19.2)	1620 (20.1)	926 (14.5)	3 (0.3)	389 (29.1)	**7211 (18.6)**
Reintubation	1079 (6.6)	345 (5.7)	245 (5.4)	1 (20.0)	102 (11.2)	**1772 (6.4)**

Non-invasive ventilation *Refers to the continuous use of a non-invasive ventilator for ≥ hour during ICU stay*
Reintubation *Refers to reintubation after intended or accidental extubation*

Figure 13 : Invasive ventilation, by category of ICU 2014



74% and 68% of ICU admissions in MOH hospitals and UMMC received invasive mechanical ventilation respectively. In contrast, majority of patients (99%) in private hospital were not mechanically ventilated

Figure 14 : Non-invasive ventilation, by category of ICU 2014

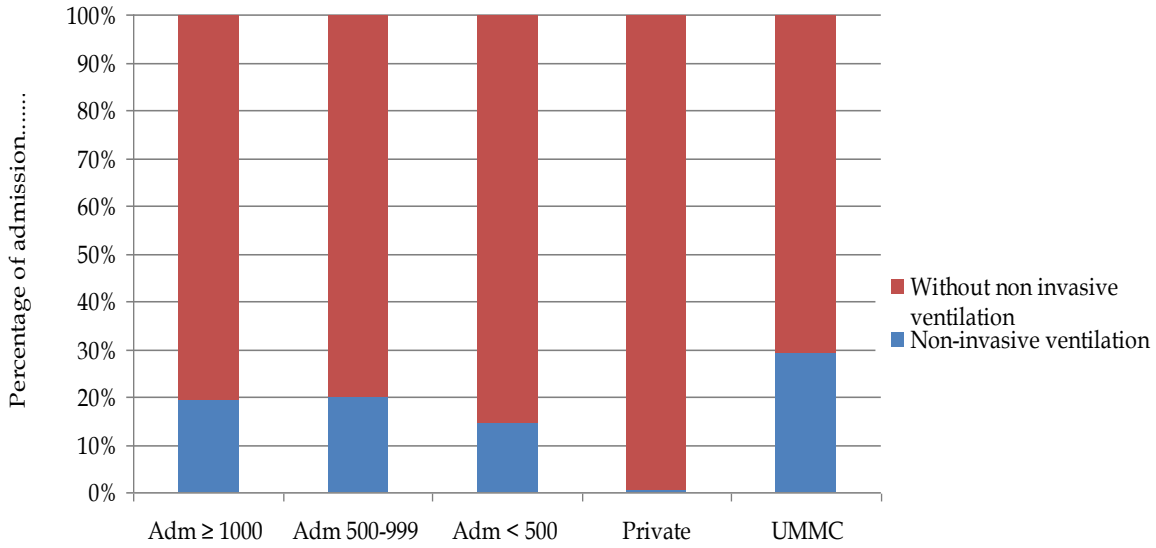
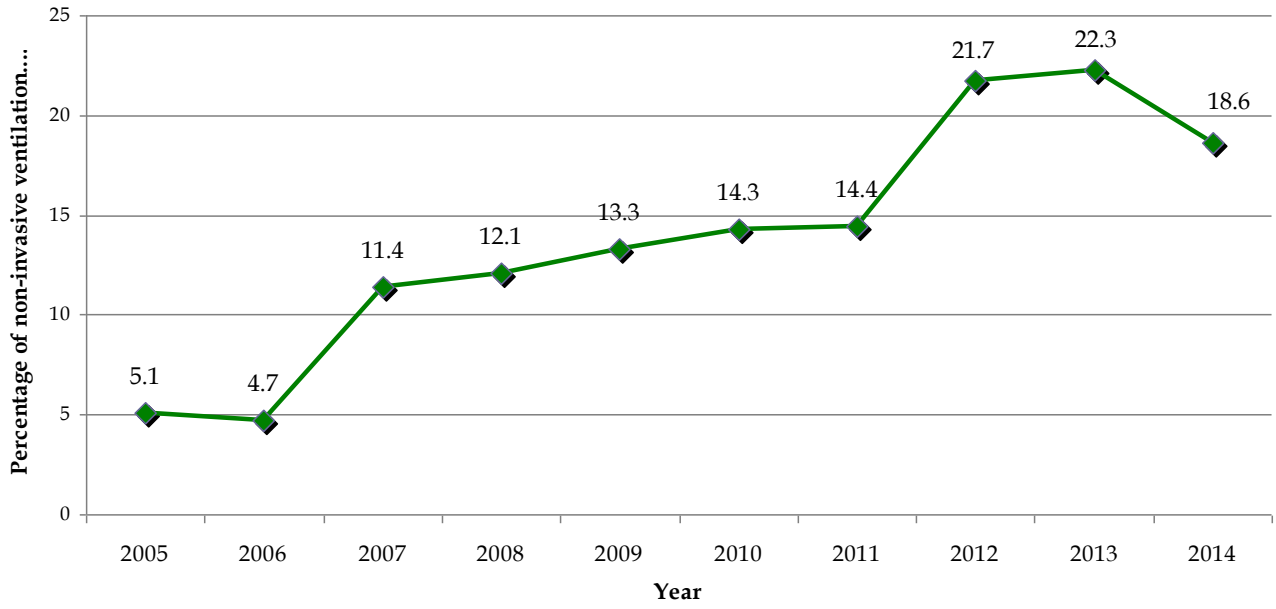


Figure 15 : Non-invasive ventilation, MOH hospitals 2005 – 2014



The percentage of patients receiving non-invasive ventilation in MOH ICUs increased by almost six fold from 3.7% in 2004 to 22.3% in 2013. This percentage decreased to 18.6% in 2014.

29% of ICU admissions in UMMC received non-invasive ventilation while 0.3% of ICU patients in SJMC received non-invasive ventilation.

Figure 16 : Reintubation by category of ICU 2014

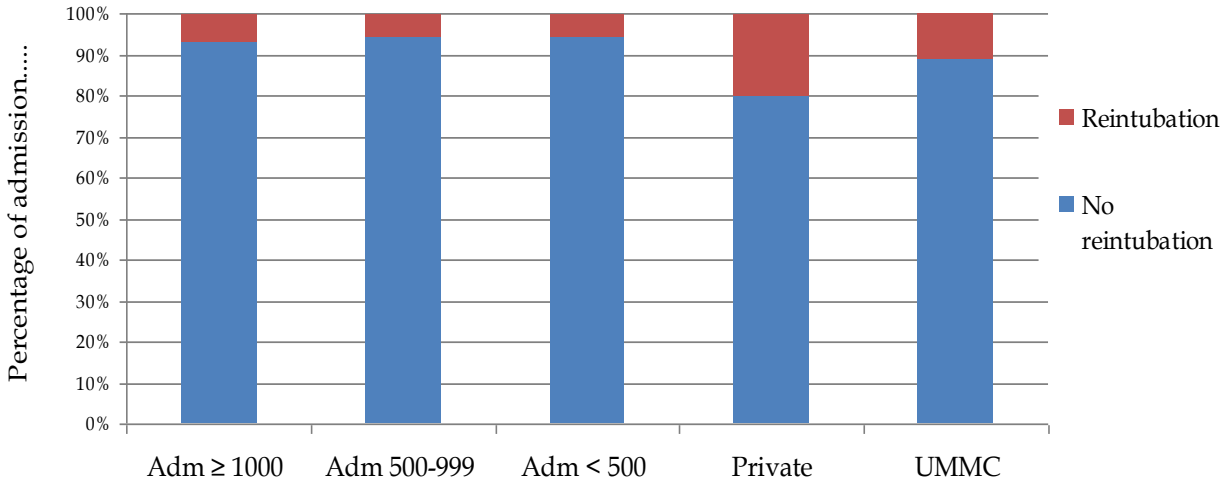
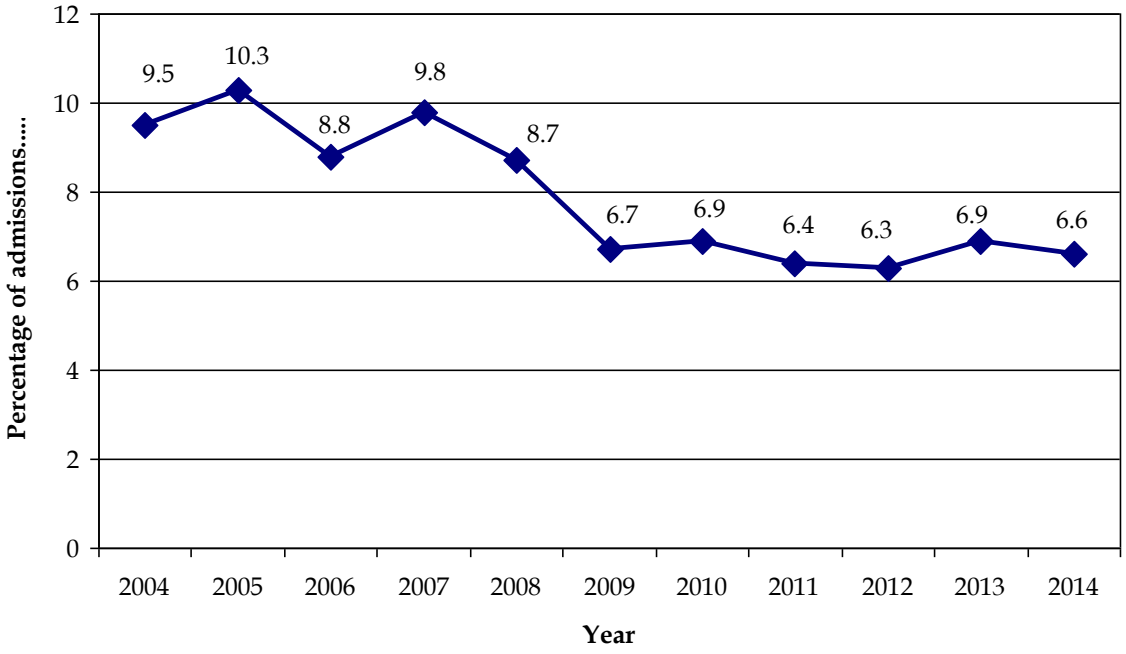


Figure 17 : Reintubation, MOH hospitals 2004 – 2014



The overall reintubation rate in MOH participating centres and UMMC in 2014 was 6.6% and 11.2% respectively.

Table 24 : Duration of invasive mechanical ventilation, by individual hospital 2010 – 2014

Hospital	Mean ± SD days				
	2010	2011	2012	2013	2014
AS	3.2 ± 4.5	3.6 ± 4.8	4.8 ± 6.0	4.1 ± 5.5	3.9 ± 5.5
PP	4.8 ± 7.6	5.1 ± 7.1	5.2 ± 7.8	5.4 ± 7.0	5.5 ± 7.1
IPH	4.3 ± 5.9	5.3 ± 7.2	5.1 ± 6.7	5.2 ± 8.2	3.8 ± 6.4
KL	3.7 ± 6.4	3.9 ± 5.8	4.5 ± 7.1	4.4 ± 7.4	4.6 ± 7.1
SLG	4.1 ± 6.4	4.5 ± 6.3	4.9 ± 5.9	4.3 ± 5.4	4.8 ± 6.4
KLG	4.1 ± 5.3	2.9 ± 4.3	2.7 ± 4.5	2.5 ± 5.7	2.5 ± 3.9
SBN	4.4 ± 6.9	5.1 ± 7.4	4.9 ± 6.8	6.1 ± 8.9	5.1 ± 7.1
MLK	4.2 ± 5.2	4.0 ± 1.7	4.3 ± 5.7	4.6 ± 6.7	4.9 ± 6.9
JB	4.2 ± 5.7	4.8 ± 6.3	4.9 ± 6.2	4.3 ± 5.5	5.1 ± 6.6
KTN	2.9 ± 3.8	4.9 ± 7.1	5.6 ± 6.9	5.0 ± 6.5	5.1 ± 8.2
KT	3.6 ± 4.3	3.5 ± 4.6	3.4 ± 4.6	3.9 ± 4.9	3.8 ± 4.9
KB	3.6 ± 6.0	3.9 ± 7.3	3.6 ± 6.3	4.0 ± 6.6	3.8 ± 6.4
KCH	4.1 ± 6.2	5.4 ± 7.4	5.0 ± 7.2	4.4 ± 6.6	3.7 ± 6.2
KK	4.7 ± 7.1	5.2 ± 7.0	5.5 ± 7.2	5.9 ± 8.8	5.3 ± 9.0
SP	3.6 ± 4.0	3.9 ± 5.3	3.9 ± 4.0	4.3 ± 5.9	4.2 ± 6.2
PJY	3.0 ± 5.7	3.3 ± 5.5	3.1 ± 4.9	3.5 ± 5.4	3.6 ± 6.9
MUR	2.9 ± 4.0	5.1 ± 8.1	3.8 ± 6.8	2.9 ± 4.4	3.5 ± 5.1
TI	3.0 ± 8.0	3.7 ± 5.8	4.0 ± 8.0	2.5 ± 3.0	2.4 ± 3.0
TPG	7.0 ± 10.1	7.3 ± 9.6	5.2 ± 8.0	4.1 ± 5.3	4.6 ± 6.8
SJ	3.7 ± 4.8	4.0 ± 6.3	4.3 ± 7.2	6.4 ± 9.7	5.5 ± 2.6
KJG	3.6 ± 4.4	4.8 ± 15.3	4.9 ± 7.3	4.1 ± 5.0	4.5 ± 5.5
KGR	3.1 ± 4.7	3.5 ± 6.3	3.8 ± 6.5	3.6 ± 7.0	3.5 ± 5.2
SJMC	4.2 ± 5.4	2.9 ± 4.7	2.5 ± 4.1	4.8 ± 5.1	2.9 ± 3.2
TML	4.5 ± 6.3	5.5 ± 8.9	4.9 ± 6.7	4.6 ± 8.2	4.7 ± 6.6
KP	2.6 ± 3.5	5.6 ± 8.2	5.0 ± 7.5	4.9 ± 7.0	4.3 ± 5.9
SMJ	3.9 ± 6.0	3.0 ± 4.9	3.2 ± 4.1	2.9 ± 4.3	2.6 ± 4.0
BP	4.5 ± 7.0	4.4 ± 6.1	5.2 ± 6.4	4.4 ± 6.0	4.4 ± 5.1
TW	3.1 ± 3.7	2.9 ± 3.9	3.2 ± 6.3	4.1 ± 6.3	4.1 ± 6.1
MRI	4.7 ± 5.7	4.6 ± 5.3	4.7 ± 5.4	4.4 ± 5.3	4.2 ± 5.5
KLM	3.2 ± 3.8	3.6 ± 5.6	3.3 ± 4.3	3.2 ± 4.8	3.2 ± 4.8
SDG	3.2 ± 4.8	4.6 ± 6.0	4.5 ± 5.4	4.3 ± 6.1	4.3 ± 6.9
SB	4.6 ± 7.3	5.1 ± 7.0	5.3 ± 9.1	5.5 ± 7.7	6.2 ± 6.8
DKS	5.8 ± 8.5	6.3 ± 11.2	5.2 ± 8.1	4.3 ± 6.2	3.3 ± 5.2
SI	4.3 ± 6.5	7.1 ± 13.6	5.9 ± 10.3	5.5 ± 8.7	4.9 ± 8.0
SBL	5.8 ± 6.6	6.2 ± 7.0	5.7 ± 6.3	5.8 ±7.6	5.4 ± 5.5
AMP	3.8 ± 5.5	5.1 ± 7.7	4.4 ± 5.9	4.8 ± 6.3	4.9 ± 6.6
LIK	1.4 ± 1.7	1.8 ± 2.2	3.6 ± 5.2	2.7 ± 3.8	3.2 ± 6.1
UMMC	-	-	8.1 ± 11.4	6.0 ± 8.2	6.1 ± 8.8
LKW	-	-	4.2 ± 7.6	4.2 ± 5.9	4.1 ± 4.5

BM	-	-	-	6.2 ± 9.1	6.6 ± 6.4
SLR	-	-	5.3 ± 6.3	5.7 ± 8.1	6.6 ± 10.0
PD	-	-	2.8 ± 3.4	2.7 ± 3.0	3.9 ± 9.5
KKR	-	-	4.8 ± 6.3	5.3 ± 7.6	5.4 ± 8.0
SGT	-	-	4.3 ± 7.1	3.0 ± 4.0	2.5 ± 2.5
TM	-	-	-	3.7 ± 4.6	4.7 ± 6.6
KEM	-	-	-	3.1 ± 2.2	5.2 ± 6.1
KLP	-	-	-	2.1 ± 4.0	3.3 ± 4.7
LAB	-	-	4.6 ± 6.6	3.8 ± 5.2	4.3 ± 5.3
KEN	-	-	-	6.7 ± 9.8	5.2 ± 5.7
BIN	-	-	6.2 ± 8.3	4.3 ± 5.0	3.9 ± 4.6
LD	-	-	5.2 ± 14.0	5.4 ± 6.7	5.1 ± 5.6
Total	**4.1 ± 6.1**	**4.6 ± 7.1**	**4.5 ± 6.8**	**4.5 ± 6.6**	**4.9 ± 6.6**

The average duration of mechanical ventilation was 4.9 days in 2014.

TI had the shortest duration of invasive mechanical ventilation at 2.4 days while BM had the longest at 6.6 days.

Table 25 : Renal replacement therapy and modalities of therapy, by category of ICU 2014

	ICUs					
	Adm ≥ 1000 n (%)	**Adm 500 - 999 n (%)**	**Adm < 500 n (%)**	**Private n (%)**	**UMMC n (%)**	**Total n (%)**
Renal replacement therapy	3237 (14.6)	1216 (15.1)	754 (11.8)	8 (0.9)	287 (21.4)	**5502 (14.2)**
Modalities of therapy						
Intermittent haemodialysis	2360 (65.5)	1016 (79.6)	668 (87.5)	7 (87.5)	93 (30.9)	**4144 (69.6)**
CRRT	1143 (31.7)	239 (18.7)	38 (5.0)	1 (12.5)	203 (67.4)	**1624 (27.3)**
Peritoneal dialysis	101 (2.8)	22 (1.7)	57 (7.5)	0 (15.4)	5 (1.7)	**185 (3.1)**
Total	**3604 (100)**	**1277 (100)**	**763 (100)**	**8 (100)**	**301 (100)**	**5953 (100)**

Figure 18 : Renal replacement therapy by category of ICU 2014

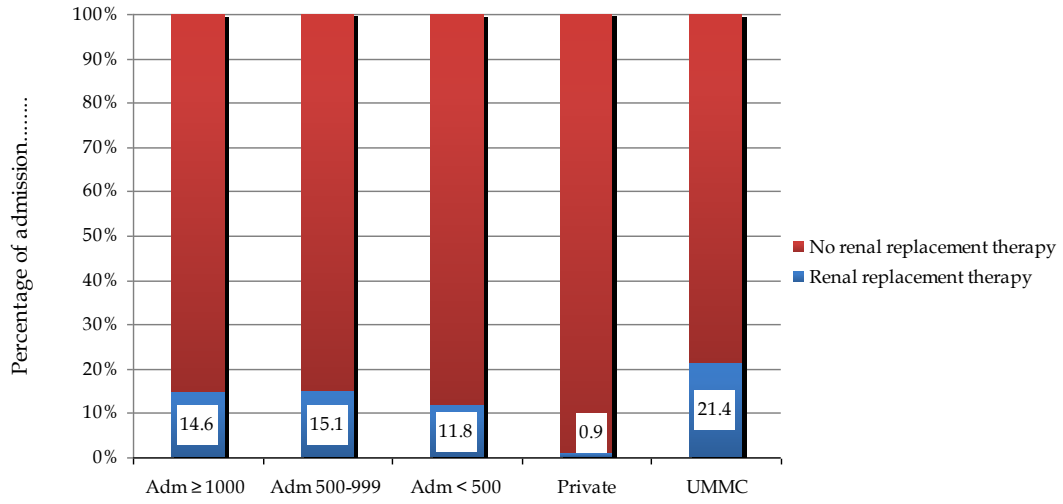
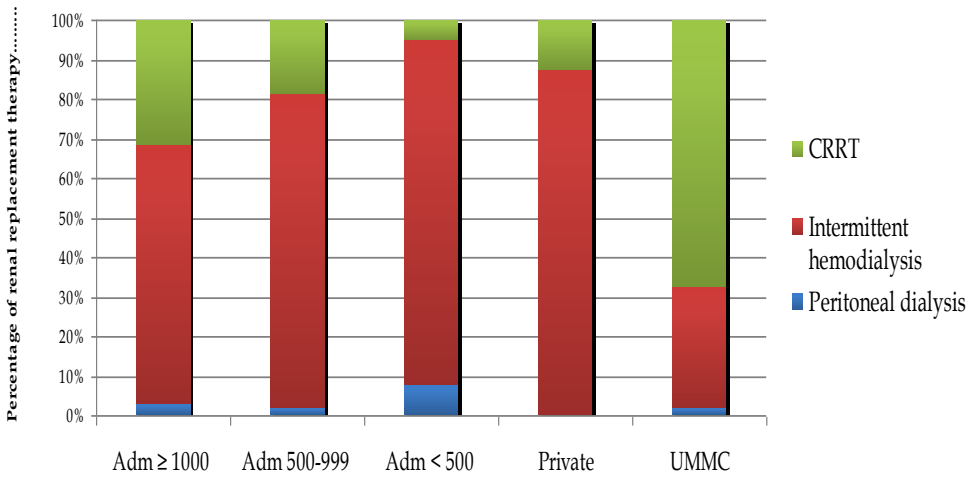


Figure 19 : Modalities of renal replacement therapy, by category of ICU 2014



In MOH ICUs, 14.2% of admissions received renal replacement therapy in 2014. These patients comprise of those with acute kidney injury and chronic kidney disease.

The worldwide prevalence of acute renal replacement therapy in ICUs is approximately 4% or two thirds of those with acute kidney injury [9]. Half of patients (49.3%) admitted with acute kidney injury underwent renal replacement therapy.

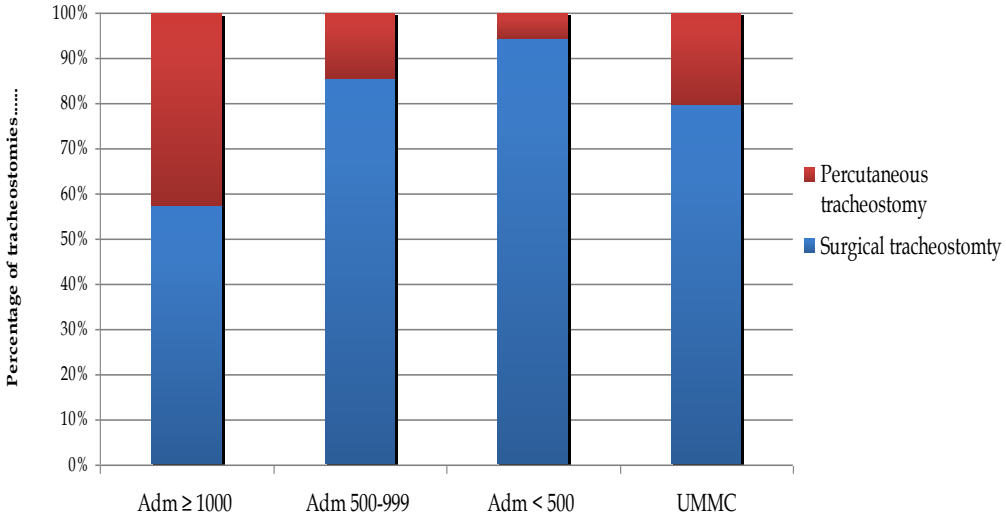
Intermittent haemodialysis and continuous renal replacement therapy were the most common modalities of renal replacement therapy performed in MOH ICUs and UMMC respectively

Table 26 : Tracheostomy, by category of ICU 2014

	ICUs					
	Adm ≥ 1000 n (%)	**Adm 500 - 999 n (%)**	**Adm < 500 n (%)**	**Private n (%)**	**UMMC n (%)**	**Total n (%)**
Tracheostomy	1700 10.4%	434 7.2%	391 8.6%	0 0.0 %	93 10.2%	**2618** **9.4%**
Tracheostomy technique						
Surgical	974 57.3%	371 85.5%	369 94.4%	0 0.0%	74 79.6%	**1788** **68.3%**
Percutaneous	726 42.7%	63 14.5%	22 5.6%	0 0.0%	19 20.4%	**830** **31.7%**

Tracheostomy: Refers to the procedure done during ICU stay

Figure 20 : Techniques of tracheostomy, by category of ICU 2014



Percutaneous tracheostomy (43%) was more commonly performed in ICUs with more than 1000 admissions.

ICUs with admissions 500 to 999 had 86% of tracheostomies performed via surgical technique, 94% of whereas ICUs with less than 500 admissions had tracheostomies performed via surgical technique.

UMMC had 20%of tracheostomies performed percutaneously.

Table 27 : Tracheostomy, by individual hospital 2014

Hospital	Tracheostomy performed n (%)	Tracheostomy in relation to days of ventilation mean (median)	Type of tracheostomy	
			Surgical n (%)	Percutaneous n (%)
AS	131 (10.6)	8.0 (7.0)	94 (71.8)	37 (28.2)
PP	196 (21.0)	7.8 (6.7)	54 (27.6)	142 (72.4)
IPH	161 (16.5)	8.3 (6.0)	85 (52.8)	76 (47.2)
KL	125 (8.7)	10.6 (8.5)	22 (17.6)	103 (82.4)
SLG	107 (10.3)	11.4 (10.9)	87 (81.3)	20 (18.7)
KLG	113 (8.5)	6.7 (5.5)	22 (19.5)	91 (80.5)
SBN	40 (9.5)	12.5 (9.5)	40 (100.0)	0 (0.0)
MLK	35 (3.9)	15.4 (13.5)	35 (100.0)	0 (0.0)
JB	207 (14.4)	7.7 (6.2)	68 (32.9)	139 (67.1)
KTN	117 (12.6)	9.1 (7.4)	107 (91.5)	10 (8.5)
KT	94 (9.9)	7.7 (6.1)	76 (80.9)	18 (19.1)
KB	38 (3.6)	14.9 (12.8)	24 (63.2)	14 (36.8)
KCH	65 (7.1)	8.4 (5.6)	63 (96.9)	2 (3.1)
KK	80 (10.5)	9.1 (7.7)	72 (90.0)	8 (10.0)
SP	46 (6.1)	12.9 (12.0)	46 (100.0)	0 (0.0)
PJY	20 (4.6)	10.2 (7.0)	20 (100.0)	0 (0.0)
MUR	23 (5.0)	10.9 (6.3)	22 (95.7)	1 (4.3)
TI	20 (6.4)	7.2 (4.9)	20 (100.0)	0 (0.0)
TPG	59 (6.5)	9.2 (6.3)	59 (100.0)	0 (0.0)
SJ	40 (11.5)	10.1 (9.5)	34 (85.0)	6 (15.0)
KJG	35 (17.0)	4.4 (4.4)	35 (100.0)	0 (0.0)
KGR	12 (4.4)	8.5 (8.5)	12 (100.0)	0 (0.0)
SJMC	0 (0.0)	0.0 (0)	0 (0.0)	0 (0.0)
TML	50 (8.0)	11.6 (8.3)	50 (100.0)	0 (0.0)
KP	12 (3.2)	14.7 (15.8)	12 (100.0)	0 (0.0)
SMJ	12 (4.0)	7.6 (5.4)	1 (8.3)	11 (91.7)
BP	48 (12.4)	7.7 (6.6)	48 (100.0)	0 (0.0)
TW	42 (11.4)	11.1 (6.0)	42 (100.0)	0 (0.0)
MRI	16 (4.7)	9.1 (8.9)	16 (100.0)	0 (0.0)
KLM	32 (6.8)	6.8 (6.1)	32 (100.0)	0 (0.0)
SDG	48 (8.8)	9.7 (7.6)	47 (97.9)	1 (2.1)
SB	73 (18.7)	9.6 (8.9)	73 (100.0)	0 (0.0)
DKS	32 (4.5)	8.0 (6.8)	28 (87.5)	4 (12.5)
SI	60 (7.1)	13.2 (11.6)	46 (76.7)	14 (23.3)
SBL	192 (13.3)	10.5 (9.8)	132 (68.8)	60 (31.2)
AMP	51 (10.4)	8.9 (8.0)	2 (3.9)	49 (96.1)
LIK	2 (2.2)	10.6 (10.6)	2 (100.0)	0 (0.0)
UMMC	93 (10.2)	12.7 (10.7)	74 (79.6)	19 (20.4)
LKW	3 (2.6)	9.0 (8.9)	3 (100.0)	0 (0.0)
BM	12 (10.6)	9.6 (9.4)	10 (83.3)	2 (16.7)

SLR	16 (9.6)	19.6 (15.0)	15 (93.8)	1 (6.2)
PD	8 (11.3)	9.7 (5.3)	8 (100.0)	0 (0.0)
KKR	7 (4.2)	22.1 (15.4)	7 (100.0)	0 (0.0)
SGT	5 (3.9)	6.7 (5.4)	5 (100.0)	0 (0.0)
TM	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
KEM	6 (12.0)	7.7 (8.2)	6 (100.0)	0 (0.0)
KLP	1 (2.2)	6.9 (6.9)	1 (100.0)	0 (0.0)
LAB	2 (1.7)	14.8 (14.8)	2 (100.0)	0 (0.0)
KEN	7 (7.7)	12.4 (10.5)	6 (85.7)	1 (14.3)
BIN	12 (5.7)	10.2 (8.8)	12 (100.0)	0 (0.0)
LD	12 (6.7)	7.6 (5.4)	11 (91.7)	1 (8.3)
Total	**2618 (9.4)**	**9.5 (7.6)**	**1788 (68.3)**	**830 (31.7)**

Among all invasively ventilated patients, 9.4% had tracheostomies performed.

The mean time from initiation of invasive ventilation to tracheostomy was 9.5 days. KJG had the shortest interval of 4.4 days while KKR had the longest interval of 22.1 days.

Table 28 : Total number of tracheostomies and percentage of percutaneous tracheostomies, by individual hospital 2010 – 2014

	Total number of tracheostomies (% percutaneous tracheostomies) n (%)				
	2010	**2011**	**2012**	**2013**	**2014**
AS	105 (42.9)	126 (23.0)	150 (23.3)	160 (23.1)	131 (28.2)
PP	135 (63.0)	199 (64.8)	210 (65.7)	196 (65.8)	196 (72.4)
IPH	153 (3.9)	140 (2.9)	109 (16.5)	141 (50.4)	161 (47.2)
KL	142 (78.2)	128 (75.0)	149 (75.8)	119 (74.8)	125 (82.4)
SLG	66 (8.0)	77 (18.2)	102 (28.4)	121 (28.1)	107 (18.7)
KLG	110 (21.8)	190 (73.7)	155 (76.1)	133 (75.9)	113 (80.5)
SBN	59 (0.0)	68 (1.5)	55 (0.0)	50 (0.0)	40 (0.0)
MLK	105 (0.0)	100 (1.0)	88 (0.0)	57 (0.0)	35 (0.0)
JB	325 (77.8)	465 (79.4)	332 (73.2)	238 (68.1)	207 (67.1)
KTN	40 (5.0)	80 (7.5)	112 (4.5)	115 (7.8)	117 (8.5)
KT	60 (78.3)	67 (50.7)	88 (37.5)	95 (38.9)	94 (19.1)
KB	14 (14.3)	29 (24.1)	27 (37.0)	40 (22.5)	38 (36.8)
KCH	47 (17.0)	63 (36.5)	71 (23.9)	76 (6.6)	65 (3.1)
KK	58 (24.1)	46 (8.7)	104 (25.0)	123 (14.6)	80 (10.0)
SP	8 (0.0)	23 (0)	11 (0.0)	30 (0.0)	46 (0.0)
PJY	11 (0.0)	21 (0)	26 (0.0)	19 (5.3)	20 (0.0)
MUR	26 (3.8)	36 (0)	40 (2.5)	29 (0.0)	23 (4.3)
TI	8 (0.0)	18 (0)	24 (0.0)	13 (0.0)	20 (0.0)
TPG	145 (0.7)	149 (0)	127 (0.8)	108 (0.0)	59 (0.0)

SJ	60 (8.3)	61 (37.7)	57 (22.8)	42 (69.0)	40 (15.0)
KJG	26 (0.0)	19 (5.3)	14 (0.0)	24 (0.0)	35 (0.0)
KGR	11 (0.0)	7 (0)	19 (0.0)	38 (2.6)	12 (0.0)
SJMC	2 (0.0)	6 (16.7)	3 (33.3)	3 (0.0)	0 (0.0)
TML	45 (0.0)	38 (0)	29 (3.4)	39 (0.0)	50 (0.0)
KP	7 (0.0)	27 (0)	24 (0.0)	14 (0.0)	12 (0.0)
SMJ	9 (66.7)	9 (88.9)	16 (75.0)	10 (100.0)	12 (91.7)
BP	46 (0.0)	54 (0)	36 (0.0)	35 (0.0)	48 (0.0)
TW	10 (0.0)	21 (0)	25 (0.0)	34 (2.9)	42 (0.0)
MRI	10 (20.0)	8 (0)	33 (18.2)	22 (4.5)	16 (0.0)
KLM	47 (0.0)	55 (0)	78 (0.0)	46 (0.0)	32 (0.0)
SDG	44 (43.2)	52 (42.3)	56 (32.1)	64 (7.8)	48 (2.1)
SB	22 (18.2)	36 (0)	56 (3.6)	52 (0.0)	73 (0.0)
DKS	13 (53.8)	21 (76.2)	25 (80.0)	36 (88.9)	32 (12.5)
SI	30 (26.7)	64 (26.6)	66 (24.2)	72 (9.7)	60 (23.3)
SBL	212 (87.3)	262 (68.3)	206 (42.7)	197 (42.6)	192 (31.2)
AMP	33 (97.0)	55 (92.7)	59 (93.2)	55 (85.5)	51 (96.1)
LIK	0 (0.0)	1 (0)	5 (0.0)	6 (0.0)	2 (0.0)
UMMC			76 (21.1)	64 (18.8)	93 (20.4)
LKW			10 (0.0)	11 (0.0)	3 (0.0)
BM			11 (0.0)	17 (17.6)	12 (16.7)
SLR			5 (0.0)	7 (14.3)	16 (6.2)
PD			5 (0.0)	5 (0.0)	8 (0.0)
KKR			6 (0.0)	7 (0.0)	7 (0.0)
SGT			7 (0.0)	10 (0.0)	5 (0.0)
TM			-		0 (0.0)
KEM			1 (0.0)	1 (0.0)	6 (0.0)
KLP			-	1 (0.0)	1 (0.0)
LAB			6 (0.0)	14 (0.0)	2 (0.0)
KEN			-	9 (0.0)	7 (14.3)
BIN			12 (58.3)	12 (0.0)	12 (0.0)
LD			10 (80.0)	21 (23.8)	12 (8.3)
Total	**2244 (39.0)**	**2821 (41.7)**	**2936 (35.8)**	**2831 (33.2)**	**2618 (31.7)**

In 2014, 31.7% of all tracheostomies were performed percutaneously. The percentage of percutaneous tracheostomies had increased from 2002 until 2011. This however, decreased in trend since 2012.

Table 29 : Withdrawal / Withholding therapy, by individual hospital 2010 – 2014

Hospital	Withdrawal / Withholding of therapy n (%)				
	2010	2011	2012	2013	2014
AS	181 (54.4)	192 (66.2)	203 (64.2)	253 (71.5)	317 (84.3)
PP	44 (41.9)	105 (60.7)	191 (91.4)	133 (78.2)	85 (42.7)
IPH	0 (0.0)	0 (0.0)	7 (4.6)	48 (23.1)	39 (19.8)
KL	183 (60.6)	230 (73.5)	299 (83.8)	267 (80.4)	250 (81.4)
SLG	3 (1.6)	6 (2.9)	42 (20.9)	110 (54.7)	71 (37.0)
KLG	25 (11.2)	162 (58.9)	206 (63.2)	137 (49.5)	164 (54.1)
SBN	47 (44.8)	58 (49.2)	61 (52.6)	36 (38.7)	48 (42.9)
MLK	41 (11.5)	38 (10.4)	22 (5.7)	58 (15.4)	146 (52.5)
JB	196 (71.5)	270 (72.8)	278 (75.7)	332 (79.8)	234 (83.0)
KTN	16 (11.5)	4 (3.8)	9 (5.8)	11 (6.0)	12 (6.4)
KT	102 (46.2)	82 (32.5)	54 (21.5)	48 (19.2)	23 (9.5)
KB	24 (15.1)	3 (1.5)	48 (23.8)	33 (17.5)	23 (12.7)
KCH	19 (23.5)	1 (0.7)	8 (5.4)	7 (4.2)	18 (11.2)
KK	27 (14.6)	29 (17.9)	43 (22.8)	60 (30.9)	121 (72.5)
SP	14 (21.9)	1 (1.1)	0 (0.0)	5 (3.9)	21 (10.0)
PJY	1 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
MUR	4 (3.1)	4 (3.1)	33 (22.4)	38 (29.0)	43 (30.7)
TI	6 (10.3)	0 (0.0)	1 (1.5)	3 (3.7)	2 (2.2)
TPG	79 (25.8)	56 (24.1)	108 (43.2)	100 (43.1)	105 (46.3)
SJ	68 (58.1)	53 (36.3)	67 (48.9)	40 (37.0)	13 (14.3)
KJG	2 (4.7)	5 (8.6)	4 (7.7)	1 (2.0)	0 (0.0)
KGR	60 (95.2)	*	1 (1.8)	0 (0.0)	11 (19.3)
SJMC	0 (0.0)	2 (2.3)	4 (6.5)	0 (0.0)	0 (0.0)
TML	8 (5.3)	2 (1.9)	4 (6.3)	9 (9.6)	11 (7.1)
KP	19 (19.4)	21 (17.2)	19 (20.2)	43 (39.8)	41 (28.5)
SMJ	42 (50.0)	31 (33.3)	27 (28.7)	17 (17.2)	21 (18.4)
BP	10 (13.0)	13 (13.4)	11 (9.2)	28 (26.9)	11(12.0)
TW	2 (4.2)	7 (16.3)	8 (14.8)	4 (6.0)	0 (0.0)
MRI	0 (0.0)	2 (2.3)	9 (10.6)	7 (7.8)	7 (10.8)
KLM	69 (53.1)	59 (44.4)	66 (54.5)	70 (52.6)	53 (40.8)
SDG	127 (89.4)	53 (34.0)	0 (0.0)	3 (1.9)	1 (0.7)
SB	57 (51.8)	63 (46.3)	58 (54.2)	51 (42.1)	31 (26.7)
DKS	3 (2.7)	10 (7.1)	5 (3.9)	4 (1.7)	23 (12.6)
SI	1 (0.7)	21 (15.2)	11 (5.6)	11 (5.5)	9 (4.1)
SBL	82 (42.9)	185 (83.3)	198 (74.2)	212 (63.9)	262 (63.0)
AMP	29 (14.7)	8 (4.2)	146 (69.2)	46 (26.7)	21 (9.4)
LIK	0 (0.0)	1 (9.1)	0 (0.0)	3 (14.3)	0 (0.0)
UMMC	-	-	63 (66.3)	89 (62.7)	156 (67.0)
LKW	-	-	11 (25.0)	8 (25.8)	3 (7.5)
BM	-	-	0 (0.0)	0 (0.0)	0 (0.0)

SLR	-	-	2 (3.4)	0 (0.0)	4 (5.8)
PD	-	-	7 (26.9)	19 (50.0)	1 (2.6)
KKR	-	-	8 (38.1)	24 (42.9)	5 (9.1)
SGT	-	-	1 (3.8)	3 (10.0)	4 (14.8)
TM	-	-	0 (0.0)	1 (3.7)	19 (55.9)
KEM	-	-	3 (33.3)	6 (40.0)	4 (33.3)
KLP	-	-	-	1 (10.0)	1 (9.1)
LAB	-	-	5 (16.7)	0 (0.0)	1 (1.50
KEN	-	-	0 (0.0)	1 (9.1)	0 (0.0)
BIN	-	-	6 (16.7)	6 (18.2)	0 (0.0)
LD	-	-	2 (4.2)	2 (4.3)	7 (13.0)
Total	**1591 (29.6)**	**1778 (30.8)**	**2359 (36.9)**	**2388 (35.1)**	**2442 (35.2)**

Withdrawal or withholding of therapy : refers to the discontinuation/not initiating any of the following: vasoactive drugs, renal replacement therapy, mechanical ventilation, surgery, cardiopulmonary resuscitation

Therapy was withheld or withdrawn in 35% of deaths in ICU. There was a wide variability of this practice ranging from 0% (BM, SJMC, LIK, PJY, KEN, BIN, TW, KJG) to 84% (AS).

In a retrospective audit of all deaths in two major tertiary ICUs in New South Wales, Australia in 2008, 34% had treatments withheld and another 47% had withdrawal of life-sustaining therapy [10].

In a prospective observational study of the end-of-life practices in 37 ICUs in 17 European countries from January 1, 1999, to June 30, 2000, 72.6% of those who died had life-limiting treatment [11].

SECTION D:

COMPLICATIONS

Table 30 : Incidence of ventilator-associated pneumonia, by individual hospital 2009 – 2014

Hospital	VAP per 1000 ventilator days					
	2009	2010	2011	2012	2013	2014
AS	4.4	9.6	7.5	3.0	1.3	0.6
PP	10.8	12.9	10.1	6.9	4.2	4.4
IPH	22.1	12.3	3.7	7.2	8.8	4.4
KL	12.3	15.2	13.6	13.5	7.5	6.0
SLG	21.4	13.5	8.4	4.6	5.6	3.8
KLG	4.4	3.5	3.8	3.6	9.2	3.1
SBN	7.3	8.7	4.4	2.4	3.4	2.5
MLK	2.8	8.5	9.1	7.0	1.6	0.9
JB	5.5	9.0	5.4	4.3	0.9	0.5
KTN	3.4	3.3	1.6	2.7	1.2	0.4
KT	1.6	8.7	4.1	7.2	2.9	0.8
KB	3.4	4.1	5.6	9.2	7.5	4.2
KCH	10.7	5.0	2.4	6.3	0.0	2.1
KK	-	0.4	-	0.8	2.4	3.2
SP	39.5	23.4	23.6	8.3	4.3	7.2
PJY	18.3	14.4	9.3	3.8	8.6	2.6
MUR	7.1	4.9	1.7	0.6	0.7	0.6
TI	5.4	8.8	1.4	2.0	0.0	4.1
TPG	28.8	3.0	0.6	1.1	0.0	0.2
SJ	28.4	14.7	5.4	3.5	3.3	5.6
KJG	15.7	10.9	6.0	10.3	14.3	4.8
KGR	6.0	10.8	8.7	21.0	11.8	8.6
TML	2.6	4.0	0.5	0	1.6	4.2
KP	4.1	2.2	0.7	0.8	1.9	2.9
SMJ	28.7	37.3	3.2	2.9	0.0	1.2
BP	1.6	2.3	0.7	1.7	0.6	0.6
TW	3.2	8.7	4.3	8.3	8.9	5.4
MRI	10.5	2.8	1.8	3.2	3.5	8.4
KLM	18.8	36.7	24.7	28.3	8.6	10.3
SDG	21.7	13.5	13.4	9.3	7.7	2.8
SB	-	7.7	10.4	11.3	6.2	7.7
DKS	-	7.0	0.4	1.6	0.0	2.2
SI	-	11.1	12.5	16.6	8.3	5.0
SBL	-	22.7	9.9	7.1	7.6	4.2
AMP	-	18.4	33.0	35.0	14.5	6.6
LIK	-	0.0	0.0	4.1	0.0	1.6
LKW	-	-	-	16.2	0.0	0.0
BM	-	-	-	-	0.7	0.8
SLR	-	-	-	24.9	13.3	11.2
PD	-	-	-	17.5	3.0	3.1
KKR	-	-	-	9.5	22.2	18.0
SGT	-	-	-	16.8	5.1	6.5
TM	-	-	-	-	0.0	0.0
KEM	-	-	-	-	0.0	0.0

KLP	-	-	-	-	0.0	0.0
LAB	-	-	-	3.6	2.0	11.1
KEN	-	-	-	-	2.3	0.0
BIN	-	-	-	22.4	11.2	0.3
LD	-	-	-	3.2		1.0
MOH hospitals	**11.6**	**10.1**	**6.8**	**7.2**	**5.4**	**3.6**
SJMC	**0.0**	**3.4**	**8.0**	**0**	**8.4**	**-**
UMMC				**8.5**	**6.0**	**7.3**

VAP: Defined as nosocomial pneumonia developing in a patient after 48 hours of mechanical ventilation with radiological evidence of new or progressive infiltrates with or without the presence of a positive bacteriological culture

Table 31 : Onset of VAP from initiation of invasive ventilation, by individual hospital 2010 – 2014

Hospital	Interval from initiation of ventilation to VAP Mean (Median) days				
	2010	**2011**	**2012**	**2013**	**2014**
AS	7.6	7.9	11.0 (9.0)	19.6 (15.0)	11.9 (10.3)
PP	10.0	11.0	11.2 (7.8)	14.0 (13.2)	16.9 (15.8)
IPH	4.3	7.7	9.1 (7.7)	7.1 (5.7)	7.7 (7.1)
KL	11.2	11.8	10.3 (8.9)	13.3 (11.0)	13.6 (12.1)
SLG	11.9	11.2	11.4 (8.0)	12.0 (11.5)	13.3 (11.7)
KLG	14.0	11.0	12.9 (12.0)	7.3 (5.8)	12.0 (11.6)
SBN	10.1	15.4	7.7 (8.3)	15.2 (7.3)	9.0 (7.1)
MLK	7.8	7.2	7.8 (5.5)	20.0 (8.6)	30.3 (31.0)
JB	8.8	8.4	10.5 (5.7)	9.3 (6.5)	7.6 (5.6)
KTN	7.0	9.5	11.5 (10.9)	11.8 (6.6)	20.4 (20.4)
KT	7.2	8.6	10.9 (10.0)	11.7 (11.2)	15.3 (15.3)
KB	9.1	11.9	13.6 (11.3)	12.0 (10.7)	16.7 (16.4)
KCH	11.5	11.4	9.3 (6.6)	12.6 (12.1)	6.4 (7.6)
KK	11.2	*	7.7 (7.1)	10.0 (7.3)	13.4 (8.9)
SP	7.2	7.0	6.5 (6.5)	9.6 (7.9)	8.0 (6.6)
PJY	9.9	13.9	12.3 (10.9)	8.1 (7.7)	12.7 (8.6)
MUR	10.3	12.2	-	-	13.3 (13.3)
TI	25.0	19.5	16.8 (16.8)	12.2 (12.2)	9.6 (10.4)
TPG	7.9	9.6	16.3 (13.1)	-	-
SJ	6.5	9.3	12.0 (10.3)	14.6 (7.9)	9.5 (10.0)
KJG	6.4	6.2	7.6 (6.7)	7.9 (6.6)	6.4 (5.8)
KGR	7.2	3.9	9.6 (7.2)	9.1 (7.4)	8.5 (6.3)
SJMC	2.0	5.4	-	3.9 (3.9)	-
TML	10.3	9.0	-	6.8 (6.8)	10.2 (8.3)
KP	6.5	20.3	21.3 (21.3)	5.1 (5.1)	15.2 (15.2)
SMJ	5.7	13.2	12.6 (12.6)	3.7 (3.7)	7.4 (7.4)
BP	21.5	7.1	32.0 (32.0)	10.1 (10.1)	8.2 (8.2)
TW	6.1	10.1	5.6 (4.1)	5.7 (4.2)	11.8 (10.5)
MRI	8.9	4.0	6.8 (6.8)	12.9 (7.5)	8.0 (8.0)
KLM	5.9	7.6	6.4 (4.6)	7.6 (8.0)	8.0 (6.1)
SDG	6.6	7.9	12.4 (12.1)	9.6 (8.2)	13.3 (10.8)
SB	7.8	6.0	10.6 (7.2)	9.1 (8.6)	8.4 (7.6)
DKS	7.7	7.1	7.0 (5.5)	6.6 (5.6)	6.4 (6.4)

SI	12.8	12.1	11.5 (10.0)	9.7 (7.5)	10.3 (9.1)
SBL	9.1	10.7	9.6 (7.8)	7.9 (6.3)	9.5 (9.2)
AMP	7.1	8.5	6.5 (5.3)	8.6 (7.9)	7.6 (7.1)
LIK	-	-	3.0 (3.0)	-	20.7 (20.7)
UMMC	-	-	15.2 (10.8)	8.2 (7.8)	11.2 (8.0)
LKW	-	-	6.0 (4.4)	9.4 (3.9)	-
BM	-	-	2.2 (2.2)	-	6.2 (6.2)
SLR	-	-	8.5 (5.9)	10.0 (7.8)	11.5 (10.3)
PD	-	-	9.5 (9.5)	11.5 (11.5)	-
KKR	-	-	8.8 (9.5)	13.3 (9.4)	7.4 (6.9)
SGT	-	-	10.0 (7.3)	6.3 (6.3)	7.0 (8.2)
TM	-	-	-	6.4 (6.5)	-
KEM	-	-	-	-	-
KLP	-	-	-	-	-
LAB	-	-	10.1 (10.1)	15.9 (15.9)	9.3 (9.3)
KEN	-	-	-	-	2.5 (2.5)
BIN	-	-	12.2 (11.2)	8.5 (9.2)	8.2 (8.2)
LD	-	-	10.5 (10.5)	7.6 (5.6)	6.3 (6.3)
Total	**8.8**	**9.7**	**10.1 (7.8)**	**10.0 (7.9)**	**10.8 (8.8)**

Figure 21 : Ventilator-associated pneumonia, per 1000 ventilator days 2004 – 2014

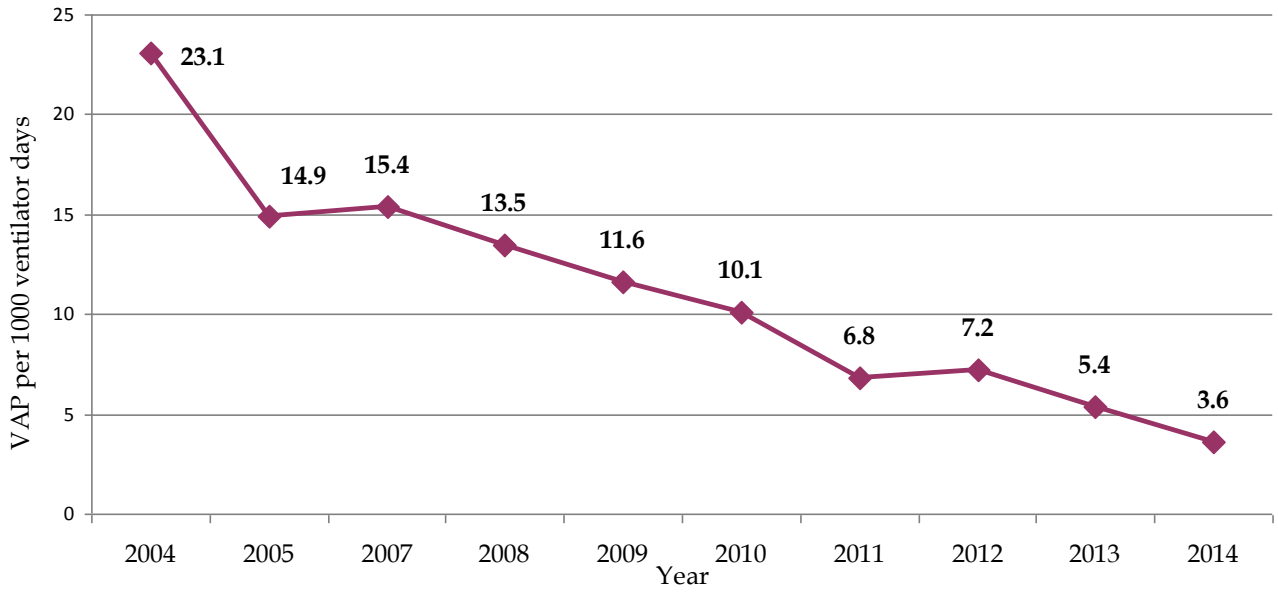
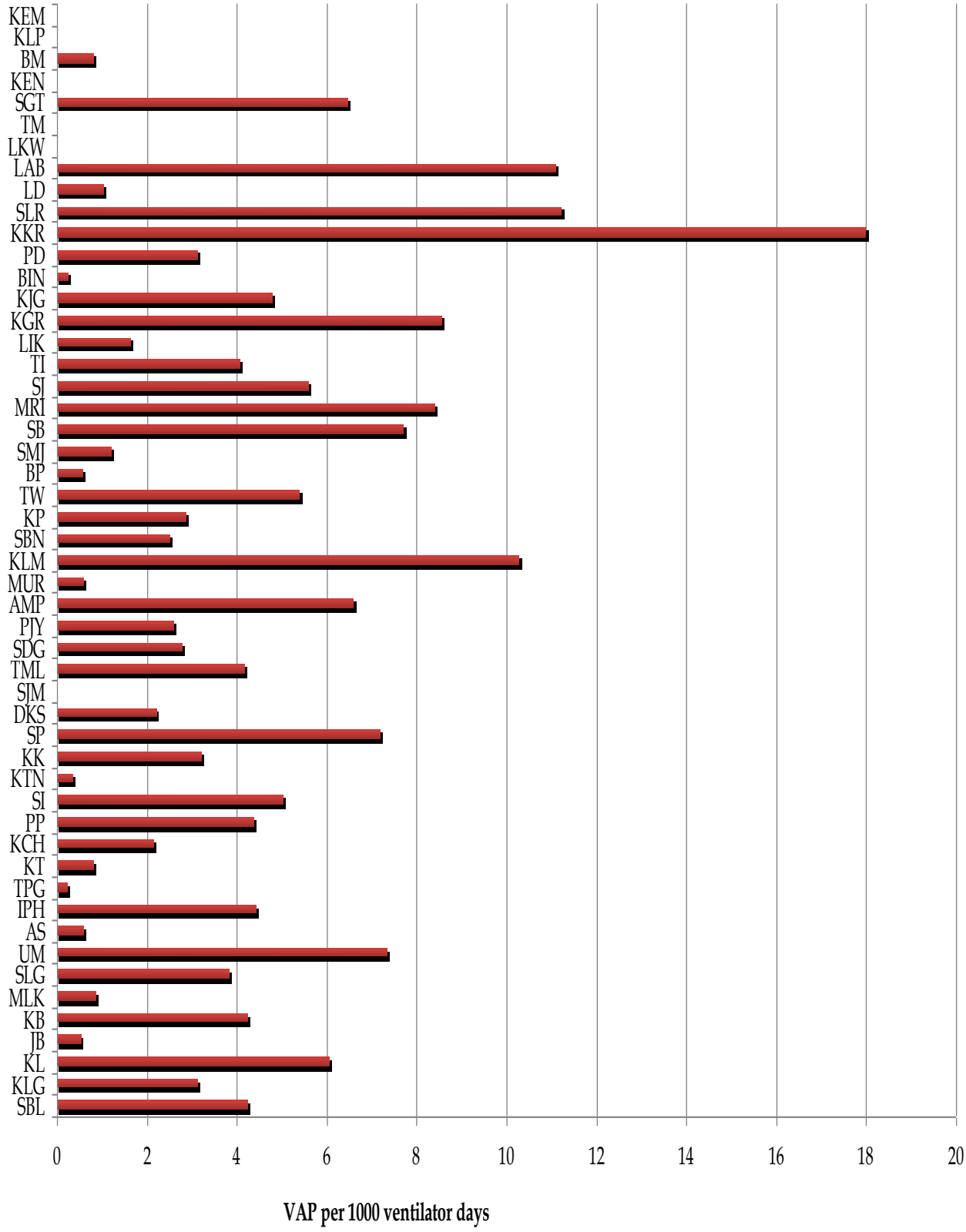


Figure 22 : Ventilator-associated pneumonia, per 1000 ventilator days, by individual hospital 2014



National Healthcare Safety Network (NHSN) report, data summary for 2012 [12]							
Types of ICU	**Ventilator utilisation ratio**	**VAP per 1000 ventilator days**					
		Pooled mean	**Percentile**				
			10th	**25th**	**50th**	**75th**	**90th**
Mixed medical/ surgical > 15 beds	0.34	0.9	0.0	0.0	0.4	1.3	2.8
Mixed medical/ surgical ≤ 15 beds	0.24	1.1	0.0	0.0	0.0	1.2	3.6
Neurosurgical	0.30	2.1	0.0	0.0	1.5	2.9	3.8
Surgical	0.34	2.0	0.0	0.0	0.9	2.8	5.9
Trauma	0.47	3.6	0.0	0.8	2.6	6.0	9.4

The incidence of VAP had decreased steadily over the past 8 years. In 2007, the VAP rate was 15.4 per 1000 ventilator days. It had decreased by more than half to 5.4 per 1000 ventilator days in 2013 and 3.6 per 1000 ventilator days in 2014.

The mean rate of VAP (3.6 per 1000 ventilator days) in our ICUs was much higher when benchmarked with that of US National Healthcare Safety Network (NHSN) [12]; as shown in the table above. The definition for VAP by NHSN has a more stringent inclusion criterion (resulting in fewer cases being defined as VAP) compared to ours.

However, the rate of VAP in our ICUs was lower compared with the pooled VAP rate of 15.8 per 1000 ventilator days as reported by Rosenthal et. al.[13] in ICUs in 36 countries in Latin America, Asia, Africa and Europe between 2004 to 2009.

Ventilator usage is a significant risk factor for developing VAP and the exposure to this risk is measured by ventilator utilisation ratio, which is calculated by dividing the number of ventilator days to number of patient days. Ventilator utilisation ratio in our ICUs was 0.6, which is more than two times higher than the ICUs in US.

The onset of VAP was 10.8 days from the initiation of invasive ventilation. Onset of VAP in all centres (except KEN) exceeded 5 days of ventilation, indicating that VAPs in MOH and UMMC ICUs were mostly of late onset.

Table 32 : Bacteriological cultures in VAP, by category of ICU 2014

Organisms	ICUs				
	Adm ≥ 1000 n (%)	Adm 500 - 999 n (%)	Adm < 500 n (%)	UMMC n (%)	Total n (%)
Acinetobacter spp.	110 (37.0)	46 (52.9)	38 (44.2)	21 (58.3)	**215 (42.5)**
MRO	104 (94.5)	43 (93.5)	31 (81.6)	16 (76.2)	**194 (90.2)**
Non-MRO	6 (5.5)	3 (6.5)	7 (18.4)	5 (23.8)	**21 (9.8)**
Pseudomonas aeruoginosa	69 (23.2)	10 (11.5)	13 (15.1)	9 (25.0)	**101 (20.0)**
MRO	21 (30.4)	2 (20.0)	6 (46.2)	0 (0.0)	**29 (28.7)**
Non-MRO	48 (69.6)	8 (80.0)	7 (53.8)	9 (100.0)	**72 (71.3)**
Klebsiella spp.	67 (22.6)	17 (19.5)	21 (24.4)	5 (13.9)	**110 (21.7)**
ESBL	49 (73.1)	14 (82.4)	14 (66.7)	2 (40.0)	**79 (71.8)**
Non-ESBL	18 (26.9)	3 (17.6)	7 (33.3)	3 (60.0)	**31 (28.2)**
MRSA	9 (3.0)	1 (1.1)	1 (1.2)	1 (2.8)	**12 (2.4)**
MSSA	7 (2.4)	4 (4.6)	3 (3.5)	0 (0)	**14 (2.8)**
Stenotrophomonas maltophilia	8 (2.7)	0 (0)	0 (0)	0 (0)	**8 (1.6)**
Coagulase negative *Staphylococcus*	2 (0.7)	1 (1.1)	1 (1.2)	0 (0)	**4 (0.8)**
Other gram negative bacteria	4 (1.3)	1 (1.1)	0 (0)	0 (0)	**5 (1.0)**
Fungal	6 (2.0)	1 (1.1)	2 (2.3)	0 (0)	**9 (1.8)**
Others	15 (5.1)	6 (6.9)	7 (8.1)	0 (0)	**28 (5.5)**
Total	**297 (100.0)**	**87 (100.0)**	**86 (100.0)**	**36 (100.0)**	**506 (100.0)**

MRSA : Methicillin-resistant Staphylococcus aureus
MSSA : Methicillin-sensitive Staphylococcus aureus

Figure 23 : Bacteriological cultures in VAP 2014

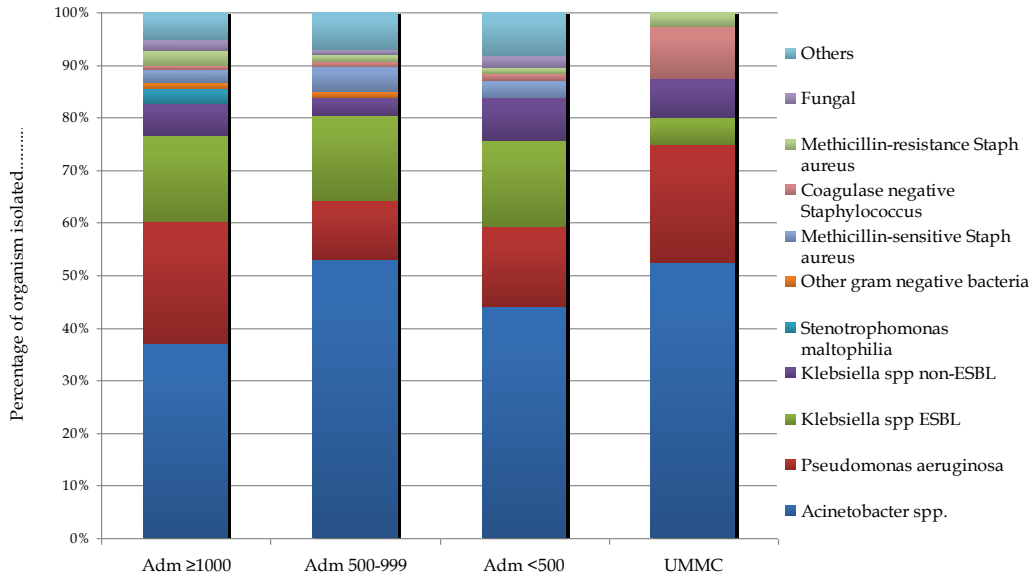
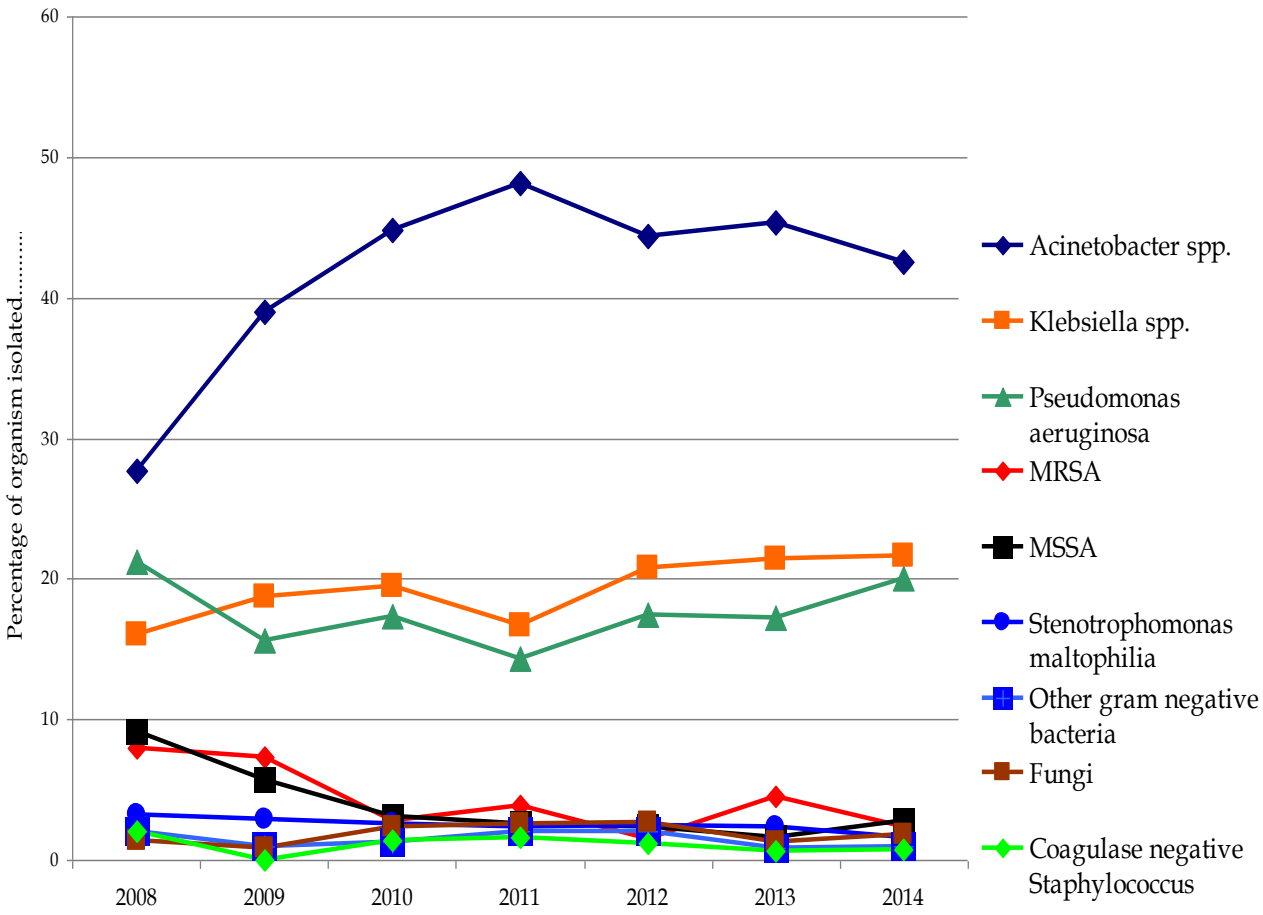


Table 33 : Bacteriological cultures in VAP 2008 – 2014

Organisms	2008 n (%)	2009 n (%)	2010 n (%)	2011 n (%)	2012 n (%)	2013 n (%)	2014 n (%)
Acinetobacter spp.	219 (27.7)	267 (39.0)	350 (44.8)	377 (48.2)	351 (44.4)	315 (45.3)	215 (42.5)
Klebsiella spp.	127 (16.0)	128 (18.7)	152 (19.5)	131 (16.7)	165 (20.8)	149 (21.4)	110 (21.7)
Pseudomonas aeruginosa	168 (21.2)	107 (15.6)	135 (17.3)	112 (14.3)	139 (17.5)	120 (17.2)	101 (20.0)
MRSA	63 (8.0)	50 (7.3)	22 (2.8)	31 (3.9)	12 (1.5)	31 (4.5)	12 (2.4)
MSSA	73 (9.2)	39 (5.7)	24 (3.1)	21 (2.6)	19 (2.4)	11 (1.6)	14 (2.8)
Stenotrophomonas maltophilia	25 (3.2)	20 (2.9)	20 (2.6)	19 (2.4)	20 (2.5)	17 (2.4)	8 (1.6)
Other gram negative bacteria	16 (2.0)	7 (1.0)	10 (1.3)	17 (2.1)	16 (2.0)	6 (0.9)	5 (1.0)
Fungi	11 (1.4)	6 (0.9)	19 (2.4)	21 (2.6)	22 (2.7)	9 (1.3)	9 (1.8)
Coagulase negative *Staphylococcus*	16 (2.0)	-	11 (1.4)	13 (1.6)	10 (1.2)	4 (0.6)	4 (0.8)
Others	73 (9.2)	60 (8.8)	38 (4.9)	40 (5.1)	36 (4.5)	34 (4.9)	28 (5.5)

Figure 24 : Common bacteriological cultures in VAP 2008 – 2014



For MOH ICUs in 2014, gram-negative organisms accounted for 92% of the causative organisms in VAP. Over the last 7 years, the most common organisms were *Acinetobacter spp*., *Klebsiella spp.* and *Pseudomonas aeruginosa*. *Acinetobacter spp*. have been the leading causative organism in VAP since 2007, accounting for 42.5% of all organisms in 2014.

Fifty eight percent of the causative organisms in VAP in MOH ICUs were of multi-drug resistant strains. *Acinetobacter spp*, *Klebsiella spp* and *Pseudomonas aeuroginosa* constituted 60.3%, 26.1% and 9.8% of multi-drug resistant strains respectively. Methicillin-resistant *Staphyloccus aureus* accounted for 46.2% of all *Staphyloccus aureus* isolated.

In UMMC, gram-negative organisms accounted for 97.2% of all causative organisms in VAP. Fifty-three percent of the causative organisms were of multi-drug resistant strains.

In the INICC report [12], 66.3% of *Acinetobacter spp* isolates in patients with VAP were carbapenem-resistant , 68.9% of *Klebsiella pneumonia* isolates were cephalosporin-resistant and 73.2% of *Staphyloccus aureus* isolates were methicillin-resistant.

Table 34 : Extra length of mechanical ventilation, ICU stay and Crude in-hospital mortality in patients with VAP 2013-2014

	2013	2014
Extra length of mechanical ventilation	15.1 days, RR 1.12 (95% CI 1.11-1.13)	13.5 days, RR 1.09 (95% CI 1.09-1.10)
Extra length of ICU stay	18.3 days, RR 1.11 (95% CI 1.10-1.12)	16.4 days, RR 1.08 (95% CI 1.07-1.09)
Extra crude mortality	26%, RR 1.54 (95% CI 1.43-1.68)	13.9% days, RR 1.79 (95% CI 1.47-2.10)

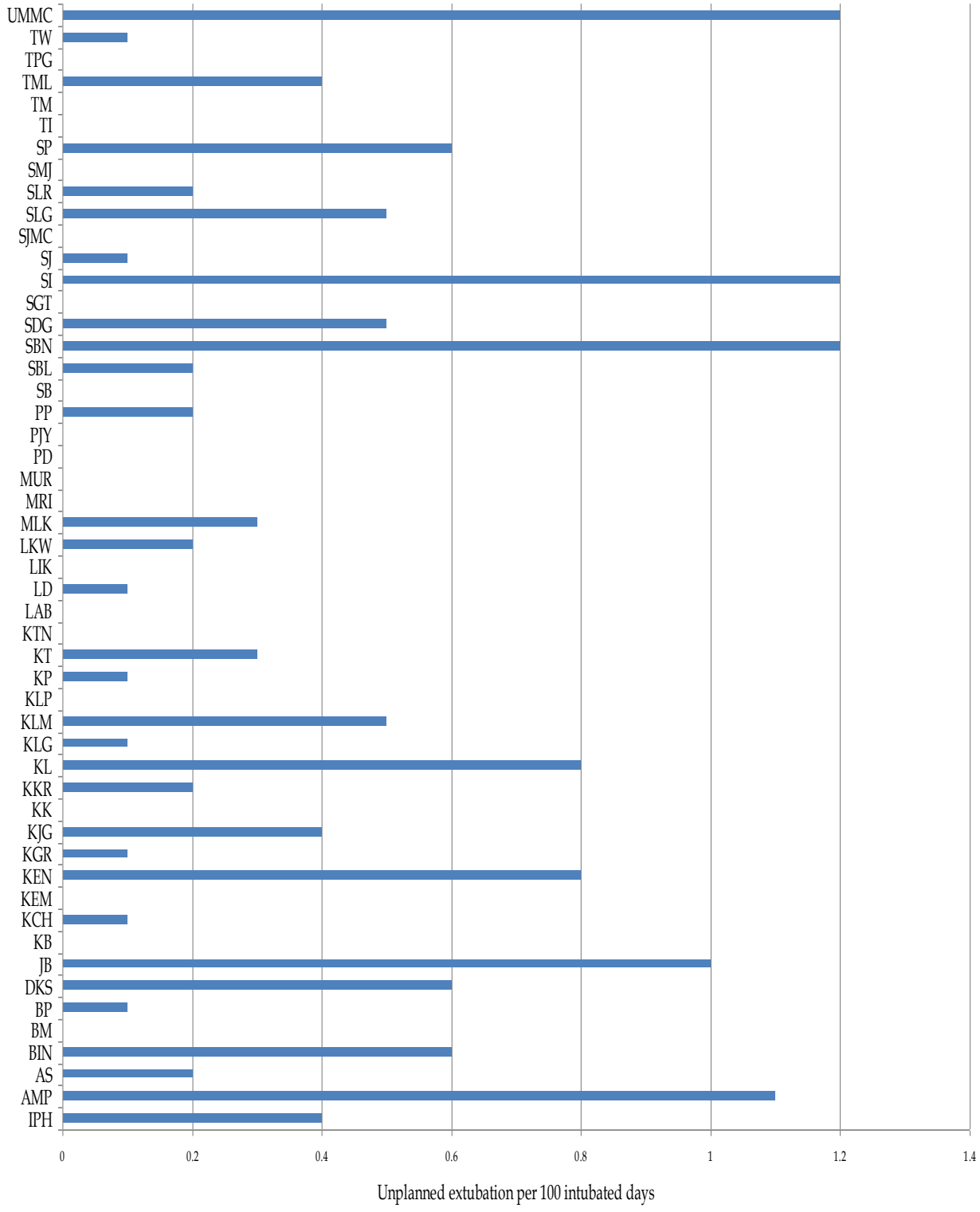
Patients with VAP stay longer on the ventilator for an additional 13 days in 2014. Their ICU stay was prolonged by an average of 16 days. They also had an excess mortality of 14%.

Table 35 : Unplanned extubation per 100 intubated days, by individual hospital 2010– 2014

Hospital	Unplanned extubation per 100 intubated days				
	2010	2011	2012	2013	2014
AS	0.4	0.3	0.3	0.3	0.2
PP	0.3	0.2	0.3	0.1	0.2
IPH	0.4	0.4	0.3	0.3	0.4
KL	1.4	1.0	0.6	0.7	0.8
SLG	0.8	0.6	0.3	0.4	0.5
KLG	0.3	0.2	0.1	0.3	0.1
SBN	0.6	0.8	0.5	0.8	1.2
MLK	0.5	0.8	0.5	0.3	0.3
JB	0.9	1.2	0.7	0.9	1.0
KTN	0.6	0.1	0.0	0.2	0.0
KT	0.6	0.6	0.3	0.1	0.3
KB	0.2	0.1	0.1	0.0	0.0
KCH	0.2	0.1	0.1	0.0	0.1
KK	0.2	0.2	0.1	0.1	0.0
SP	0.4	0.5	0.0	0.5	0.6
PJY	0.5	0.1	0.2	0.1	0.0
MUR	0.2	0.0	0.0	0.1	0.0
TI	0.9	0.2	0.0	0.0	0.0
TPG	0.4	0.5	0.3	0.3	0.0
SJ	0.5	0.4	0.2	0.5	0.1
KJG	0.7	0.0	0.0	0.8	0.4
KGR	0.3	0.0	0.1	0.0	0.1
TML	0.4	0.2	0.5	0.3	0.4
KP	0.6	0.3	0.3	0.2	0.1
SMJ	0.2	0.0	0.0	0.3	0.0
BP	0.2	0.1	0.2	0.1	0.1
TW	0.2	0.0	0.5	0.3	0.1
MRI	0.3	0.1	0.0	0.1	0.0
KLM	1.0	0.6	0.6	0.3	0.5
SDG	0.3	0.4	0.4	0.2	0.5
SB	0.3	0.1	0.0	0.2	0.0
DKS	0.2	0.0	0.0	0.3	0.6
SI	0.5	0.4	0.7	0.8	1.2
SBL	0.2	0.0	0.0	0.1	0.2
AMP	0.7	1.0	0.9	1.0	1.1
LIK	0.0	0.0	0.3	0.0	0.0
LKW			0.8	0.6	0.2
BM			0.0	0.0	0.0
SLR			0.1	0.0	0.2

PD			0.0	0.7	0.0
KKR			0.0	0.4	0.2
SGT			0.2	0.3	0.0
TM			0.0	0.0	0.0
KEM			0.0	0.0	0.0
KLP			0.0	1.9	0.0
LAB			0.0	0.5	0.0
KEN			0.0	0.2	0.8
BIN			0.2	0.5	0.6
LD			0.1	0.1	0.1
Total MOH				**0.3**	**0.4**
SJMC	0.3	0.2	0.0	0.0	0.0
UMMC			0.8	0.9	1.2
Total	**0.5**	**0.4**	**0.3**	**0.3**	**0.4**

Figure 25 : Unplanned extubation, by individual hospital 2014



The rate of unplanned extubation has remained fairly similar over the past 5 years with a rate of 0.4 per 100 intubated days in 2014.

Table 36 : Pressure ulcer, by individual hospital 2010 – 2014

Hospital	Pressure ulcer per 1000 ICU days				
	2010	2011	2012	2013	2014
AS	14.9	15.2	8.6	10.4	4.5
PP	6.6	3.4	6.0	8.4	3.3
IPH	9.0	6.4	8.0	5.2	4.4
KL	8.3	7.9	7.1	9.7	7.3
SLG	13.5	14.4	11.3	16.6	17.8
KLG	2.4	5.6	6.1	6.5	2.3
SBN	2.6	1.1	2.8	4.2	1.9
MLK	4.5	3.8	2.5	1.3	1.9
JB	8.2	6.9	6.7	6.9	13.1
KTN	1.8	0.8	4.2	8.4	10.0
KT	4.3	2.5	1.8	1.3	0.0
KB	3.0	3.2	3.4	1.5	3.0
KCH	10.9	5.0	5.1	7.8	5.6
KK	5.2	5.1	9.8	5.8	5.3
SP	3.2	2.7	3.2	2.2	6.6
PJY	2.2	1.7	4.2	3.2	0.8
MUR	0.4	1.3	0.9	0.5	0.9
TI	3.5	1.6	1.3	0.8	0.8
TPG	9.7	5.4	1.6	1.3	0.7
SJ	9.1	3.2	2.8	10.1	5.3
KJG	10.6	14.5	5.9	2.0	5.2
KGR	4.1	2.9	13.4	14.1	13.3
TML	1.0	0.7	2.4	1.0	1.5
KP	6.1	5.7	11.2	3.7	4.9
SMJ	0.0	0.0	0.0	2.2	0.0
BP	14.7	10.1	3.9	1.9	1.5
TW	4.1	11.2	15.9	21.1	8.5
MRI	2.5	12.2	5.7	12.5	23.2
KLM	8.1	11.0	13.0	7.7	9.8
SDG	8.7	4.5	3.0	6.2	5.5
SB	9.2	9.3	10.0	17.8	13.3
DKS	7.2	0.0	2.1	6.7	2.8
SI	8.1	9.7	13.5	10.7	16.3
SBL	5.6	2.2	8.4	8.7	18.4
AMP	6.0	7.2	7.4	8.5	2.5
LIK	0.0	1.0	5.8	1.7	2.7
LKW	-	-	15.0	1.4	4.9
BM	-	-	3.7	4.2	4.9
SLR	-	-	2.7	2.8	11.8
PD	-	-	9.8	2.8	0.0
KKR	-	-	6.5	3.7	3.3
SGT	-	-	8.5	3.8	0.0

TM	-	-	0.0	4.1	1.5
KEM	-	-	2.5	2.0	15.4
KLP	-	-	0.0	11.8	3.5
LAB	-	-	10.4	9.7	5.9
KEN	-	-	0.0	4.5	9.0
BIN	-	-	1.9	5.0	0.0
LD	-	-	4.5	3.4	5.4
Total MOH				**6.5**	**6.9**
UMMC	-	-	27.0	7.5	5.3
SJMC	4.3	6.8	6.9	2.0	5.0
Total	**6.6**	**5.8**	**6.8**	**6.6**	**6.8**

Pressure ulcer: A circumscribed area in which cutaneous tissue has been destroyed and there is progressive destruction of underlying tissue caused by interference with circulation and nutrition to the area. Signs include blisters or broken skin or sore formation over pressure areas

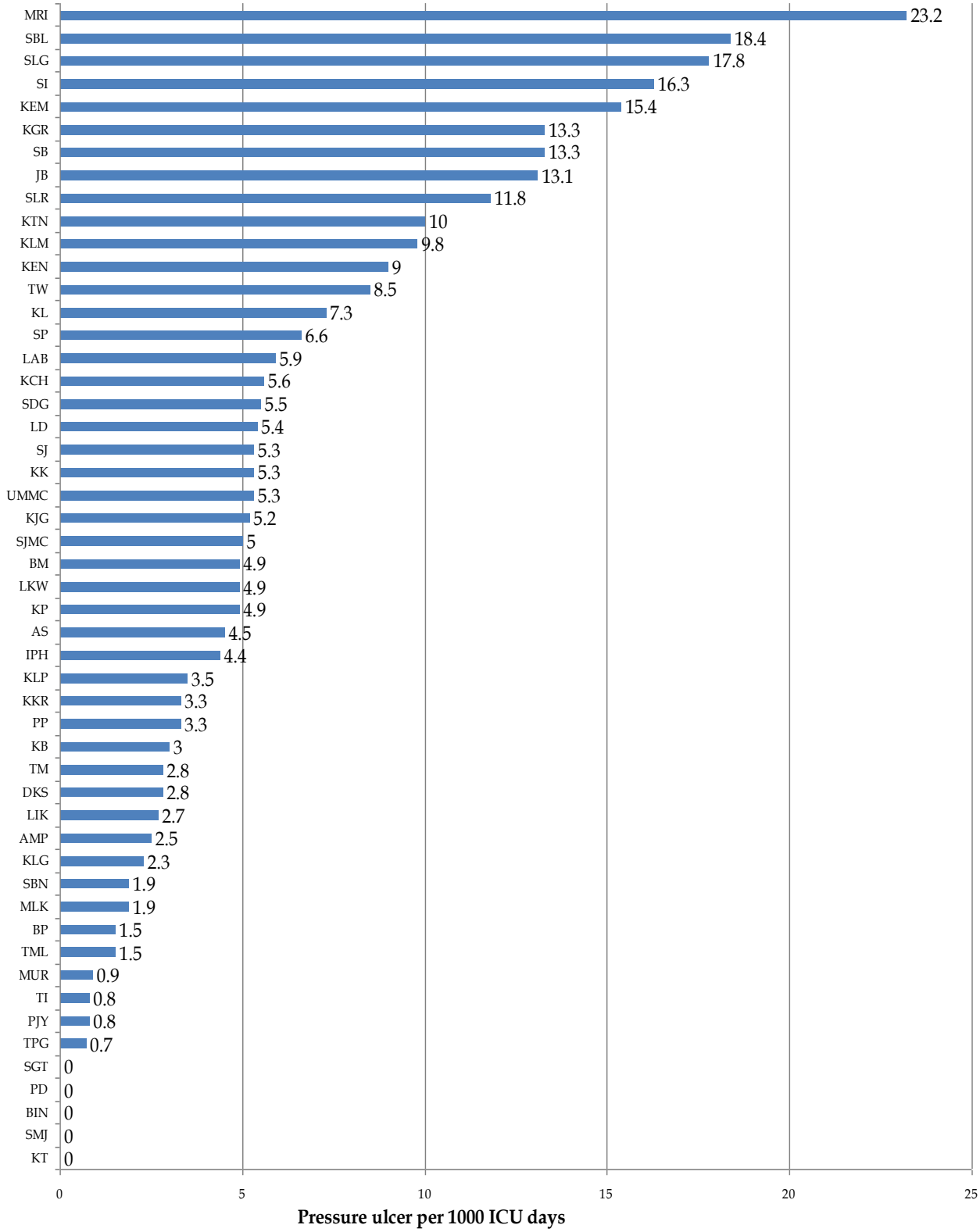
The incidence of pressure ulcers ranged from 0.0 to 23.2 per 1000 ICU days with a mean of 6.8.

For MOH hospitals, the average incidence of pressure ulcers was 6.8 per 1000 ICU days.

Comparisons of rate of pressure ulcers with international standards to describe performance of individual units are not without limitations. Incidence or prevalence rates are frequently used to describe the frequency of pressure ulcers. Prevalence is a measure of the number of cases of pressure ulcers at a specific time, providing a description of the total burden of the disease, while incidence describes the number of new pressure ulcers. Incidence density describes number of new pressure ulcers per 1,000 days rather than per patient. Also the definition of pressure ulcers does vary between studies; some consider all pressure ulcers while others only include stage 2 and above ulcers.

Interventions used in ICUs are sometimes contradictory to good skin care practices. For prevention of ventilator-associated pneumonia, it is recommended that the head of bed is raised to 45^0. However, maintaining the head of a bed that high predisposes the patient to sliding down the bed, causing shearing and friction, and leading to development of pressure ulcers. As a compromise, it is now recommended to nurse critically ill patients with head of bed elevated at 30^0. Hypotension predisposes to skin breakdown, yet haemodynamic instability prevents the staff from turning patients at the recommended frequency of every 2 hours.

Figure 26 : Pressure ulcers, by individual hospital 2014



SECTION E:

MORTALITY OUTCOMES

Crude mortality rates are convenient measures of outcome. However, they are poor indicators of performance of intensive care as they do not take into account variations in patient characteristics such as case mix and the severity of illness.

A better measure of ICU performance is standardised mortality ratio (SMR), comparing the observed to the predicted mortality, using a severity scoring system. SMR stratifies patients according to the severity of illness. SMR of more than one indicates that the actual number of deaths is more than the predicted number of deaths and vice versa.

When interpreting SMR values, one must take into consideration factors which affect the severity scoring system used to predict mortality. These include interval between onset of illness to ICU admission (lead time bias), post-ICU care and small sample size. Lead-time bias refers to the erroneous estimation of risk at the time of admission to the ICU due to the results of therapeutic actions taken previously.

Table 37 : ICU outcome, by category of ICU 2014

ICU outcome	ICUs					
	Adm ≥ 1000 n (%)	Adm 500 - 999 n (%)	Adm < 500 n (%)	Private n (%)	UMMC n (%)	Total n (%)
Alive	18177 81.8%	6113 75.9%	4973 77.7%	859 98.7%	1094 81.4%	**31216** **80.2%**
Died	3763 16.9%	1706 21.2%	1217 19.0%	11 1.3%	233 17.3%	**6930** **17.8%**
Discharged with grave prognosis	127 0.6%	84 1.0%	77 1.2%	0 0.0%	14 1.0%	**302** **0.8%**
Transfer to another hospital	163 0.7%	155 1.9%	135 2.1%	0 0.0%	3 0.2%	**456** **1.2%**
Total	**22230** **100%**	**8058** **100%**	**6402** **100%**	**870** **100%**	**1344** **100%**	**38904** **100%**

Table 38 : Hospital outcome, by category of ICU 2014

Hospital outcome	ICUs					
	Adm ≥ 1000 n (%)	Adm 500 - 999 n (%)	Adm < 500 n (%)	Private n (%)	UMMC n (%)	Total n (%)
Alive	16004 72.0%	5353 66.4%	4498 70.3%	850 97.7%	993 73.9%	**27698** **71.2%**
Died	5178 23.3%	2219 27.5%	1556 24.3%	17 2.0%	318 23.7%	**9288** **23.9%**
Discharged with grave prognosis	245 1.1%	123 1.5%	119 1.9%	2 0.2%	29 2.2%	**518** **1.3%**
Transfer to another hospital	803 3.6%	363 4.5%	229 3.6%	1 0.1%	4 0.3%	**1400** **3.6%**
Total	**22230** **100.0%**	**8058** **100.0%**	**6402** **100.0%**	**870** **100.0%**	**1344** **100.0%**	**38904** **100.0%**

Table 39 : Crude in-ICU and in-hospital mortality rate, by individual hospital 2010 – 2014

Hospital	Crude in-ICU mortality (in-hospital mortality) %				
	2010	2011	2012	2013	2014
AS	32.1 (43.1)	24.1 (34.4)	26.7 (44.5)	27.3 (37.3)	28.9 (39.7)
PP	12.6 (22.8)	14.4 (23.3)	16.5 (26.9)	15.6 (25.0)	18.3 (25.7)
IPH	21.9 (27.3)	22.4 (30.0)	16.5 (25.5)	18.5 (25.6)	16.7 (24.7)
KL	15.5 (22.0)	17.0 (24.7)	18.4 (27.0)	17.5 (25.8)	14.3 (21.9)
SLG	18.0 (24.5)	17.9 (25.8)	16.5 (27.1)	17.2 (24.5)	15.7 (20.8)
KLG	18.7 (26.3)	17.1 (25.1)	15.5 (22.9)	13.6 (21.7)	13.3 (19.3)
SBN	19.9 (28.8)	21.3 (30.0)	22.1 (30.4)	19.7 (25.7)	21.1 (27.9)
MLK	23.2 (30.8)	23.6 (32.7)	13.5 (32.1)	19.9 (28.2)	20.0 (27.7)
JB	20.3 (27.7)	22.3 (31.4)	21.4 (30.0)	22.2 (29.9)	17.4 (25.5)
KTN	19.4 (28.5)	17.2 (24.3)	24.1 (34.9)	22.2 (32.2)	17.8 (25.5)
KT	21.3 (30.6)	20.9 (27.2)	18.5 (28.1)	22.0 (32.0)	21.0 (30.0)
KB	19.2 (26.8)	17.8 (24.4)	16.0 (22.6)	15.0 (21.3)	11.6 (16.1)
KCH	15.8 (21.1)	22.1 (29.1)	17.4 (24.3)	18.0 (24.0)	13.9 (17.7)
KK	24.6 (33.5)	20.5 (27.3)	21.7 (34.0)	19.5 (25.3)	17.2 (22.5)
SP	33.3 (43.0)	32.6 (42.2)	26.9 (38.4)	23.3 (32.6)	22.8 (30.4)
PJY	19.3 (23.1)	18.4 (21.9)	16.9 (19.3)	19.9 (22.9)	15.9 (19.6)
MUR	18.8 (24.6)	20.9 (29.2)	24.1 (33.8)	20.7 (24.7)	24.2 (26.2)
TI	21.7 (34.1)	22.4 (35.1)	17.7 (31.9)	21.9 (34.6)	23.4 (34.7)
TPG	38.1 (48.4)	27.0 (43.4)	21.4 (35.3)	19.3 (30.1)	20.9 (28.8)
SJ	22.4 (33.6)	25.2 (35.2)	23.2 (35.5)	29.3 (40.2)	24.2 (28.4)
KJG	16.1 (20.7)	19.6 (27.0)	15.0 (23.8)	15.9 (26.8)	12.0 (21.1)
KGR	21.8 (29.6)	18.1 (25.8)	16.3 (22.1)	18.0 (24.5)	17.0 (17.3)
TML	25.6 (32.5)	19.7 (23.0)	14.7 (21.0)	16.0 (22.5)	19.1 (25.7)
KP	41.9 (46.2)	34.3 (47.1)	28.9 (42.4)	28.7 (38.0)	`30.5 (37.1)
SMJ	29.9(39.2)	24.5 (33.2)	24.3 (29.6)	27.6 (32.7)	30.1 (36.1)
BP	18.8 (33.0)	21.4 (32.6)	29.8 (40.7)	22.7 (31.0)	20.0 (34.6)
TW	21.8 (30.3)	15.7 (27.0)	13.7 (24.3)	17.8 (29.6)	16.3 (23.7)
MRI	15.9 (24.2)	22.6 (29.6)	18.3 (24.1)	18.7 (22.0)	15.4 (16.8)
KLM	29.7 (37.6)	30.9 (40.2)	21.0 (32.5)	25.8 (39.0)	26.5 (40.0)
SDG	17.5 (23.5)	18.0 (22.9)	17.7 (25.9)	18.3 (26.3)	16.6 (22.6)
SB	23.4 (28.9)	24.3 (31.8)	22.8 (30.2)	24.9 (39.5)	27.1 (35.3)
DKS	48.0 (59.3)	27.8 (30.2)	25.5 (26.8)	26.9 (31.3)	22.3 (31.5)
SI	26.8 (31.7)	22.1 (28.7)	24.6 (28.6)	21.2 (26.5)	20.2 (26.1)
SBL	16.0 (23.3)	18.0 (28.5)	17.2 (25.2)	18.6 (26.9)	18.7 (24.1)
AMP	37.1 (41.8)	35.1 (43.9)	37.9 (47.8)	31.1 (42.1)	35.6 (44.0)
LIK	1.9 (1.9)	2.9 (3.7)	5.6 (6.5)	4.1 (6.0)	2.3 (4.0)
LKW	-	-	28.6 (36.2)	17.8 (22.3)	26.1 (33.3)
BM	-	-	13.2 (21.1)	29.8 (34.8)	19.9 (22.2)
SLR	-	-	42.8 (52.6)	27.6 (31.1)	32.7 (39.0)
PD	-	-	14.6 (18.4)	15.9 (23.0)	15.5 (20.0)
KKR	-	-	15.0 (24.4)	23.7 (28.7)	21.5 (21.5)

SGT	-	-	24.5 (30.4)	21.4 (34.5)	18.0 (25.3)
TM	-	-	5.9 (11.8)	23.7 (24.4)	22.5 (24.4)
KEM	-	-	9.9 (12.6)	15.3 (17.1)	13.2 (23.1)
KLP	-	-	0 (0)	8.6 (11.2)	12.5 (14.6)
LAB	-	-	29.7 (34.3)	35.7 (40.0)	40.4 (43.4)
KEN	-	-	11.4 (20.0)	6.8 (12.4)	9.7 (12.5)
BIN	-	-	17.8 (27.7)	12.7 (17.7)	14.5 (19.8)
LD	-	-	29.8 (38.1)	23.0 (35.3)	29.5 (40.6)
MOH Hospitals	**20.9 (28.1)**	**21.2 (29.5)**	**19.4 (27.9)**	**19.9 (27.7)**	**19.0 (25.7)**
SJMC	4.2 (4.6)	4.3 (4.8)	4.3 (4.9)	2.4 (3.0)	1.3 (2.2)
UMMC	**-**	**-**	20.3 (31.8)	16.7 (24.8)	18.4 (25.8)

The overall in-ICU and in-hospital mortality rates for MOH hospitals in 2014 were 19.0% and 25.7% respectively.

UMMC had fairly similar in-ICU and in-hospital mortality rates of 18.4% and 25.8% respectively.

SJMC had a very low in-ICU and in-hospital mortality rates of 1.3% and 2.2% respectively.

Figure 27 : Crude In-ICU and In-hospital mortality rates, by individual hospital 2014

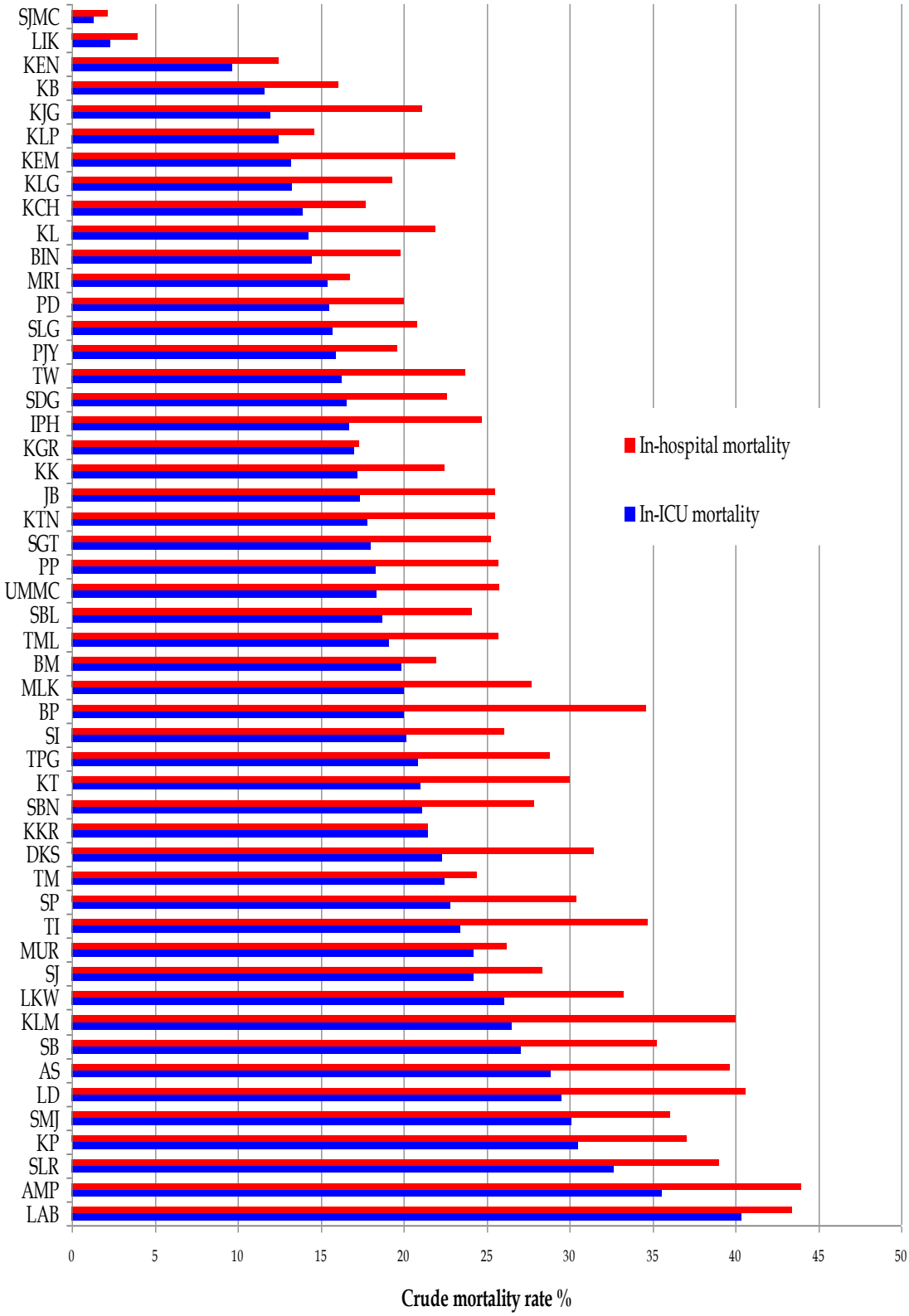


Table 40 : Ten most common diagnoses leading to ICU admission in MOH hospitals and observed in-hospital mortality 2010 – 2014

Diagnosis	Mortality (%)				
	2010	2011	2012	2013	2014
Dengue infection	8.6	6.4	5.6	5.6	7.1
Sepsis	59.3	58.9	54.4	53.4	52.8
Head injury	27.4	25.2	23.1	22.1	22.2
Community-acquired pneumonia	42.6	40.6	39.0	38.9	36.2
Cerebral vascular disease	-	41.9	40.5	45.5	41.1
Chronic lower respiratory disease	26.2	24.9	23.6	22.1	18.8
Bronchial asthma	7.8	10.9	7.5	8.1	7.6
Non-cardiogenic pulmonary oedema	29.5	22.3	18.9	21.4	21.6
Infection/gangrene of limb (include osteomyelitis, necrotising fasciitis)	39.1	41.8	39.6	37.7	36.9
DKA/HHS	-	-	-	21.1	19.3

In-hospital mortality for dengue infection increased slightly in 2014 compared to the previous years. In-hospital mortality for patients with sepsis, community-acquired pneumonia, and acute exacerbation of chronic lower respiratory disease had steadily improved over the past five years.

Table 41 : Severe sepsis, ARDS and AKI within 24hrs of ICU admission and observed in-hospital mortality 2012 - 2014

	In-hospital Mortality (%)		
	2012	2013	2014
Severe sepsis	43.1	41.6	35.5
ARDS	37.3	36.6	35.9
AKI	41.4	43.9	38.0
Severe sepsis + ARDS	67.1	60.3	62.7
Severe sepsis + AKI	61.3	59.3	61.5
Severe sepsis + ARDS + AKI	80.4	73.4	73.7

The in-hospital mortality for severe sepsis within 24 hours of ICU admission decreased to 35.5% in 2014. However, it is higher when compared with the in-ICU mortality of the Sepsis Occurrence in Acutely Ill Patient (SOAP) study. The in-ICU mortality was 27% in patient with sepsis on ICU admission [5].

Reported mortality in ICU patients with AKI varies considerably between studies depending on definition of AKI, patient population (e.g., sepsis, trauma, cardiothoracic surgery) and severity of AKI. Patients with maximum RIFLE class R, class I and class F had hospital mortality rates of 8.8%, 11.4% and 26.3%, respectively [14]. Payen et al reported that patients with acute renal failure had higher mortality rates than patients without acute renal failure among patients enrolled in the SOAP study (60-day mortality 35.7% versus 16.4%; $P < 0.01$) [15].

Table 42 : Standardised mortality ratio, by individual hospital 2010 – 2014

Hospital	Standardised mortality ratio (95% CI)				
	2010	2011	2012	2013	2014
AS	0.93	0.82 (0.60-1.11)	1.07 (0.81-1.39)	1.01 (0.76-1.32)	0.91 (0.68-1.20)
PP	0.68	0.67 (0.47-0.96)	0.74 (0.51-1.01)	0.71 (0.49-0.99)	0.69 (0.49-0.98)
IPH	0.82	0.96 (0.67-1.35)	0.83 (0.58-1.17)	0.74 (0.51-1.04)	0.75 (0.52-1.05)
KL	0.62	0.61 (0.43-0.87)	0.63 (0.44-0.88)	0.60 (0.42-0.84)	0.58 (0.39-0.82)
SLG	0.76	0.75 (0.52-1.05)	0.75 (0.54-1.05)	0.68 (0.48-0.97)	0.63 (0.43-0.91)
KLG	0.85	0.62 (0.43-0.87)	0.60 (0.41-0.86)	0.54 (0.37-0.80)	0.57 (0.38-0.84)
SBN	0.74	0.77 (0.55-1.04)	0.73 (0.50-1.03)	0.71 (0.51-0.99)	0.79 (0.56-1.10)
MLK	0.97	0.98 (0.71-1.33)	0.81 (0.58 –1.10)	0.86 (0.61-1.21)	0.82 (0.59-1.15)
JB	0.71	0.78 (0.56-1.05)	0.71 (0.51-0.97)	0.66 (0.47-0.91)	0.61 (0.42-0.85)
KTN	0.90	0.72 (0.50-1.01)	0.84 (0.62-1.21)	0.82 (0.58-1.09)	0.69 (0.49-0.97)
KT	0.86	0.67 (0.48-0.94)	0.65 (0.46-0.89)	0.72 (0.53-0.98)	0.73 (0.54-1.00)
KB	1.00	0.76 (0.52-1.07)	0.67 (0.46-0.95)	0.62 (0.44-0.92)	0.60 (0.39-0.91)
KCH	0.63	0.82 (0.58-1.13)	0.75 (0.51-1.06)	0.69 (0.47-0.98)	0.56 (0.36-0.84)
KK	0.83	0.71 (0.50-1.00)	1.00 (0.70-1.38)	0.8 (0.55-1.14)	0.51 (0.36-0.74)
SP	0.97	1.00 (0.75-1.30)	0.77 (0.57-1.03)	0.75 (0.54-1.02)	0.79 (0.56-1.07)
PJY	0.83	0.76 (0.50-1.10)	0.69 (0.45-1.03)	0.80 (0.54-1.14)	0.59 (0.40-0.88)
MUR	0.88	0.78 (0.56-1.06)	0.89 (0.63-1.23)	0.55 (0.37-0.79)	0.63 (0.44-0.88)
TI	0.71	0.77 (0.57-1.05)	0.72 (0.53-0.99)	0.65 (0.46-0.88)	0.74 (0.53-1.00)
TPG	1.03	0.92 (0.69-1.20)	0.80 (0.58-1.07)	0.64 (0.45-0.89)	0.68 (0.49-0.95)
SJ	0.76	0.84 (0.61-1.12)	0.87 (0.64-1.17)	0.95 (0.73-1.25)	0.70 (0.49-0.95)
KJG	0.64	0.79 (0.57-1.11)	0.85 (0.55-1.14)	0.88 (0.61-1.20)	0.73 (0.50-1.05)
KGR	0.75	0.72 (0.51-1.04)	0.62 (0.42-0.89)	0.64 (0.44-0.90)	0.61 (0.40-0.91)
TML	0.86	0.59 (0.41-0.85)	0.64 (0.43-0.90)	0.80 (0.56-1.15)	0.83 (0.59-1.15)
KP	0.90	1.06 (0.79-1.37)	0.95 (0.72-1.25)	0.95 (0.71-1.26)	0.98 (0.74-1.33)
SMJ	0.93	0.78 (0.57-1.07)	0.70 (0.51-0.97)	0.69 (0.49-0.95)	0.82 (0.60-1.10)
BP	0.76	0.69 (0.50-0.94)	0.87 (0.65-1.14)	0.69 (0.47-0.97)	0.79 (0.58-1.06)
TW	0.55	0.72 (0.51-0.98)	0.67 (0.47-0.93)	0.76 (0.53-1.03)	0.65 (0.43-0.93)
MRI	0.69	0.89 (0.62-1.25)	0.65 (0.42-0.96)	0.62 (0.43-0.89)	0.50 (0.32-0.73)
KLM	0.87	0.83 (0.62-1.11)	0.69 (0.50-0.94)	0.75 (0.56-1.00)	0.79 (0.58-1.04)
SDG	0.71	0.61 (0.42-0.86)	0.61 (0.44-0.85)	0.65 (0.46-0.90)	0.57 (0.41-0.81)
SB	0.74	0.88 (0.64-1.17)	0.75 (0.54-1.01)	0.87 (0.65-1.14)	0.78 (0.56-1.04)
DKS	1.04	0.76 (0.55-1.02)	0.74 (0.52-1.01)	0.76 (0.52-1.06)	0.83 (0.61-1.14)
SI	0.72	0.77 (0.56-1.07)	0.73 (0.52-1.01)	0.78 (0.55-1.10)	0.78 (0.55-1.11)
SBL	0.73	0.74 (0.53-1.03)	0.63 (0.45-0.90)	0.92 (0.65-1.28)	0.67 (0.48-0.97)
AMP	0.89	0.92 (0.71-1.20)	0.90 (0.69-1.17)	0.89 (0.69-1.15)	0.9 (0.69-1.17)
LIK	0.14	0.19 (0.10-0.45)	0.27 (0.14-0.57)	0.58 (0.30-1.08)	0.28 (0.11-0.57)
LKW	-	-	0.96 (0.71-1.25)	0.74 (0.48-1.08)	0.84 (0.61-1.12)
BM	-	-	0.54 (0.36-0.79)	0.58 (0.41-0.79)	0.33 (0.22-0.48)
SLR	-	-	0.98 (0.76-1.26)	0.71 (0.51-0.99)	0.80 (0.59-1.04)
PD	-	-	0.60 (0.40-0.92)	0.74 (0.51-1.05)	0.75 (0.48-1.08)
KKR	-	-	0.68 (0.47-0.96)	0.64 (046-0.88)	0.40 (0.27-0.60)

SGT	-	-	0.74 (0.51-1.03)	0.73 (0.54-0.99)	0.50 (0.35-0.71)
TM	-	-	0.76 (0.49-1.13)	0.68 (0.46-0.96)	0.60 (0.41-0.84)
KEM	-	-	0.30 (0.17-0.46)	0.44 (0.28-0.65)	0.67 (0.48-0.94)
KLP	-	-	0 (0)	0.53 (0.31-0.83)	0.65 (0.43-0.96)
LAB	-	-	0.87 (0.64-1.16)	0.94 (0.72-1.23)	0.83 (0.64-1.06)
KEN	-	-	0.55 (0.39-0.77)	0.41 (0.25-0.63)	0.33 (0.20-0.51)
BIN	-	-	1.15 (0.84-1.51)	0.6 (0.40-0.87)	0.60 (0.42-0.87)
LD	-	-	0.68 (0.5-0.9)	0.77 (0.54-1.06)	0.90 (0.67-1.17)
Total MOH				0.72 (0.51-1.00)	0.69 (0.48-0.95)
UMMC	-	-	0.83 (0.60-1.14)	0.65 (0.44-0.91)	0.65 (0.44-0.90)
SJMC	0.36	0.44 (0.24-0.89)	0.44 (0.23-0.85)	0.28 (0.14-0.68)	0.22 (0.11-0.59)

The pooled standardized mortality ratio for MOH ICUs in 2014 was 0.69 (95% CI 0.48 – 0.95).

It is observed that the SMR has been steadily decreasing over the years. However, risk-adjusted severity scoring systems are known to drift in calibration over time and this may result in lower SMR over the years.

SECTION F:

QUALITY IMPROVEMENT ACTIVITIES

VENTILATOR CARE BUNDLE

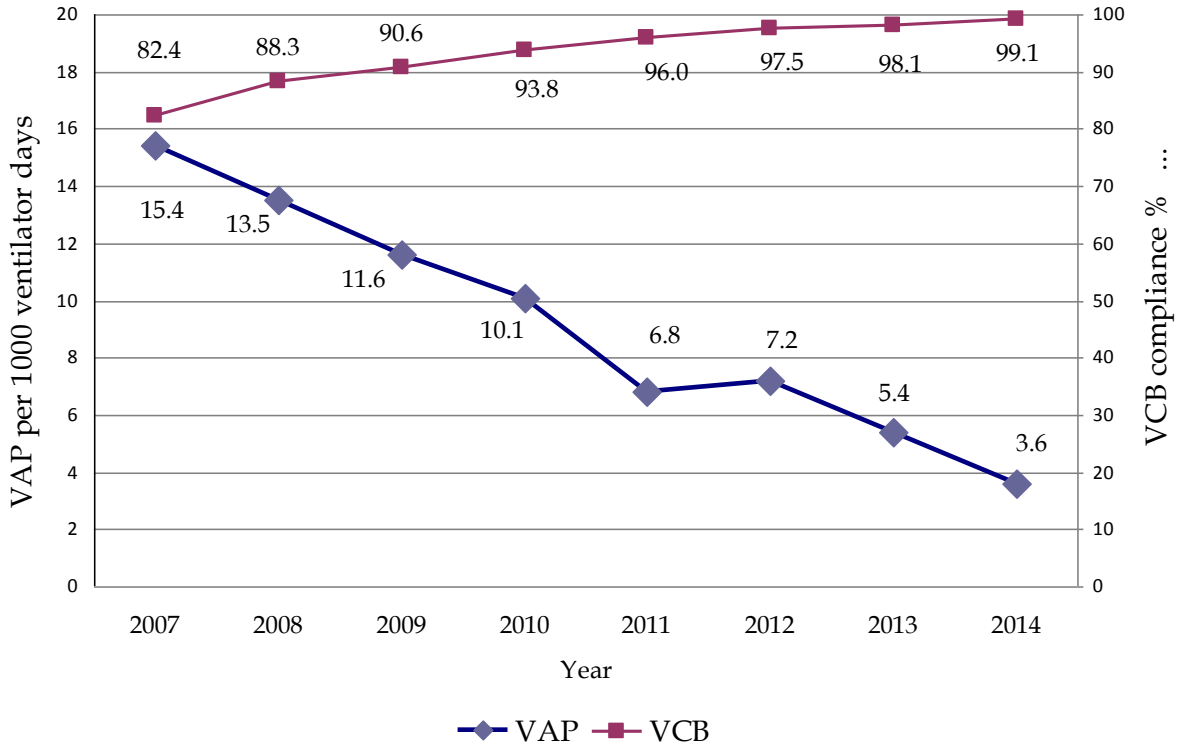
Table 43 : Ventilator Care Bundle Compliance, by individual hospital, 2010 - 2014

Hospital	% Compliance Year				
	2010	2011	2012	2013	2014
AS	91.75	95.85	97.6	100.0	100.00
PP	99.05	94.79	92.8	93.5	92.74
IPH	97.67	98.65	98.5	97.8	97.02
KL	90.93	94.70	96.6	96.2	96.19
SLG	88.18	96.38	96.8	96.1	96.20
KLG	89.14	94.46	95.3	97.4	99.07
SBN	100.00	100.00	99.4	100.0	100.00
MLK	-	98.36	100	99.3	99.23
JB	99.30	98.97	99.2	99.5	99.42
KTN	96.57	98.13	98.4	100.0	99.32
KT	100.00	98.71	97.9	100.0	100.00
KB	99.13	100.00	100	100.0	100.00
KCH	85.14	92.08	97.2	96.1	96.41
KK	76.79	72.41	100	98.5	99.7
SP	98.13	100.00	100	100.0	92.96
PJY	100.00	100.00	100	100.0	100.00
MUR	98.29	100.00	100	99.1	100.00
TI	92.15	91.04	100	100.0	100.00
TPG	94.57	98.11	98.4	97.9	100.00
SJ	97.05	98.70	100	100.0	100.00
KJG	96.96	100.00	100	100.0	100.00
KGR	96.49	100.00	100	100.0	100.00
TML	90.95	97.60	97.2	99.0	96.82
KP	90.24	95.31	98.1	100.0	99.28
SMJ	-	96.15	98.5	100.0	100.00
BP	96.52	95.31	96.7	99.5	97.55
TW	100.00	94.44	100	100.0	100.00
MRI	96.90	87.61	100	100.0	100.00
KLM	90.00	86.77	93.9	94.7	96.85
SDG	86.25	96.04	100	100.0	100.00
SB	-	-	95.9	97.2	100.00
DKS	-	-	100	100.0	100.00
SI	-	-	91.3	92.9	90.00
SBL	-	-	99.8	100.0	98.97
AMP	-	-	95.0	94.4	93.62
LIK	-	-	100	100.0	100.00
UMMC				100.0	100.00
LKW	-	-	74.2	90.4	100.00
BM	-	-	100	100.0	97.85

SLR	-	-	92.0	89.4	93.33
PD	-	-	100	100.0	100.00
KKR	-	-	100	100.0	100.00
SGT	-	-	100	91.7	100.00
TM				100.0	100.00
KEM	-	-	100	100.0	100.00
LAB	-	-	100	100.0	100.00
KEN	-	-	100	100.0	100.00
BIN	-	-	97.6	95.7	100.00
LD	-	-	100	98.8	100.00
Total	**94.13**	**96.00**	**97.5**	**98.2**	**99.05**

The overall VCB compliance rate for 2014 was 99%. VCB compliance is one of the key performance indicators for the Anaesthesia program in MOH. All centres had VCB compliance rates above 85%, which is the target set for this indicator.

Figure 28 : Ventilator care bundle compliance and ventilator-associated pneumonia rates, 2007 – 2014



CENTRAL VENOUS CATHETER (CVC) CARE BUNDLE

Central venous catheter (CVC) care bundle was initiated in ICUs in MOH hospitals in 2008. This evidence-based practice has been implemented in many units worldwide following landmark studies that demonstrated substantial reduction in CVC-BSI [20], [21].

In the NAICU Report 2007, 66.2% of ICU admissions had central venous catheters in-situ. The incidence of CVC-BSI can be used as a measure of the safety of clinical practice processes within an ICU. CVC care bundle compliance rate and incidence of CVC-BSI are monitored in ICUs in MOH hospitals since October 2012.

Measurement of CVC-BSI as a performance indicator may pose some problems. The clinical decision to obtain blood cultures directly impacts CVC-BSI rates. ICUs that obtain more blood cultures will inevitably document more CVC-BSI. In addition, the definition of CVC-BSI stipulates absence of other sources of infection to explain positive blood cultures. The degree to which an alternate source of infection could explain a positive blood culture, however, also involves subjective judgment.

The denominator used in measurement of CVC-BSI is catheter-days. The catheter-day denominator adjusts for the number of patients with catheters when CVC-BSI rates are compared between units. It is also important to realise that unless the catheter-day denominator for the surveillance period is large, the standard error of an individual rate measurement is high.

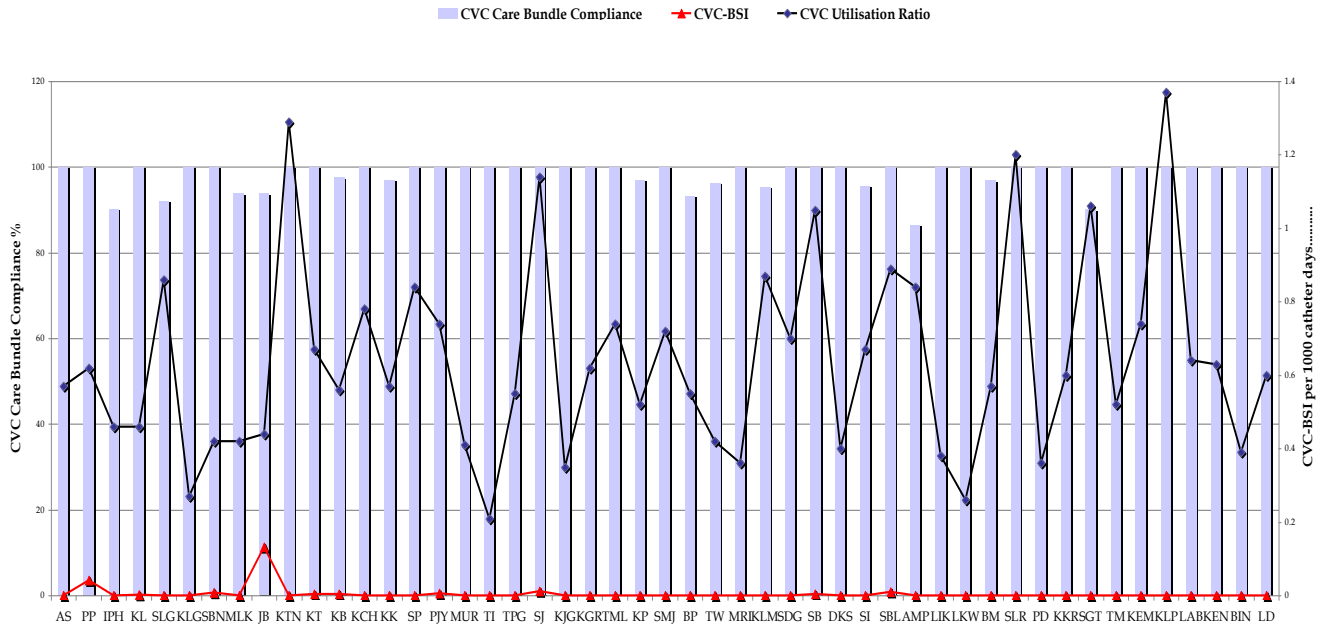
The need for placement of CVC is dependent on patient disease severity. However, the use of catheter-days does not adjust fully for the difference of patient case mix. Catheter utilisation ratio can be measured to overcome this problem. It is defined as the ratio of the number of CVC-days divided by the number of patient days during a specific surveillance period. Catheter utilisation ratio varies by type of ICU due to patient case mix. It is dependent on patient disease severity, which affects the need to insert the catheter. It is also a reflection on the catheter removal practice or policy in the unit.

Table 44 : Catheter Utilisation Ratio, Central Venous Catheter Care Bundle Compliance and incidence of central venous catheter-related blood stream infection (CVC-BSI), by individual hospital 2013 – 2014

Hospitals	Central Venous Catheter utilisation ratio		CVC care bundle compliance		Incidence of CVC-BSI per 1000 catheter days	
	2013	2014	2013	2014	2013	2014
AS	0.46	0.57	100.0	100.0	0.0	0.0
PP	0.80	0.62	100.0	100.0	2.6	3.5
IPH	0.48	0.46	95.7	90.3	0.3	0.0
KL	0.49	0.46	100.0	100.0	1.5	0.2
SLG	0.91	0.86	90.8	92.1	0.0	0.0
KLG	0.27	0.27	100.0	100.0	0.0	0.0
SBN	0.42	0.52	99.5	100.0	0.9	0.7
MLK	0.62	0.42	99.1	93.8	0.0	0.0
JB	0.32	0.44	96.3	93.8	16.4	11.3
KTN	1.23	1.29	100.0	100.0	0.0	0.0
KT	0.54	0.67	100.0	100.0	0.3	0.3

KB	0.73	0.56	100.0	97.5	0.4	0.3
KCH	0.78	0.79	100.0	100.0	0.0	0.0
KK	0.71	0.57	95.1	97.0	0.2	0.0
SP	1.54	0.84	100.0	100.0	0.0	0.0
PJY	0.71	0.74	100.0	100.0	0.7	0.5
MUR	0.36	0.41	100.0	100.0	0.0	0.0
TI	0.75	0.21	100.0	100.0	0.0	0.0
TPG	0.53	0.55	100.0	100.0	0.0	0.0
SJ	0.77	1.14	100.0	100.0	0.0	1.0
KJG	0.34	0.35	100.0	100.0	0.0	0.0
KGR	0.80	0.62	100.0	100.0	0.0	0.0
TML	0.95	0.74	100.0	100.0	0.4	0.0
KP	0.61	0.52	100.0	97.0	0.0	0.0
SMJ	0.54	0.72	100.0	100.0	2.7	0.0
BP	0.46	0.55	91.1	93.3	2.1	0.0
TW	0.53	0.42	86.8	96.1	0.0	0.0
MRI	0.33	0.36	100.0	100.0	0.0	0.0
KLM	0.93	0.87	95.5	95.4	0.0	0.0
SDG	0.41	0.70	100.0	100.0	0.0	0.0
SB	0.89	1.05	92.9	100.0	0.0	0.3
DKS	0.58	0.40	100.0	100.0	0.0	0.0
SI	0.80	0.67	97.1	95.5	0.0	0.0
SBL	0.87	0.89	100.0	100.0	0.4	0.9
AMP	0.92	0.84	82.4	86.6	0.0	0.0
LIK	0.36	0.38	100.0	100.0	0.0	0.0
LKW	0.73	0.26	100.0	100.0	0.0	0.0
BM	0.80	0.57	93.1	96.9	0.0	0.0
SLR	1.00	1.20	100.0	100.0	0.0	0.0
PD	0.31	0.36	100.0	100.0	0.0	0.0
KKR	0.59	0.60	99.1	100.0	1.2	0.0
SGT	0.85	1.06	85.0	90.1	2.2	0.0
TM	0.64	0.52	77.6	100.0	0.0	0.0
KEM	0.16	0.74	100.0	100.0	0.0	0.0
KLP	0.72	1.37	100.0	100.0	0.0	0.0
LAB	0.50	0.64	100.0	100.0	0.0	0.0
KEN	0.08	0.63	100.0	100.0	0.0	0.0
BIN	0.60	0.39	100.0	100.0	0.0	0.0
LD	0.70	0.60	100.0	100.0	0.0	0.0
MOH Hospitals	**0.64**	**0.63**	**97.5**	**98.4**	**0.8**	**0.7**
SJMC	NA	NA	NA	NA	NA	NA
UMMC	0.39	0.64	100.0	100.0	0.0	0.4

Figure 29 : **Catheter Utilisation Ratio, Central Venous Catheter Care Bundle Compliance and incidence of central venous catheter-related blood stream infection (CVC-BSI), by hospital 2014**



National Healthcare Safety Network (NHSN) report, data summary for 2013 [23]							
Types of ICU	**Catheter utilisation ratio**	**CVC-BSI per 1000 catheter days**					
		Pooled mean	**Percentile**				
			10th	**25th**	**50th**	**75th**	**90th**
Mixed medical/ surgical > 15 beds	0.49	0.8	0.0	0.0	0.6	1.2	2.0
Mixed medical/ surgical ≤ 15 beds	0.37	0.8	0.0	0.0	0.0	1.0	2.4
Neurosurgical	0.43	0.9	0.0	0.0	0.7	1.4	2.2
Surgical	0.55	0.9	0.0	0.0	0.7	1.4	2.5
Trauma	0.53	1.4	0.0	0.5	1.2	2.1	3.4

Table 45 : Bacteriological cultures in CVC-BSI, 2013 - 2014

Organisms	2013 n (%)	2014 n (%)
Klebsiella spp.	**25 (34.2)**	**30 (39.0)**
MRO	**8**	**23**
Non-MRO	**17**	**7**
Acinetobacter spp.	**12 (16.4)**	**20 (26.0)**
MRO	**5**	**18**
Non-MRO	**7**	**2**
Pseudomonas aeruginosa	**15 (20.5)**	**14 (18.2)**
MRO	**0**	**2**
Non-MRO	**15**	**12**
Enterobacter spp.	**0 (0.0)**	**6 (7.8)**
MRO	**0**	**3**
Non- MRO	**0**	**3**
Stenotrophomonas maltophilia	**3 (4.1)**	**0 (0)**
Other gram negative bacteria	**5 (6.8)**	**1 (1.3)**
MRO	**2**	**0**
Non-MRO	**3**	**1**
Staphylococcus aureus	**7 (9.6)**	**3 (3.9)**
MRSA	**7**	**2**
MSSA	**0**	**1**
Coagulase negative *Staphylococcus*	**3 (4.1)**	**1 (1.3)**
Methicillin resistant	**2**	**1**
Methicillin sensitive	**1**	**0**
Enterococcus faecium	**0 (0)**	**1 (1.3)**
Fungal	**3 (4.1)**	**1 (1.3)**
Total	**73 (100.0)**	**77 (100)**

The mean compliance rate to CVC care bundle in MOH ICUs in 2014 was 98.4%. The incidence of CVC-BSI was 0.7 per 1000 catheter days and it was comparable when benchmarked with that of US National Healthcare Safety Network (NHSN) [23]; as shown in the table above. However, there was a high possibility of under diagnosis and under reporting in many MOH ICUs.

The pooled catheter utilization ratio was 0.63, which was higher than the benchmark.

Gram-negative organisms accounted for 92% of causative organisms for CVC-BSI in 2014 in MOH ICUs. The predominant organisms isolated were *Klebsiella pneumonia* followed by *Acinetobacter sp*. and *Pseudomonas aeruginosa.*

Majority of CRBSIs are associated with CVCs, and in prospective studies, the relative risk for CRBSI is up to 64 times greater with CVCs than with peripheral venous catheters.

The risk of CRBSI is considerably higher in the ICU population than in the non-ICU population. One of the main reasons for this was the frequent insertion of multiple catheters. Moreover the catheters may have been placed in emergency circumstances, repeatedly accessed each day, and often needed for extended periods.

Meta-analytical study done at the Johns Hopkins University showed that bloodstream infections were the third leading cause of hospital-acquired infections. These infections have an attributable mortality rate of 12% to 25%. Individuals counteract 250,000 bloodstream infections each year in the United States and over 80,000 of these appeared in ICUs. These infections were associated with increased length of hospital stay from 10 to 20 days and increased in the cost of care [25]. 60% of CRBSIs were caused by micro-organisms from the patient's skin. 64% of the pathogens causing CRBSI were gram-positive and 36% were gram-negative.

In a recent meta-analysis of CRBSIs, gram-positive cocci constituted 27% of isolates and gram-negative bacilli contributed 56%. The proportion of gram-negative CRBSI was much higher than that reported in western hospitals [22].

Pronovost's Michigan Health and Hospital Association (MHA) Keystone Center for Patient Safety and Quality Keystone ICU project is one of the most successful recent collaborative efforts to reduce CRBSIs. The Keystone Project involved the contribution and analysis of data from 103 ICUs in 67 hospitals. These hospitals implemented five evidence-based procedures (hand washing, use of full-barrier precautions during CVC insertion, skin cleaning with chlorhexidine, avoiding the use of the femoral site and removal of unnecessary catheters) and were able to reduce the median rate of CRBSI infections per 1000 catheter-days from 2.7 infections at baseline to 0 infection at 3 months after implementation of the study intervention ($p \leq 0.002$) [21].

In the UK, CRBSI accounts for 10% to 20% of hospital-acquired infections and is associated with both increased ICU stay and mortality [21].

EARLY MOBILITY IN ICU

A high proportion of patients who survive intensive care suffer from significant physical disabilities secondary to neuromuscular weakness from critical illness, prolonged bed rest, and immobility. Evidence suggests that early mobilisation in mechanically ventilated patients mitigates the physical, cognitive and psychological complications of critical illness [26]. Early mobilisation has also been shown to decrease the duration of mechanical ventilation and hospital length of stay [27], [28].

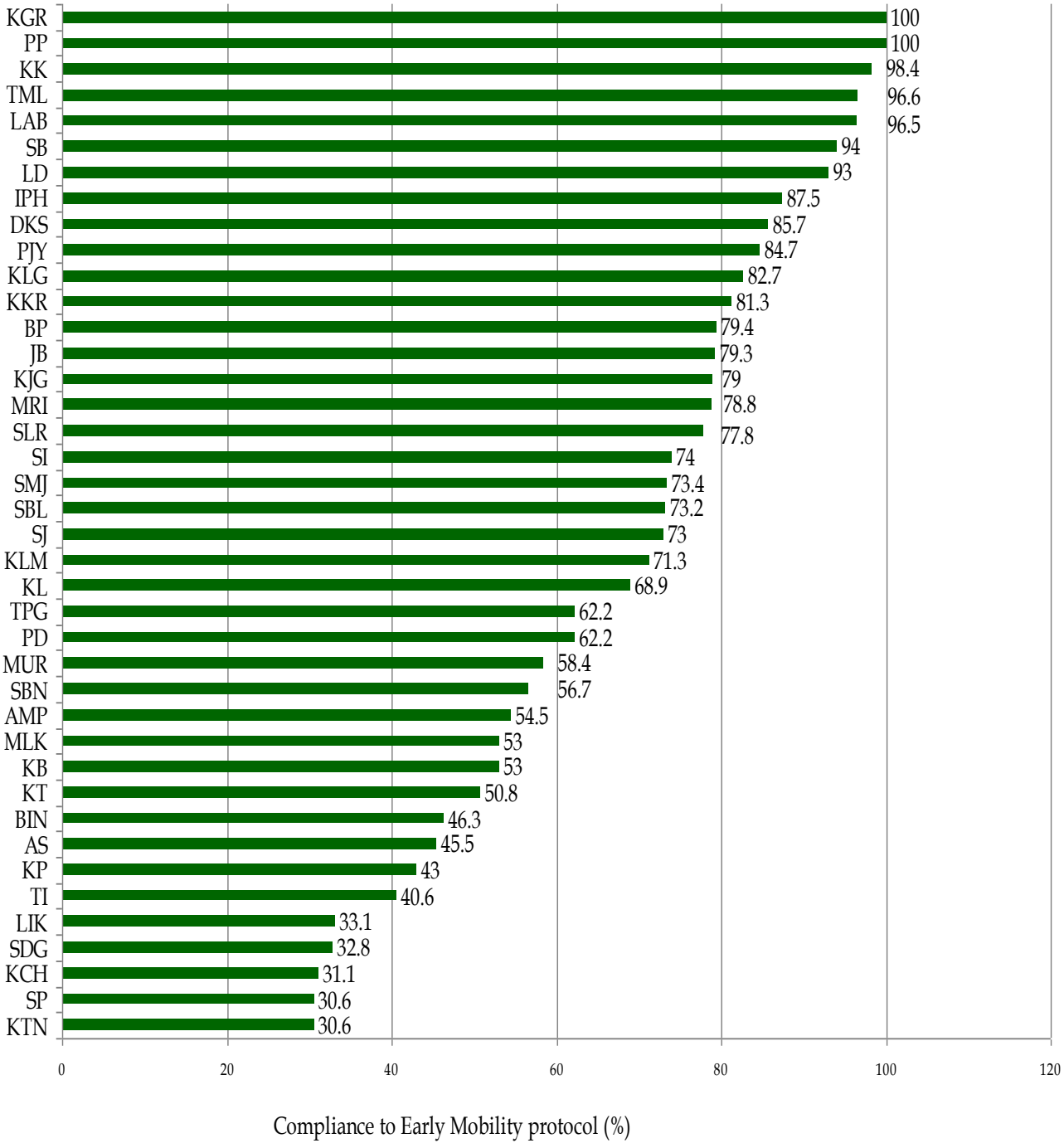
Early mobility therapy is a quality improvement initiative introduced in the ICUs in MOH hospitals in the second half of the year 2013. This is a multi-disciplinary team effort involving the clinicians, nurses and physiotherapists to ensure that early mobility becomes a routine part of care for all patients admitted to the intensive care unit. The Early Mobility Protocol consists of 4 levels of physical activity and progression from one level to another depends on the conscious state and functional ability of the patient. Activities in this protocol include body positioning, passive and active range of limb motions, sitting to walking.

Compliance to the protocol is calculated as the percent of actual number of activities performed against the expected to be performed for the highest level of mobility for all patients in the ICU.

In 2014, there were 40 hospitals that reported their compliance rate to the Early Mobility Protocol. The compliance rate ranged from 30.6% to 100%, with an average of 75.5%. Some of the barriers identified to the implementation of the protocol included concerns on safety of mobilisation of ventilated patients, lack of resources (both staff and equipment) and excessive sedation and delirium.

9 hospitals (SLY, TW, LGW, BM, SGT, TM, KEM, KLP, KEN) did not report their compliance rate to the protocol in 2014.

Figure 30 : Compliance to Early Mobility in ICU protocol, by hospital 2014



SECTION G:

REPORT ON DENGUE INFECTION IN MOH ICUs 2010 - 2014

Report on patients with dengue infection who were admitted to the intensive care units in the Ministry of Health hospitals from 2010 - 2014

In 2014, the number of dengue cases reported by the Ministry of Health increased by 151% from 43,346 in 2013 to 108,698 in 2014 [19] [24]. The number of dengue cases in 2012, 2011 and 2010 were 21,900, 19,884 and 46,171 respectively [16] [17] [18].

Admissions with dengue infection to ICU had increased from 3.6% in 2010 to 9.0% in 2014. In 2014, dengue infection was the most common diagnosis leading to ICU admission.

Demographics for the patients who were admitted to ICU had been fairly consistent over the last 5 years, except for duration of mechanical ventilation; ICU and hospital stay which had increased in 2014 as compared to previous years. The crude in-hospital mortality was higher, 7.1% in 2014 compared to 5.9% in 2013. The SMR was also higher, 0.57 in 2014 compared to 0.5 in 2013.

The majority of patients admitted to ICU with dengue infection were young, with a median age of 34.6 years in 2014. The median interval from hospital to ICU admission was short, being further shortened to 9.6 hours compared to 12 hours in the previous years.

The median length of ICU stay for dengue patients was longer than that of all ICU admissions from the 51 participating ICUs in 2014 (2.8 days compared to 2.5 days). The median length of hospital stay for dengue admissions was shorter compared with that of all ICU admissions (7.1 days compared to 8.7 days).

The median length of mechanical ventilation for dengue admissions was 5.0 days which was longer than their median length of ICU stay of 2.8 days. This could be explained by the fact that only 12.1% dengue patients were ventilated.

Patients with dengue infection had a much lower SAPS II score on ICU admission compared with the rest of the ICU admissions (mean SAPS II score of 18.6 vs. 36.3).

Haematological failure remained the main organ failure on ICU admission over the past 5 years.

23% of the patients had associated co-morbid diseases.

Table 46 : General comparison for Dengue infection MOH ICUs 2010 – 2014

	Dengue Infection 2010 n = 1643	Dengue Infection 2011 n = 798	Dengue Infection 2012 n = 906	Dengue Infection 2013 n=1550	Dengue Infection 2014 n=3261
Age, years median (IQR)	28.8 (22.5 – 47.3)	29.5 (21.0 – 44.1)	32.8 (21.5-41.8)	31.3 (21.7-46.1)	34.6 (22.0-45.4)
Interval from hospital to ICU admission, days median (IQR)	Not available	0.5 (0.1 – 1.3)	0.5 (0.1-1.3)	0.5 (0.1-1.4)	0.4 (0.1-1.2)
Length of ICU stay, days median (IQR)	1.9 (1.9 – 9.6)	2.0 (1.3 – 3.0)	1.9 (1.2-2.7)	1.9 (1.3-2.9)	2.8 (1.3-3.1)
Length of hospital stay, days median (IQR)	5.5 (3.4 – 17.5)	5.8 (4.1 – 8.3)	5.2 (3.9-7.2)	5.3 (3.9-7.2)	7.1 (3.8-7.2)
Length of mechanical ventilation, days median (IQR)	3.8 (1.4 – 7.2)	3.6 (1.6 - 7.9)	4.2 (1.0-5.0)	2.9 (1.2-6.2)	5.0 (1.5-6.5)
Total SAPS II score, mean +/-SD Median (IQR)	19.0 ± 14.1	19.6 ± 16.0	17.4 ± 13.0	18.6 ± 13.2	18.6 ± 15.0 15.0 (10.0-23.0)
% Invasive mechanical ventilation	18.6	13.8	9.5	11.2%	12.1
% Co-morbid diseases	18.1	22.3	18.3	25	22.9
Main organ failure %					
Without organ failure	32.2	27.3	35.2	36.3	32.4
Respiratory failure	4.7	3.0	3.3	2.9	5.9
Cardiovascular failure	7.1	7.2	6.9	6.1	6.0
Neurological failure	0.6	0.4	0.1	0.7	0.4
Renal failure	0.9	0.7	0.8	1.1	1.2
Hepatic failure	0.4	0.1	0.1	0.3	0.4
Haematological failure	54.0	40.9	53.4	52.5	53.6
SMR (95% CI)	0.75 (0.42-1.20)	0.50 (0.26 – 0.86)	0.51 (0.26 - 0.94)	0.50 (0.28-0.95)	0.57 (0.33-1.05)

Table 47 : Dengue infection by individual hospital and crude all-cause in-hospital mortality 2010-2014

Hospital	Year									
	2010		2011		2012		2013		2014	
	ICU admission n (%)	All-cause In hospital mortality n (%)	ICU admission n (%)	All-cause In-hospital mortality n (%)	ICU admission n (%)	All-cause In-hospital mortality n (%)	ICU admission n(%)	All-cause In-hospital mortality n(%)	ICU admission n(%)	All-cause In-hospital mortality n(%)
AS	10 (0.6)	0 (0)	14 (1.8)	0 (0.0)	20 (2.2)	0 (0.0)	18	1 (5.6)	9 (0.3)	1 (11.1)
PP	56 (3.4)	2 (3.6)	73 (9.1)	1 (1.4)	14 (1.5)	1 (7.1)	53	5 (9.4)	77 (2.4)	10 (13.0)
IPH	78 (4.7)	6 (7.7)	26 (3.2)	3 (11.5)	18 (2.0)	2 (11.1)	57	3 (5.3)	87 (2.7)	9 (10.3)
KL	165 (10.0)	5 (3.0)	71 (8.9)	2 (2.8)	127 (14.0)	2 (1.6)	141	4 (2.8)	429 (13.2)	23 (5.4)
SLG	98 (6.0)	5 (3.0)	40 (5.0)	1 (2.5)	19 (2.1)	0 (0.0)	76	2 (2.6)	196 (6.0)	12 (6.1)
KLG	164 (10.0)	16 (9.8)	98 (12.3)	6 (6.1)	186 (20.5)	10 (5.4)	190	9 (4.8)	456 (14.0)	34 (7.5)
SBN	34 (2.1)	5 (14.7)	15 (1.9)	3 (20.0)	11 (1.2)	1 (9.1)	24	1 (4.8)	40 (1.2)	5 (12.5)
MLK	256 (15.6)	18 (7.0)	48 (6.0)	4 (8.3)	38 (4.2)	3 (7.9)	212	14 (6.6)	123 (3.8)	7 (5.7)
JB	84 (5.1)	7 (8.3)	22 (2.8)	3 (13.6)	23 (2.5)	2 (8.6)	83	17 (20.5)	75 (2.3)	14 (18.7)
KTN	25 (1.5)	2 (8.0)	11 (1.4)	1 (9.1)	3 (0.3)	0 (0.0)	23	2 (8.6)	26 (0.8)	2 (7.7)
KT	13 (0.8)	0 (0.0)	30 (3.8)	4 (13.3)	24 (2.6)	1 (4.2)	19	1 (5.3)	52 (1.6)	4 (7.7)
KB	36 (2.2)	11 (30.6)	13 (1.6)	1 (7.7)	3 (0.3)	0 (0.0)	25	2 (8.0)	286 (8.8)	20 (7.0)
KCH	22 (1.3)	8 (36.4)	10 (1.3)	1 (10.0)	13 (1.4)	1 (7.7)	25	3 (12.0)	31 (1.0)	2 (6.5)
KK	17 (1.0)	4 (23.5)	19 (2.4)	0 (0.0)	12 (1.3)	0 (0.0)	23	2 (8.7)	31 (1.0)	1 (3.2)
SP	6 (0.4)	2 (33.3)	5 (0.6)	0 (0.0)	11 (1.2)	0 (0.0)	21	1 (4.8)	42 (1.3)	8 (19.0)
PJY	10 (0.6)	1 (10.0)	11 (1.4)	1 (9.1)	10 (1.1)	1 (10.0)	29	1 (3.4)	56 (1.7)	4 (7.1)
MUR	52 (3.2)	0 (0.0)	2 (0.3)	0 (0.0)	4 (0.4)	0 (0.0)	15	1 (6.7)	9 (0.3)	0 (0.0)
TI	2 (0.1)	0 (0.0)	6 (0.8)	0 (0.0)	4 (0.4)	1 (25.0)	6	0 (0.0)	5 (0.2)	1 (20.0)
TPG	8 (0.5)	2 (25.0)	26 (3.3)	2 (7.7)	43 (4.7)	4 (9.5)	32	1 (3.1)	52 (1.6)	3 (5.8)
SJ	-	-	3 (0.4)	0 (0.0)	1 (0.1)	0 (0.0)	5	0 (0.0)	6 (0.2)	0 (0.0)
KJG	53 (3.2)	5 (9.4)	17 (2.1)	2 (11.8)	23 (2.5)	1 (4.3)	27	0 (0.0)	55 (1.7)	9 (16.4)
KGR	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	6 (0.7)	1 (16.7)	11	1 (9.1)	14 (0.4)	0 (0.0)
SJMC	-	-	-	-	54 (6.0)	0 (0.0)	-	-	-	-
TML	47 (2.9)	3 (6.4)	28 (3.5)	3 (10.7)	8 (0.9)	0 (0.0)	15	1 (6.7)	90 (2.8)	6 (6.7)
KP	3 (0.2)	2 (66.7)	3 (0.4)	1 (33.3)	-	-	1	0 (0.0)	21 (0.6)	1 (4.8)
SMJ	17 (1.0)	1 (5.9)	7 (0.9)	1 (14.3)	13 (1.4)	4 (30.8)	5	0 (0.0)	11 (0.3)	1 (9.1)
BP	16 (1.0)	2 (12.5)	9 (1.1)	0 (0.0)	6 (0.7)	0 (0.0)	21	2 (9.5)	14 (0.4)	1 (7.1)
TW	2 (0.1)	1 (50.0)	2 (0.3)	0 (0.0)	9 (1.0)	0 (0.0)	37	2 (5.4)	50 (1.5)	1 (2.0)
MRI	7 (0.4)	1 (14.3)	-	-	5 (0.6)	3 (60.0)	16	1 (6.2)	15 (0.5)	1 (6.7)
KLM	6 (0.4)	1 (16.7)	8 (1.0)	1 (12.5)	9 (1.0)	1 (11.1)	4	1 (25.0)	20 (0.6)	2 (10.0)
SDG	97 (5.9)	15 (15.5)	50 (6.3)	6 (12.0)	33 (3.6)	0 (0.0)	63	6 (9.5)	158 (4.8)	9 (5.7)
SB	38 (2.3)	10 (26.3)	1 (0.1)	0 (0.0)	9 (1.0)	1 (11.1)	8	1 (12.5)	13 (0.4)	2 (15.4)
DKS	3 (0.2)	1 (33.3)	19 (2.4)	2 (10.5)	5 (0.6)	0 (0.0)	15	1 (6.7)	15 (0.5)	1 (6.7)
SI	15 (0.9)	2 (13.3)	24 (3.0)	3 (12.5)	23 (2.5)	3 (13.0)	96	1 (1.0)	119 (3.6)	8 (6.7)
SBL	164 (10.0)	11 (6.7)	62 (7.8)	3 (4.8)	95 (10.5)	4 (4.2)	74	3 (4.1)	451 (13.8)	24 (5.3)
AMP	36 (2.2)	1 (2.8)	19 (2.4)	0 (0.0)	4 (0.4)	2 (50.0)	12	1 (8.3)	38 (1.2)	3 (7.9)
LIK	1 (0.1)	0 (0.0)	5 (0.6)	0 (0.0)	2 (0.2)	0 (0.0)	3	0 (0.0)	2 (0.1)	0 (0.0)
UMMC	-	-	-	-	3 (0.3)	0 (0.0)	-	-	-	-

BM	-	-	-	-	-	-	1	0 (0.0)	3 (0.1)	0 (0.0)
SLR	-	-	-	-	2 (0.2)	0 (0.0)	4	0 (0.0)	8 (0.2)	0 (0.0)
PD	-	-	-	-	4 (0.4)	0 (0.0)	12	0 (0.0)	19 (0.6)	0 (0.0)
KKR	-	-	-	-	-	-	3	0 (0.0)	12 (0.4)	1 (8.3)
SGT	-	-	-	-	1 (0.1)	0 (0.0)	1	0 (0.0)	2 (0.1)	1 (50.0)
TM	-	-	-	-	-	-	8	0 (0.0)	5 (0.2)	0 (0.0)
KLP	-	-	-	-	-	-	1	0 (0.0)	3 (0.1)	0 (0.0)
LAB	-	-	-	-	1 (0.1)	1 (100.0)	3	0 (0.0)	2 (0.1)	1 (50.0)
KEN	-	-	-	-	1 (0.1)	0 (0.0)	9	0 (0.0)	7 (0.2)	0 (0.0)
BIN	-	-	-	-	2 (0.2)	1 (50.0)	13	1 (7.7)	6 (0.2)	0 (0.0)
LD	-	-	-	-	4 (0.4)	0 (0.0)	13	0 (0.0)	12 (0.4)	1 (8.3)
Total	**1643 (100)**	**150 (9.1)**	**853 (100)**	**55 (6.4)**	**906 (100)**	**51 (5.6)**	**1550**	**92 (5.9)**	**3261 (100)**	**233 (7.1)**

SUMMARY

1. The total number of ICU beds in the 49 MOH participating centres was 637, with a median bed occupancy of 90.5%.

2. The number of cases analysed for year 2013 was 38,904, an increase of 4% over the previous year.

3. The percentage of patients denied admission due to the unavailability of ICU beds had declined from 37% to 30% in the last five years.

4. The average age of patients excluding those below 18 years was 49.7 years.

5. In MOH hospitals, foreigners constituted 7.1% of all ICU admissions.

6. The average lengths of ICU and hospital stay were 4.7 and 14.2 days respectively.

7. In MOH hospitals, 68% of admissions were non-operative patients, an increase of 5% in the last five years.

8. Direct admission to MOH ICUs from the emergency department had steadily increased over the past 10 years from 10% in 2005 to 31% in 2014.

9. In MOH ICUs, cardiovascular failure (36%) was the most common organ failure during the first 24 hours of ICU admission, followed by respiratory (25%), neurological (19%), renal (10%), haematological (9%) and hepatic (1%).

10. Dengue infection, sepsis and head injury were the three most common diagnoses leading to ICU admission. The in-hospital mortality for this group of patients was 7.1%, 52.8% and 22.2%respectively.

11. During the first 24 hours of ICU admission, 20%, 9% and 15% of patients had severe sepsis, acute respiratory distress syndrome and acute kidney injury respectively.

12. The average SAPS II score was 36.3, which carries a predicted risk of in-hospital mortality of 30.4%.

13. The average Sequential Organ Failure Assessment (SOFA) score was 6.4 in 2014.

14. 74%of patients in MOH ICUs and 68% of patients in UMMC ICU received invasive ventilation with an average duration of 4.9 days. 1% of ICU admissions in the private hospital were mechanically ventilated with average duration of 2.9 days.

15. The percentage of patients who received non-invasive ventilation increased from 5.1% in 2005 to 18.6% in 2014.

16. In MOH hospitals, 14.2% of ICU admissions received renal replacement therapy, with intermittent haemodialysis being the most common modality of therapy.

17. Among patients who were invasively ventilated, 9.4% had tracheostomy performed, with the median time from initiation of ventilation to tracheostomy being 9.5 days.

18. The decision to withdraw or withhold therapy was made in 35.2% of patients who died in ICU.

19. The incidence of VAP had decreased by more than half from 10.1 to 3.6 per 1000 ventilator days over the last five years.

20. Gram-negative organism accounted for 92% and 97% of causative organisms for VAP in MOH and UMMC ICUs respectively. *Acinetobacter spp*., *Klebsiella spp*., and *Pseudomonas spp*. remained the 3 most common organisms causing VAP over the last 7 years in MOH ICUs. 58% of organisms causing VAP were multi-drug resistant.

21. The ventilator care bundle compliance rates for MOH hospitals improved from 94% in 2010 to 99% in 2014.

22. The unplanned extubation rate was 0.4 per 100 intubated days in 2014.

23. The mean incidence of pressure ulcers was 6.9, 5.3 and 5.0 per 1000 ICU days in MOH, UMMC and SJMC ICUs respectively.

24. The incidence of central venous catheter-related bloodstream infection in MOH ICUs was 0.7 per 1000 catheter days in 2014.

25. 92.3%, 6.5% and 1.3% of the organisms isolated for CVC-BSI were gram-negative, gram-positive and fungal respectively.

26. The predominant organisms causing CVC-BSI were *Klebsiella pneumonia* followed by *Acinetobacter spp*. and *Pseudomonas aeruginosa*.

27. The crude in-ICU and in-hospital mortality rates for MOH ICUs were 19.0% and 25.7% respectively.

28. The mean standardised mortality ratio was 0.69 [95%C.I. 0.48–0.95], 0.65 [95%C.I.0.44 – 0.90] and 0.22 [95%C.I. 0.11–0.59] for MOH, UMMC and SJMC ICUs respectively.

29. The average compliance rate to the Early Mobility in ICU protocol was 75.5% in 2014.

30. The average all cause in-hospital mortality rate for patients admitted for dengue infection in MOH ICUs had increased from 5.9% in 2013 to 7.1% in 2014.

REFERENCES

1.	Sydney E. S. Brown1, Sarah J Ratcliffe, Jeremy M Kahn and Scott D Halpern. The Epidemiology of Intensive Care Unit Readmissions in the United States. January 26, 2012, doi: 10.1164/rccm.201109-1720OC *Am J Respir Crit Care Med.*
2	Clinical Markers in Intensive care. In: Determining the Potential to Improve the Quality of Care in Australian Health Care Organizations. Australian Council on Healthcare Standards. Health Services Research Group, University of Newcastle. 2000; 52-4
3	Garrousle-Orgeas M et al. Predictors of intensive care unit refusal in French intensive care units: a multi-centre study. *Crit Care Med* 2005; 33(4):750-755
4.	Vincent JL, Moreno R, Takala J, et al. The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. *Intensive Care Med* 1996;22:707-710
5.	Vincent JL et al. Sepsis in European intensive care units: Results of the SOAP study. *Crit Care Med* 2006;34(2):344-353
6.	Piccinni P et al. Prospective multicentre study on epidemiology of acute kidney injury in the ICU: a critical care nephrology Italian collaborative effort (NEFROINT) *Minerva Anestesiologie* 2011 Nov 77(11):1072-83
7.	Le Gall JR, Lemeshow S, Saulnier F. A New Simplified Acute Physiology Score (SAPS II) based on a European/North American Multi-centre Study *JAMA* 1993;270(24):2957-2963
8.	Tai LL et al . Validation and recustomisation of Simplified Acute Physiologic score II (SAPS II) in patients in Malaysian ICU. *Poster presentation at the 13th Western Pacific Association of Critical Care Medicine Conference, Seoul 2004*
9.	Uchino S et al. Acute renal failure in critically ill patients. A multinational, multicenter study. *JAMA* 2005;294(7):813-818
10.	Brieva JL et al. Withholding and withdrawal of life-sustaining therapies in intensive care: An Australian experience. *Crit Care Med* 2009;11(4):266-268
11	Sprung CL et al End-of-life practices in European intensive care units: the Ethicus Study. *JAMA* 2003 Aug 13;290(6):790-7
12.	Dudeck MA et al. National Healthcare Safety Network (NHSN) Report, Data Summary for 2012, Device-associated Module. *Am J Infection Control* 2013;41:1148-66
13.	Rosenthal VD et al. International Nosocomial Infection Control Consortium (INICC) report, data summary for 36 countries from 2004-2009. *Am J Infection Control* 2012; 40:396-407
14.	Hoste EA, Clermont G, Kersten A. RIFLE criteria for acute kidney injury are associated with hospital mortality in critically ill patients: a cohort analysis. *Crit Care*. 2006;10(3): R73. Epub 2006 May 12

15.	Payen D, de Pont AC, Sakr Y. A positive fluid balance is associated with a worse outcome in patients with acute renal failure. *Crit Care.*2008;12:R74. Epub 2008 June 4
16.	Situasi Semasa Demam Denggi Di Malaysia Bagi Minggu 52/2011 (25 hingga 31 Dis 2011). http://www.moh.gov.my
17.	Situasi Semasa Demam Denggi Dan Chikungunya Di Malaysia Bagi Minggu 52/2010 (26 Dis 2010 hingga 01 Jan 2011). http://www.moh.gov.my
18.	Situasi Demam Denggi Di Malaysia Bagi Minggu 52/2012 (23 - 29 Dis 2012) http://www.moh.gov.my/press_releases/357
19.	Situasi Demam Denggi Di Malaysia Bagi Minggu 52/2013 (22 - 28 Dis 2013) http://www.moh.gov.my/index.php/database_stores/store_view_page/17/458
20.	Berenholtz SM, Pronovost PJ, Lipset PA, et al. Eliminating catheter-related bloodstream infection in the intensive care unit. *Crit Care Med*. 2004 ; 32: 2014 - 2020.
21.	Pronovost PJ, Needham DM, Berenholtz SM et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med*. 2006; 355(26):2725-32.
22.	Gahlot R et al. Catheter-related bloodstream infections. International J of Critical Illness & Injury Science 2014;4(2):162-167
23	Dudeck MA et al. National Healthcare Safety Network (NHSN) Report, Data Summary for 2013, Device-associated Module. *Am J Infection Control* 2015; 43:206-221
24	http://reliefweb.int/report/malaysia/dengue-situation-update-456-13-january-2015
25	Maki DG, Kluger DM, Crnich CJ. The risk of bloodstream infection in adults with different intravascular devices: a systematic of 200 published prospective studies. *Mayo Clin Proc*. 2006;81(9):1159–1171
26	Hopkins RO, Jackson JC: Short and long term cognitive outcomes in intensive care unit survivors. *Clin Chest Med* 2009; 30: 143A153.
27	Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomized controlled trial. *Lancet* 2009;373(9678):1874–1882.
28	Needham DM, Korupolu R, Zanni JM, et al. Early physical medicine and rehabilitation for patients with acute respiratory failure: a quality improvement project. *Arch Phys Med Rehabil* 2010;91(4):!536A542.