National Audit on
Adult Intensive Care Units (NAICU)

2007 Report

1st January 2007 – 31st December 2007

Prepared by

The National Committee for NAICU

A quality improvement initiative by

The Medical Development Division

Ministry of Health Malaysia

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EXECUTIVE SUMMARY

The National Audit of Adult Intensive Care Units (NAICU) is a quality improvement initiative or activity established in 2002 by the Ministry of Health (MOH) to evaluate the performance of the intensive care services. From the original 14 ICUs, recruitment increased gradually over the years to the current state of 30 MOH ICUs and 1 private ICU. This report is the 5th in the series and is based on the 13,148 patients admitted to 30 MOH ICUs during the twelve month period from 1st January to 31st December 2007.

The main findings of this report are as follows:

- The acute shortage of ICU beds has remained a major problem. Despite the increase in ICU capacity in most State hospitals over the past five years, the total number of patients denied immediate ICU admission due to the unavailability of ICU beds remained high in 2007 (8,448 patients), accounting for 48% of all patients referred.
- Patient characteristics, types of intervention, length of ICU stay and length of hospital stay remained consistent over the past five years.
- A downward trend was observed in the incidence of ventilator-associated pneumonia (VAP); however, the rate remained high at 15.4 cases per 1000 ventilator days.
- Sepsis was the main diagnosis leading to ICU admission with a hospital mortality of 56.0%.
- The mean in-ICU mortality rate (22.35%) and in-hospital mortality rate (30.1%) did not vary much over the years even with the addition of new centres. However, the mean standardised mortality ratio (SMR) for 2007 (0.89) was the lowest over the past five years.
- The average SAPS II score was 37.2 and did not change much over the past five years.

The following are the recommendations of the NAICU:

1. To meet the increasing demand for intensive care beds, the number of ICU beds must be increased in almost all hospitals. Hospitals with the most serious shortages are: H. Alor Setar, H. Pulau Pinang, H. Klang, H. Ipoh, H. Kota Bharu and H. Seremban.
2. The issue of non-functional ICU beds needs to be addressed urgently. More nurses need to be posted to the following hospitals to ensure that all existing ICU beds are utilized: H. Alor Setar , H. Sungai Petani, H. Taiping, H. Ipoh, H. Sungai Buloh, H. Selayang, H. Serdang, H. Ampang and H. Kuala Lumpur.
3. There is a need to improve the efficiency of the three existing ICU networks (Central, Northern and Perak) by ensuring good internet access and compliance by all the ICUs concerned.
4. The use of heparin in thromboprophylaxis needs to be further emphasized.
5. Ventilator-associated pneumonia (VAP) should be further reduced by intensifying the use of ventilator care bundles.
6. Participating ICUs must ensure proper data collection to maintain accuracy and completeness of data.
7. NAICU should be further expanded. There should be a concerted effort to ensure that ICUs in the universities and private hospitals participate in the national audit. This can be achieved by mandating their participation through a national patient safety approach or an accreditation activity e.g. Malaysian Society for Quality of Health (MSQH) or Joint Commission International (JCI).

8. There should be adequate funding to support continuous training, purchase of computers/printers and software development under the activity of NAICU.

ACKNOWLEDGEMENTS

The NAICU is now in its 7th year and we are pleased to present our 5th report. From 2007 onwards, the annual reports will be based on a twelve month period from 1st January to 31st December of the same year. This report provides detailed information on the clinical practice in the intensive care units in 30 Ministry of Health hospitals.

This report would not have been possible without the hard work and dedication of:

1. The site co-ordinators and data collectors in the 30 centres who painstakingly collected and entered the data and subsequently uploaded the data to the co-ordinating centre. To these dedicated staff, I express my heartfelt thanks and deep appreciation.
2. The continued support by the Medical Development Division, in particularly Dato' Dr. Noorimi bt. Hj Morad, the Deputy Director-General (Medical) who retired last year. The Ministry of Health's yearly funding enables us to maintain and enhance the computer software which is crucial in ensuring data integrity.
3. The Ministry's secretariat support (Section on Quality in Medical Care) in organising regular training workshops and printing of this report is greatly appreciated.
4. The Ministry's partnership with Amorphous Telehealth Sdn. Bhd. in continual software development, data management and technical expertise has been rewarding.

I would like to express special thanks to the members of the NAICU committee: Dr Tai Li Ling, Dr Jenny Tong and Dr Tan Cheng Cheng for writing this report.

Dr Ng Siew Hian
Chairperson
National Committee NAICU

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NAICU NATIONAL COMMITTEE

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	Dr. PAA Mohamed Nazir bin Abdul Rahman Senior Principal Assistant Director (assistant editor)
	Dr. Fakhruddin bin Amran Assistant Director
	Puan Hjh Azizah bt. Murid Matron
	Puan Nor Wati bt. Mohd Nursing Sister

PARTICIPATING HOSPITALS

Since 2002

1. Hospital Sultanah Bahiyah, Alor Setar (Alor Setar)
2. Hospital Ipoh (Ipoh)
3. Hospital Raja Perempuan Zainab 11, Kota Bharu (K Bharu)
4. Hospital Kuala Lumpur (K Lumpur)
5. Hospital Sultanah Nur Zahirah Kuala Terengganu (K Terengganu)
6. Hospital Melaka (Melaka)
7. Hospital Pulau Pinang (P Pinang)
8. Hospital Queen Elizabeth, Kota Kinabalu (K Kinabalu)
9. Hospital Selayang (Selayang)
10. Hospital Tuanku Jaafar, Seremban (Seremban)
11. Hospital Sultanah Aminah, Johor Bahru (J Bahru)
12. Hospital Tengku Ampuan Afzan, Kuantan (Kuantan)
13. Hospital Tengku Ampuan Rahimah, Klang (Klang)
14. Hospital Umum Sarawak (Kuching)

Since 2005

15. Hospital Sultan Abdul Halim, Sungai Petani (S Petani)
16. Hospital Putrajaya (Putrajaya)
17. Hospital Muar (Muar)
18. Hospital Teluk Intan (T Intan)
19. Hospital Taiping (Taiping)
20. Hospital Seberang Jaya (S Jaya)
21. Hospital Kajang (Kajang)
22. Hospital Kangar (Kangar)

Since 2006

23. Hospital Seri Manjung (Sri Manjung)
24. Hospital Kulim (Kulim)
25. Hospital Serdang (Serdang)
26. Hospital Kuala Pilah (K Pilah)
27 Hospital Batu Pahat (Batu Pahat)
28 Hospital Temerloh (Temerloh)
29. Hospital Miri (Miri)
30. Hospital Tawau (Tawau)

LIST OF SITE CO-ORDINATORS AND DATA COLLECTORS

January 2007 to December 2007

No	Hospital	Site coordinator	Data collectors
1	Alor Setar	Dr Ahmad Shaltut Othman	SN Azura Che Don SN Mazni bte Abas
2	Ipoh	Dr Azlina Muhamad	SN Vijaya Kumari SN Hamidah Zainul
3	Kota Bharu	Dr Mat Ariffin Saman	SN Azilah Ishak SN Norhayati Mamat
4	Kuala Lumpur	Dr Tai Li Ling	SN Prema Chitrasenan SN Alice Nesamany a/p Thangapandi
5	Sultanah Nur Zahirah, Kuala Terengganu	Dr Zurhayati Awang	SN Paridah Sulong SN Zawiah Idris
6	Melaka	Dr Siti Zuraidah Abdul Karim	SN Santhravathani Mariappen
7	Pulau Pinang	Dr Lim Chew Har	SN Chin Lai Gan SN Wong Gaik Lean
8	Queen Elizabeth, Kota Kinabalu	Dr Ouspal Kaurgill	SN Doren Abel SN Jusim Lugu
9	Selayang	Dr Haslinda Abd Hashim	SN Noorliza Othman SN Norzaila bte Saad
10	Tuanku Ja'afar Seremban	Dr Jenny Tong May Geok	SN Chew Bee Ngoh SN Lee New
11	Sultanah Aminah, Johor Bahru	Dr Tan Cheng Cheng	SN Hasnitah Mohd Taib MA Mohd Zakuan Mohd Nor MA Annuar Ismail
12	Tengku Ampuan Afzan, Kuantan	Dr Rusnah bte Ab. Rahman	SN Aminah bte Abd Hamid SN Rosma Idrus
13	Tengku Ampuan Rahimah, Klang	Dr Faezah Shaari	SN Latifah Omar SN Norlaili Ismail
14	Umum Sarawak	Dr Intan Zarina	SN Winnie Suai SN Jati AK Jampong

15	Sungai Petani	Dr Ahmad Zaini Mohd Salleh	SN Halijah Hasim SN Rafiza Md Zuki
16	Putrajaya	Dr Fauziah Yusoff	SN Mazura Ismail SN Haryati Hasan
17	Muar	Dr Abu Bakar Mohd Supaat	SN Ropeah Ahmad SN Sasikala Sivalingam
18	Teluk Intan	Dr Khairudin Zainal Abidin	SN Aziza Zakaria MA Mohd Najib Misbah
19	Taiping	Dr As-niza Abdul Shukor	SN Dominca Rose SN Norlida Abu Bakar
20	Seberang Jaya	Dr Ang Chin Auang	SN Lim Lee Kean SN Hasni Hussain
21	Kajang	Dr Wan Hafizah Wan Tajul Ariffin	SN Saiza Mat Yussof SN Siti Aminah Othman
22	Kangar	Dr Ismail Ahmad	SN Norzarin Jamalludin SN Julaida Din
23	Kulim	Dr.Chua Kok Boon	SN Mohana Omar SN Mahani Hassan
24	Serdang	Dr.Mohd Yani	SN Zamzurina
25	Kuala Pilah	Dr.Sharuddin Musa	MA Hazli Aziz
26	Seri Manjung	Dr.Tin Tin Myint	SN Rohana Ali SN Hartini A.Rahman
27	Miri	**transferred back to KL	SN Norida Daud SN Zuriha Achim
28	Termeloh	Dr.Rahimah Haron	SN Rakiah Mohd Noor SN Zaiton Isa
29	Batu Pahat	Dr.Hamizad Omar	SR Heng Jer Soon SN Zaidah Othman
30	Tawau	Dr.Kyaw Soe	SN Harmaiti Batjo SN Haliza Skasau

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INTRODUCTION

The National Audit on Adult Intensive Care Units (NAICU) was established in 2002 as a quality improvement activity. Its objectives are to review the clinical practices in the adult intensive care units and evaluate the unit performance based on severity-adjusted patient mortality and complication rates.

Under the audit, demographic data and outcome of the patients admitted to the participating ICUs are reviewed. Data is collected by trained nurses (data collectors) and specialists (site co-ordinators) based on set protocols and standard forms. They are keyed into the computer using a specialised software (SyNapse). Every three months, the data is 'burned' into a compact disc and sent to the co-ordinating centre for 'data merging' at the central server. Data is 'cleaned' and verified before being analysed using SPSS. This report is based on the findings of the 5th cycle of data collection i.e. a twelve month period from 1st January 2007 to 31st December 2007.

The audit started with 14 State hospitals. Over the years, more ICUs were recruited and currently, there are 31 ICUs participating in the audit. Nine new ICUs were recruited in the last cycle viz H. Kulim, Seri Manjung, Serdang, Batu Pahat, Kuala Pilah, Miri, Tawau and Subang Jaya Medical Centre. This report covers the 30 participating ICUs in the Ministry of Health.

Activities in 2007

1. **ICU networking**

ICU networking is recommended as part of the multi-prong approach to ensure that all deserving patients receive appropriate intensive care and to optimise the utilisation of the available intensive care facilities within a geographical region. The first ICU network was started in the Klang Valley in 2006. A web-based programme (ICU Bed-Watcher) was developed to track ICU beds and provide on-line " real-time" bed availability in the participating ICUs. A similar network was developed for the paediatric intensive care units in the Klang Valley last year.

2. **Ventilator Care Bundle (VCB)**

One of the major findings of the NAICU is the high incidence of ventilator-associated pneumonia (VAP) among the participating centres. As a result, the National Committee recommended that ventilator care bundle be introduced as a remedial measure. The VCB comprises of four clinical practices which have been shown to reduce VAP. These clinical practices are introduced as a 'care bundle' and applied whenever a patient is put on mechanical ventilation. The four clinical practices are: (1) head of bed elevation (2) daily 'sedation vacation' (3) peptic ulcer disease prophylaxis and (4) deep venous thrombosis (DVT) prophylaxis.

The Ventilator Care Bundle was introduced in January 2007 and the findings of this activity will be presented in a separate report.

Issues

1. Incomplete Data

One of the main problems encountered is the incomplete data seen in some hospitals. For this cycle, hospitals with gross under-reporting were Hospital Seberang Jaya, Hospital Sungai Petani, Hospital Kajang and Hospital Kuala Terengganu. Hospital Putrajaya did not submit any data for the entire year. Apart from the above- mentioned hospitals, the overall reporting rates have been satisfactory.

2. Participation by non-MOH ICU

Although the NAICU started as a Ministry of Health project, it soon became clear that NAICU should include universities and private hospitals to make it a truly national registry for intensive care in Malaysia. Unfortunately, our overtures to the universities have not been met with favorable response. We have had better response from the private hospitals, though, and are pleased that Subang Jaya Medical Centre, a major private centre, officially joined the audit in 2006.

One of the ways to promote the participation of ICUs in the universities and private hospitals is to consider running the NAICU under an intensive care professional body such as the Intensive Care Section of Malaysian Society of Anaesthesiolgists independent of the Ministry of Health. This will allay concerns related to confidentiality and fear of punitive action by the regulatory bodies. Alternatively, the NAICU can develop independently into a full-fledged audit centre, modeled after the ICNARC (Intensive Care and National Centre for Audit and Research) in the UK.

Another measure that one may consider is to mandate the participation in NAICU as one of the requirements for the accreditation of ICUs. This is possible with the co-operation of the Malaysian Society for Quality of Health, which is the professional body entrusted with conducting the local Hospital Accreditation Programme.

3. Review of Patient Data Form

We have observed that over the years, there had been little changes to most of the findings. Fatigue and low reporting may result if the sites continue to capture data which have little application or clinical significance. Therefore, there is a need to re-think the types of data to be captured in the next cycles and the National Committee has decided to review the patient data form to reduce the number of data fields for baseline data.

RESULTS AND DISCUSSION

Analysis was based on the data collected from all patients admitted to the ICU from 1st January to 31st December 2007. Patients admitted during this period but were still in hospital on 31st January 2008 were excluded. So were patients admitted to the private hospital (Subang Jaya Medical Centre). For readmissions to ICU, only the data for the first admission was included in the analysis. Data analysis was done using SPSS version 10.0.1. Due to missing data, the sum total of some variables shown in the tables may not add up to the actual number of ICU admissions. The total number of patients analysed is 13,148 and the number of participating units, 30.

Section A

Table 1 : Number of ICU beds by hospitals (as of 31st December 2007)

Hospital	Number of functional beds
A	13
B	8
C	16
D	16
E	14
F	11
G	8
H	16
I	16
J	8
K	8
L	12
M	14
N	10
O	11
P	14
Q	4
R	12
S	7
T	4
U	7
V	5
W	4
X	5
Y	6
Z	5
AA	4
AB	4
AC	6
AD	7
Total	275

Admissions and Refusals

Table 2 : ICU admissions by participating hospitals, 2007

Hospital	2003		2004		2005		2006		2007	
	n	%	n	%	n	%	n	%	n	%
A	394	5.8	320	4.4	340	4.6	383	3.8	418	3.2
B	482	7.2	518	7.2	488	6.5	535	5.3	439	3.3
C	395	5.9	379	5.3	335	4.5	692	6.8	723	5.5
D	909	13.5	991	13.7	1158	15.5	942	9.3	943	7.2
E	366	5.4	432	6.0	580	7.8	692	6.8	738	5.6
F	335	5.0	327	4.5	399	5.3	491	3.9	482	3.7
G	325	4.8	304	4.2	295	3.9	292	2.9	427	3.2
H	479	7.1	717	9.9	666	8.9	634	6.3	1175	8.9
I	980	14.5	1026	14.2	920	12.3	1018	10.1	1074	8.2
J	454	6.7	475	6.6	478	6.4	432	4.3	513	3.9
K	293	4.3	338	4.7	361	4.8	417	4.1	270	2.1
L	455	6.8	422	5.8	469	6.3	442	4.4	725	5.5
M	426	6.3	503	7.0	528	7.1	594	5.9	461	3.5
N	446	6.6	467	6.5	455	6.1	454	4.5	517	3.9
O	-	-	-	-	-	-	202	2.0	119	0.9
P	-	-	-	-	-	-	328	3.2	611	4.6
Q	-	-	-	-	-	-	318	3.1	253	1.9
R	-	-	-	-	-	-	259	2.0	684	5.2
S	-	-	-	-	-	-	412	4.1	59	0.4
T	-	-	-	-	-	-	228	2.3	146	1.1
U	-	-	-	-	-	-	211	2.1	238	1.8
V	-	-	-	-	-	-	-	-	382	2.9
W	-	-	-	-	-	-	-	-	140	1.1
X	-	-	-	-	-	-	-	-	226	1.7
Y	-	-	-	-	-	-	-	-	266	2.0
Z	-	-	-	-	-	-	-	-	256	1.9
AA	-	-	-	-	-	-	-	-	180	1.4
AB	-	-	-	-	-	-	-	-	298	2.3
AC	-	-	-	-	-	-	-	-	385	2.9
AD	-	-	-	-	-	-	234	2.3	0	0.0
Total	**6739**	**100.0**	**7219**	**100.0**	**7472**	**100.0**	**10110**	**100.0**	**13148**	**100.0**

The above figures do not include readmissions into ICU.

The majority of the State hospitals recorded significant increases in their admissions. Hospitals with the highest increase were H, G, P, R and L. The increase in admissions in

these hospitals was either due to the establishment of new intensive care units (G, R) or the upgrading of high dependency beds to ICU beds (H, P, L).

Table 3 : Reporting rates

Hospital	Reporting rate (%)
A	86.7
B	93.2
C	97.1
D	98.4
E	99.2
F	99.4
G	97.7
H	99.9
I	99.5
J	99.4
K	49.6
L	100.0
M	93.0
N	75.2
O	29.2
P	74.3
Q	87.6
R	99.9
S	12.1
T	54.0
U	82.2
V	95.7
W	89.4
X	92.5
Y	90.9
Z	90.3
AA	82.9
AB	98.1
AC	97.5
AD	0

The reporting rate is calculated by comparing the number of cases reported to NAICU and the number of ICU admissions captured through the national census. Since NAICU excludes re-admissions (patient admitted more than once) and patients who were discharged from the ICU but remained in the hospital on 31.12.2007, its numbers will be slightly less than the total number of admissions captured by routine census.

The overall reporting rate to NAICU was 85.3%.
Hospitals with poor reporting rates are: S (12.1%), Y (29.2%), K (49.6%) and T (54.0%). AD did not submit data for the entire year.

Table 4 : ICU referrals and refusals of admission, 2003-2007

Hospital	2003		2004		2005		2006		2007	
	Number patients referred for int. care	% denied admissi-on	Number patients referred for int. care	% denied admissi-on	Number patients referred for int. care	% denied admissi-on	Number patients referred for int. care	% denied admissi-on	Number patients referred for int. care	% denied admissi-on
A	446	57.0	224	37.9	*	*	#	#	429	76.2
B	637	68.9	827	70.5	1024	73.2	1054	78.1	1299	81.8
C	752	85.4	789	90.4	872	91.6	351	94.3	635	77.2
D	1199	35.2	1795	32.5	2170	38.0	2294	38.4	2327	36.2
E	145	51.7	290	51.7	*	*	185	45.9	79	16.5
F	553	57.7	387	55.6	737	73.8	876	74.5	1490	82.3
G	722	71.1	984	74.6	1048	69.8	1330	66.0	1558	62.6
H	356	57.0	116	31.9	811	50.7	879	52.2	1085	43.2
I	1511	58.8	1524	61.4	870	68.5	2066	57.2	2101	48.6
J	352	38.4	467	37.0	454	35.0	447	36.9	811	33.3
K	373	29.8	398	43.0	404	30.2	476	29.2	160	20.6
L	729	63.6	812	52.2	908	50.7	720	57.9	953	68.1
M	511	43.4	544	32.2	535	29.7	315	30.5	569	51.5
N	329	67.8	115	67.8	*		249	48.6	299	60.9
O	-	-	-	-	-	-	#	#	95 +	60.9
P	-	-	-	-	-	-	#	#	575	18.1
Q	-	-	-	-	-	-	#	#	211	9.5
R	-	-	-	-	-	-	488	62.9	685	5.7
S	-	-	-	-	-	-	*	*	226	1.3
T	-	-	-	-	-	-	*	*	9 +	22.2
U	-	-	-	-	-	-	*	*	84	19.1
V	-	-	-	-	-	-	-	-	416	22.1
W	-	-	-	-	-	-	-	-	225	26.7
X	-	-	-	-	-	-	-	-	192	35.4
Y	-	-	-	-	-	-	-	-	310	14.8
Z	-	-	-	-	-	-	-	-	248	0.0
AA	-	-	-	-	-	-	-	-	116	25.0
AB	-	-	-	-	-	-	-	-	289	17.7
AC	-	-	-	-	-	-	-	-	162	27.8
AD	-	-	-	-	-	#	#	#	#	#
Total	**8615**	**57.0**	**9272**	**54.5**	**9833**	**56.5**	**12280**	**53.4**	**17638**	**47.9**

**These centres were excluded due to gross under-reporting*
 # These centres did not submit data for this module.
+ These centres had gross under-reporting but were not excluded

48% of patients referred for intensive care were denied ICU admission due to the unavailability of beds. This means that about 8400 patients were denied immediate ICU admission upon referral in 2007. These figures also show that despite the increase in ICU capacity in most state hospitals, almost all hospitals continued to experience a shortage of ICU beds. From 2003 to 2005, there were about five thousand patients each year who were denied ICU admission. This number rose to 6600 in 2006. Hospitals with high rates of refusal included A, B, F, C, L and G. Reasons for the increase in demand for ICU admission include increasing complexity of surgical operations, earlier referral and better resuscitation by primary unit. These figures suggest that there is an urgent need to build more intensive care facilities even in hospitals with fairly new ICUs.

Table 5 : Hospital outcome of patients refused admission to ICU by hospitals, 2007

Hospital	Alive n (%)	Transfer to other hosp n (%)	AOR discharge n (%)	Died n (%)	Discharge with grave prognosis n (%)
A	102 (31.2)	13 (4.0)	21 (6.4)	181 (55.4)	2 (0.6)
B	442 (41.6)	56 (5.3)	27 (2.5)	462 (43.5)	7 (0.7)
C	190 (38.8)	14 (2.9)	18 (3.7)	267 (54.5)	1 (0.2)
D	252 (29.9)	66 (7.8)	28 (3.3)	484 (57.4)	4 (0.5)
E	6 (46.2)	2 (15.4)	0 (0.0)	5 (38.5)	0 (0.0)
F	634 (51.7)	39 (3.2)	24 (2.0)	529 (43.1)	0 (0.0)
G	405 (41.5)	45 (4.6)	37 (3.8)	480 (49.2)	1 (0.1)
H	211 (45.0)	14 (3.0)	28 (6.0)	212 (45.2)	3 (0.6)
I	267 (26.2)	72 (7.1)	49 (4.8)	552 (54.1)	7 (0.7)
J	79 (29.3)	26 (9.6)	8 (3.0)	157 (58.1)	0 (0.0)
K	14 (42.4)	1 (3.0)	1 (3.0)	17 (51.5)	0 (0.0)
L	269 (41.4)	32 (4.9)	27 (4.2)	315 (48.5)	2 (0.3)
M	217 (74.1)	0 (0.0)	0 (0.0)	74 (25.3)	1 (0.3)
N	81 (44.5)	7 (3.8)	2 (1.1)	90 (49.5)	0 (0.0)
O	9 (42.9)	6 (28.6)	0 (0.0)	5 (23.8)	0 (0.0)
P	14 (13.5)	10 (9.6)	1 (1.0)	20 (19.2)	0 (0.0)
Q	3 (15.0)	2 (10.0)	0 (0.0)	8 (40.0)	0 (0.0)
R	18 (46.2)	2 (5.1)	3 (7.7)	13 (33.3)	0 (0.0)
S	2 (66.7)	1 (33.3)	0 (0.0)	0 (0.0)	0 (0.0)
T	-	-	-	-	-
U	9 (56.3)	-	-	4 (25.0)	-
V	49 (53.3)	9 (9.8)	1 (1.1)	28 (30.4)	-
W	23 (38.3)	15 (25.0)	2 (3.3)	20 (33.3)	-
X	17 (25.0)	34 (50.0)	7 (10.3)	7 (10.3)	3 (4.4)
Y	4 (8.7)	4 (8.7)	1 (2.2)	36 (78.3)	-

Hospital	Alive n (%)	Transfer to other hosp n (%)	AOR discharge n (%)	Died n (%)	Discharge with grave prognosis n (%)
Z	-	-	-	-	-
AA	6 (20.7)	-	-	18 (62.1)	-
AB	20 (39.2)	11 (21.6)	1 (2.0)	17 (33.3)	-
AC	7 (15.6)	9 (20.0)	-	6 (13.3)	-
AD	-	-	-	-	-
Total	**3354 (39.7)**	**492 (5.8)**	**286 (3.4)**	**4007 (47.4)**	**31 (0.4)**

-These centres did not submit any data regarding this module

About half of the patients (44.4%) who were denied immediate ICU admission upon referral died. The in-hospital mortality for those patients admitted to ICU was 30.1%. A UK study indicated that mortality at 90 days after referral was 37% among the admitted group and 46% among the refused group [1].

Section B

Patient characteristics

Table 6 : Gender 2003-2007

Gender	2003 n (%)	2004 n (%)	2005 n (%)	2006 n (%)	2007 n (%)
Male	3901 (57.9)	4150 (57.5)	4406 (59.0)	5821 (57.6)	7654 (58.2)
Female	2833 (42.0)	3058 (42.4)	3066 (41.0)	4289 (41.0)	5492 (41.8)

The gender ratio has not changed much over the last 5 years.

Table 7 : Age groups 2003-2007

Age (yrs)	2003 n (%)	2004 n (%)	2005 n (%)	2006 n (%)	2007 n (%)
Below 10	513 (7.6)	472 (6.5)	420 (5.6)	499 (5.0)	540 (4.1)
10-19.9	788 (11.7)	856 (11.9)	860 (11.5)	1065 (10.6)	1232 (9.4)
20-29.9	1048 (15.6)	1052 (14.6)	1130 (15.1)	1533 (15.3)	1904 (14.5)
30-39.9	923 (13.70	1058 (14.70	970 (13.0)	1422 (14.2)	1663 (12.6)
40-49.9	870 (12.9)	1003 (13.9)	1041 (13.9)	1432 (14.3)	1754 (13.3)
50-59.9	948 (14.1)	1039 (14.4)	1156 (15.5)	1536 (15.3)	2038 (15.5)
60-69.9	887 (13.2)	955 (13.2)	1047 (14.0)	1426 (14.2)	1977 (15.0)
70-79.9	539 (8.0)	582 (8.1)	575 (7.7)	894 (8.9)	1356 (10.3)
80 and above	156 (2.3)	119 (1.6)	152 (2.0)	207 (2.1)	327 (2.5)

Table 8 : Mean and Median age (years) by hospitals, 2007

Hospital	Age, mean ± SD years	Median	Range
A	45.6 ± 19.9	46.6	7.8 - 88.9
B	42.4 ± 19.2	41.5	0.3 – 95.5
C	41.4 ± 19.1	39.0	4.5 – 92.3
D	47.1 ± 18.7	48.3	9.8 – 88.5
E	41.5 ± 23.1	42.3	0.1 – 89.3
F	41.5 ± 19.1	39.5	2.0 – 83.2
G	46.2 ± 22.0	46.9	0.1 – 95.7
H	47.1 ± 22.3	50.1	0.1 – 98.9
I	40.2 ± 19.4	39.4	0.3 – 100.8
J	45.3 ± 19.0	45.1	1.8 – 88.7
K	46.5 ± 21.5	46.8	0.4 – 88.1
L	42.6 ± 23.0	42.6	0.0 – 96.0
M	42.4 ± 20.0	40.7	2.5 - 86.5
N	45.3 ± 20.7	46.5	0.1 – 90.7
O	47.6 ± 19.0	49.8	14.3 – 88.4
P	46.2 ± 21.8	49.9	0.2 – 93.5
Q	53.4 ± 20.0	57.5	1.5 – 90.9
R	50.8 ± 20.4	54.4	1.0 – 93.5
S	47.7 ± 19.3	49.6	9.2 – 84.5
T	47.6 ± 20.1	48.8	0.0 -86.4
U	45.2 ± 21.6	46.4	0.6 – 90.7
V	47.6 ± 21.3	50.0	0.4 – 91.7
W	50.8 ± 18.6	54.2	0.6 – 84.5
X	51.2 ± 19.7	52.7	3.5 – 97.7
Y	49.2 ± 22.1	52.1	0.3 – 88.5
Z	38.8 ± 22.2	38.7	0.0 – 90.2
AA	38.1 ± 23.7	41.7	0.0 – 81.2
AB	47.7 ± 20.3	48.8	0.5 – 89.9
AC	45.3 ± 22.4	48.4	0.1 – 95.5
AD	-	-	-
Total	**45.0 ± 21.0**	**46.1**	**0.0 – 100.8**

The mean age of patients admitted to ICU was 45 years. Patients older than 70 years comprised approximately 13% of total admissions.

Table 9 : Ethnic groups by hospitals, 2007

Hospital	Malay n (%)	Chinese n (%)	Indian n (%)	Orang asli n (%)	B'putra E. M'sia n (%)	Other M'sian n (%)	Foreigner n (%)
A	329 (78.7)	45 (10.8)	23 (5.5)	-	-	9 (2.2)	12 (2.9)
B	207 (47.2)	162 (36.9)	52 (11.8)	-	-	2 (0.5)	16 (3.6)
C	385 (53.4)	163 (22.6)	121 (16.8)	20 (2.8)	-	5 (0.7)	27 (3.7)
D	470 (49.8)	155 (16.4)	199 (21.1)	2 (0.2)	12 (1.3)	17 (1.8)	88 (9.3)
E	370 (50.1)	208 (28.2)	98 (13.3)	7 (0.9)	3 (0.4)	9 (1.2)	43 (5.8)
F	265 (55.0)	59 (12.2)	108 (22.4)	2 (0.4)	3 (0.6)	-	45 (9.3)
G	228 (53.4)	87 (20.4)	85 (19.9)	3 (0.7)	5 (1.2)	2 (0.5)	17 (4.0)
H	776 (66.1)	255 (21.7)	106 (9.0)	1 (0.1)	3 (0.3)	5 (0.4)	28 (2.4)
I	600 (55.9)	240 (22.3)	123 (11.5)	6 (0.6)	8 (0.7)	12 (1.1)	85 (7.9)
J	409 (79.7)	59 (11.5)	14 (2.7)	13 (2.5)	3 (0.6)	-	15 (2.9)
K	262 (97.0)	4 (1.5)	1 (0.4)	-	-	-	3 (1.1)
L	683 (94.2)	10 (1.4)	4 (0.6)	3 (0.4)	1 (0.1)	9 (1.2)	15 (2.1)
M	139 (30.2)	110 (23.9)	1 (0.2)	-	193 (41.9)	3 (0.7)	15 (3.3)
N	21 (4.2)	79 (15.8)	6 (1.2)	-	275 (55.0)	99 (19.8)	20 (4.0)
O	91 (76.5)	8 (6.7)	15 (12.6)	1 (0.8)	-	-	4 (3.4)
P	425 (69.6)	139 (22.7)	26 (4.3)	-	2 (0.3)	-	19 (3.1)
Q	162 (64.0)	35 (13.8)	48 (19.0)	3 (1.2)	-	-	5 (2.0)
R	480 (70.2)	115 (16.8)	79 (11.5)	1 (0.1)	1 (0.1)	1 (0.1)	7 (1.0)
S	34 (57.6)	12 (20.3)	8 (13.6)	-	-	-	5 (8.5)
T	86 (58.9)	20 (13.7)	25 (17.1)	-	2 (1.4)	2 (1.4)	11 (7.5)
U	201 (84.5)	21 (8.8)	3 (1.3)	-	-	8 (3.4)	5 (2.1)
V	281 (73.6)	41 (10.7)	27 (7.1)	16 (4.2)	1 (0.3)	3 (0.8)	13 (3.4)
W	115 (83.3)	4 (2.9)	9 (6.5)	2 (1.4)	-	3 (2.2)	5 (3.6)
X	131 (58.0)	53 (23.5)	36 (15.9)	1 (0.4)	-	2 (0.9)	3 (1.3)
Y	219 (82.3)	34 (12.8)	5 (1.9)	1 (0.4)	-	1 (0.4)	6 (2.3)
Z	6 (2.4)	37 (14.6)	1 (0.4)	-	28 (11.0)	131 (51.6)	51 (20.1)
AA	43 (23.9)	24 (13.3)	2 (1.1)	5 (2.8)	94 (52.2)	2 (1.1)	10 (5.6)
AB	194 (65.1)	30 (10.1)	61 (20.5)	-	1 (0.3)	2 (0.7)	10 (3.4)
AC	211 (54.9)	69 (18.0)	63 (16.4)	-	4 (1.0)	7 (1.8)	30 (7.8)
AD	-	-	-	-	-	-	-
Total	**7823 (59.6)**	**2278 (17.4)**	**1349 (10.3)**	**87 (0.7)**	**639 (4.9)**	**334 (2.5)**	**613 (4.7)**

The distribution of patients admitted to ICU reflected the distribution of the ethnic groups in the general population in Malaysia. Foreigners constituted about 5% of the ICU population. Z (20%) and ICUs in the Klang Valley had a higher percentage of foreigners when compared with the national average : D (9.3%) and F (9.3%).

Table 10 : Length of ICU stay, mean (SD) days, 2003-2007

Hospital	Mean (Median), days				
	2003	**2004**	**2005**	**2006**	**2007**
A	3.5	3.9	4.0	4.3	4.3 (2.4)
B	5.3	5.0	5.5	4.5	5.2 (2.2)
C	5.1	5.1	5.8	5.1	5.4 (2.7)
D	5.1	5.4	4.7	5.2	5.1 (2.9)
E	6.2	5.8	5.1	4.6	4.5 (2.6)
F	6.1	6.5	5.3	4.9	4.4 (1.9)
G	4.4	4.7	4.8	5.4	4.8 (3.0)
H	3.5	2.7	2.8	2.8	3.7 (1.9)
I	5.4	5.2	5.9	4.8	4.9 (2.5)
J	4.1	3.9	3.9	4.2	4.2 (2.3)
K	4.9	4.1	3.9	3.5	4.3 (2.3)
L	5.0	5.4	4.6	4.5	4.8 (2.5)
M	4.3	3.8	3.4	3.3	4.7 (2.3)
N	5.0	4.5	4.7	5.0	4.6 (2.3)
O	-	-	-	5.1	6.4 (4.1)
P	-	-	-	5.7	5.1 (2.8)
Q	-	-	-	3.9	4.4 (2.5)
R	-	-	-	4.3	4.8 (2.5)
S	-	-	-	4.6	5.9 (1.9)
T	-	-	-	4.5	4.4 (2.7)
U	-	-	-	3.5	5.2 (2.1)
V	-	-	-	-	4.4 (2.2)
W	-	-	-	-	5.4 (2.6)
X	-	-	-	-	6.4 (2.5)
Y	-	-	-	-	5.5 (2.7)
Z	-	-	-	-	4.0 (2.3)
AA	-	-	-	-	5.5 (3.1)
AB	-	-	-	-	3.5 (2.2)
AC	-	-	-	-	4.6 (2.1)
AD	-	-	-	-	-
Total	**4.9**	**4.7**	**4.6**	**4.5**	**4.7 (2.4)**

The mean length of ICU stay was 4.7 days. H and AB had ICU length of stay less than 4 days. X and O had average ICU length of stay exceeding than 6 days.

Table 11 : Length of hospital stay by hospitals, 2003-2007

Hospital	Mean (Median), days				
	2003	**2004**	**2005**	**2006**	**2007**
A	17.3	16.8	14.9	14.8	14.2 (9.7)
B	26.5	24.3	22.1	20.3	21.7 (14.0)
C	19.8	19.8	19.0	16.6	15.4 (10.6)
D	22.6	22.9	18.7	19.6	19.7 (12.4)
E	20.3	20.3	17.6	17.1	17.2 (10.7)
F	18.8	19.2	17.0	15.9	15.7 (10.8)
G	17.7	16.7	15.8	17.1	16.6 (11.1)
H	16.1	15.0	14.0	12.5	13.6 (9.7)
I	17.9	17.7	17.9	15.7	16.2 (11.3)
J	16.6	18.9	16.5	16.0	17.5 (12.1)
K	19.5	16.6	14.4	16.1	15.2 (9.0)
L	17.4	17.8	15.7	16.1	16.4 (10.7)
M	20.4	21.2	17.4	17.7	20.4 (13.1)
N	24.0	22.8	22.8	23.3	29.5 (19.0)
O	-	-	-	14.0	11.4 (7.6)
P	-	-	-	17.9	15.7 (10.5)
Q	-	-	-	12.3	10.8 (8.03)
R	-	-	-	15.6	12.0 (8.3)
S	-	-	-	10.7	14.5 (8.4)
T	-	-	-	13.3	13.9 (10.3)
U	-	-	-	14.5	18.1 (10.4)
V	-	-	-	-	13.9 (9.8)
W	-	-	-	-	13.8 (7.6)
X	-	-	-	-	13.5 (9.0)
Y	-	-	-	-	13.0 (7.7)
Z	-	-	-	-	12.4 (8.9)
AA	-	-	-	-	15.2 (10.3)
AB	-	-	-	-	11.4 (7.2)
AC	-	-	-	-	16.6 (10.4)
AD	-	-	-	-	-
Total	**19.8**	**19.5**	**17.6**	**16.4**	**16.3 (10.5)**

The mean length of hospital stay has decreased over the years. N and B have persistently showed a mean length of hospital stay exceeding 20 days.

Both the length of ICU stay and hospital stay are comparable to that of Hong Kong and UK but are longer than in US (hospital stay 11.8 days) and Northern Europe (ICU stay 2.9 days) [2], [3], [4], [5].

Table 12 : Referring units, 2003-2007

Hospital	Mean (Median), days				
	2003	2004	2005	2006	2007
Medicine	1872 (27.8)	1973 (27.3)	2221 (29.7)	3215 (32.1)	5077 (38.6)
General Surgery	2000 (29.7)	2181 (30.2)	2051 (27.4)	3029 (30.2)	3757 (28.6)
Orthopaedics	600 (8.9)	702 (9.7)	700 (9.4)	936 (9.3)	1126 (8.6)
Obs. & Gynae	603 (8.9)	650 (9.0)	588 (7.9)	857 (8.6)	939 (7.1)
Vascular Surgery	79 (1.2)	103 (1.4)	126 (1.7)	94 (0.9)	123 (0.9)
Paediatric Surgery	98 (1.50)	105 (1.5)	96 (1.3)	102 (1.0)	132 (1.0)
Neurosurgery	665 (9.9)	732 (10.1)	812 (10.9)	845 (8.4)	801 (6.1)
Plastic Surgery	47 (0.7)	44 (0.6)	47 (0.6)	57 (0.6)	66 (0.5)
Ear, Nose & Throat	171 (2.5)	210 (2.9)	186 (2.5)	228 (2.3)	263 (2.0)
Ophthalmology	19 (0.3)	18 (0.2)	26 (0.3)	13 (0.1)	23 (0.2)
Urology	97 (1.4)	72 (1.0)	98 (1.3)	125 (1.2)	127 (1.0)
Dental Surgery	46 (0.7)	33 (0.5)	32 (0.4)	49 (0.5)	71 (0.5)
Paediatric Medicine	278 (4.1)	205 (2.8)	171 (2.3)	229 (2.3)	335 (2.5)
Cardiology	6 (0.1)	5 (0.1)	11 (0.1)	7 (0.1)	10 (0.1)
Haematology	21 (0.3)	29 (0.4)	33 (0.4)	32 (0.3)	7 (0.1)
Nephrology	51 (0.8)	60 (0.8)	103 (1.4)	136 (1.4)	147 (1.1)
Neurology	38 (0.6)	42 (0.6)	74 (1.0)	64 (0.8)	55 (.4)
Cardiothoracic Surgery	5 (0.1)	1 (0.0)	2 (0.0)	1 (0.0)	-
Missing	4 (0.1)	4 (0.1)	13 (0.2)	-	89 (0.7)
Others	39 (0.6)	50 (0.7)	82 (1.1)	57 (0.7)	-

The proportion of patients admitted from the Medical Unit has steadily increased while that from the neurosurgical unit has decreased. The latter may be contributed by the establishment of dedicated neurosurgical ICUs in respective hospitals with this specialty.

Table 13 : Category of patients by hospitals, 2007

Hospital	Non-operative n (%)	Operative elective n (%)	Operative emergency n (%)
A	218 (52.3)	61 (14.6)	138 (33.1)
B	251 (57.2)	75 (17.1)	113 (25.7)
C	281 (38.9)	137 (19.0)	304 (42.1)
D	569 (60.3)	102 (10.8)	272 (28.8)
E	461 (62.5)	108 (14.6)	169 (22.9)
F	242 (50.2)	84 (17.4)	156 (32.4)
G	274 (64.2)	23 (5.4)	130 (30.4)
H	743 (63.3)	85 (7.2)	346 (29.5)

Hospital	Non-operative n (%)	Operative elective n (%)	Operative emergency n (%)
I	505 (47.0)	115 (10.7)	454 (42.3)
J	312 (60.8)	58 (11.3)	143 (27.9)
K	171 (63.3)	14 (5.2)	85 (31.5)
L	313 (43.2)	135 (18.6)	277 (38.2)
M	159 (34.5)	130 (28.2)	172 (37.3)
N	188 (36.6)	139 (27.0)	187 (36.4)
O	73 (61.3)	8 (6.7)	38 (31.9)
P	444 (72.8)	68 (11.1)	98 (16.1)
Q	177 (70.2)	6 (2.4)	69 (27.4)
R	431 (63.0)	64 (9.4)	189 (27.6)
S	-	-	-
T	107 (73.3)	11 (7.5)	28 (19.2)
U	94 (40.2)	52 (22.2)	88 (37.6)
V	173 (45.3)	46 (12.0)	163 (42.7)
W	108 (77.1)	5 (3.6)	27 (19.3)
X	132 (59.2)	30 (13.5)	61 (27.4)
Y	175 (65.8)	9 (3.4)	82 (30.8)
Z	143 (56.3)	37 (14.6)	74 (29.1)
AA	135 (75.0)	14 (7.8)	31 (17.2)
AB	185 (62.1)	19 (6.4)	94 (31.5)
AC	235 (61.2)	86 (22.4)	63 (16.4)
AD	-	-	-
Total	**7299 (55.8)**	**1721 (13.2)**	**4051 (31.0)**

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

Operative elective: — *Refers to patients in whom 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 patients in whom surgery was done within 7 days before ICU admission or during the first 24 hours after ICU admission on an unscheduled basis*

The number of non-operative patients exceeded that of operative patients in 2007. From 2003-2006, there was an equal percentage of operative and non-operative patients. It can also be noted that smaller hospitals tended to have a much higher number of non-operative admissions. Admissions after emergency surgery were more common in all hospitals except AC.

Table 14 : Location before admission to ICU by hospitals, 2007

Hospital	Ward n (%)	OT n (%)	A&E n (%)	Other critical areas n (%)	Other location n (%)	Other hospital n (%)
A	126 (30.2)	166 (39.8)	56 (13.4)	46 11.0()	1 (0.2)	22 (5.3)
B	205 (46.7)	149 (33.9)	25 (5.7)	18 (4.1)	0 (0.0)	42 (9.6)
C	138 (19.1)	350 (48.5)	146 (20.2)	88 (12.2)	0 (0.0)	0 (0.0)
D	350 (37.1)	292 (31.0)	178 (18.9)	60 (6.4)	10 (1.1)	53 (5.6)
E	220 (29.8)	239 (32.4)	142 (19.2)	33 (4.5)	1 (0.1)	103 (14.0)
F	173 (35.9)	210 (43.6)	29 (6.0)	65 (13.5)	1 (0.2)	4 (0.8)
G	238 (55.7)	124 (29.0)	16 (3.7)	33 (7.7)	0 (0.0)	16 (3.7)
H	505 (43.0)	304 (25.9)	244 (20.8)	34 (2.9)	7 (0.6)	80 (6.8)
I	400 (37.2)	415 (38.6)	34 (3.2)	170 (15.8)	8 (0.7)	47 (4.4)
J	129 (25.1)	174 (33.9)	61 (11.9)	74 (14.4)	0 (0.0)	75 (14.6)
K	98 (36.3)	96 (35.6)	43 (15.9)	31 (11.5)	1 (0.4)	1 (0.4)
L	119 (16.4)	374 (51.6)	59 (8.1)	94 (13.0)	5 (0.7)	74 (10.2)
M	141 (30.6)	249 (54.0)	46 (10.0)	5 (1.1)	0 (0.0)	20 (4.3)
N	185 (35.8)	257 (49.7)	55 (10.6)	7 (1.4)	4 (0.8)	9 (1.7)
O	48 (40.3)	29 (24.4)	23 (19.3)	0 (0.0)	0 (0.0)	19 (16.0)
P	362 (59.3)	139 (22.8)	78 (12.8)	15 (2.5)	0 (0.0)	16 (2.6)
Q	98 (39.4)	49 (19.7)	50 (20.1)	9 (3.6)	0 (0.0)	43 (17.3)
R	272 (39.8)	220 (32.2)	58 (8.5)	88 (12.9)	1 (0.1)	45 (6.6)
S	15 (25.4)	39 (66.1)	2 (3.4)	1 (1.7)	0 (0.0)	2 (3.4)
T	69 (47.3)	29 (19.9)	33 (22.6)	3 (2.1)	0 (0.0)	12 (8.2)
U	75 (32.1)	115 (49.1)	27 (11.5)	12 (5.1)	2 (0.9)	3 (1.3)
V	106 (27.7)	176 (46.1)	59 (15.4)	10 (2.6)	4 (1.0)	27 (7.1)
W	44 (31.4)	28 (20.0)	22 (15.7)	39 (27.9)	3 (2.1)	4 (2.9)
X	108 (48.4)	79 (35.4)	24 (10.8)	1 (0.4)	2 (0.9)	9 (4.0)
Y	171 (64.3)	74 (27.8)	7 (2.6)	0 (0.0)	0 (0.0)	14 (5.3)
Z	150 (58.8)	79 (31.0)	19 (7.5)	7 (2.7)	0 (0.0)	0 (0.0)
AA	88 (48.9)	43 (23.9)	41 (22.8)	0 (0.0)	1 (0.6)	7 (3.9)
AB	120 (40.3)	77 (25.8)	71 (23.8)	12 (4.0)	0 (0.0)	18 (6.0)
AC	127 (33.1)	119 (31.0)	83 (21.6)	7 (1.8)	6 (1.6)	42 (10.9)
AD	-	-	-	-	-	-
Total	**4880 (37.2)**	**4694 (35.7)**	**1731 (13.2)**	**962 (7.3)**	**57 (0.4)**	**807 (6.1)**

**Ward:* *Refers to general wards in the same hospital*
OT: *Refers to operating theatres in the same hospital*
A&E: *Refers to the accident and emergency department*

Other critical care areas: *Refers to areas in the same hospital such as coronary care unit, cardiothoracic, neonatal/paediatric, urological ICUs, haemodialysis unit, high dependency unit, labour rooms*

Other locations: *Refers to areas in the same hospital other than wards, OT, A&E, critical care areas. Includes radiology, endoscopy suites and clinics in the hospital*

Other hospitals: *Refers to other private or public hospitals*

The average number of patients admitted from the ward exceeded that from the operating theatre for the first time in 5 years. From 2003-2006, the number of admissions from OT exceeded that from the wards. However the number of patients admitted from A&E remained low (13.2%). This is in contrast with ICUs in developed countries where the majority of admissions are from the emergency rooms [5].

Table 15 : Indication for admission by hospitals, 2007

Hospital	Mechanical ventilation n (%)	Post-op ventilation n (%)		Post-op monitoring/ intervention		Non-op monitoring (%)
		Planned	Unplanned	Planned	Unplanned	
A	208 (49.9)	154 (36.9)	13 (3.1)	16 (3.8)	5 (1.2)	21 (5.0)
B	208 (47.5)	122 (27.9)	26 (5.9)	27 (6.2)	2 (0.5)	53 (12.1)
C	241 (33.4)	310 (42.9)	24 (3.3)	76 (10.5)	15 (2.1)	56 (7.8)
D	525 (55.7)	264 (28.0)	37 (3.9)	28 (3.3)	17 (1.8)	72 (7.6)
E	420 (56.9)	164 (22.2)	44 (6.0)	14 (1.9)	49 (6.6)	47 (6.4)
F	228 (47.3)	168 (34.9)	29 (6.0)	16 (3.3)	3 (0.6)	38 (7.9)
G	281 (65.8)	113 (26.5)	16 (3.7)	7 (1.6)	2 (0.5)	8 (1.9)
H	462 (39.4)	218 (18.6)	51 (4.4)	85 (7.3)	45 (3.8)	311 (26.5)
I	457 (42.6)	381 (35.5)	58 (5.4)	71 (6.6)	18 (1.7)	89 (8.3)
J	291 (56.7)	146 (28.5)	24 (4.7)	23 (4.5)	3 (0.6)	26 (5.1)
K	164 (60.7)	74 (27.4)	7 (2.6)	15 (5.6)	3 (1.1)	7 (2.6)
L	296 (40.8)	335 (46.2)	14 (1.9)	48 (6.6)	6 (0.8)	26 (3.6)
M	166 (36.1)	179 (38.9)	33 (7..2)	51 (11.1)	5 (1.1)	26 (5.7)
N	176 (34.0)	255 (49.3)	14 (2.7)	38 (7.4)	2 (0.4)	32 (6.2)
O	79 (66.4)	26 (21.8)	2 (1.7)	7 (5.9)	-	5 (4.2)
P	183 (30.0)	71 (11.7)	10 (1.6)	54 (8.9)	12 (2.0)	279 (45.8)
Q	149 (58.9)	45 (17.8)	11 (4.3)	11 (4.3)	5 (2.0)	32 (12.6)
R	370 (54.1)	132 (19.3)	101 (14.8)	5 (0.7)	12 (1.8)	64 (9.4)
S	16 (27.1)	19 (32.2)	4 (6.8)	18 (30.5)	-	2 (3.4)
T	97 (66.9)	15 (10.3)	11 (7.6)	3 (2.1)	6 (4.1)	13 (9.0)
U	97 (42.0)	71 (30.7)	6 (2.6)	34 (14.7)	6 (2.6)	17 (7.4)
V	158 (42.1)	83 (22.1)	8 (2.1)	84 (22.4)	10 (2.7)	32 (8.5)
W	104 (74.8)	11 (7.9)	2 (1.4)	9 (6.5)	2 (1.4)	11 (7.9)
X	129 (57.8)	31 (13.9)	20 (9.0)	25 (11.2)	10 (4.5)	8 (3.6)
Y	125 (47.0)	51 (19.2)	-	27 (10.2)	4 (1.5)	59 (22.2)
Z	110 (43.3)	28 (11.0)	21 (8.3)	20 (7.9)	16 (6.3)	59 (23.2)

AA	121 (67.2)	18 (10.0)	5 (2.8)	11 (6.1)	2 (1.1)	23 (12.8)
AB	165 (55.7)	55 (18.6)	33 (11.1)	9 (3.0)	12 (4.1)	22 (7.4)
AC	205 (53.7)	45 (11.8)	17 (4.5)	40 (10.5)	28 (7.3)	47 (12.3)
AD	-	-	-	-	-	-
Total	**6231 (47.5)**	**3584 (27.3)**	**641 (4.9)**	**872 (6.6)**	**300 (2.3)**	**1485 (11.3)**

Planned admission: *Refers to an admission where the decision to admit the patient to ICU was made before the induction of anaesthesia.*

Unplanned admission: *Refers to an admission where the decision to admit the patient to ICU was made after induction of anaesthesia.*

As in previous years, mechanical ventilation was the main indication for ICU admission. P had about 56.7% of its total admissions for intensive monitoring and intervention. This was probably attributed to the fact that the high dependency beds (HDU) had been incorporated with the ICU beds for this audit. H had an equal number of ICU and HDU beds and 37.6% of its total admissions were for monitoring and intervention. The smaller hospitals tended to have a higher percentage of patients admitted for monitoring and intervention compared to tertiary hospitals.

R had the highest percentage of unplanned admissions to ICU for post-operative patients (17% of its total admissions). This was also seen in 2006, where 30% of its admissions were unplanned post-operative patients.

Table 16 : Readmissions to ICU by hospitals, 2007

Hospital	Total number of admissions	Total Readmissions	% Readmission
A	430	6	1.4
B	480	17	3.5
C	743	6	0.8
D	996	18	1.8
E	777	13	1.7
F	500	8	1.6
G	434	4	0.9
H	1275	40	3.1
I	1117	21	1.9
J	532	6	1.1
K	277	3	1.1
L	746	4	0.5
M	477	11	2.3
N	569	13	2.3
O	120	1	0.8

Hospital	Total number of admissions	Total Readmissions	% Readmission
P	641	11	1.7
Q	262	4	1.5
R	727	25	3.4
S	63	2	3.2
T	150	2	1.3
U	254	5	2.0
V	400	4	1.0
W	143	3	2.1
X	236	1	0.4
Y	273	1	0.4
Z	261	2	0.8
AA	184	2	1.1
AB	310	6	1.9
AC	397	2	0.5
AD	-	-	-
Total	**13774**	**241**	**1.7**

The readmission rate of 1.7% had been consistently low over the years compared to other ICUs in the world (7%) [6].

Readmission rate is an indicator of premature discharge. It is based on the assumption that all patients whose condition deteriorated in the ward are re-admitted. This may not be the case in the Malaysian setting due to the keen competition for ICU beds.

The relatively low readmission rates observed in our ICUs may be either due to sound clinical judgment or it could also be attributed to constraints in readmitting these patients due to the shortage of ICU beds. Alternatively, if an ICU bed is unavailable, patients may be admitted to high dependency wards.

Table 17 : Cardiac arrest within 72 hours & Trauma within one week prior to ICU admission by hospitals, 2007

Hospital	Cardiac arrest within 72 hours prior to ICU admission n (%)	Trauma within one week prior to ICU admission n (%)
A	15 (3.6)	103 (24.9)
B	16 (3.6)	72 (16.4)
C	17 (2.4)	254 (35.2)
D	37 (3.9)	117 (12.4)

Hospital	Cardiac arrest within 72 hours prior to ICU admission n (%)	Trauma within one week prior to ICU admission n (%)
E	120 (16.3)	129 (17.5)
F	22 (4.6)	100 (20.7)
G	22 (5.2)	110 (25.8)
H	39 (3.3)	192 (16.4)
I	33 (3.1)	276 (25.7)
J	12 (2.3)	94 (18.3)
K	8 (3.0)	67 (24.8)
L	21 (2.9)	66 (9.1)
M	19 (4.1)	70 (15.2)
N	9 (1.7)	86 (16.6)
O	7 (5.9)	33 (27.7)
P	12 (2.0)	66 (10.8)
Q	23 (9.1)	20 (7.9)
R	36 (5.3)	118 (17.3)
S	2 (3.2)	15 (25.4)
T	11 (7.5)	25 (17.1)
U	9 (3.9)	53 (22.9)
V	7 (1.8)	42 (11.1)
W	7 (5.0)	13 (9.3)
X	15 (6.7)	22 (9.9)
Y	31 (11.7)	31 (11.7)
Z	12 (4.7)	44 (17.3)
AA	15 (8.3)	28 (15.6)
AB	16 (5.4)	59 (19.9)
AC	26 (6.8)	47 (12.4)
AD	-	-
Total	**619 (4.7)**	**2352 (17.9)**

Cardiac arrest: ***Refers to a state of absent cardiac output requiring CPR. Excludes patients who had "collapsed" and did not require CPR***

Trauma: *Refers to accidental or non-accidental injury from motor vehicle accident, fall, assault, near-drowning and burns*

4.7% of ICU admissions had suffered a cardiac arrest 72 hours prior to admission. It is interesting to note that E admitted quite a number of patients with cardiac arrest (16.3%). This may be due to the fact that patients could not be ventilated in the general wards in this hospital.

18% of ICU admissions suffered from trauma prior to ICU admission. Q had the lowest percentage of patients admitted after trauma (7.9%).

Table 18 : Main organ failure on ICU admission by hospitals, 2007*

Hospital	Nil %	Resp. %	Cardio. %	Neuro. %	Renal %	Hepatic %	Haemato %
A	28.9	21.6	20.1	19.8	6.3	1.5	1.8
B	31.3	21.4	22.9	11.2	4.5	0.7	8.0
C	46.6	9.6	23.5	14.3	2.9	0.7	2.3
D	29.4	20.6	31.3	8.7	4.8	1.0	4.1
E	31.2	18.1	22.5	14.7	5.9	4.4	3.1
F	38.1	23.5	23.9	7.3	1.6	0.9	4.7
G	28.2	26.1	23.2	18.7	2.1	0.5	1.3
H	43.2	11.5	17.8	10.3	9.2	1.2	6.8
I	30.3	17.7	25.1	15.5	6.3	0.3	4.8
J	31.3	22.9	19.7	17.1	4.7	1.9	2.4
K	39.4	13.4	16.7	21.1	6.9	0.0	2.4
L	53.9	12.2	23.1	4.3	4.0	1.1	1.4
M	40.5	13.8	26.9	13.3	2.6	0.7	2.1
N	46.6	9.1	22.3	11.8	8.6	0.7	0.9
O	23.5	4.2	47.9	16.8	6.7	0.8	0.0
P	34.0	23.1	23.1	5.5	5.5	0.8	8.1
Q	18.9	32.5	29.4	11.8	6.1	0.0	1.3
R	21.1	15.3	41.7	14.0	3.5	0.8	3.6
S	50.0	22.4	13.8	12.1	1.7	0.0	0.0
T	27.2	28.7	19.1	19.1	2.2	0.7	2.9
U	43.3	15.7	17.1	16.1	6.0	1.4	0.5
V	42.5	21.6	20.3	9.8	2.9	2.3	0.7
W	24.8	28.8	16.0	23.2	4.0	0.8	2.4
X	30.8	24.2	25.1	6.6	10.4	0.9	1.9
Y	33.3	9.9	43.2	5.9	5.9	0.0	1.8
Z	26.1	16.4	13.9	29.1	10.3	2.4	1.8
AA	33.9	20.3	18.6	18.6	4.2	0.8	3.4
AB	29.1	20.0	26.8	18.1	4.5	0.4	1.1
AC	30.9	9.5	22.0	11.3	15.9	2.4	8.0
AD	-	-	-	-	-	-	-
Total	**35.1**	**17.4**	**24.5**	**12.8**	**5.6**	**1.1**	**3.6**

**In 2007, the definition of organ failure was changed to the Sequential Organ Failure Assessment (SOFA) [7].*
This score is taken for the first 24 hours after ICU admission.
Hence, comparisons cannot be made with the previous years.

In 2007, 35% of the admissions were without any organ failure for the first 24 hours. Interestingly, cardiovascular failure accounted for the highest proportion of organ failure followed by respiratory failure.

L (54%) and S (50%) had about more than half their patients admitted without any organ failure.

In a study of 5816 randomly selected ICU admissions from 13 major medical centres in the United States, 51% did not have any organ failure on admission [8].

Table 19 : Total number of organ failure on ICU admission by hospitals, 2007

Hospital	0 %	1 %	2 %	3 %	4 %	5 %	6 %
A	28.9	33.7	21.6	12.1	3.5	0.3	0.0
B	31.3	32.6	21.9	9.7	4.0	0.5	0.0
C	46.6	29.3	17.9	5.2	0.7	0.0	0.1
D	29.4	31.5	24.8	11.0	2.8	0.3	0.1
E	31.2	27.9	23.7	12.1	3.9	1.1	0.0
F	38.1	30.2	22.0	7.3	2.2	0.2	0.0
G	28.2	29.2	25.0	13.7	2.9	1.1	0.0
H	43.2	31.3	18.0	6.4	1.1	0.1	0.0
I	30.3	28.0	24.0	12.4	3.6	1.7	0.0
J	31.3	31.7	23.6	11.3	1.9	0.2	0.0
K	39.4	31.3	18.7	7.7	2.8	0.0	0.0
L	53.9	25.8	10.5	6.5	3.0	0.3	0.0
M	40.5	30.7	17.3	8.4	1.6	1.4	0.0
N	46.6	31.6	13.9	6.1	1.1	0.2	0.5
O	23.5	27.7	24.4	23.5	0.8	0.0	0.0
P	34.0	36.7	17.4	9.5	2.3	0.2	0.0
Q	18.9	29.8	30.7	14.5	4.8	0.9	0.4
R	21.1	32.9	27.7	13.5	3.8	1.0	00
S	50.0	24.1	17.2	6.9	1.7	0.0	0.0
T	27.2	32.4	22.8	8.8	7.4	1.5	0.0
U	43.3	24.9	18.9	9.2	3.2	0.5	0.0
V	42.5	25.5	22.2	6.9	2.0	0.7	0.3
W	24.8	24.8	25.6	17.6	5.6	1.6	0.0
X	30.8	25.6	22.7	14.2	5.2	0.9	0.5
Y	33.3	23.9	24.3	14.4	3.2	0.9	0.0
Z	26.1	23.0	27.9	16.4	6.1	0.6	0.0
AA	33.9	22.9	32.2	9.3	1.7	0.0	0.0
AB	29.1	30.6	22.6	8.0	2.1	0.0	0.0
AC	30.9	36.4	22.6	8.0	2.1	0.0	0.0
AD	-	-	-	-	-	-	-
Overall	**35.1**	**30.0**	**21.4**	**10.1**	**2.7**	**0.6**	**0.1**

It is interesting to note that the percentage of admissions steadily decreased when the number of organ failures increased.

Table 20 : Ten most common diagnoses leading to ICU admission, 2007 (For complete list refer to Appendix 1)

Diagnosis	Number	Percentage (%)
Sepsis	1186	9.1
Head injury	1175	8.9
Community acquired pneumonia	664	5.1
Bronchial asthma	469	3.6
Gastrointestinal perforation (including anastomotic leak)	456	3.5
Dengue fever	383	2.9
Intra-abdominal injury	378	2.9
Chronic lower respiratory disease (COAD, bronchiectasis, restrictive lung disease)	354	2.7
Non-cardiogenic pulmonary oedema (post upper airway obstruction, neurogenic, fluid overload)	340	2.6
Intra-abdominal / pelvic malignancy	300	2.3

For the first time, **sepsis** replaced head injury as the main diagnosis leading to ICU admission. In the past, head injury was the main diagnosis leading to ICU admission. Sepsis, head injury, community-acquired pneumonia, bronchial asthma and gastrointestinal perforation have been in the top 5 diagnoses leading to ICU admission since 2006. Note that dengue fever has taken 6th place with the addition of 8 new centres in 2006.

Table 21 : Ten most common diagnoses leading to ICU admission using APACHE II diagnostic category, 2007 (For complete list refer to Appendix 2)

Diagnosis	Number	Percentage
Non-operative: sepsis	1030	7.8
Non-operative: respiratory infection	1007	7.7
Non-operative: respiratory system as principal reason for admission	791	6.0
Operative: Respiratory system as principal reason for admission	673	5.1
Operative: G I perforation / obstruction	630	4.8
Operative: Cardiovascular system as principal reason for admission	597	4.5
Operative: Multiple trauma	463	3.5
Operative: Respiratory insufficiency after surgery	459	3.5
Non-operative: Metabolic / renal system as principal reason for admission	438	3.3
Non-operative: Asthma / allergy	423	3.2

Using APACHE II diagnostic category, **sepsis** was the main diagnosis leading to ICU admission. The in-hospital mortality of this group of patients was 56.0% with an SMR of 1.1 and risk of death of 51.7%.

Table 22 : Ten most common surgical operations by systems, 2007 (For complete list refer to Appendix 3)

Operations	Number	Percentage
Gastrointestinal (abdominal) surgery	2093	36.1
Orthopaedic surgery	952	16.4
Neurosurgery	780	13.5
Obstetric surgery	606	10.5
Other surgery not mentioned above	286	4.9
ENT surgery	274	4.7
Urological surgery	185	3.2
Gynaecological surgery	127	1.0
Spinal surgery	117	2.0
Vascular surgery	105	1.8

The three commonest types of surgery performed were laparotomies, orthopaedic operations and craniotomies and they have remained unchanged over the past 5 years.

Table 23 : Types of co-morbid diseases, 2007

Operations	Number	Percentage
Hypertension	3684	35.1
Diabetes mellitus	2980	28.4
Chronic lung disease	1124	10.7
Chronic liver disease	966	9.2
Chronic renal failure	719	6.9
Other disabling conditions	478	4.6
Chronic cardiovascular disease	220	2.1
HIV positive	117	1.1
Active cancer	98	0.9
Immunosuppression	98	0.9

Hypertension and diabetes mellitus remain the most common co-morbid diseases. The number of patients with retroviral disease, active cancer and immunosuppression being admitted to ICU is relatively small.

Table 24 : SAPS II score [9] by hospitals, 2003-2005 and 2007

Hospital	SAPS II score			
	2003	2004	2005	2007
A	30.5	28.5	32.4	40.4
B	32.4	32.1	33.5	33.4
C	32.9	32.0	27.0	31.5
D	35.1	36.9	37.2	39.1
E	41.3	35.3	34.2	40.2
F	39.3	36.4	35.7	31.9
G	38.8	39.5	37.9	43.3
H	36.9	34.5	34.1	34.4
I	38.2	38.6	39.1	38.6
J	37.7	35.7	38.8	36.3
K	42.1	37.1	42.7	39.8
L	36.2	33.1	34.4	32.8
M	35.6	31.4	32.6	32.0
N	31.1	29.1	30.3	32.8
O	-	-	-	44.2
P	-	-	-	32.5
Q	-	-	-	49.2
R	-	-	-	43.5
S	-	-	-	35.8
T	-	-	-	43.6
U	-	-	-	35.3
V	-	-	-	37.1
W	-	-	-	47.9
X	-	-	-	39.2
Y	-	-	-	40.8
Z	-	-	-	43.2
AA	-	-	-	35.2
AB	-	-	-	40.7
AC	-	-	-	35.4
	-	-	-	-
Total	**36.1**	**34.8**	**35.5**	**37.2**

**Exclude: Patients with acute coronary syndrome, burns or post cardiac surgery, less than 18 years of age or stay less than 8 hours in ICU.*

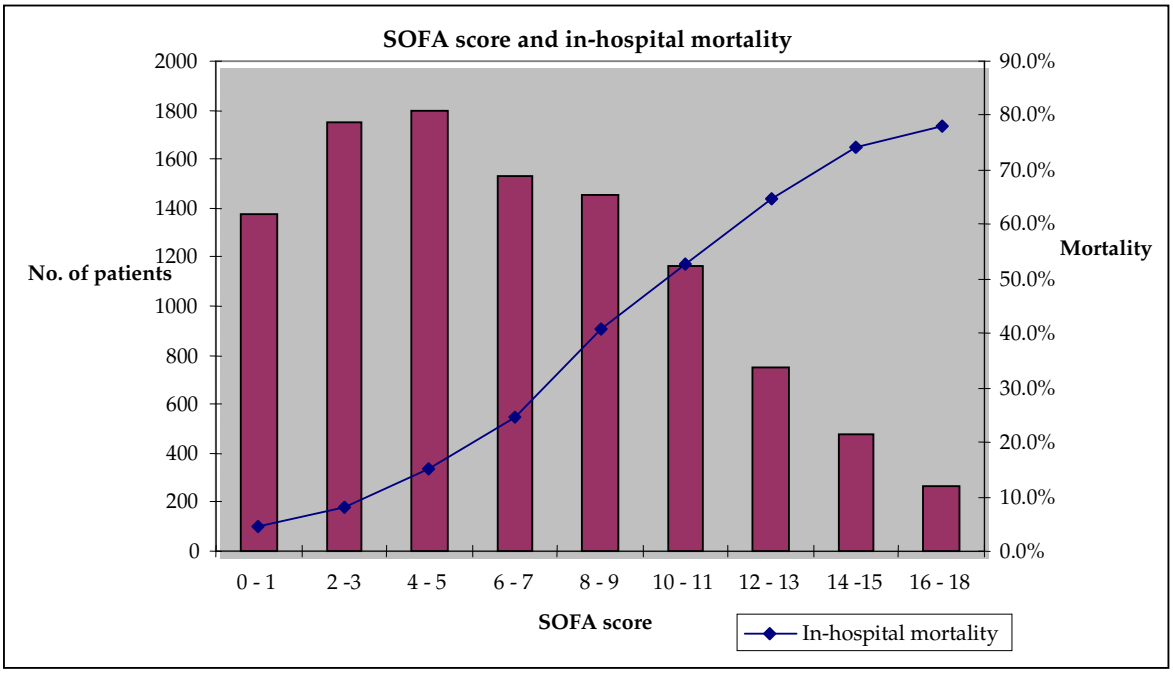
The average SAPS II score did not change much over the years. A score of 37.2 carries a predicted risk of in-hospital mortality of 30.44% [10].

Table 25 : Mean and Median of Sequential Organ Failure Assessment (SOFA) by hospitals, 2007 [7]

Hospital	SOFA scores			
	n	Mean	Median	Range
A	398	6.8	6	0 - 20
B	402	6.9	6	0 - 21
C	686	5.3	5	0 - 21
D	887	7.1	7	0 - 23
E	612	7.6	7	0 - 22
F	451	6.1	6	0 - 21
G	380	7.2	7	0 - 19
H	1045	5.2	4	0 - 21
I	975	7.5	7	0 - 21
J	467	6.4	6	0 - 18
K	246	5.7	5	0 - 17
L	629	4.8	3	0 - 19
M	427	5.4	5	0 - 19
N	440	4.5	4	0 - 23
O	119	7.6	8	0 - 16
P	529	6.2	5	0 - 19
Q	228	8.7	8.5	0 - 21
R	607	7.9	7	0 - 20
S	58	5.4	4	0 - 17
T	136	7.4	7	0 - 20
U	217	6.0	5	0 - 19
V	306	5.9	5	0 - 20
W	125	8.3	8	0 - 19
X	211	7.4	7	0 - 22
Y	222	6.8	7	0 - 20
Z	165	7.5	7	0 - 21
AA	118	6.0	6	0 - 19
AB	265	7.4	7	0 - 17
AC	327	6.2	6	0 - 16
AD	-	-	-	-
Overall	**11678**	**6.5**	**6**	**0 - 23**

SOFA scores are indicative of the severity of illness of the patient [11]. The maximum score is 24.

Figure 1 : SOFA scores and In-hospital Mortality 2007



B.

Section C

Monitoring

Table 26 : Monitoring modalities by hospitals, 2007

Hospital	Arterial cannulation %	Central venous catheterisation %	Cardiac output monitoring %
A	97.6	72.1	0.0
B	98.6	74.7	1.6
C	93.6	46.1	0.4
D	99.8	66.3	1.1
E	90.6	57.7	2.0
F	93.6	50.4	0.8
G	96.3	63.0	0.5
H	83.1	65.4	0.2
I	97.4	78.7	3.7
J	93.2	76.4	6.0
K	97.4	79.0	2.6
L	84.6	60.3	0.0
M	96.5	70.7	0.4
N	93.0	69.5	0.2
O	98.3	90.5	0.0
P	49.5	52.5	0.3
Q	93.5	72.5	0.0
R	81.6	79.8	0.0
S	96.6	72.9	5.1
T	100.0	82.6	1.4
U	93.3	67.1	0.0
V	91.4	75.3	0.8
W	91.2	58.4	0.0
X	93.2	80.6	0.5
Y	83.5	65.1	0.0
Z	21.9	41.0	0.4
AA	75.1	30.9	0.6
AB	89.9	68.8	0.0
AC	87.9	72.1	1.3
AD	-	-	-
Overall	**88.5**	**66.2**	**1.1**

Arterial lines and central venous lines were inserted in 88% and 66%respectively of patients. Z had a low incidence of arterial and central venous line cannulation compared with other centres. J had the highest incidence of cardiac output monitoring.

Section D

Interventions

Table 27 : Invasive, Non-invasive mechanical ventilation and Re-intubation by hospitals, 2007

Hospital	Invasive mechanical ventilation n (%)	Non-invasive mechanical ventilation [1] n (%)	Reintubation [2] n (%)
A	359 (85.9)	48 (11.7)	16 (4.5)
B	355 (80.9)	35 (8.1)	25 (7.1)
C	562 (77.7)	93 (12.9)	71 (12.7)
D	789 (83.7)	235 (24.9)	101 (12.8)
E	606 (82.1)	85 (11.6)	58 (9.6)
F	394 (81.7)	75 (15.6)	10 (2.5)
G	379 (88.8)	57 (13.3)	38 (10.0)
H	723 (61.5)	162 (13.8)	90 (12.5)
I	885 (82.4)	93 (8.7)	134 (15.1)
J	446 (86.9)	31 (6.0)	32 (7.2)
K	237 (87.8)	18 (6.7)	14 (5.9)
L	604 (83.3)	150 (20.7)	41 (6.8)
M	378 (82.0)	35 (7.6)	37 (9.8)
N	454 (87.8)	4 (0.8)	35 (7.8)
O	105 (88.2)	0 (0.0)	7 (6.7)
P	280 (45.8)	27 (4.4)	11 (4.0)
Q	198 (78.3)	23 (9.2)	29 (14.8)
R	597 (87.3)	0 (0.0)	85 (14.3)
S	37 (62.7)	0 (0.0)	2 (5.6)
T	122 (83.6)	25 (17.4)	15 (12.5)
U	177 (74.4)	37 (15.9)	17 (9.8)
V	305 (79.8)	22 (5.9)	24 (8.0)
W	110 (78.6)	36 (26.3)	11 (10.3)
X	181 (80.1)	7 (3.1)	8 (4.4)
Y	203 (76.3)	71 (27.0)	24 (12.0)
Z	170 (66.4)	1 (0.4)	11 (6.5)
AA	142 (78.9)	13 (7.2)	20 (14.1)
AB	252 (84.6)	29 (9.8)	32 (12.8)
AC	266 (69.1)	73 (19.2)	12 (4.6)
AD	-	-	-
Total	**10316 (78.5)**	**1485 (11.4)**	**1010 (9.8)**

1: Refers to the continuous use of a non-invasive ventilator for ≥ 24 hours
2: Refers to reintubation after intended or accidental extubation with an undefined time interval between the two processes

Approximately 78.5% of all patients admitted to ICUs required invasive mechanical ventilation. This figure was slightly lower than the previous years where 83% of patients received invasive mechanical ventilation. One of the reasons for this reduction may be attributed to increased use of non-invasive ventilators.

The use of non-invasive ventilators for more than 24 hours has increased over the years and this is likely due to the availability of non-invasive ventilators in many hospitals.

The reintubation rate has remained around 8.8 to 10.3% over the 5 years. The rate of reintubation ranges between 4.5% and 23% in the literature. This significant difference among different studies is probably due to the inclusion of patients from different types of ICUs (trauma, medical, surgical), who present with different preconditions, have different duration of mechanical ventilation, and who undergo different decision-making process. In addition, the period of time used to define the incidence of reintubation varies between studies, ranging from 48 hours to an undefined period of time [12]. Reintubation has been found to be significantly associated with ventilator-associated pneumonia [13] [14] [15] [16].

Table 28 : Duration of mechanical ventilation, mean (SD) days

Hospital	Mean ± SD days				
	2003	2004	2005	2006	2007
A	6.1 ± 10.2	3.5 ± 4.8	3.9 ± 6.5	3.9 ± 6.0	3.9 ± 5.1
B	3.9 ± 5.5	5.2 ± 7.2	5.6 ± 8.7	5.0 ± 7.0	5.8 ± 7.6
C	5.5 ± 7.5	5.1 ± 5.4	6.0 ± 7.5	5.6 ± 7.0	5.5 ± 7.9
D	5.2 ± 8.7	4.0 ± 5.9	4.4 ± 6.4	4.8 ± 7.3	4.6 ± 6.1
E	6.1 ± 9.2	5.7 ± 8.0	5.3 ± 8.3	4.5 ± 6.4	4.2 ± 5.6
F	3.9 ± 4.8	7.4 ± 8.9	5.8 ± 6.9	4.9 ± 6.9	4.7 ±7.8
G	4.2 ± 8.1	4.9 ± 7.8	5.1 ± 8.1	5.4 ± 7.1	4.7 ± 5.5
H	4.6 ± 7.6	2.7 ± 6.8	2.9 ± 4.4	3.0 ± 3.8	4.2 ± 5.2
I	6.4 ± 9.7	5.5 ± 6.5	5.9 ± 8.4	4.9 ± 6.2	5.1 ±6.6
J	4.7 ± 8.3	4.0 ± 5.3	3.8 ± 5.5	4.3 ± 5.9	3.9 ±5.0
K	6.5 ± 8.7	3.8 ± 4.9	4.7 ± 8.0	3.6 ± 5.2	3.9 ± 5.0
L	6.9 ± 8.7	5.3 ± 8.0	4.4 ± 6.7	4.2 ± 6.3	4.0 ± 6.0
M	5.4 ± 7.6	3.7 ± 4.8	3.3 ± 4.7	3.3 ± 4.9	4.8 ± 7.5
N	3.9 ± 8.7	3.9 ± 5.7	4.9 ± 6.6	4.9 ± 6.0	4.0 ± 5.4
O	-	-	-	6.0 ±7.0	6.0 ± 7.7
P	-	-	-	7.0 + 9.5	5.8 ± 7.7
Q	-	-	-	3.9 ± 7.7	4.1 ± 7.2
R	-	-	-	4.4 ± 6.3	4.7 ± 7.0
S	-	-	-	4.7 ± 6.1	5.7 ± 12.0
T	-	-	-	4.0 ± 5.2	3.7 ± 4.8

U	-	-	-	3.0 ± 3.4	4.4 ± 7.3
V	-	-	-	-	4.1 ± 6.5
W	-	-	-	-	5.2 ± 10.0
X	-	-	-	-	5.9 ± 7.8
Y	-	-	-	-	6.4 ± 8.7
Z	-	-	-	-	4.4 ± 7.3
AA	-	-	-	-	5.8 ± 7.2
AB	-	-	-	-	2.9 ± 3.5
AC	-	-	-	-	4.2 ± 6.3
AD	-	-	-	5.8 ± 8.3	#
Total	**5.2 ± 8.3**	**4.5 ± 6.5**	**4.6 ± 7.0**	**4.5 ± 6.4**	**4.6 ± 6.6**

 # This centre did not submit data

The average duration of mechanical ventilation was 4.6 days. There has been not much change in the duration of mechanical ventilation over the years.

Table 29 : Interventions in ICU, 2007

Intervention	**2003 n (%)**	**2004 n (%)**	**2005 n (%)**	**2006 n (%)**	**2007 n (%)**
Non-invasive ventilation [1]	364 (6.5)	268 (3.7)	380 (5.1)	469 (4.7)	1485 (11.4)
Reintubation [2]	575 (10.3)	571 (9.5)	637 (10.3)	707 (8.8)	1010 (9.8)
Stress ulcer prophylaxis [3]	5515 (81.8)	6061 (84.0)	6486 (86.8)	8911 (88.8)	11623 (88.7)
Use of muscle relaxant [4]	664 (11.9)	494 (8.2)	385 (5.2)	413 (5.1)	376 (3.7)
Bronchoscopy [5]	293 (4.3)	259 (4.3)	266 (3.6)	430 (5.4)	394 (3.8)
Use of vasoactive drugs [6]	3050 (45.3)	3232 (44.8)	3441 (46.1)	4579 (45.7)	6190 (47.3)
Use of heparin [7]	1036 (15.4)	988 (13.7)	1007 (13.5)	1545 (15.4)	2984 (22.8)
Renal replacement therapy [8]	613 (9.1)	713 (9.9)	828 (11.1)	1168 (11.7)	1655 (12.6)
Use of albumin [9]	591 (8.8)	637 (8.8)	630 (8.4)	689 (6.9)*	900 (6.9)
Use of blood/blood products [10]	3160 (46.9)	3401 (47.1)	3415 (45.7)	4470 (44.8)	5440 (41.6)
Use of total parenteral nutrition [11]	242 (3.6)	334 (4.6)	336 (4.5)	497 (5.0)	634 (4.8)
Tracheostomy [12]	901 (16.1)	908 (15.1)	929 (15.0)	1161 (20.2)	1472 (14.4)

1: Refers to the continuous use of a non-invasive ventilator for ≥ 24 hours
2: Refers to reintubation after intended or accidental extubation
3: Refers to the use of drugs for the purpose of prevention of stress induced ulcers or upper gastrointestinal bleeding
4: Refers to the continuous use of non-depolarising muscle relaxants for ≥ 24 hours
5: Refers to fibreoptic bronchoscopy done in ICU for therapeutic or diagnostic purposes
6: Refers to the continuous use of vasoactive drugs for ≥ 1 hr in ICU
7: Refers to the use of either unfractionated or low-molecular weight heparin in ICU for any indication
8: Refers to the use of peritoneal dialysis, intermittent haemodialysis, continuous veno-veno haemodiafiltration for treatment of acute or chronic renal failure
9: Refers to the use of commercially prepared albumin solutions (5%, 20%, 25%) in ICU irrespective of indication

** From 2005, only the use of albumin for ≥ 72 hours was noted*
10: Refers to the transfusion of blood/blood products during patient's ICU stay.
11.Refers to continuous use of total parenteral nutrition(> 10% dextrose solution, amino acid solution with/without fat emulsion solutions for ≥ 72 hrs
12: Refers to the procedure done via the surgical or the percutaneous technique during ICU stay

The interventions carried out in ICU have remained relatively unchanged, except for the increased use of non-invasive ventilators and the use of heparin for deep vein thromboprophylaxis. The commencement of the ventilator care bundle in January 2007 in all the ICUs mandates the use of stress ulcer and deep vein thromboprophylaxis except for accepted contraindications.

The use of albumin and blood/blood products has decreased steadily over the years. The latter fact is in keeping with current evidence of tolerance for a lower haemoglobin level. Several studies have shown and suggested the association between red cell transfusion and poor outcome [17] [18].

Table 30 : Stress ulcer prophylaxis by hospitals, 2007

Hospital	Stress ulcer prophylaxis n (%)	Type of drug , n (%)		
		Sucralfate	H_2 receptor antagonist	Proton pump inhibitor
A	398 (95.4)	1 (0.2)	282 (70.3)	118 (29.5)
B	409 (94.0)	0 (0.0)	340 (79.8)	86 (20.2)
C	710 (98.3)	1 (0.1)	699 (95.1)	35 (4.8)
D	884 (93.7)	0 (0.0)	849 (91.3)	35 (8.7)
E	571 (77.7)	1 (0.2)	493 (76.3)	152 (23.5)
F	433 (89.8)	1 (0.2)	354 (81.2)	81 (18.6)
G	409 (95.8)	0 (0.0)	360 (84.9)	64 (15.1)
H	967 (82.4)	6 (0.6)	921 (93.3)	60 (6.1)
I	982 (91.4)	166 (16.6)	791 (79.2)	42 (4.2)
J	459 (89.5)	3 (0.7)	415 (90.2)	42 (9.1)
K	263 (97.4)	0 (0.0)	246 (93.5)	17 (6.5)
L	597 (82.3)	2 (0.3)	505 (83.7)	96 (16.0)
M	436 (94.6)	0 (0.0)	323 (74.1)	113 (25.9)
N	460 (89.3)	14 (2.8)	344 (74.5)	105 (22.7)
O	110 (94.0)	3 (2.7)	63 (56.3)	46 (41.0)
P	513 (84.0)	2 (0.4)	465 (89.6)	52 (10.0)
Q	210 (84.3)	0 (0.0)	193 (88.1)	26 (11.9)
R	619 (90.5)	0 (0.0)	532 (82.5)	113 (17.5)
S	55 (93.2)	0 (0.0)	44 (80.0)	11 (20.0)
T	137 (95.1)	1 (0.7)	120 (85.7)	19 (13.6)
U	205 (88.0)	0 (0.0)	190 (90.9)	19 (9.1)
V	329 (87.5)	2 (0.6)	227 (68.2)	104 (31.2)

W	121 (87.7)	0 (0.0)	98 (79.7)	25 (20.3)
X	210 (94.2)	0 (0.0)	198 (93.8)	13 (6.2)
Y	222 (84.7)	1 (0.4)	200 (88.9)	24 (10.7)
Z	187 (73.6)	0 (0.0)	107 (55.2)	87 (44.8)
AA	166 (92.2)	0 (0.0)	127 (70.9)	52 (29.1)
AB	255 (85.6)	0 (0.0)	255 (98.8)	3 (1.2)
AC	306 (81.0)	1 (0.3)	264 (82.0)	57 (17.7)
AD	-	-	-	-
Total	**11623 (88.7)**	**205 (1.7)**	**10005 (83.7)**	**1743 (14.6)**

The use of sucralfate has declined further. This is to be expected as the national ICU management guidelines recommend the use of H_2-receptor antagonist for stress ulcer prophylaxis.

Table 31 : Use of vasoactive drugs 2003-2007

Type of drug	2003 n (%)	2004 n (%)	2005 n (%)	2006 n (%)	2007 n (%)
Dopamine	2682 (47.2)	2752 (47.6)	2877 (44.8)	3620 (42.2)	4583 (39.5)
Noradrenaline	1271 (22.4)	1396 (24.2)	1767 (27.5)	2781 (32.4)	4084 (35.2)
Dobutamine	986 (17.3)	958 (16.6)	1058 (16.5)	1617 (18.9)	2198 (18.9)
Adrenaline	742 (13.1)	670 (11.6)	688 (10.7)	560 (6.5)	708 (6.1)
Phenylephrine	-	-	-	2 (0.0)	2 (0.0)
Vasopressin	-	-	-	2 (0.0)	31 (0.3)

Dopamine is still the 'first line' and main vasoactive agent used in many ICU although its use has slowly declined over the past 5 years. The use of noradrenaline has increased.

Table 32 : Vasoactive drugs by hospitals, 2007

Hospital	Vasoactive drug n (%)
A	208 (50.1)
B	232 (53.5)
C	282 (39.1)
D	509 (54.0)
E	375 (51.1)
F	212 (44.0)
G	210 (49.2)
H	509 (43.5)
I	527 (49.1)
J	234 (45.7)

Hospital	Vasoactive drug n (%)
K	113 (42.2)
L	281 (38.8)
M	176 (38.3)
N	163 (31.7)
O	83 (70.9)
P	232 (38.1)
Q	143 (57.7)
R	439 (64.2)
S	19 (32.2)
T	73 (50.7)
U	99 (42.5)
V	143 (38.1)
W	77 (55.8)
X	126 (56.5)
Y	140 (53.2)
Z	121 (47.6)
AA	101 (56.1)
AB	166 (55.9)
AC	197 (52.7)
AD	-
Total	**6190 (47.3)**

Nearly half of the patients in our ICUs required some form of vasoactive therapy.

Table 33 : Use of heparin by hospitals, 2007

Hospital	DVT prophylaxis n (%)	Type of heparin , n (%)	
		Low molecular weight heparin	Unfractionated heparin
A	67 (16.6)	35 (52.2)	32 (47.8)
B	80 (18.4)	8 (9.9)	73 (90.1)
C	239 (33.1)	90 (37.2)	152 (62.8)
D	393 (41.7)	380 (96.5)	14 (3.5)
E	127 (17.3)	70 (53.4)	61 (46.6)
F	46 (9.5)	34 (73.9)	12 (26.1)
G	130 (30.7)	117 (90.0)	13 (10.0)
H	209 (17.8)	68 (32.4)	142 (67.6)
I	359 (33.4)	232 (62.9)	137 (37.1)
J	154 (30.0)	34 (21.9)	121 (78.1)
K	31 (11.5)	10 (33.3)	20 (66.7)

Hospital	DVT prophylaxis n (%)	Type of heparin , n (%)	
		Low molecular weight heparin	Unfractionated heparin
L	97 (13.4)	1 (1.0)	95 (99.0)
M	14 (3.0)	13 (92.9)	1 (7.1)
N	17 (3.3)	10 (58.8)	7 (41.2)
O	13 (11.1)	2 (15.4)	11 (84.6)
P	105 (17.2)	20 (18.9)	86 (81.1)
Q	36 (14.5)	3 (8.3)	33 (91.7)
R	365 (53.4)	18 (4.9)	348 (95.1)
S	7 (11.9)	0 (0.0)	7 (100.0)
T	23 (16.0)	11 (47.8)	12 (52.2)
U	49 (21.3)	13 (26.0)	37 (74.0)
V	36 (9.5)	28 (77.8)	8 (22.2)
W	31 (22.5)	20 (64.5)	11 (35.5)
X	53 (23.9)	38 (71.7)	15 (28.3)
Y	87 (33.1)	19 (21.8)	68 (78.2)
Z	34 (13.3)	16 (47.1)	18 (52.9)
AA	57 (31.7)	55 (96.5)	2 (3.5)
AB	45 (15.2)	6 (13.1)	40 (86.9)
AC	79 (21.4)	74 (93.7)	5 (6.3)
AD	-	-	-
Total	**2984 (22.8)**	**1425 (47.4)**	**1581 (52.6)**

An increasing number of patients in ICU were on deep vein thromboprophylaxis and this is in keeping with the ventilator care bundle protocol and current evidence [19] [20] [21] [22].

Table 34 : Renal replacement therapy by hospitals, 2007

Hospital	Renal replacement therapy n (%)	Type of therapy, n (%)		
		Intermittent haemodialysis	CVVH	Peritoneal dialysis
A	45 (10.7)	14 (35.0)	12 (30.0)	14 (35.0)
B	85 (19.4)	64 (69.6)	27 (29.3)	1 (1.1)
C	43 (5.9)	39 (90.7)	3 (7.0)	1 (2.3)
D	216 (22.9)	117 (44.7)	141 (53.8)	4 (1.5)
E	92 (12.5)	69 (65.1)	34 (32.1)	3 (2.8)
F	57 (11.8)	28 (44.4)	32 (50.8)	3 (4.8)
G	55 (12.9)	40 (59.7)	7 (10.4)	20 (29.9)
H	159 (13.5)	117 (68.4)	32 (18.7)	22 (12.9)
I	155 (14.4)	101 (55.8)	68 (37.6)	12 (6.6)
J	31 (6.0)	6 (18.8)	21 (65.6)	5 (15.6)
K	28 (10.4)	13 (38.2)	14 (41.2)	7 (20.6)
L	71 (9.8)	24 (30)	26 (32.5)	30 (37.5)
M	48 (10.4)	29 (53.7)	19 (35.2)	6 (11.1)
N	58 (11.2)	56 (96.6)	2 (3.4)	0
O	18 (15.1)	8 (42.1)	0	11 (57.9)
P	67 (11.0)	38 (54.3)	3 (4.3)	29 (41.4)
Q	40 (15.8)	28 (63.6)	0	16 (36.4)
R	83 (12.1)	62 (69.7)	0	27 (30.3)
S	8 (13.6)	5 (62.5)	0	3 (37.5)
T	17 (11.6)	17 (100)	0	0
U	24 (10.1)	17 (70.8)	0	7 (29.2)
V	19 (5.0)	11 (100)	0	11
W	28 (20)	18 (56.3)	0	14 (43.8)
X	37 (16.4)	22 (52.4)	0	20 (47.6)
Y	38 (14.3)	8 (21.1)	0	30 (78.9)
Z	19 (7.4)	8 (36.4)	0	14 (63.6)
AA	15 (8.3)	9 (45.0)	0	11 (55.0)
AB	36 (12.1)	25 (61.0)	0	16 (39.0)
AC	59 (15.3)	28 (42.4)	37 (56.1)	1 (1.5)
AD	-	-	-	-
Total	**1651 (12.6)**	**1021 (55.9)**	**478 (26.2)**	**327 (17.9)**

Intermittent haemodialysis remains the commonest mode of dialysis performed in the ICUs. In spite of its limited role in treating acute renal failure in the critically ill, peritoneal dialysis is still performed in some tertiary hospitals and smaller hospitals.

Table 35 : Tracheostomy by hospitals, 2007

Hospital	Tracheostomy Performed n (%)	Tracheostomy in relation to day of ventilation Day, mean (median)	Type of tracheostomy n (%)	
			Surgical	Percutaneous
A	48 (13.6)	6.6 (5.2)	38 (76.0)	12 (24.0)
B	61 (17.4)	7.8 (7.0)	37 (59.7)	25 (40.3)
C	84 (15.0)	10.6 (7.0)	36 (42.9)	48 (57.1)
D	116 (14.9)	5.7 (3.7)	38 (32.8)	78 (67.2)
E	75 (12.5)	8.8 (6.9)	68 (89.5)	8 (10.5)
F	35 (8.9)	11.8 (10.1)	33 (94.3)	2 (5.7)
G	58 (15.3)	6.9 (5.9)	58 (100)	0
H	91 (12.7)	7.8 (7.3)	87 (95.6)	4 (4.4)
I	292 (33.0)	4.8 (4.0)	39 (13.3)	255 (86.7)
J	44 (10.0)	7.2 (6.2)	29 (65.9)	15 (34.1)
K	24 (10.3)	10.0 (8.4)	13 (54.2)	11 (45.8)
L	21 (3.5)	17.6 (17.8)	13 (61.9)	8 (38.1)
M	53 (14.1)	10.4 (9.4)	25 (46.3)	29 (53.7)
N	55 (12.2)	5.7 (5.5)	54 (100.0)	0
O	13 (13.5)	8.1 (6.5)	13 (100.0)	0
P	25 (8.9)	8.6 (6.3)	15 (60.0)	10 (40.0)
Q	25 (12.8)	8.3 (5.8)	7 (28.0)	18 (72.0)
R	118 (19.8)	5.8 (4.7)	118 (100.0)	0
S	3 (8.1)	13.8 (11.4)	3 (100.0)	0
T	15 (12.5)	5.4 (4.9)	14 (93.3)	1 (6.7)
U	37 (21.6)	6.7 (4.6)	37 (100.0)	0
V	35 (12.0)	8.1 (6.7)	35 (100.0)	0
W	10 (9.4)	11.1 (9.1)	10 (100.0)	0
X	11 (6.1)	22.0 (22.7)	9 (81.8)	2 (18.2)
Y	26 (13.2)	11.3 (10.4)	25 (96.2)	1 (3.8)
Z	12 (7.1)	5.4 (4.1)	12 (100.0)	0
AA	32 (22.7)	5.1 (4.7)	27 (81.8)	6 (18.2)
AB	26 (10.3)	5.5 (4.2)	26 (100.0)	0
AC	27 (10.3)	8.4 (7.4)	9 (31.0)	20 (69.0)
AD	-	-	-	-
Total	**1472 (14.4)**	**7.7 (6.2)**	**928 (62.7)**	**553 (37.3)**

Tracheostomy was performed in 14% of ICU patients. I had the highest rate of tracheostomy with 33%. This practice was necessary in order to free beds for further ICU admissions.

The median number of days to tracheostomy was 6.2 days with D having the shortest median duration of 3.7 days followed by I with 4 days.

The percutaneous route was less commonly done compared with the surgical route. Despite the established role of percutaneous tracheostomy in ICU [23], it is surprising to note that 10 hospitals did not perform any percutaneous tracheostomy at all.

Table 36 : Other interventions by hospitals, 2007

Hospital	Type of interventions, n (%)				
	Muscle relaxants	Broncho-scopy	Parenteral nutrition	Blood products	Albumin
A	10 (2.8)	7 (2.0)	11 (2.7)	155 (37.3)	82 (19.8)
B	34 (9.7)	13 (3.7)	27 (6.2)	153 (35.3)	82 (18.9)
C	23 (4.1)	30 (5.3)	28 (3.9)	302 (41.9)	58 (8.0)
D	14 (1.8)	30 (3.8)	54 (5.7)	441 (46.8)	17 (1.8)
E	20 (3.3)	57 (9.4)	20 (2.7)	337 (45.9)	36 (4.9)
F	12 (3.0)	10 (2.5)	25 (5.2)	195 (40.5)	34 (7.1)
G	7 (1.8)	12 (3.2)	31 (7.3)	152 (35.6)	8 (1.9)
H	5 (0.7)	23 (3.2)	28 (2.4)	488 (41.6)	4 (0.3)
I	27 (3.1)	32 (3.6)	23 (2.1)	492 (45.9)	16 (1.5)
J	9 (2.0)	40 (9.0)	20 (3.9)	146 (28.5)	20 (3.9)
K	5 (2.1)	5 (2.1)	13 (4.9)	98 (36.4)	18 (6.7)
L	39 (6.5)	6 (1.0)	66 (9.1)	293 (40.4)	62 (8.6)
M	2 (0.5)	30 (7.9)	53 (11.5)	204 (44.3)	22 (4.8)
N	5 (1.1)	3 (0.7)	38 (7.4)	213 (41.4)	8 (1.6)
O	0 (0.0)	0 (0.0)	4 (3.4)	47 (40.5)	5 (4.3)
P	16 (5.7)	1 (0.4)	17 (2.8)	203 (33.2)	52 (8.5)
Q	1 (0.5)	2 (1.0)	6 (2.4)	132 (53.0)	8 (3.2)
R	1 (0.2)	11 (1.8)	27 (3.9)	321 (46.9)	98 (14.3)
S	1 (2.7)	0 (0.0)	19 (32.2)	36 (61.0)	13 (22.0)
T	1 (0.8)	11 (9.2)	4 (2.8)	60 (41.7)	2 (1.4)
U	15 (8.7)	17 (9.8)	18 (7.8)	113 (48.9)	22 (9.4)
V	35 (11.7)	5 (1.7)	14 (3.7)	144 (38.5)	50 (13.3)
W	2 (1.9)	3 (2.8)	11 (8.0)	62 (44.9)	9 (6.5)
X	37 (20.6)	3 (1.7)	22 (9.9)	121 (54.0)	65 (29.0)
Y	2 (1.0)	4 (2.0)	16 (6.1)	88 (33.5)	24 (9.1)

Z	24 (14.1)	3 (1.8)	7 (2.7)	106 (41.4)	7 (2.7)
AA	4 (2.8)	9 (6.3)	9 (5.0)	75 (41.7)	17 (9.4)
AB	14 (5.6)	10 (4.0)	8 (2.7)	143 (48.0)	46 (15.5)
AC	11 (4.2)	17 (6.5)	15 (4.0)	120 (31.7)	15 (3.9)
AD		**-**	**-**	**-**	**-**
Total	**376 (3.7)**	**394 (3.8)**	**634 (4.8)**	**5440 (41.6)**	**900 (6.9)**

The use of muscle relaxants in ICU remained low. Muscle relaxants have been implicated in the development of critical illness polyneuropathy in critically ill patients [24] [25] However, it is surprising to note that 20% of patients in one hospital received muscle relaxants for more than 24 hours during their ICU stay.

Section E

Complications

Table 37 : Incidence of ventilator-associated pneumonia (VAP) per 1000 ventilator days, 2003-2005 and 2007

Hospital	VAP per 1000 ventilator days			
	2003	**2004**	**2005**	**2007**
A	*	*	20.0	3.3
B	27.6	13.2	16.9	18.3
C	11.2	9.6	8.6	7.4
D	41.7	36.1	19.5	17.9
E	50.8	52.6	7.7	49.2
F	43.2	27.6	27.4	12.8
G	22.1	26.4	9.9	4.9
H	23.0	11.7	11.0	13.0
I	28.5	17.5	17.5	17.6
J	30.0	19.1	11.8	2.6
K	26.2	29.7	6.8	6.2
L	21.3	30.8	11.3	9.9
M	10.5	11.7	26.4	13.4
N	*	*	5.8	0
O	-	-	-	21.8
P	-	-	-	8.6
Q	-	-	-	24.2
R	-	-	-	31.0
S	-	-	-	36.0
T	-	-	-	12.5
U	-	-	-	21.6
V	-	-	-	2.7
W	-	-	-	17.1
X	-	-	-	30.3
Y	-	-	-	9.8
Z	-	-	-	0
AA	-	-	-	9.0
AB	-	-	-	16.3
AC	-	-	-	20.2
AD	-	-	-	-
Total	**28.0**	**23.1**	**14.9**	**15.4**

** Centres with under-reporting and excluded from analysis in 2003 and 2004*

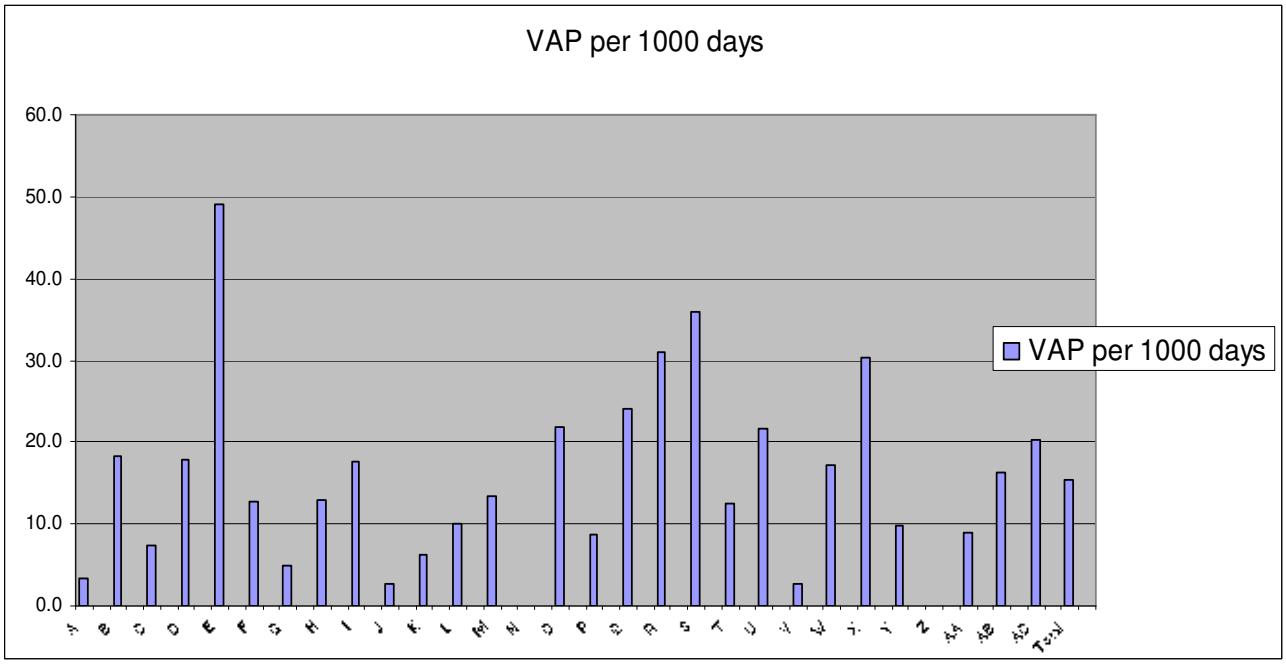
 # In 2003 and 2004, VAP was defined as Nosocomial pneumonia developing in a patient after 48 hours on mechanical ventilation with radiological evidence of new/or progressive infiltrates and a positive bacteriological tracheal, blood or bronchoalveoloar lavage culture.

@ In 2005, the definition of VAP was changed to Nosocomial pneumonia developing in a patient receiving mechanical ventilation $\geq$ 48 hours. Diagnosis was based on
(i) Suspicion of VAP
(ii) CXR shows new and/or progressive pulmonary infiltrates
(iii) Presence of either 2 of the following 4 criteria

- *Fever $\geq$ 38.5^{0}C or < 36 ^{0}C within 24 hours*
- *Total white cell count > 12 000/mm^3 within 24 hours*
- *Purulent tracheobronchial secretions within 24 hours*
- *Reduction of PaO_2/FiO_2 in the last 48 hours*

The definition of VAP does not require positive bacteriological culture

Figure 2 : VAP rate by hospital (per 1000 days)



Hospital

The national average VAP rate was 15.4 per 1000 ventilator days. This falls within the 80th percentile of the National Nosocomial Infection Surveillance (NNIS) benchmark [26].

There is a wide variation in the VAP rate among hospitals. There were 2 hospitals with zero VAP, of which one hospital admitted they did not report on this complication. There was one hospital with a high VAP rate of 49.2 per 1000 ventilator days.

Table 38 : Onset of VAP from initiation of Mechanical Ventilation and VAP per 1000 ventilator days by hospitals, 2007

Hospital	Onset of VAP, mean day of mechanical ventilation	VAP per 1000 ventilator days
A	7.9	3.3
B	10.3	18.3
C	10.3	7.4
D	10.1	17.9
E	6.3	49.2
F	12.0	12.8
G	8.1	4.9
H	7.5	13.0
I	7.6	17.6
J	14.1	2.6
K	9.7	6.2
L	11.2	9.9
M	7.9	13.4
N	0	0
O	10.0	21.8
P	14.4	8.6
Q	9.5	24.2
R	6.8	31.0
S	0	36.0
T	6.1	12.5
U	12.8	21.6
V	16.0	2.7
W	12.3	17.1
X	7.5	30.3
Y	14.3	9.8
Z	0	0
AA	9.0	9.0
AB	4.2	16.3
AC	8.4	20.2
AD	-	-
Total	**8.6**	**15.4**

The mean number of days of mechanical ventilation when VAP occurred was 8.6. All hospitals had onset of VAP exceeding 4 days of mechanical ventilation-which meant that most VAP were late-onset in nature.

Table 39 : Bacteriologic cultures for ventilator-associated pneumonia, 2007

Organisms	Number	Percentage
Acinetobacter species	218	25.4
Pseudomonas species	169	19.7
Klebsiella species	128	14.9
Others	94	11.0
No organisms	80	9.3
Fungus	68	7.9
CoNS	46	5.4
Stenotrophomonas maltophilia	23	2.7
Other gram negative bacteria	21	2.4
Staphylococcus aureus	6	0.7
MRSA	5	0.6

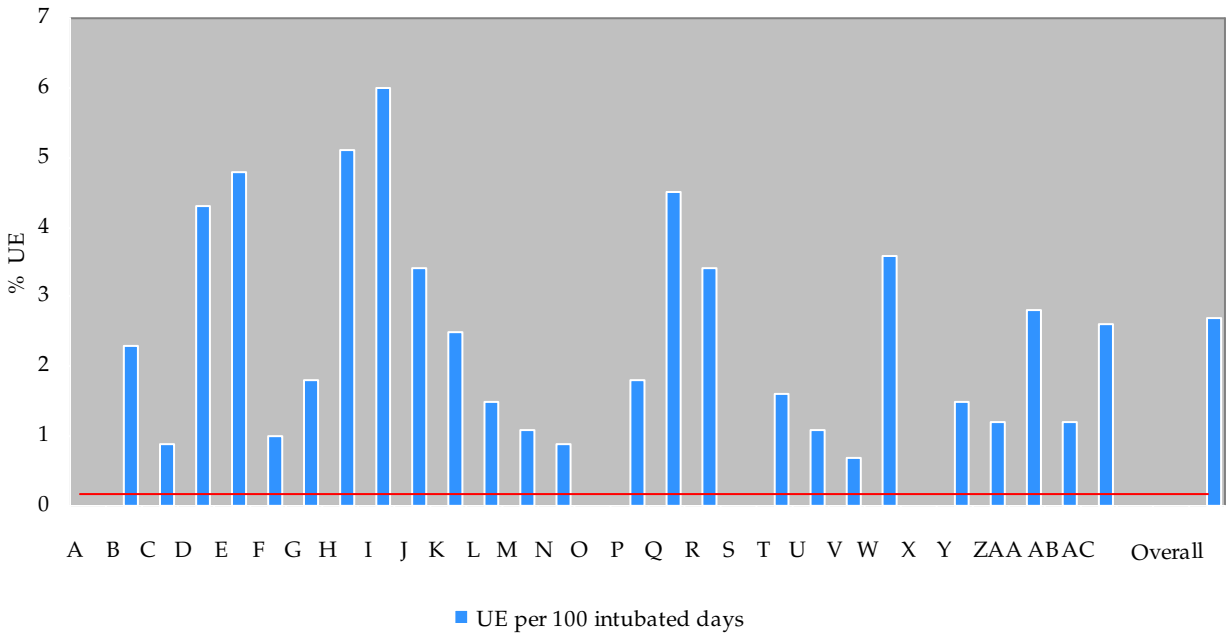
Most (72%) of the micro-organisms causing VAP were gram-negative. *Acinetobacter spp, Pseudomonas spp* and *Klebseilla spp* remained the 3 most common organisms causing VAP over the past 5 years. This is comparable to the data from the United States where 64% of the nosocomial pneumonia was caused by gram-negative aerobes and Pseudomonas aeruginosa was the most frequent pathogen causing VAP [27].

Table 40 : Incidence of unplanned extubation per 100 intubated days 2003-2005 and 2007

Hospital	Unplanned extubation per 100 intubated days			
	2003	2004	2005	2007
A	0.4	0.3	0.5	0
B	*	*	0.0	2.3
C	0.1	0.2	0.3	0.9
D	0.5	0.6	0.5	4.3
E	0.7	0.4	0.8	4.8
F	0.6	0.2	0.3	1.0
G	1.4	1.4	0.3	1.8
H	0.2	0.8	1.8	5.1
I	0.9	1.1	0.9	6.0
J	0.7	0.4	0.6	3.4
K	0.9	0.6	0.3	2.5
L	1.1	0.9	0.1	1.5
M	1.3	0.9	0.7	1.1
N	0.8	1.0	0.3	0.9
O	-	-	-	0

P	-	-	-	1.8
Q	-	-	-	4.5
R	-	-	-	3.4
S	-	-	-	0
T	-	-	-	1.6
U	-	-	-	1.1
V	-	-	-	0.7
W	-	-	-	3.6
X	-	-	-	0
Y	-	-	-	1.5
Z	-	-	-	1.2
AA	-	-	-	2.8
AB	-	-	-	1.2
AC	-	-	-	2.6
AD	-	-	-	-
Total	**0.7**	**0.7**	**0.5**	**2.7**

Figure 3 : Incidence of unplanned extubation by hospital



The overall rate for unplanned extubation was 2.7 per 100 intubated days.

The incidence of unplanned extubation varied among hospitals. 4 hospitals reported zero rates. One hospital had the highest rate of 6.0 per 100 intubated days. The accepted rate of unplanned extubation is 0.5 per 100 intubated days [28].

Table 41 : Other Complications

Hospital	% Complications				
	Pneumothorax/ Haemothorax from CV cannulation	Pneumothorax due to mechanical ventilation	Bedsores	Keratitis	Foot Drop
A	0.0	0.3	0.7	0.0	0.2
B	0.6	0.6	8.2	0.2	2.1
C	0.3	0.0	0.1	0.0	1.4
D	0.5	1.8	8.9	0.1	0.6
E	0.0	0.0	11.7	0.3	0.5
F	0.0	0.0	0.2	0.0	0.0
G	0.7	0.0	2.6	0.0	0.5
H	0.7	0.0	3.1	0.2	0.0
I	1.8	2.1	9.4	0.7	2.7
J	0.0	0.2	1.4	0.2	0.0
K	0.0	0.0	0.0	0.0	0.4
L	0.0	0.0	2.3	0.0	0.0
M	0.9	0.5	0.9	0.0	0.2
N	0.0	0.2	0.0	0.0	0.0
O	0.0	0.0	1.7	0.0	1.7
P	0.3	0.4	2.9	0.3	1.0
Q	2.2	1.0	3.2	0.0	0.0
R	1.5	0.0	6.6	0.0	0.6
S	0.0	0.0	6.8	0.0	0.0
T	1.8	0.8	3.4	0.7	1.4
U	0.0	0.0	1.3	0.0	0.0
V	0.0	0.3	1.6	0.3	0.3
W	0.0	0.0	3.6	0.7	0.0
X	1.1	1.7	0.4	0.0	1.0
Y	3.0	1.5	2.6	0.0	0.8
Z	1.9	3.0	3.5	0.0	0.0
AA	0.0	0.0	5.0	0.0	1.1
AB	0.0	0.8	0.7	0.0	0.0
AC	0.4	0.8	7.0	0.8	1.3
AD	-	-	-	-	-
Total	**0.6**	**0.6**	**4.1**	**0.2**	**0.7**

The overall incidence for the above complications in ICU was low. Bedsores occurred in 4.1% of ICU patients. Two hospitals reported zero bedsore rates in their ICUs. It is believed that all these complications were under-reported as the incidence of bedsores ranged from 0.4% to 38% in acute care setting [28].

Section F

Mortality Outcome

Crude mortality rates are convenient measures of outcome as death can be clearly defined and deaths are recorded by all hospitals as part of their basic census. For this audit purposes, the mortality outcome is taken at the point of discharge from admitting hospital i.e. a patient who is transferred to another hospital will have the vital status at hospital discharge recorded as alive. Those who are discharged from hospital with grave prognosis are not expected to survive and their outcomes are reclassified as death. Patients who are discharged from hospital against advice (AOR discharge) are excluded in the analysis of mortality rates.

Crude mortality rates are a poor means to assess performance of intensive care because they do not take into account the variation in the characteristics of the patients admitted to the intensive care unit.

The main use of in-ICU mortality as an outcome measure is for audit within an individual ICU as it is independent of effects of subsequent hospital care. Tracking a unit's mortality over time will allow acute changes and trends to be spotted. In-ICU mortality should not be used to compare quality of care between units as it simply reflects organisational factors e.g. admission and discharge policies, bed availability, staffing etc.

Besides delivery of intensive care, organisational factors also influence in-hospital mortality rates. Early or premature discharge of critically ill patients who still require a high level of support is associated with higher hospital mortality. This is inevitable in most units which are under pressure to admit new patients due to the acute shortage of ICU beds.

A better measure of ICU performance is the standardised mortality rates (SMR). SMR is the mortality ratio comparing the observed to the expected (or predicted) mortality calculated by a scoring system. SMR may be used to compare ICU performance between units within certain limitations.

Table 42 : In-ICU mortality rates by hospitals, 2003-2007

Hospital	In-ICU mortality, %				
	2003	2004	2005	2006	2007
A	15.1	18.1	22.4	18.3	26.6
B	12.7	14.1	15.8	11.6	13.9
C	16.6	15.0	14.7	19.5	14.9
D	25.4	21.2	20.3	20.6	19.5
E	37.6	26.2	25.9	25.5	25.7
F	25.7	24.5	21.0	26.9	19.3
G	18.2	22.0	25.0	21.6	24.8
H	24.7	21.1	22.6	26.0	19.5
I	24.6	23.1	23.4	23.7	23.2
J	24.1	25.5	26.8	26.0	20.5
K	23.5	25.1	32.7	27.0	23.7
L	24.2	26.8	21.5	21.6	19.0
M	20.0	13.9	15.0	12.8	13.4
N	14.0	17.1	19.4	16.2	14.5
O	-	-	-	25.0	49.6
P	-	-	-	20.3	20.5
Q	-	-	-	33.5	30.0
R	-	-	-	13.5	36.0
S	-	-	-	23.9	28.8
T	-	-	-	26.1	28.8
U	-	-	-	23.0	16.0
V	-	-	-	-	16.2
W	-	-	-	-	40.7
X	-	-	-	-	35.0
Y	-	-	-	-	33.5
Z	-	-	-	-	23.4
AA	-	-	-	-	21.1
AB	-	-	-	-	26.5
AC	-	-	-	-	22.9
AD	-	-	-	19.8	-
Total	**22.1**	**21.0**	**21.8**	**21.7**	**22.3**

Table 43 : In-hospital mortality rates by hospitals, 2003-2007

Hospital	In-hospital mortality, %				
	2003	**2004**	**2005**	**2006**	**2007**
A	22.6	22.5	31.7	27.8	35.2
B	25.6	25.5	26.5	25.6	26.0
C	30.4	25.9	23.2	29.1	22.7
D	32.8	28.5	29.0	33.3	29.8
E	44.8	35.2	34.2	34.1	34.1
F	32.8	33.9	30.3	35.1	28.8
G	28.9	28.0	36.3	28.4	32.1
H	33.2	31.0	34.2	35.8	29.5
I	33.5	33.6	33.5	32.6	32.1
J	33.1	32.0	39.1	35.7	30.4
K	33.8	31.4	42.0	38.1	33.0
L	30.8	29.9	28.7	24.8	22.9
M	30.4	24.5	24.6	20.5	19.1
N	22.4	22.7	24.1	22.8	24.2
O	-	-	-	35.5	49.6
P	-	-	-	28.4	25.4
Q	-	-	-	45.9	38.3
R	-	-	-	32.7	43.1
S	-	-	-	28.6	28.8
T	-	-	-	35.0	32.9
U	-	-	-	34.4	26.5
V	-	-	-	-	20.7
W	-	-	-	-	45.7
X	-	-	-	-	42.9
Y	-	-	-	-	39.5
Z	-	-	-	-	27.0
AA	-	-	-	-	26.1
AB	-	-	-	-	33.9
AC	-	-	-	-	28.3
AD	-	-	-	22.0	-
Total	**31.1**	**29.2**	**31.1**	**31.0**	**30.1**

As can be seen from the above two tables, the national means for in-ICU mortality and in-hospital mortality rates were remarkably similar throughout the last five years. Variations among units may reflect organisational factors such as the selection of patients and not the unit performance.

Table 44 : Standardised mortality ratios (SMR) by hospitals, 2003-2005 and 2007

Hospital	Standardised mortality ratios			
	2003	2004	2005	2007
A	0.92	0.75	1.23	0.92
B	1.16	1.06	1.00	0.92
C	1.26	1.15	1.51	0.89
D	0.94	0.77	0.77	0.82
E	1.06	1.42	1.58	0.91
F	0.72	1.06	0.85	1.11
G	0.62	0.66	0.89	0.69
H	1.03	0.99	0.96	0.98
I	0.88	0.84	0.87	0.92
J	1.07	0.87	1.02	0.95
K	0.89	1.01	1.22	0.88
L	0.91	0.89	0.86	0.83
M	0.91	0.98	0.91	0.70
N	1.05	1.11	0.95	0.83
O	-	-	-	1.12
P	-	-	-	0.92
Q	-	-	-	0.75
R	-	-	-	1.01
S	-	-	-	0.90
T	-	-	-	0.79
U	-	-	-	0.85
V	-	-	-	0.62
W	-	-	-	0.95
X	-	-	-	1.18
Y	-	-	-	1.01
Z	-	-	-	0.62
AA	-	-	-	0.83
AB	-	-	-	0.88
AC	-	-	-	0.89
AD	-	-	-	-
Total	**0.96**	**0.95**	**1.0**	**0.89**

The mean SMR for 2007 (0.89) was the lowest over the 5 years. Only 5 hospitals had SMR above 1.0.

Table 45 : Abdominal Aortic Aneurysm surgery Number of Cases and Mortality 2006-2007

Hospital	No. of cases (mortality rate %)			
	Elective		Emergency	
	2006	2007	2006	2007
A	0 (0.0)	-	1 (0.0)	-
B	6 (0.0)	5 (0.0)	7 (71.4)	3 (33.3)
D	18 (0.0)	25 (32.0)	38 (26.3)	29 (31.0)
L	3 (0.0)	2 (0.0)	1 (100)	2 (50.0)
M	3 (0.0)	10 (0.0)	0 (0.0)	-
N	3 (0.0)	4 (0.0)	2 (100)	4 (0)
E	-		-	2 (100)
Total	**33 (0.0)**	**46 (17.4)**	**49 (36.7)**	**40 (32.5)**

Overall, the mortality for elective and emergency AAA surgery in 2007 was 17.45% and 32.5% respectively. Duek et al quoted a 30-day mortality of 3.5-5.0% and 38.2-42.5% following elective and emergency AAA repair respectively [29].

Table 46 : Elective oesophageal surgery and mortality 2006-2007

Hospital	2006		2007	
	No. of cases n	Mortality rate %	No. of cases n	Mortality rate %
A	5	0.0	5	20.0
B	1	0.0	1	0.0
C	3	33.3	-	-
D	7	28.6	4	0.0
E	6	0.0	1	0.0
G	1	100.0	2	0.0
I	1	0.0	-	-
N	1	100.0	1	0.0
U	-	-	1	0.0
AA	-	-	2	0.0
M	-	-	5	0.0
F	-	-	1	0.0
O			1	0.0
Total	**26**	**19.2**	**24**	**4.2**

The mortality rate for patients who underwent elective esophageal surgeries and admitted into ICU was 4.2%. This compares favorably with the mortality rate of 26.4% and 19.2%in the 2004 and 2006 series respectively. Jamieson et al reported an overall mortality rate of 8.8% following oesophagectomy [30].

SUMMARY

1. The total number of admissions reported to NAICU in the twelve month period from the 29 centres was 13,148. This represented 85.3% of the actual number of admissions.

2. The total number of patients denied immediate ICU admission due to unavailability of ICU beds was 8448 representing 48% of all patients referred.

3. Foreigners made up 4.7% of ICU admissions; with the highest numbers in Z (20.0 %), D and F (9.3%).

4. The mean age of the patients admitted to ICU was 45.0 years.

5. The average length of ICU stay was 4.7 days and hospital stay was 16.3 days.

6. More than half of the admissions (55.8%) were non-operative. Of the operative patients, 70% were for emergency surgery.

7. The readmission rate was 1.7% during the same hospital stay.

8. Sepsis was the main diagnosis leading to ICU admission.

9. The mean SAPS II score was 37.2 with a predicted risk of death of 30.44%.

10. 78.5% of the patients admitted required mechanical ventilation for a mean duration of 4.6 days.

11. The incidence of ventilator-associated pneumonia (VAP) remained high at 15.4 per 1000 ventilator days (within the 80th percentile of the NNIS benchmark). Gram-negative organisms accounted for 72% of positive cultures. The most common organisms causing VAP were Acinetobacter spp, Pseudomonas spp and Klebsiella spp.
12. The incidence of unplanned extubation was 2.7per 100 intubated days.
13. The in-ICU and in-hospital mortality was 22.3% and 30.1% respectively.

14. The mean standardised mortality ratio was 0.89 (lowest over past 5 years).

RECOMMENDATIONS

1. As in the previous four reports, the issue of severe shortage of ICU beds still exists. This was evident from the high refusal rate (48%) for patients referred for ICU admission. This was despite the increase in ICU beds in several state hospitals over the past 5 years. In order to meet current and increasing demand for ICU beds, this issue needs to be addressed urgently. The number of ICU beds must be increased in hospitals where the shortage is greatest i.e. H. Alor Setar, H. Pulau Pinang, H. Klang, H. Ipoh, H. Kota Bharu and H. Seremban.

2. The issue of non-functional ICU beds needs to be addressed urgently. A number of hospitals have big intensive care capacity, unfortunately, due to the shortage of nurses, these ICU beds cannot be utilized. It should be stressed that nurses should be posted to such hospitals to ensure that all the existing ICU beds are utilised. The opening of ICU beds in one hospital will benefit other hospitals within the same geographical region via the existing network. Hospitals where ICU beds can further be increased are: H. Alor Setar , H. Sungai Petani, H. Taiping, H. Ipoh, H. Sungai Buloh, H. Selayang, H. Serdang, H. Ampang and H. Kuala Lumpur.

3. Other measures to overcome the shortage of beds include better utilisation of the existing beds via networking of ICUs. Currently, three networks have been established i.e. Central Network, Northern Network and Perak Network. There is a need to improve the efficiency of these networks by ensuring good internet access in the ICU and compliance of all the units concerned.

4. Although the use of thromboprophylaxis has increased from previous years (from 15.4 to 22.8%), its usage is still far from satisfactory. Current evidence showed that the use of heparin prophylaxis prevents thromboembolism and improves outcome in the critically ill.

5. The incidence of ventilator-associated pneumonia (VAP) in our ICUs remains high. In an effort to reduce the incidence of VAP, the ventilator care bundle (VCB) was implemented in January 2007 in all the 30 participating centres. Studies have shown that a high compliance to VCB can result in a lower incidence of VAP.

6. There should be further emphasis on the rigor of proper data collection to ensure accuracy and completeness of data. The capture of ICU referrals for intensive care should be as complete as possible and all participating units are urged to comply. It is imperative that hospitals who under-report their referrals for ICU admissions should improve their reporting rates in order to obtain a more accurate picture of the demands for intensive care and facilitate further planning for the service.

7. The NAICU should be further expanded to include as many ICUs in the country as possible. Participation of ICUs in KKM hospitals is mandatory and in 2008, five more new KKM hospitals will be recruited into the NAICU. They are H Ampang, H Sungei Buloh, H Pandan, H Sandakan and H Sibu. There should be a concerted effort to ensure that ICUs in the universities and private hospitals participate in the national audit. This can be achieved by

mandating their participation through a national patient safety approach or an accreditation activity e.g. MSQH or JCI.

8. Since its inception in 2002, NAICU has been shown to be an effective tool in quality and resource management. There has to be adequate funding to support continuous training, purchase of computers/printers and software development.

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APPENDIX 1

List of diagnoses leading to ICU admission

Diagnosis	Number	Percentage
Sepsis (gram positive, gram negative and septic shock)	1186	9.1
Head injury	1175	8.9
Community acquired pneumonia	664	5.1
Bronchial asthma	469	3.6
Gastrointestinal perforation (including anastomotic leak)	456	3.5
Dengue fever	383	2.9
Intraabdominal injury	378	2.9
Chronic lower respiratory disease (COAD, bronchiectasis, restrictive lung disease)	354	2.7
Non-cardiogenic pulmonary oedema (post upper airway obstruction, neurogenic, fluid overload)	340	2.6
Intra-abdominal/pelvic malignancy	300	2.3
Cerebrovascular disease (infarct, thrombosis, haemorrhage)	277	2.1
Gastrointestinal obstruction	259	2.0
Gastrointestinal bleeding	252	1.9
Ischaemic heart disease/acute coronary syndrome	246	1.9
Infection/gangrene of limb (including osteomyelitis, necrotising fascitis)	228	1.7
Chest injury	225	1.7
Meningitis/encephalitis/myelitis/intracranial abscess/ spinal cord abscess	224	1.7
Intracranial tumour	220	1.7
ENT/oral conditions	218	1.7
Injury to extremities including fractures	216	1.6
Heart failure	215	1.6
Diabetes mellitus	213	1.6
Ante/postpartum haemorrhage	207	1.6
Pregnancy-induced hypertension/eclampsia	183	1.4
Other abdominal/pelvic conditions	173	1.3
Hospital-acquired pneumonia	153	1.2
Epilepsy	148	1.1
Hepatobiliary disease	148	1.1
Chronic renal failure/end-stage renal failure	146	1.1
Adverse peri-operative events - respiratory related events (eg. failed intubation, desaturation, pneumothorax, inadequate reversal etc)	140	1.1
Other obstetric conditions	137	1.0
Acute poisoning/drug overdose	132	1.0
Other respiratory conditions	132	1.0
Acute renal failure	130	1.0
Aspiration pneumonia	118	0.9
Pancreatic disorder (including acute pancreatitis)	105	0.8
Other renal/genito-urinary conditions (UV prolapse, TURP syndrome)	100	0.8
Aortic aneurysm or dissection	93	0.7
Other surgical conditions	92	0.7
Adverse peri-operative events - bleeding	91	0.7
Urosepsis	83	0.6
Other disorders of the musculoskeletal system	80	0.6

Other CNS conditions	78	0.6
Adverse peri-operative events - hemodynamic instability (hypo/hypertension – cause undetermined)	74	0.6
Hypertensive heart disease	67	0.5
Other endocrine/metabolic disorders	66	0.5
Leptospirosis	64	0.5
Intra-abdominal/pelvic abscess	63	0.5
Disorder of the thyroid gland	62	0.5
Disease of myoneural junction (myasthenia gravis)	52	0.4
Facio-maxillary injury	52	0.4
Burns/electrocution	51	0.4
Tuberculosis	51	0.4
Acute lung injury/ARDS	51	0.4
Disease of pleura (pleural effusion, haemothorax, pneumothorax)	51	0.4
Gastrointestinal ischaemia/gangrene	50	0.4
Other cardiovascular conditions	50	0.4
Spinal cord injury	49	0.4
Other systemic infections	48	0.4
Dorsopathies (prolapsed intervertebral disc, scoliosis)	48	0.4
Snake/insect bite	47	0.4
Adverse peri-operative events - myocardial ischaemia	47	0.4
Adverse peri-operative events – others	46	0.3
Pulmonary thromboembolism	44	0.3
Encephalopathy (hypoxic, alcoholic, hepatic)	43	0.3
Diseases of the upper respiratory tract (epiglottitis, retropharyngeal abscess)	41	0.3
Fat embolism	40	0.3
Cardiac arrhythmia or conduction disorder	38	0.3
Connective tissue disorders	36	0.3
Fracture spine	36	0.3
Disease of spinal cord (myelopathy, tumour, degenerative disease)	35	0.3
Cardiac disease in pregnancy	35	0.3
Iatrogenic complications unrelated to surgery	32	0.2
Pelvic/perineal injury	31	0.2
Drug reactions including anaphylaxis	29	0.2
Disease of nerve (neuropathy, Gullain Barre syndrome, motor neurone disease)	29	0.2
Myeloproliferative disorder (leukaemia, lymphoma)	26	0.2
Malaria	24	0.2
Congenital heart disease	22	0.2
Carcinoma of lung/mediastinal tumour	20	0.2
Inflammatory bowel disease	20	0.2
Tetanus	20	0.2
Other haematological conditions	18	0.1
Cardiomyopathy	18	0.1
Sleep apnea	17	0.1
Near-drowning	17	0.1
Inflammation/infection of heart (pericarditis, endocarditis, myocarditis)	16	0.1
Vascular injury	16	0.1
Adverse peri-operative events – iatrogenic complications	14	0.1
Valvular heart disease	13	0.1
Pulmonary heart disease	13	0.1
Airway injury	13	0.1
Disseminated intravascular coagulation	12	0.1

Disorder of the parathyroid gland	12	0.1
Lung abscess	11	0.1
HIV infection	10	0.1
Purpuric disorder (idiopathic thrombocytopaenic purpura, thrombotic thrombocytopaenic purpura, haemolytic uraemic syndrome)	10	0.1
Arterial embolism or thrombosis of arteries	10	0.1
Hemolytic anaemia	9	0.1
Puerperal sepsis	9	0.1
Typhoid fever	8	0.1
Disorder of the adrenal gland	7	0.1
Adverse peri-operative events - anesthetic-related reaction including anaphylaxis	7	0.1
Myopathy/muscular dystrophy/myositis	6	0.0
Amniotic fluid embolism	6	0.0
Pulmonary embolism in pregnancy	5	0.0
Morbid obesity including Pickwickian Syndrome	3	0.0
Herpes infection	3	0.0
Aplastic anaemia	2	0.0
Heat stroke	2	0.0
Adverse peri-operative events – cerebral vascular accident	2	0.0

APPENDIX 2

List of diagnoses leading to ICU admission according to APACHE II diagnostic category

Non-operative patients	Number	Percentage
Sepsis	1030	8.1
Respiratory infection	1007	7.9
Respiratory system as the principal reason for admission	791	6.2
Metabolic / renal system as the principal reason for admission	438	3.4
Asthma / allergy	423	3.3
Neurologic system as the principal reason for admission	391	3.1
Cardiovascular system as the principal reason for admission	381	3.0
Multiple trauma	356	2.8
Head trauma	354	2.8
COPD	301	2.4
Non-cardiogenic pulmonary edema	289	2.3
Seizure disorder	243	1.9
Diabetic ketoacidosis	183	1.4
Congestive heart failure	177	1.4
ICH / SDH / SAH	174	1.4
Gastrointestinal system as the principal reason for admission	166	1.3
Aspiration / poisoning / toxic	164	1.3
Hemorrhagic shock / hypovolemia	133	1.0
Coronary artery disease	125	1.0
Cardiogenic shock	99	0.8
GI bleeding	76	0.6
Hypertension	71	0.6
Pulmonary embolus	63	0.5
Post-cardiac arrest	57	0.4
Drug overdose	51	0.4
Neoplasm	31	0.2
Rhythm disturbance	26	0.2
Post-respiratory arrest	23	0.2
Dissecting thoracic / abdominal aneurysm	11	0.1

Diagnosis for operative patients	Number	Percentage
Respiratory system as the principal reason for admission	673	5.3
GI perforation / obstruction	630	5.0
Cardiovascular system as the principal reason for admission	597	4.7
Multiple trauma	463	3.6
Respiratory insufficiency after surgery	459	3.6

Hemorrhagic shock	302	2.4
Craniotomy for ICH / SDH / SAH	276	2.2
Gastrointestinal system as the principal reason for admission	232	1.8
GI surgery for neoplasm	208	1.6
GI bleeding	193	1.5
Head trauma	181	1.4
Craniotomy for neoplasm	178	1.4
Neurologic system as the principal reason for admission	157	1.2
Metabolic / renal system as the principal reason for admission	138	1.1
Laminectomy and other spinal cord surgery	131	1.0
Peripheral vascular surgery	115	0.9
Admission due to chronic vascular disease	108	0.8
Renal surgery for neoplasm	35	0.3
Thoracic surgery for neoplasm	7	0.1
Renal transplant	3	0.0

APPENDIX 3

List of surgical operations

Operations	Number	Percentage
Other gastro-intestinal (abdominal) surgery	1016	7.7
Other orthopaedic surgery	748	5.7
Colorectal surgery	489	3.7
Upper gastro-intestinal surgery	404	3.1
Craniotomy for evacuation of haematoma	392	3.0
LSCS	372	2.8
Other surgeries not mentioned above	286	2.2
ENT surgery	274	2.1
Above knee/ below knee amputation	204	1.6
Craniotomy for debulking of tumour	186	1.4
Other intracranial surgery	157	1.2
Hepatobiliary surgery	144	1.1
Other obstetric surgery	139	1.1
Gynaecological surgery	127	1.0
Spinal surgery	117	0.9
Other urological surgery	96	0.7
Caesarean hysterectomy	95	0.7
Endoscopic procedure	95	0.7
Repair of abdominal aortic aneurysm	89	0.7
Dental surgery	54	0.4
Breast /endocrine surgery	53	0.4
Craniotomy for clipping of aneurysm/excision of arterio-venous malformation	45	0.3
Plastic surgery	43	0.3
Whipple's or pancreatic surgery	40	0.3
Other thoracic surgery	37	0.3
Oesophagectomy	24	0.2
Percutaneous nephrolithotripsy	21	0.2
Other vascular surgery	21	0.2
Ilio-femoral-popliteal bypass surgery	14	0.1
Interventional radiological procedure (eg embolism)	9	0.1
Transurethral resection of prostate	6	0.0
Pneumonectomy /lobectomy	1	0.0
Total	5798	100