Characteristics and Outcomes of Patients Admitted to ICU Following Activation of the Medical Emergency Team: Impact of Introducing a Two-Tier Response System

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Objective: To determine the impact of introducing a two-tier system for responding to deteriorating ward patients on ICU admissions after medical emergency team review.

Design: Retrospective database review before (2006–2009) and after (2011–2013) the introduction of a two-tier system.

Setting: Tertiary, university-affiliated hospital.

Patients: A total of 1,564 ICU admissions.

Interventions: Two-tier rapid response system.

Measurements and Main Results: The median number of medical emergency team activations/1,000 hospitalizations increased from 22 to 31 (difference [95% CI], 9 [5–10]; $p < 0.0001$) with a decreased rate of medical emergency team activations leading to ICU admission (from median 11 to 8; difference [95% CI], 3 [3–4]; $p = 0.03$). The median proportion of medical emergency team reviews leading to ICU admission increased for those triggered by tachypnoea (from 11% to 15%; difference [95% CI], 4 [3–5]; $p < 0.0001$) and by hypotension (from 27% to 43%; difference [95% CI], 15 [12–19]; $p < 0.0001$) and decreased for those triggered by reduced level of consciousness (from 20% to 17%; difference [95% CI], 3 [2–4]; $p < 0.0001$) and by clinical concern (from 18% to 9%; difference [95% CI], 10 [9–13]; $p < 0.0001$). The proportions of ICU admissions following medical emergency team review did not change significantly for tachycardia, seizure, or cardiorespiratory arrest. The overall ICU mortality for admissions following medical emergency team review for tachypnoea, tachycardia, and clinical concern decreased (from 29% to 9%: difference [95% CI], 20 [11–29]; $p < 0.0001$) but did not change for the other triggers. The Acute Physiology and Chronic Health Evaluation predicted and observed ICU mortality and the proportion of patients dying with a not-for-resuscitation order decreased.

Conclusions: The introduction of a two-tier response to clinical deterioration increased ICU admissions triggered by cardiorespiratory criteria, whereas admissions triggered by more subjective criteria decreased. The overall ICU mortality for patients admitted following medical emergency team review decreased, suggesting that the two-tier system led to earlier recognition of reversible pathology or a decision not to escalate the level of care. (*Crit Care Med* 2015; 43:765–773)

Key Words: hospital rapid response team; intensive care unit; patient care management; patient outcome assessment

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This study was performed at Intensive Care Unit, Liverpool Hospital, Liverpool, NSW, Australia.

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Rapid response systems (RRSs) have been implemented to facilitate the early recognition and treatment of deteriorating ward patients (1). Evidence for the effectiveness of RRS is conflicting, possibly related to methodological research difficulties (2), but recent reviews suggest improved patient safety (3, 4) and many influential organizations support the use of RRS (5). The performance of RRS has typically been measured by rates of cardiac arrests, unexpected admissions to the ICU, and unexpected deaths (6).

The optimal RRS structure remains a matter of debate with regard to staffing and necessary expertise, calling criteria and pathways for escalation of care (1). Although most rapid response teams (RRT) use staff associated with the ICU, similar benefits have been reported in systems managed by the primary providers of care (7, 8). The afferent arm of a RRS typically uses

track and trigger criteria or aggregate scoring systems to activate the RRT based on derangements of physiological variables or clinical concern (9). The ideal criteria for activating the RRT have not been established and are likely to vary between patient populations and healthcare contexts (1, 9).

A two-tier system to respond to at-risk patients was recently introduced in New South Wales, Australia, launched as "Between The Flags" by the Clinical Excellence Commission (10). In this system, the parent clinical team responds to less serious first-tier criteria, and the RRS is activated when the patient meets the more serious second-tier criteria (**Table 1**, and **supplemental data**, Supplemental Digital Content 1, http://links.lww.com/CCM/B148). The premise of the two-tier system was that a first-tier clinical review by the patient's admitting team could identify and correct early states of deterioration, thus obviating further progression and escalation of care to the RRT, including admission to the ICU. Few reports have been published to date on the performance of a two-tier compared with a traditional one-tier RRS (11, 12) with little information on the impact on patients admitted to ICU following RRT review.

The specific characteristics of patients admitted to ICU following RRS activation have been sparsely reported (13, 14). In those studies, a significant severity of disease associated with a considerable mortality was observed, whereas no benefits of the RRS on mortality were found. A decision to limit medical therapy was made in about a quarter of patients admitted to ICU, which was significantly more frequent compared with patients admitted without RRS review (13).

A RRS, referred to as the "medical emergency team" (MET), has been in continuous operation at Liverpool Hospital since 1990, and trends in long-term operational characteristics were recently reported (15). The impact of introducing a two-tier response system on the performance and outcomes of a well-established and mature RRS has not been previously reported. The aim of this study was to review the clinical attributes and outcomes of patients acutely admitted to ICU following MET review at Liverpool Hospital before (one-tier system) and after the implementation of a two-tier system.

MATERIALS AND METHODS

Study Design, Patients, and Data Sources

This retrospective observational study was approved by the local Ethics and Research Governance Office (LNR/13/LPOOL/169). Liverpool Hospital is a tertiary level, university-affiliated 850-bed hospital within the South Western Sydney Local Health District serving a population of 850,000. The Liverpool ICU is a mixed, adult surgical-medical unit with 26–29 beds during the time period studied. The hospital and ICU provides services for all adult medical and surgical specialties, excluding solid-organ transplantation, and is a major trauma center in New South Wales.

The MET is led by an ICU trainee and also includes an ICU registered nurse and a medical trainee. An ICU consultant is always available to provide senior medical advice and is informed of all ICU admissions. The MET database is maintained by a MET coordinator who enters and verifies all data.

Liverpool ICU uses a database for reporting to the Australian and New Zealand Intensive Care Society Centre for Outcome and Resource Evaluation (16). All MET reviews that resulted in emergency admission to ICU were retrieved from the MET and ICU databases. A quality criterion for annual data based on more than 90% matching of admissions from the MET and ICU databases was used to ensure the integrity of data, and this criterion was consistently met between January 1, 2006, and December 31, 2013. Furthermore, only patients for whom there was a complete match between the two databases for the unique medical record number, name, date of birth, and date of ICU admission within 24 hours of date of MET review were retrieved for further analysis, and hence, only events leading to the immediate transfer to ICU were considered.

Emergency ICU admissions between 2006 and 2013 that were not preceded by a MET call were retrieved from the ICU database and used for comparative analyses.

Data retrieved from the MET database included activation criteria, time for MET activation, days between hospital admission and MET activation, and presence of any first- or second-tier activation criteria in the preceding 24, 8, and 4 hours of the index MET activation. Data retrieved from the ICU database included time of admission, age, Acute Physiology and Chronic Health Evaluation (APACHE) II score, diagnostic group and predicted risk of death in hospital, length of ICU stay, vital status on ICU discharge, and details of any limitation of medical therapy (not-for-resuscitation [NFR], therapy limited, and therapy withdrawn).

All data were imported from the original databases into Filemaker Pro Advanced 12.0 (v5; FileMaker, Santa Clara, CA) for further analysis.

Data on the annual number of hospital admissions and in-hospital deaths were sourced from the Clinical Information Department at Liverpool Hospital.

Intervention

The "Between The Flags" (Clinical Excellence Commission) two-tier system was introduced in 2010 across 250 hospitals in New South Wales (10). In January 2010, a Standard Adult General Observation (SAGO) chart was introduced at Liverpool Hospital with the two-tier color-coded to facilitate recognition of calling criteria for clinical review by the parent team (Yellow Zone Criteria) and for the MET (Red Zone Criteria) (Table 1, and supplemental data, Supplemental Digital Content 1, http://links.lww.com/CCM/B148). During two months, all clinical ward staff received an education package (Detecting deterioration, Evaluation, Treatment, Escalation, and Communicating in Teams) on the use of SAGO, tools for structured clinical communication, and the two-tier RRS (10) with complete implementation achieved in May 2010.

Statistical Analysis

An interrupted time series model was used to examine the effect of introducing a two-tier RRS on MET call criteria, MET call rates,

TABLE 1. Calling Criteria for Review by the Medical Emergency Team or Clinical Review by the Parent Team

Activation Criteria	
Call MET	**Clinical Review by Parent Team**
Respiratory rate < 5 or > 30 breaths/min	Respiratory rate 5–10 or 25–30 breaths/min
Heart rate < 40 or > 140 beats/min	Heart rate 40–50 or 120–140 beats/min
Systolic blood pressure < 90 mm Hg or > 200 mm Hg	Systolic blood pressure 90–100 or 180–200 mm Hg
Spo_2 < 90%	Spo_2 90-04%
Decrease in Glasgow Coma Scale > 2 points, only responses to pain on AVPU scale or sudden decrease in level of consciousness	Decrease in AVPU score from alert to voice or new onset of confusion
Repeat/prolonged seizures	Temperature < 35.5°C or > 38.5°C
Staff worried	Concern by any staff member
Threatened airway	
Respiratory arrest	
Cardiac arrest	
Additional Calling Criteria for MET	Additional Calling Criteria for Clinical Review
Increasing oxygen requirements to maintain Spo_2 > 90%	Increasing oxygen requirement
Patient deteriorates further before, during, or after clinical review	Excess or increasing blood loss
Arterial blood gas: Pao_2 < 60 mm Hg (8 kPa) or $Paco_2$ > 60 mm Hg (8 kPa) or pH < 7.2 or base excess < −5	Greater than expected fluid loss from a drain
Venous blood gas: $Pvco_2$ > 65 mm Hg (8.5 kPa) or pH < 7.2	New, increasing, or uncontrolled pain (including chest pain)
Blood glucose level < 4 mmol/L or > 20 mmol/L with a decreased level of consciousness	Blood glucose level < 4 mmol/L or > 20 mmol/L with no decrease in level of consciousness
	Ketonemia > 1.5 mmol/L or ketonuria 2+ or more
Lactate ≥ 4 mmol/L	Poor peripheral circulation
Low urine output < 200 mL over 8 hr or < 0.5 mL/kg/hr (via IDC) persisting for 8 hr	Low urine output < 100 mL over 4 hr or < 0.5 mL/kg/hr (via IDC) for 4 hr
	Polyuria, urine output > 200 mL/hr for 2 hr (in the absence of diuretics)
Serious concern by any patient of family member	Concern by patient or family member
Deterioration not reversed within 1 hr of clinical review	

AVPU = Alert, Voice, Pain, Unresponsive, IDC = indwelling catheter, MET = medical emergency team.

proportion of MET calls leading to ICU admission, and predicted hospital and observed ICU mortality. An autoregressive component with one degree was also included in the model to account for any autocorrelation between consecutive measures. Outcome data included a total of 90 months, 48 months before and 42 months after the implementation of the two-tier RRS, and were analyzed in bins of 6 months generating a total of 15 data points. Continuous data for RRS activation within the one-tier or two-tier periods were summarized as median ± interquartile range since not normally distributed and compared by analysis of variance followed by the Dunn multiple comparisons test. Medians for diagnostic categories during the one-tier versus two-tier periods were compared by the Mann-Whitney test, including the 95% CI for the difference between medians. Mortality data were summarized as rates with the Poisson 95% CI and compared by the absolute difference and the relative risk, including the 95% CIs. Data were indexed per 1,000 hospital admissions (hospitalizations) when appropriate. Statistical analyses were performed using SPSS (v22.0; IBM SPSS Statistics for Macintosh, Armonk, NY). A two-sided *p* value of less than 0.05 was considered statistically significant.

RESULTS

We reviewed 1,564 MET activations leading to ICU admission and 5,679 emergency ICU admissions without previous MET

activation. The annual number of MET activations increased overall between 2006 and 2013 from 21 (19–23)/1,000 hospitalizations to 35 (31–36)/1,000 hospitalizations (**Fig. 1**). One, 2, and 3 years after the implementation of the two-tier RRS, the number of MET calls/1,000 hospitalizations had increased by 5.6 (3.7–7.5), 8.6 (6.5–11), and 12 (9–14), respectively. Similarly, the total number of ICU admissions increased from 27 (26–28)/1,000 hospitalizations in 2006 to 33 (32–37)/1,000 hospitalizations in 2013, corresponding to a difference of 8 (6–9) admissions/1,000 hospitalizations ($p < 0.0001$) for the one-tier and two-tier time periods.

Although the number of MET to ICU admissions/1,000 hospitalizations did not change significantly between the one-tier and two-tier time periods, the proportion out of the total ICU admissions decreased (Table 1). This was in contrast to emergency ICU admissions without preceding MET review that increased both in absolute numbers/1,000 hospitalizations as well as a proportion of total ICU admissions (**Table 2**).

The proportion of MET reviews that resulted in ICU admission decreased 1 year (–5.4% [–2.0 to –8.8%]), 2 years (–5.1% [-2.1 to -8.1%]), and 3 years (–4.8% [–1.0 to –8.7%]) after the two-tier system (Fig. 1). Most patients admitted to ICU following MET review had a nonoperative diagnosis (**Table 3**). The rate of operative diagnoses increased after the introduction of the two-tier system and correspondingly nonoperative diagnoses decreased. Apart from a decrease in respiratory diagnoses, no significant changes were found in other nonoperative diagnostic categories.

Approximately 40% of MET reviews leading to ICU admission occurred during office hours (08:00–17:00) with 30% during evening (17:00–24:00) and 30% at night (00:00–08:00), and no significant changes were found after introduction of the two-tier system.

The age, proportion male gender, or days hospitalized before MET activation did not change over time, and although the ICU length of stay varied between years, no significant difference was found comparing the one-tier and two-tier time periods (**Table 4**). The number of medical patients admitted to ICU following a MET call decreased after implementing the two-tier RRS from the respiratory, coronary care, renal, geriatric, neurology, and acute assessment units and remained unchanged in other areas including the gastroenterology and hematology units. The number of surgical patients admitted to ICU following a MET call increased after implementing the two-tier RRS from the cardiothoracic unit, decreased from the vascular and general surgery units, and remained unchanged from the urology, orthopedic, head and neck, plastics, and neurosurgical units.

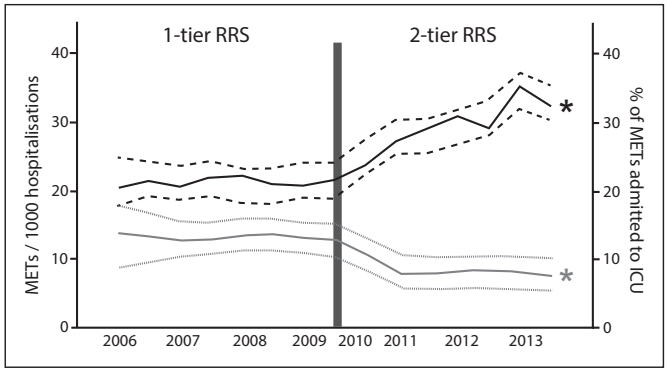

Figure 1. Number of medical emergency team (MET) activations per 1,000 hospitalizations (left *y*-axis) plotted by *solid/hatched black lines* and proportion of MET activations resulting in admission to ICU (%, right *y*-axis) plotted by *solid/dotted gray lines*. Six monthly data were analyzed using an interrupted time series model to generate trends with the 95% CIs. The *asterisks* represent significant ($p < 0.05$) changes in trends after implementation of the two-tier rapid response system (RRS) (*solid dark gray*, excluding January–June 2010 data during implementation, including July–December 2010 data postimplementation).

The APACHE II score decreased toward the end of the study period with a median difference between the one-tier and two-tier time periods of –7 (5–8) ($p < 0.0001$) points. The overall APACHE II score in emergency ICU admissions was lower at 25 (24–26).

The proportions of specific MET activation criteria that subsequently resulted in admission to ICU showed significant differences over the time period studied. Only six MET calls for respiratory rate less than 5 and 17 breaths/min and for heart rate less than 40 beats/min resulted in admission to ICU between 2006 and 2013 and were included in the cardiorespiratory arrest category.

Systolic hypotension, reduced level of consciousness, and clinical concern were the most frequent criteria before the introduction of the two-tier system, and systolic hypotension became even more frequent afterward (+21% [15–27%]; $p < 0.0001$), tachypnea increased (+7% [3–12%]; $p < 0.001$), reduced level of consciousness decreased (–10% [–5 to –15%]; $p < 0.0001$), and clinical concern decreased (–14% [–10 to –18%]; $p < 0.0001$). N o significant changes were observed for the rates of cardiorespiratory arrest, tachycardia, seizures, or threatened airway as MET triggers.

The presence of second-tier (MET) criteria that were not acted upon in patients who were subsequently admitted to ICU during 2006–2009 was noted in 12% of all patients (10–15%) in the preceding 24 hours, in 17% (14–20%) in the preceding 8 hours, and in 5% (4–7%) in the preceding 4 hours. The presence of first-tier criteria that were not acted upon in patients subsequently admitted to ICU during 2011–2013 following the introduction of the two-tier system was noted in 15% of all patients (11–18%) in the preceding 24 hours, in 14% (11–17%) in the preceding 8 hours, and in 20% (17–24%) in the preceding 4 hours. The presence of any calling criteria not acted upon in the preceding 4 hours was 15% (11–19%) ($p < 0.0001$) higher after implementing the two-tier system.

In patients admitted to ICU following MET activation, both the predicted risk of death in hospital and the total observed mortality in ICU decreased after the introduction of a two-tier system. One, 2, and 3 years after the introduction of a two-tier RRS, the predicted risk of death in hospital for patients admitted to ICU following MET activation decreased by 6.8% (5.9–7.7%), 7.7% (6.6–8.8%), and 8.7% (7.3–10%), respectively (**Fig. 2** and Table 2). The observed ICU mortality at similar time points decreased by 58% (31–84%), 46% (19–73%), and 35% (10–60%), respectively (Fig. 2 and Table 2).

The mortality for patients admitted to ICU following a MET remained considerably higher compared with emergency

TABLE 2. ICU Admissions Following Medical Emergency Team Review (Medical Emergency Team to ICU) and Emergency ICU Admissions Without Preceding Medical Emergency Team Review (Emergency Nonmedical Emergency Team to ICU) Before (2006–2009) and After (2011–2013) the Introduction of a Two-Tier Rapid Response System

	MET to ICU		Emergency Non-MET to ICU	
Variable	2006–2009	2011–2013	2006–2009	2011–2013
ICU admissions/1,000 hospitalizations	2.5 (2.3–2.7)	2.4 (2.2–2.7)	6.7 (6.4–7.1)[a]	14 (13–15)[a,b]
Fraction of total ICU admissions (%)	9.7 (9.0–10)	7.3 (6.7–7.9)[b]	26 (25–27)[a]	42 (41–43)[a,b]
ICU length of stay (d)	3.8 (2.4–6.1)	3.5 (2.1–5.5)	3.2 (2.1–5.0)[a]	2.8 (1.9–4.4)[a,b]
Predicted risk of death in hospital based on Acute Physiology and Chronic Health Evaluation II (%)	34 (26–47)	24 (13–36)[b]	15 (8–24)[a]	16 (8–29)[a,b]
Total observed ICU mortality (%)	24 (20–28)	16 (12–19)[b]	8.3 (7.1–9.7)[a]	8.6 (7.6–9.7)[a]
Observed ICU mortality excluding limitation of medical therapy (%)	9.3 (7.2–12)	11 (8.5–14)	4.3 (3.4–5.3)[a]	6.3 (5.5–7.3)[a,b]
Fraction with not-for-resuscitation order (%)	23 (20–27)	14 (11–17)[b]	6.3 (5.2–7.5)[a]	8.7 (7.7–9.8)[a,b]
Fraction with withdrawal of therapy (%)	8.2 (6.2–11)	4 (2.7–6.4)[b]	2.1 (1.5–2.8)[a]	3.2 (2.6–3.9)[b]
Fraction with limitation of therapy (%)	20 (17–24)	11 (8.7–15)[b]	5.4 (4.4–6.5)[a]	6.7 (5.7–7.6)[a]

MET = medical emergency team.
[a]$p < 0.05$ between similar time periods in the two admission cohorts.
[b]$p < 0.05$ between time periods within each admission cohort.
Values are median (interquartile range).

admissions without preceding MET review (Table 2). In this latter cohort, both the predicted risk of death in hospital and the observed mortality in ICU in the absence of any limitations of medical therapy increased slightly (+1% [0.2–3%]; $p = 0.02$ and +2% [1–3%]; $p = 0.002$) over the time period studied. This was similar to the overall hospital mortality that increased from 11% (10–12%) before to 14% (11–15%) after the introduction of the two-tier system (+2% [0.5–4%]; $p = 0.008$).

The mortality was reduced after introducing the two-tier system in patients admitted to ICU after MET review triggered by tachypnea, tachycardia, or clinical concern but did not change significantly in patients admitted after MET review triggered by other criteria (Table 5).

The observed ICU mortality in the subgroup of MET to ICU patients issued a limitation of medical therapy was not significantly different between the one-tier and two-tier time

TABLE 3. Percentage of Diagnostic Categories Among Patients Admitted to ICU Following Medical Emergency Team Review During the One-Tier System (2006–2009) and After Implementing a Two-Tier System (2011–2013)

	One-Tier System	Two-Tier System	
Variable	2006–2009	2011–2013	Difference, Median (95% CI)
Operative	7 (5–9)	18 (14–22)	11 (7–14), $p < 0.0001$
Nonoperative	93 (86–100)	82 (75–90)	11 (1–21), $p = 0.04$
Respiratory	27 (23–30)	19 (15–23)	8 (2–13), $p = 0.005$
Cardiovascular	26 (22–30)	24 (20–29)	NS
Gastrointestinal	5 (4–7)	4 (2–6)	NS
Neurological	11 (8–13)	9 (7–12)	NS
Trauma	1 (1–2)	2 (1–3)	NS
Sepsis	16 (14–20)	16 (13–20)	NS

NS = not significant.
Values are rates and 95% CI.

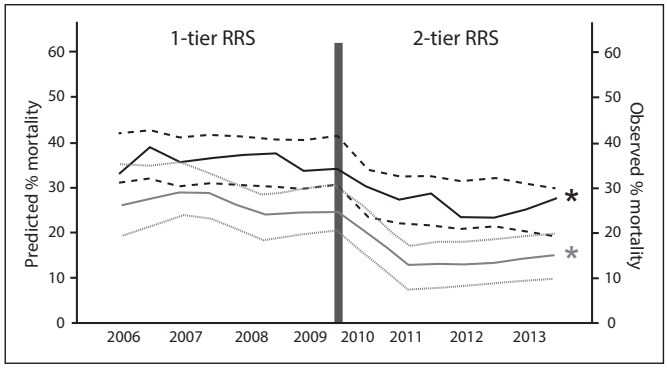

Figure 2. Predicted mortality in hospital for patients admitted to ICU following review by the medical emergency team (MET) (%, left *y*-axis) plotted by *solid/hatched black lines* and total observed mortality in ICU for patients admitted following MET review (%, right *y*-axis) plotted by *solid/dotted gray lines*. Six monthly data were analyzed using an interrupted time series model to generate trends with the 95% CIs. The *asterisks* represent significant ($p < 0.05$) changes in trends after implementation of the two-tier rapid response system (RRS) (*solid dark gray*, excluding January–June 2010 data during implementation, including July–December 2010 data postimplementation).

periods. Limitations of medical therapy in ICU were, however, less frequent after the two-tier system: NFR, 10% (5–15%; $p = 0.0001$), withdrawal of therapy, 4% (1–7%; $p = 0.007$), and limitation of therapy, 9% (5–14%; $p = 0.0001$). Limitations of medical therapy were noticeably more frequent in MET to ICU patients compared with emergency admissions without preceding MET review, particularly before the two-tier system.

DISCUSSION

This retrospective observational study in patients admitted to ICU following review by the MET demonstrated several changes associated with the introduction a two-tier RRS. The frequency of cardiorespiratory criteria to activate a MET review increased, whereas clinical concern decreased as a trigger and the ICU mortality observed with these triggers decreased. The APACHE-predicted risk of death in hospital and the observed total mortality in ICU decreased, and the proportion of orders limiting medical therapy was reduced. None of these changes were observed in a comparative cohort of emergency patients admitted to ICU without preceding review by the MET.

The resource requirements to operate a RRS are significant. A total of 14,509 MET activations occurred during the study period, and the introduction of a two-tier system did not moderate the increasing rate of MET activations (15). Just above 10% of MET activations resulted in admission to ICU, and hence, the vast majority of patients were believed to be stable enough to remain on the ward and not requiring care beyond what could be provided on the ward or thought not to benefit from admission to ICU. The rationale of introducing a two-tier RRS in which the parent team would respond to the first-tier criteria of clinical deterioration would thus seem justified. A "dose-response" relationship has been proposed for RRS by which the purported benefits are only realized at a dose above 20 RRS activations/1,000 hospitalizations (17). The observed MET dose throughout

TABLE 4. Annual Characteristics of Medical Emergency Team Activations Leading to ICU Admission

Variable	One-Tier System			
	2006	2007	2008	2009
Age	68 (54–76)	66 (57–78)	70 (59–78)	70 (58–79)
Male gender %	65	54	60	52
Days between hospital admission and medical emergency team activation	4 (2–12)	5 (2–12)	5 (1–15)	5 (2–16)
Acute Physiology and Chronic Health Evaluation II	41 (30–56)	43 (30–55)	43 (34–54)	40 (31–50)
ICU length of stay	2 (1–5)	3 (1–6)	4 (2–6)[a]	3 (1–7)[a]
Cardiorespiratory arrest %	8 (5–13)	8 (5–14)	7 (3–12)	8 (5–13)
Respiratory rate > 36 (> 30) %	11 (7–16)	8 (5–14)	12 (7–19)	14 (9–20)
Heart rate > 140 %	9 (5–14)	7 (4–13)	8 (5–12)	8 (6–12)
Systolic blood pressure < 90 mm Hg %	24 (18–32)	20 (14–28)	26 (19–35)	29 (22–35)
Drop in Glasgow Coma Scale > 2 points %	20 (14–27)	26 (19–35)	22 (15–31)	18 (12–25)
Seizure %	2 (1–5)	2 (1–6)	4 (1–8)	4 (2–8)
Airway %	3 (1–6)	2 (0–5)	1 (0–4)	1 (0–3)
Concern %	21 (15–29)	25 (18–34)	20 (13–27)	20 (16–24)

NS = not significant.

[a]$p < 0.05$ by analysis of variance and Dunn multiple comparisons test.

Values are median (interquartile range). Trends during the one-tier and two-tier systems were analyzed using an interrupted time series model, and any significant differences were summarized as medians with the 95% CIs for the time periods.

this study was well within the range reported to produce the most improved outcomes.

Although a two-tier system did not reduce the number of MET activations, the proportion of patients admitted to ICU following MET review out of the total ICU admissions decreased. Fewer patients with nonoperative diagnoses were admitted following MET review after introduction of the two-tier system. Although such change could relate to changes in patient demographics, it suggests that in particular, medical teams became increasingly engaged in the ward-based management of patients. The rate of respiratory diagnoses decreased in particular and was the only category in which significant changes were observed.

At the time of the MET activation that resulted in transfer to ICU, the median length of stay in hospital was 4–5 days, similar to a recent study also investigating the characteristics of MET to ICU patients (13). Length of stay before ICU admission is an independent predictor of hospital mortality even for relatively short pre-ICU periods such observed in this study (18). The introduction of a two-tier system did not shorten the time between hospitalization and ICU admission, as might have been expected if using the first-tier criteria would facilitate earlier recognition of the need to escalate the level of care. Failure to act upon calling criteria of clinical deterioration (afferent limb failure) has been identified as a major reason for lack of improved outcomes despite using a RRS (19). In this study, the prevalence of any calling criteria that were not acted upon in the 4 hours before ICU admission was higher after a two-tier system was implemented. This could be interpreted as a failure of the parent team to recognize the severity of the patient's condition. It should be noted that this compares the presence of second-tier criteria before and first-tier criteria after the two-tier system. The unchanged number of days in hospital before MET to ICU admission as well the unchanged prevalence of trigger criteria not acted upon in the preceding 8 and 24 hours suggest that the two-tier system had it most significant impact on performance within the 4-hour window. It may be speculated that the presence of less serious calling criteria for a short and limited period of time (i.e., 4 hr) was still perceived as "safe," but the persistence of criteria into the 8- or 24-hour time windows was acted upon in a timely fashion, similarly before and after implementing the two-tier system.

The division of MET reviews that resulted in ICU admission between day, evening, and night hours did not change following the introduction of a two-tier system. An increased proportion of day-time admissions with possibly improved outcomes might have been expected following greater engagement by parent teams, although any correlation between day versus night admissions and ICU mortality remains equivocal (20).

A major finding in this study was the increased prevalence of cardiorespiratory variables, and the decreased prevalence of reduced level of consciousness and clinical concern as triggers for MET activations leading to ICU admission following the introduction of a two-tier system. Overall, the prevalence of MET activations triggered by tachypnea was similar to that

Introduction	Two-Tier System			Trend
2010	2011	2012	2013	Median (95% CI)
68 (57–76)	70 (56–79)	65 (56–75)	70 (59–79)	NS
51	60	57	49	NS
4 (1–12)	5 (2–13)	4 (1–14)	4 (3–11)	NS
40 (29–51)	39 (30–50)	34 (25–45)[a]	34 (27–45)[a]	−7 (5–8)
2 (1–5)	4 (2–6)[a]	5 (2–7)[a]	3 (1–5)	NS
6 (3–10)	7 (3–12)	8 (5–13)	7 (4–12)	NS
17 (12–23)[a]	22 (20–30)[a]	18 (13–23)[a]	18 (3–24)[a]	+7 (3–12)
11 (7–17)	5 (2–11)	9 (5–14)	7 (4–12)	NS
36 (30–44)[a]	47 (42–56)[a]	42 (35–50)[a]	47 (40–56)[a]	+21 (15–27)
17 (12–23)	6 (2–12)[a]	13 (9–20)[a]	13 (9–12) [a]	−10 (5–15)
1 (0–3)	2 (0–6)	1 (0–4)	2 (1–5)	NS
3 (1–7)	2 (0–6)	1 (0–4)	1 (0–4)	NS
7 (4–12)[a]	3 (1–8)[a]	7 (4–12)[a]	4 (2–8)[a]	−14 (10–18)

TABLE 5. Mortality Rates for Patients Admitted to ICU Following Medical Emergency Team Review Separated by Activation Criterion During the One-Tier System Period (2006–2009) and the Two-Tier System Period (2011–2013)

Variable	One-Tier System 2006–2009	Two-Tier System 2011–2013	Relative Risk
Cardiorespiratory arrest	0.19 (0.10–0.33)	0.26 (0.14–0.45)	1.1 (0.90–1.35)
Respiratory rate > 36 (30)	0.26 (0.16–0.40)	0.11 (0.05–0.21)[a]	0.83 (0.71–0.97)[a]
Heart rate > 140	0.27 (0.14–0.48)	0.05 (0.01–0.18)[a]	0.77 (0.63–0.93)[a]
Systolic blood pressure < 90 mm HG	0.24 (0.19–0.31)	0.16 (0.10–0.25)	0.91 (0.82–1.00)
Drop in Glasgow Coma Scale > 2 points	0.21 (0.15–0.30)	0.19 (0.12–0.30)	0.97 (0.86–1.10)
Seizure	0.23 (0.07–0.53)	0 (0–0.41)	0.80 (0.61–1.05)
Clinical concern	0.27 (0.19–0.37)	0.10 (0.03–0.23)[a]	0.81 (0.71–0.93)[a]

[a]$p < 0.05$ between time periods.
Values are rates or relative risk and 95% CI.

reported in the Medical Emergency Response and Intervention Trial, the largest study to date on RRS (21), whereas the prevalence of hypotension toward the end of the study period was two-fold higher. The apparent vigilance in detecting tachypnea, the trigger in about 20% of MET to ICU patients following the two-tier system, is encouraging given the importance of this vital sign (22). A substudy of the MERIT results noted that implementation of a RRS was associated with significantly increased documentation of vital signs, including respiratory rate and blood pressure (23). The introduction of a two-tier system might have improved the attention to recording and acting on objective changes in vital signs. A reduced level of consciousness and most notably clinical concern were the most common triggers for MET reviews before the introduction of the two-tier system (15). Most of these calls were initiated by nursing staff. The markedly decreased prevalence of these triggers leading to ICU admission following a two-tier system suggests that the parent teams became more involved with patient care and limited any subsequent MET reviews to distinct signs of cardiorespiratory compromise. The combination of tachypnea and hypotension is a hallmark of the systemic inflammatory response. Although sepsis was the third most common MET to ICU diagnosis with a similar prevalence compared with the previous reports (13), no changes were noted following introduction of the two-tier system. Interestingly, the ICU mortality associated with admission triggered by tachypnoea, tachycardia, and clinical concern was significantly reduced after implementing the two-tier system. These findings suggest that clinical deterioration was identified earlier at a stage with greater potential for reversal by intensive care therapies.

Patients admitted to ICU after MET review had an almost two-fold higher APACHE II score and predicted risk of death in hospital compared with emergency admissions not reviewed by the MET. The finding of such high severity of disease score among MET to ICU patients is consistent with two recent single-center studies (13, 14), investigating the implementation of RRS and the impact on patients transferred from wards to ICU. These results confirm that the population triggering MET activation and subsequent ICU admission has significantly deranged physiology. The presence of severely unwell patients on wards clearly demonstrates the need for a mechanism such as a RRS to provide timely escalation of medical management. Furthermore, introducing a two-tier system for assessing and managing ward patients with clinical deterioration appeared to offer additional benefit as both the predicted risk of death in hospital and total observed ICU mortality decreased after it had been implemented. The latter result was however not observed when patients with limitations of medical therapy were excluded from assessment. About 20% of patients admitted to ICU subsequently had an order limiting medical therapy, and for the vast majority of patients, this decision was made quite early during the ICU stay (data not shown). The MERIT investigators reported an increased rate of NFR orders issued in hospitals operating a RRS with 3% of orders being issued at the time of the MET activation (24). Overall, one in four patients admitted to ICU before the two-tier system had an order limiting medical therapy, very similar to the proportion of 23% for MET to ICU admissions observed in a Scandinavian single-center study (13).

A recent study found that implementation of a RRS increased the number of orders issued to limit medical therapy although this increase was still associated with transfer of patients from wards to ICU (25). Furthermore, in half of patients, the decision to limit medical therapy was made within 4 days of ICU admission and the odds ratio for NFR orders being issued in patients admitted to ICU following MET activation was almost three-fold higher compared with patients who were left on the ward. A recent systematic review (26) confirmed the common occurrence of orders limiting medical therapy in patients reviewed by RRTs although a multicenter retrospective review of end-of-life care 5 years following the introduction of a RRS failed to demonstrate any significant associated improvement (27). The role of RRS in the recognition and management of the dying patient has become an evolving and increasingly complex challenge (28). The opportunity to assess and implement limitations of therapy by the MET has previously been reported from

Liverpool Hospital (29). The introduction of a two-tier response system appeared to increase awareness among first-tier responders to assess for appropriateness of escalating care, since the rates of orders limiting medical therapy in patients subsequently admitted to ICU were halved after it had been implemented.

This study is limited by its retrospective and single-center design that, while changes associated with introducing a two-tier system may be identified, precludes conclusions regarding causality. Hence, caution is warranted when extrapolating the results to other hospitals, ICUs, and healthcare contexts. The before-and-after design is a recurrent theme in studies investigating system-level changes in healthcare such as RRS (2). Many of the observations were nevertheless well aligned with recently published data from other institutions and healthcare systems and were obtained within a well-matured RRS, over a long period of time and involved a large number of patients. It is noteworthy that traditional measures of RRS efficacy such as rates for cardiorespiratory arrest and unplanned ICU admissions did not change following the two-tier system, whereas many other variables relevant to managing a RRS, particularly from the ICU point of view, did demonstrate a significant impact of the two-tier system. This illustrates the need to refine endpoints of efficacy and effectiveness when evaluating RRS outcomes.

CONCLUSIONS

The introduction of a two-tier response to clinical deterioration increased MET to ICU admissions triggered by cardiorespiratory criteria, whereas admissions triggered by more subjective triggers decreased. The overall ICU mortality for patients admitted following MET review decreased, suggesting that the two-tier system led to earlier recognition of reversible pathology or a decision not to escalate the level of care.

ACKNOWLEDGMENTS

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NSW GOVERNMENT Health

FAMILY NAME | MRN

GIVEN NAME | ☐ MALE ☐ FEMALE

D.O.B. _____ / _____ / _____ | M.O.

ADDRESS

STANDARD ADULT GENERAL OBSERVATION CHART

☐ Altered Calling Criteria

LOCATION

ALL OBSERVATIONS MUST BE GRAPHED

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

SMR110010

Holes punched as per AS2828.1:2012

BINDING MARGIN - NO WRITING

AIRWAY/BREATHING

- Respiratory Rate: 35, 30, 25, 20, 15, 10, 5
- SpO_2%: 100, 95, 90, 85
- Oxygen: O_2Lpm / Device / mode

Key: RA = Room Air, NP = Nasal Prongs, FM = Simple facemask, NRB = Non Re-breather, VM = Venturi Mask

CIRCULATION

- Blood Pressure (mmHg) SBP is trigger < >: 230, 220, 210, 200, 190, 180, 170, 160, 150, 140, 130, 120, 110, 100, 90, 80, 70, 60, 50, 40
- Heart Rate •: Rhythm; 160, 150, 140, 130, 120, 110, 100, 90, 80, 70, 60, 50, 40

DISABILITY

- Neurological: A, V, P, U

Enter appropriate letter. A= Alert, V= Rousable by voice (conduct GCS). P= Rousable only by pain (conduct GCS). U= Unresponsive

Initials

NSW GOVERNMENT Health

FAMILY NAME | MRN

GIVEN NAME | ☐ MALE ☐ FEMALE

D.O.B. _____ / _____ / _____ | M.O.

ADDRESS

STANDARD ADULT GENERAL OBSERVATION CHART

☐ Altered Calling Criteria

LOCATION

ALL OBSERVATIONS MUST BE GRAPHED

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

EXPOSURE

- Temperature (°C) •: 41, 40.5, 40, 39.5, 39, 38.5, 38, 37.5, 37, 36.5, 36, 35.5, 35, 34.5, 34

Pain

Assess pain level at rest and with movement. Enter R for at rest, M for movement

- Severe (7-10)
- Moderate (4-6)
- Mild (1-3)
- Nil

Initials

Blood Glucose

- Date
- Time
- BGL

Bowels

- Date

Weight

- Date
- ☐ Daily

Urinalysis

- Date
- Time
- SG
- pH
- Leuk
- Blood
- Nitrite
- Ketones
- Bilirubin
- U/Bil
- Protein
- Glucose

NSW GOVERNMENT Health

STANDARD ADULT GENERAL OBSERVATION CHART

☐ Altered Calling Criteria

ALL OBSERVATIONS MUST BE GRAPHED

FAMILY NAME | MRN

GIVEN NAME | ☐ MALE ☐ FEMALE

D.O.B. _____ / _____ / _____ | M.O.

ADDRESS

LOCATION

COMPLETE ALL DETAILS OR AFFIX PATIENT LABEL HERE

OTHER CHARTS IN USE

☐ **Neurological Observation** ☐ **Insulin Infusion** ☐ **Alcohol Withdrawal**
☐ **Fluid Balance** ☐ **Pain / Epidural / Patient Control Analgesia** ☐ **Resuscitation Plan**
☐ **Anticoagulant** ☐ **Neurovascular** ☐ **Other** _____

PRESCRIBED FREQUENCY OF OBSERVATIONS

Observations must be performed routinely at least 8th hourly, unless advised below

DATE:		dd/MM/yy				
Time:		hh:mm				
Frequency Required		Twice daily				
Medical Officer Name (BLOCK letters)		P. SMITH				
Medical Officer Signature		P. SMITH				
Attending Medical Officer Signature		R. Bloggs				

ALTERATIONS TO CALLING CRITERIA
MUST BE REVIEWED WITHIN 72 HOURS OR EARLIER IF CLINICALLY INDICATED
Any alterations MUST be signed by a Medical Officer and confirmed by Attending Medical Officer
Document rationale for altering CALLING CRITERIA in the patient's health care record

DATE:		dd/MM/yy				
TIME:		hh:mm				
Next review due Date & Time		dd/MM/yy hh:mm				
Respiratory Rate	Yellow Zone	30-34				
	Red Zone	≥ 35				
SpO_2	Yellow Zone					
	Red Zone					
Heart Rate	Yellow Zone					
	Red Zone					
Blood Pressure	Yellow Zone					
	Red Zone					
Other	Yellow Zone					
	Red Zone					
Medical Officer Name (BLOCK letters)		P. SMITH				
Medical Officer Signature		P. SMITH				
Attending Medical Officer Signature		R. Bloggs				

EXAMPLE

INTERVENTIONS / COMMENTS / ACTIONS

	Date	Time	
1.			
2.			
3.			
4.			

STANDARD ADULT GENERAL OBSERVATION CHART SMR110.010

REFER TO YOUR LOCAL CLINICAL EMERGENCY RESPONSE SYSTEM (CERS) PROTOCOL FOR INSTRUCTIONS ON HOW TO MAKE A CALL TO ESCALATE CARE FOR YOUR PATIENT

CHECK THE HEALTH CARE RECORD FOR AN END OF LIFE CARE PLAN WHICH MAY ALTER THE MANAGEMENT OF YOUR PATIENT

Yellow Zone Response

IF YOUR PATIENT HAS ANY YELLOW ZONE OBSERVATIONS OR ADDITIONAL CRITERIA* YOU MUST

1. Initiate appropriate clinical care
2. Repeat and increase the frequency of observations, as indicated by your patient's condition
3. Consult promptly with the **NURSE IN CHARGE** to decide whether a **CLINICAL REVIEW** (or other CERS) call should be made

Consider the following:

- What is usual for your patient and are there documented 'ALTERATIONS TO CALLING CRITERIA'?
- Does the trend in observations suggest deterioration?
- Is there more than one Yellow Zone observation or additional criterion?
- Are you concerned about your patient?

IF A CLINICAL REVIEW IS CALLED:

1. Reassess your patient and escalate according to your local CERS if the call is not attended within 30 minutes or you are becoming more concerned
2. Document an A-G assessment, reason for escalation, treatment and outcome in your patient's health care record
3. Inform the Attending Medical Officer that a call was made as soon as it is practicable

***Additional YELLOW ZONE Criteria**

- Increasing oxygen requirement
- Poor peripheral circulation
- Excess or increasing blood loss
- Decrease in Level of Consciousness or new onset of confusion
- Low urine output persistent for 4 hours (< 100mLs over 4 hours or < 0.5mL/kg/hr via an IDC)
- Polyuria, in the absence of diuretics (urine output > 200mL/hr for 2 hours)
- Greater than expected fluid loss from a drain
- New, increasing or uncontrolled pain (including chest pain)
- Blood Glucose Level < 4mmol/L or > 20mmol/L with no decrease in Level of Consciousness
- Ketonaemia > 1.5mmol/L or Ketonuria 2 + or more
- **Concern by patient or family member**
- **Concern by you or any staff member**

CONSIDER IF YOUR PATIENT'S DETERIORATION COULD BE DUE TO SEPSIS, A NEW ARRHYTHMIA, HYPOVOLAEMIA/HAEMORRHAGE, PULMONARY EMBOLUS/DVT, PNEUMONIA/ATELECTASIS, AN AMI, STROKE, OR AN OVERDOSE/OVER SEDATION

Red Zone Response

IF YOUR PATIENT HAS ANY RED ZONE OBSERVATIONS OR ADDITIONAL CRITERIA# YOU MUST CALL FOR A RAPID RESPONSE (as per local CERS) AND

1. Initiate appropriate clinical care
2. Inform the **NURSE IN CHARGE** that you have called for a **RAPID RESPONSE**
3. Repeat and increase the frequency of observations, as indicated by your patient's condition
4. Document an A-G assessment, reason for escalation, treatment and outcome in your patient's health care record
5. Inform the Attending Medical Officer that a call was made as soon as it is practicable

#Additional RED ZONE Criteria

- **Cardiac or respiratory arrest**
- **Airway obstruction or stridor**
- **Patient unresponsive**
- Deterioration not reversed within 1 hour of Clinical Review
- Increasing oxygen requirements to maintain oxygen saturation > 90%
- Arterial Blood Gas: PaO_2 < 60 or $PaCO_2$ > 60 or pH < 7.2 or BE < -5
- Venous Blood Gas: $PvCO_2$ > 65 or pH < 7.2
- Only responds to Pain (P) on the AVPU scale
- Sudden decrease in Level of Consciousness (a drop of 2 or more points on the GCS)
- Seizures
- Low urine output persistent for 8 hours (< 200mLs over 8 hours or < 0.5mL/kg/hr via an IDC)
- Blood Glucose Level < 4mmol/L or > 20mmol/L with a decreased Level of Consciousness
- Lactate ≥ 4mmol/L
- **Serious concern by any patient or family member**
- **Serious concern by you or any staff member**

Holes punched as per AS2828.1:2012
BINDING MARGIN - NO WRITING

SMR110010

ANZICS

ANZICS Centre for Outcome and Resource Evaluation

CORE Training Workshop

- Overview of CORE registries
- Data Collection & Management
- AORTIC
- Reporting & Query Tools

2014

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Table of Contents

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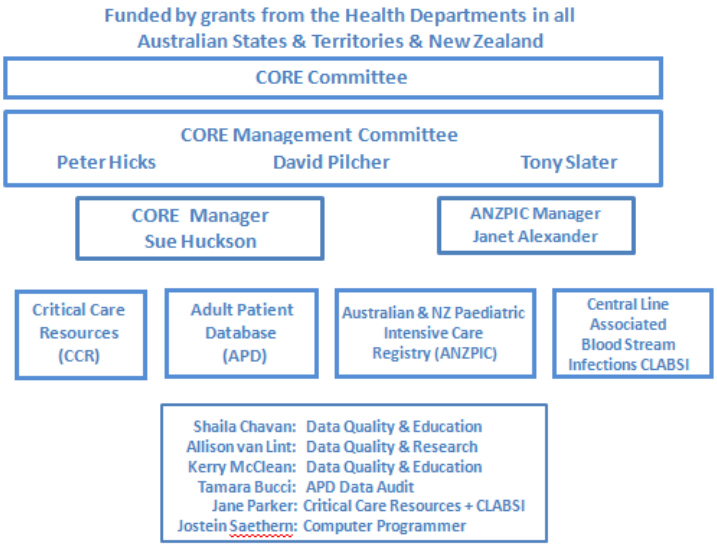
Section 1: CORE Overview

The ANZICS CORE (Centre for Outcome and Resource Evaluation) group is administered by a Management Committee and is funded by grants from Health Departments in all Australian States and Territories and New Zealand. The CORE team is made up of four registries; the Adult Patient Database (APD), Critical Care Resources (CCR) and the Australian & NZ Paediatric Intensive Care Registry (ANZPICR) and the Registry for Central Line Associated Blood Stream Infections (CLABSI). The APD holds one of the largest, not-for-commercial-gain, intensive care comparative datasets in the world. Data contributions enable ICUs to benchmark performance.

The structure:



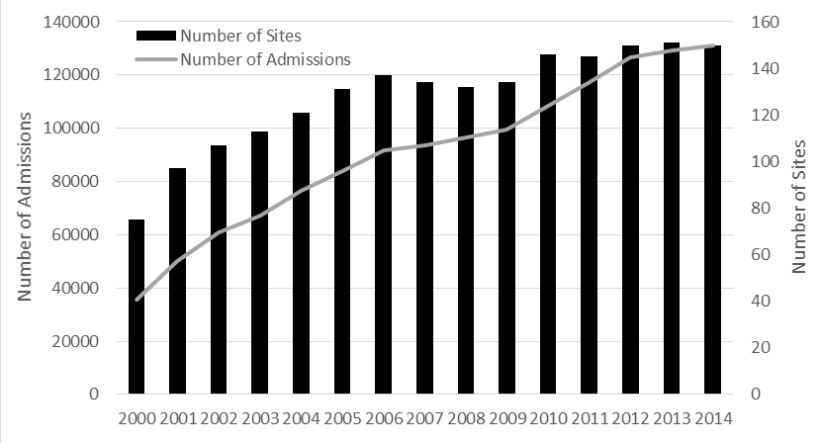
Terms of Reference:

- Liaise with intensive care community on appropriate goals of data acquisition
- Promote research activities directed at understanding critical care illness and outcome
- Provide peer review mechanism for ICUs through data processing and reporting
- Enable research

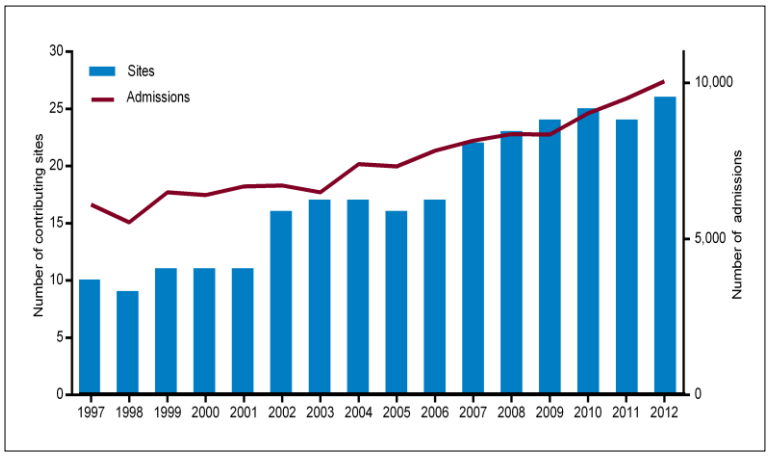
CORE Deliverables:

- Increase the number of contributing sites
- Benchmark healthcare quality in intensive care
- Enable ICUs to access their reports online
- Continue to develop reporting methods
- National Health Data Dictionary linkage
- Data audit of ICUs in Australia and New Zealand

Figure 1. Contributions to ANZICS



This demonstrates the number of contributing sites and number of patient admissions per year to the APD.



This demonstrates the number of contributing sites and number of patient admissions per year to the ANZPIC.

Contributions to ANZICS

- Compare the quality of care across different units
- Improve the quality of care provided by intensive care units
- Compare clinical practice
- Use as a resource for epidemiological research

Comparing quality of care within the ICU

A number of factors can be considered when comparing the quality of care provided by ICUs:

- Patient-to-nurse ratio
- Access/Exit block
- Length of stay
- Duration of mechanical ventilation
- Use of Thromboembolism prophylaxis
- CLAB
- Unplanned readmissions
- Mortality rates

Comparing mortality rates between units:

It is impossible to compare the performance of ICUs without some objective index of disease severity and prognosis. A number of prognostic models are available, and these can be important in providing case mix-adjusted analysis for comparison and providing a foundation for research into therapeutic efforts and the economics of care in the ICU.

Prognostic models:

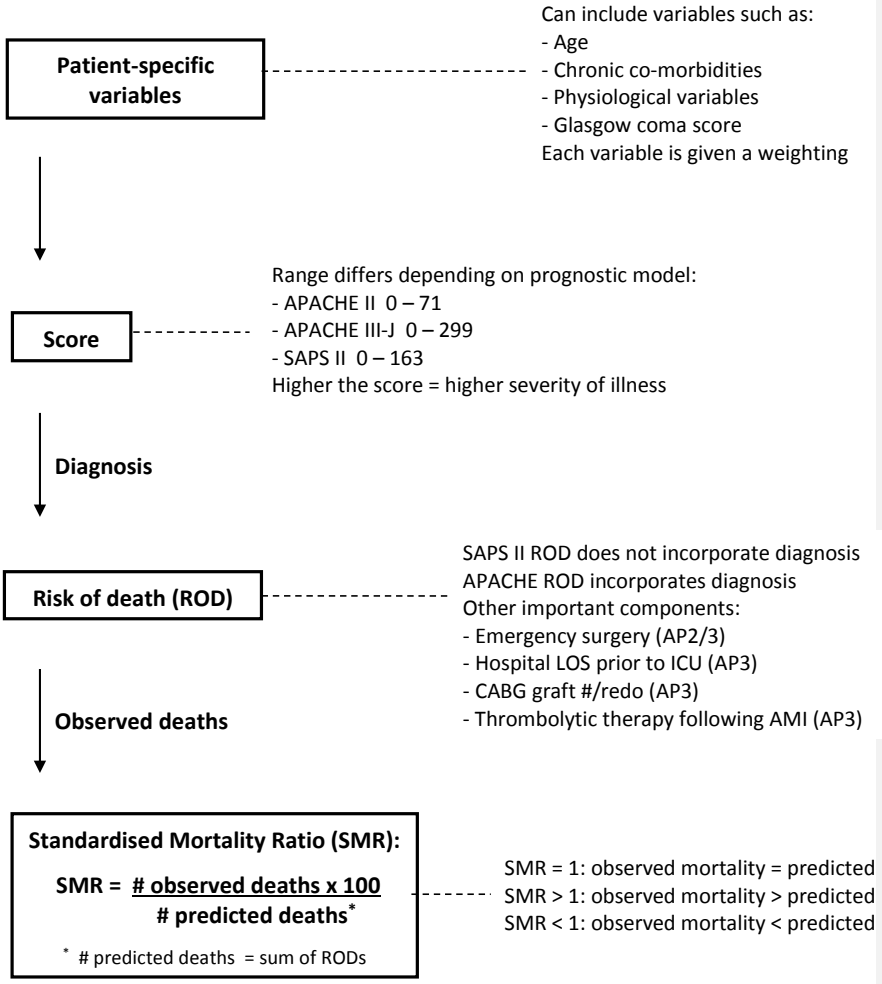
- ANZROD (Australian and New Zealand Risk of Death)

- APACHE (Acute Physiology, Age and Chronic Health Evaluation)
- SAPS (Simplified Acute Physiological Score)
- MPM (Mortality Probability Model)
- PIM (Paediatric Index of Mortality)

How useful a model is depends upon its predictive accuracy, made up of its discrimination and calibration. **Discrimination** refers to the ability to accurately distinguish survivors from non-survivors, while **calibration** refers to the ability to match predicted and observed death rates across the entire spread of data.

The APD currently reports on ANZROD, APACHE III-J, APACHE II and SAPS II.

How Prognostic Models work:



ANZROD: Australian and New Zealand Risk of Death

- Newly developed model, will be used by the APD from November 2014 onwards
- Based around APACHE III-J but developed using Australian and New Zealand patients
- This model is designed to obtain a risk-adjusted prediction of mortality
- This model will be regularly recalibrated to ensure the Australian and New Zealand SMR sits around 1

APACHE®: Acute physiology, Age and chronic health evaluation

- The APACHE severity of disease classification system is a prognostic model that was originally designed to obtain risk-adjusted predictions of mortality
- As the name suggests it is based on 3 scores – Acute physiology score (APS) + Age score + chronic health evaluation – the higher the score the "sicker" the patient
- A risk of death is determined using the APACHE score and the reason for ICU admission (diagnosis)
- The first version of APACHE originated in the USA, first published in 1981
    - This original APACHE focused on 33 physiological measurements
- The APACHE equations have undergone a number of re-evaluations/ recalibrations over the years and can now be used to predict a range of things:
    - Hospital and ICU mortality
    - Hospital and ICU length of stay
    - Risk of active treatment
    - Duration of mechanical ventilation
    - Remaining days in ICU for patients in ICU on day 5
    - Therapeutic intervention scoring system (TISS)
- Each of these predictive values can be calculated for each day a patient is in ICU
- The APD focuses on the first day of ICU admission – the first 24 hours – and reports scores and risk of death for groups of patients

APACHE II

- APACHE II was released in 1985
- 12 physiological variables and 56 diagnosis categories

APACHE III-J

- APACHE III was released in 1991 with 16 physiological variables and 94 diagnosis categories
- APACHE III-J (the 10th recalibration) was released in 2001
- APACHE III had several changes:
    - The weighting of the Acute physiology score (APS) was changed
    - Elements included in the APS were now based on those scientifically proven to have an impact on severity – rather than upon a panel of experts' selection
    - Hospital length of stay prior to ICU was now a factor in the calculations

  - Thrombolytic therapy variable was added if reason for ICU admission is AMI
  - A specific prognostic model for coronary artery bypass graft patients was included. This requires the collection of two additional pieces of information: The number of grafts and whether the operation is a redo.
- The APD has an expanded list of 114 APACHE III-J diagnoses
- The APD collects an APACHE III-J diagnosis and then maps this to an APACHE II diagnosis, thus providing units with both APACHE II and III-J comparisons

APACHE IV:

- Not used by the APD
- Released in 2005
- Developed from over 100,000 patients in American ICUs between the start of 2002 and the end of 2003
- ANZICS CORE has decided to use ANZROD instead of APACHE IV

SAPS II:

- Released in 1993: 12 physiological variables collected over the first 24 hours of ICU admission
- Can only be used for the first 24 hours in ICU (you can't calculate scores/ROD for subsequent days in ICU)
- Includes age and chronic conditions in the calculation
- The risk of death does not incorporate the reason for ICU admission (diagnosis)
- The risk of death has no direct relevance to the individual patient – it is designed to be used for groups of patients
- SAPS III has now been released (2005) – this collects data from within 1 hour of ICU admission

The ANZPIC registry current reports on PIM2 and PIM 3 Paediatric prognostic models.

PIM3

PIM3, published in 2013, is the mortality prediction model used for paediatric patients in the ANZPIC registry. PIM3 describes how unwell the child was at the time of admission to the Intensive Care Unit by recording observations made at about the time of first face-to-face contact between the patient and a doctor from the intensive care unit (or a doctor from a specialist paediatric transport team). The first contact may be in the ICU, the emergency department, a ward or in another hospital (on retrieval). The first value for each variable is recorded from the time of first contact to 1 hour after arrival to ICU. The model includes 7 components for increased risk, and 6 components for decreased risk. The ANZPIC Registry routinely (every 2 years) recalibrates the PIM model based on the most recent ANZ data.

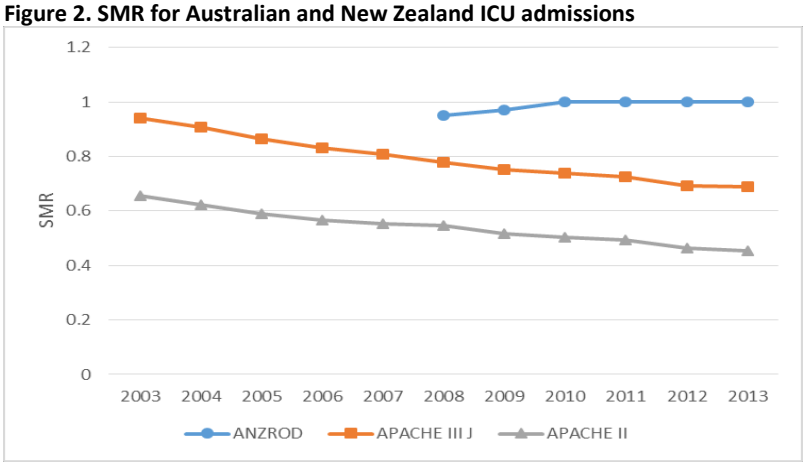
Importance of complete data:
For most physiological variables the APD asks units to submit the highest and lowest values obtained during the first 24 hours in ICU. This allows the APD to use 1 set of data to calculate several different disease severity scores.
Therefore it is important to submit a complete dataset in order to ensure accurate scores, predicted morality and standardised mortality ratios.

Calibration of Prognostic Models

Over time, prognostic models begin to overestimate the predicted risk of death. This leads to SMRs dropping below 1.

Calibration of APACHE III-J and APACHE II:
The graph below shows the APACHE III-J and APACHE II SMRs for all Australian and New Zealand ICU admissions between 2000 and 2009. As shown, the SMRs for both models have been dropping over time.

Figure 2. SMR for Australian and New Zealand ICU admissions



Implications:
Prognostic models need to be continually recalibrated, or newer models adopted. ANZICS CORE is currently developing an adult model calibrated on Australian and New Zealand patients.

Australia and New Zealand Risk of Death (ANZROD):

- Generated and calibrated using recent AUSNZ data
- Uses eight different equations for major diagnostic categories
- Exclusions: <16year of age, all physiology data missing, unknown hospital outcome, palliative care admissions, readmissions
- Well calibrated with SMR ~1

APD Data Collection

Data is collected locally at approximately 140 sites. Each site collects the APD minimum dataset, additional data that can be collected and used locally includes:

- Interventions (AORTIC can be used to provide data to the CCR on ventilation)
- CCU admissions
- Ward and procedure only admissions
- Site-specific local data

At a local level the data is identifiable, and must therefore be properly protected.

Data Submission

The APD collects data on individual episodes of care in critical care units. The APD minimum dataset is submitted to the APD every 3 months (AORTIC creates a compliant excel file that can be sent to the APD).

The episodes collected include:

- All admissions to ICU
- All admissions to other units under the care umbrella of the ICU (including HDU)

The following episodes are excluded:

- All admissions to units remote from the ICU (e.g., separate neurosurgical HDU or cardiothoracic unit not controlled by intensivists or staff providing intensive care services)
- Coronary care patients (CCU)
- Ward admissions
- Patients admitted to ICU for solitary procedures (e.g., central line insertion).

Exported data is de-identified; it contains age, sex and postcode. This means that the data received does not permit the identification of individual patients, except at contributing sites (password protected).

Data validation

Data submitted to the APD is run through a series of validation checks prior to being loaded to the central database.

Data is rejected when >20% of admissions are excluded from the APACHE III SMR analysis due to missing data:

- Missing diagnosis
- Missing hospital outcome
- Missing ALL physiology
- Missing CABG graft or redo values

Missing or illogical data is queried – reports are sent to sites for amendment.

Missing or out-of-range values are treated as normal.

Central calculations:
The excel files submitted by sites are converted to SAS files and loaded to the central SAS database. The site identifier and hospital classification are added to each file during this process.

The SAS database also calculates the score and risk of death for each episode using three predictive scoring algorithms: APACHE II, APACHE III-J and SAPS II. There are different exclusions for each of these models which should be taken into consideration when interpreting analysis.

APD Reporting
APD Standard reports are generated each quarter (~1 week after data submission closes), and are available through the CORE SAS Portal.

Each unit receives a single logon for the SAS Portal – the logon is available to the "prime" contact of each unit (usually the director or NUM). The logon details can then be given to others within the unit who want to review APD data.

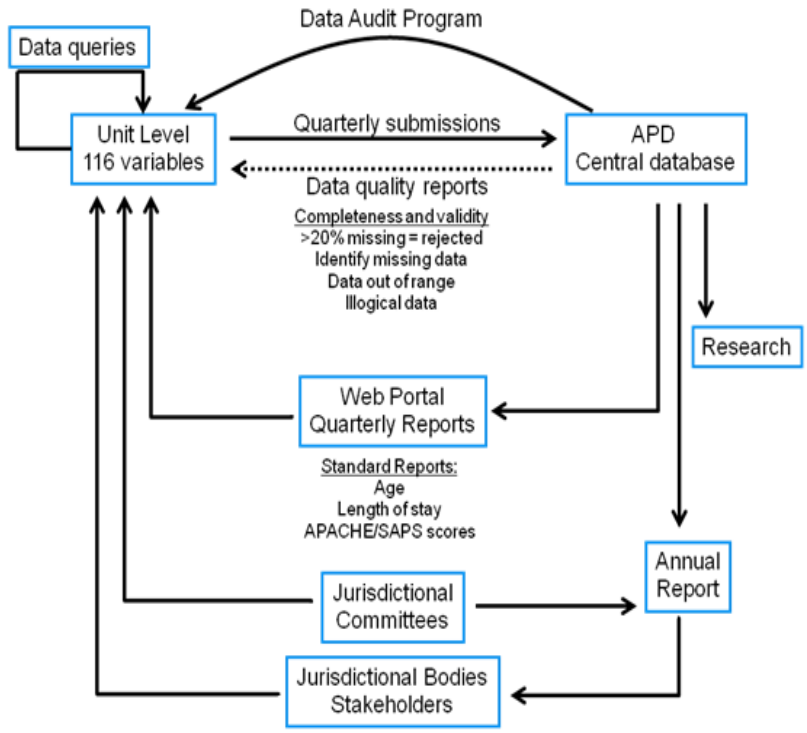
The data submitted enables a contributing ICU to compare their performance with other contributing ICUs. ICUs are classified as one of the following:

- Rural/regional
- Metropolitan
- Tertiary
- Private

Reports show the performance of the contributing unit and the combined performance of all contributing units within the four classification groups.

Data comparison is for the same time period for all units. Therefore, to make comparisons meaningful the APD requests data submission at regular quarterly intervals.

APD Data Submission and Reporting:

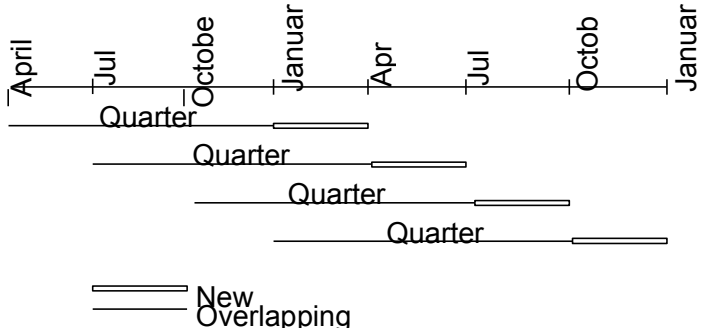


APD Standard Reports

Following each data submission, reports are made available to contributing sites. The reports are based on the data submitted each quarter (shown below).

Data submission and reporting schedule:

The figure below shows the overlapping nature of data submissions to the APD. At each submission a new quarter (3 months) of data is submitted along with the previous 3 quarters of data (9 months). The reports generated for each quarter are based on the 12 months of data submitted.



Note: APD data submissions overlap so that data corrected locally following a previous submission can be resubmitted to the APD and the central database can be updated. It also allows the APD to collect information on patients who were still in hospital at the time of the previous submission.

Exclusions applied to APD reports:

Exclusion criteria for APACHE III-J SMR analysis:

- Length of stay < 4 hours
- Age < 16 years
- Unknown hospital outcome (including transfers to other ICU)
- Missing or non valid APACHE III diagnostic codes.
- 16 physiological variables required for the APACHE III-J score calculation are all missing

Exclusion criteria for APACHE II SMR analysis:

- Length of stay < 8 hours
- Age < 16 years
- Unknown hospital outcome (including transfers to other ICU)
- Missing or non valid APACHE II diagnostic codes
- 12 physiological variables required for the APACHE II score calculation are all missing

Readmissions are excluded from all SMR analysis.

Description of Reports:

Primary Validation Report

This report is generated when data is submitted to the APD and is sent to the data submission contact at the contributing unit. It lists any data quality issues identified in the file. These issues should be corrected locally and then resubmitted to the APD next submission period.

Sites using AORTIC should have minimal data quality issues as the majority would be identified (and corrected) during data entry.

Example:

The data submitted contains 935 records, with the last admission to ICU 30/09/2010.

A preliminary check of the data set has found the following data quality issues.
Please refer to the Data Dictionary for details of verification rules and the treatment of invalid values.
Where possible, please fix invalid values prior to the next submission.

Patient Id (mrn)	Admission Date	Admisssion Time	Field	Invalid Value
1015253	20/08/2009	1111	hco3Hi	1
1027295	11/06/2009	2330	Pregnancy_Validation_Age	Female age <= 10 or age >= 61 with a PREG_STAT of 1. Currently Pregnant or 2. Not Pregnant or 3.Postpartum Period or 4. Unknown
1035242	05/08/2009	645	albumin	1
	05/08/2009	645	creat	4
	05/08/2009	645	creatHi	4

Example:

The data submitted contains 1588 records, with the last admission to ICU 30/09/2010.

A preliminary check of the data set has found the following data quality issues.
Please refer to the Data Dictionary for details of verification rules and the treatment of invalid values.
Where possible, please fix invalid values prior to the next submission.

Patient Id (mrn)	Admission Date	Admisssion Time	Field	Invalid Value
100000000125	05/05/2010	1600	GCSEYE	5
	31/08/2010	38	albumin	3
	05/05/2010	1600	gcs	16
100000000427	01/08/2010	2200	GCSEYE	5
	01/08/2010	2200	gcs	16

Secondary Validation Report (Exclusion data report)

This report is generated when data is submitted to the APD and is sent to the data submission contact at the contributing site. It lists the level of missing data for the SMR-required fields and tells sites whether their submission has been accepted or not.

We have reviewed your data for the time period 01/01/2010 to 30/09/2010. Secondary findings are as follows:

No missing APACHE physiological variables.

No records which have duplicate patient ID and ICU admission date and time

5 records which are missing the Hospital Outcome (Please see exclusion report below). Because of these records, the SMR calculations will be affected. If you are an AORTIC User please note: These records can be identified within AORTIC by running the data clean report: -Missing Hospital Outcome- .

No records which are missing the APACHE III diagnostic code

4 CABGs which are missing a redo value and 4 CABGs which are missing a graft value (lease see exclusion report below). Please note that for this reporting round and in the future, CABG (1207) admissions will be included in the APACHE III-J SMR reports. For a predictive risk of death to be calculated, the number of grafts and whether the operation was a redo must be recorded. If you are an AORTIC User please note: These records can be identified within AORTIC by running the data clean report: -Missing CABG redo and graft values-. Report will be available only in Aortic 9.1 (upon release) or higher versions.

Please fix any errors listed above for the next submission.

This file will be loaded to the central database as the level of errors in the data set is not significant. If your file has in excess of 20% data missingness for any relevant data entry field, it will not be loaded to the central database

ANZICS ADULT PATIENT DATABASE
Exclusion Data Report: 15/04/2005
St Elsewhere Hospital

01/01/2004 to 31/12/2004	**Number Balance**
Number in File	**1464**
Duplicate patient ID and ICU admission date	4
Invalid Age	0
Number in Age Report	**1460**
APACHE III-J SMR	
APACHE physiological variables not recorded	38
<16 or age missing	16
Missing hospital outcome	2
Transfer to another ICU	6
Stay < 4 hours	22
Non scoring APACHE III-J diagnosis	342
Hospital outcome recorded, no ICU discharge date	3
CABG missing redo value	0
CABG missing redo value	0
Number in APACHE III-J SMR report	**1031**
Non scoring APACHE III-J diagnosis breakdown	
Missing APACHE III-J diagnosis	342
Other medical (1002)	0
Total	**342**

Summary Report (SUMM):

Summary Table Report -
Monday, 1 October 2012 to Monday, 30 September 2013

Summary Indicators	All Rural/Regional	All Metropolitan	All Tertiary	All Private
Admissions	15736	21209	51550	29316
Adult Admissions	15237	20955	49907	29136
First Admissions	15289	20406	48701	28041
Median Age	63.3	63.8	61.8	68.5
Q1 Age	45.5	46.1	46.0	58.0
Q3 Age	75.3	76.0	72.8	77.8
Median ICU Length of Stay	43.1	46.3	44.0	35.2
Q1 Length of Stay	21.2	22.7	22.4	21.0
Q3 Length of Stay	84.6	93.1	91.7	62.8
Percent Male admissions	54.8	52.7	62.0	54.7
Percent Long Stay Admissions (ICU length of Stay greater than 7 days)	8.3	10.5	12.0	4.5
Percent Admissions from OT/Recovery	27.2	31.4	49.1	80.8

(Continued)

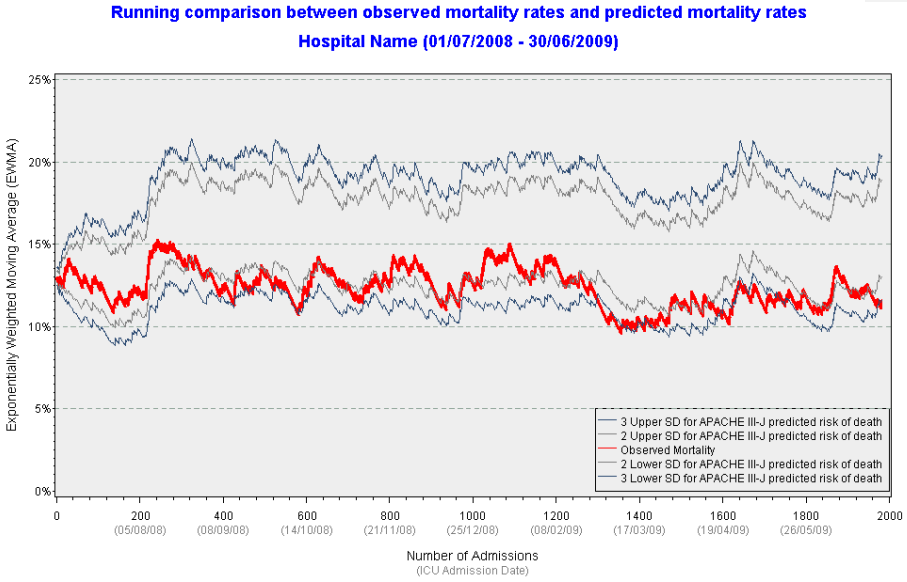
The Summary Report shows you unit versus the 4 comparative groups for a number of different measures. These measures include:

- Length of stay
- ICU admission sources/discharge destinations
- Ventilation
- DVT prophylaxis
- After hours discharges
- Exit block
- Mortality and APACHE relates scores and risk of death predictions.

You should compare your unit to whichever comparative group you belong.

Exponentially Weighted Moving Average (EWMA) Chart

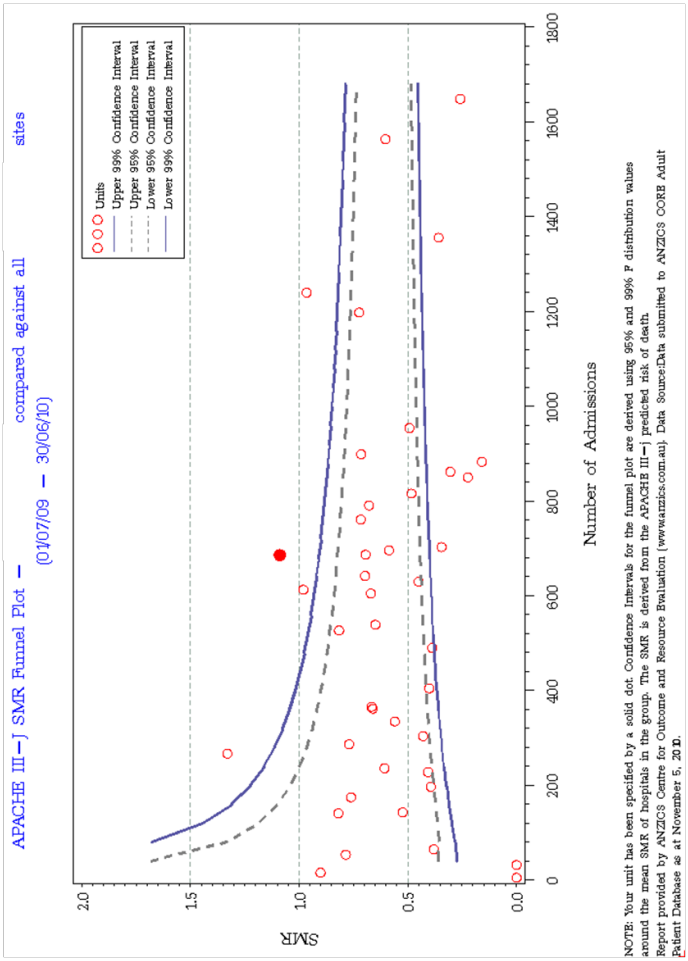
Displays graphically the moving averages of the observed and APACHE III-J predicted mortality for the reporting period. This chart shows data from your hospital alone. The red line represents the observed mortality while the grey and blue lines represent the upper and lower predicted mortality control limits (2 and 3 standard deviations respectively). The chart begins with the first patient that was admitted during the reporting period. The average mortality for each patient is based on the average mortality of the unit over the 6 months prior to that patient's admission date. However, the data is treated in such a way that the weighting for each data point decreases exponentially as time progresses, giving more importance to recent data and allowing trends in mortality to be easily identified - the line moving up indicates an increase in mortality, while the line moving down indicates a decrease.



NOTE: Control limits for predicted mortality rates are derived using APACHE III-J; Lines shown are calculated using an exponentially weighted moving average with a weighting of 0.005.
Report provided by ANZICS Centre for Outcome and Resource Evaluation (www.anzics.com.au). Data Source:Data submitted to ANZICS CORE Adult Patient Database as at October 2, 2009.

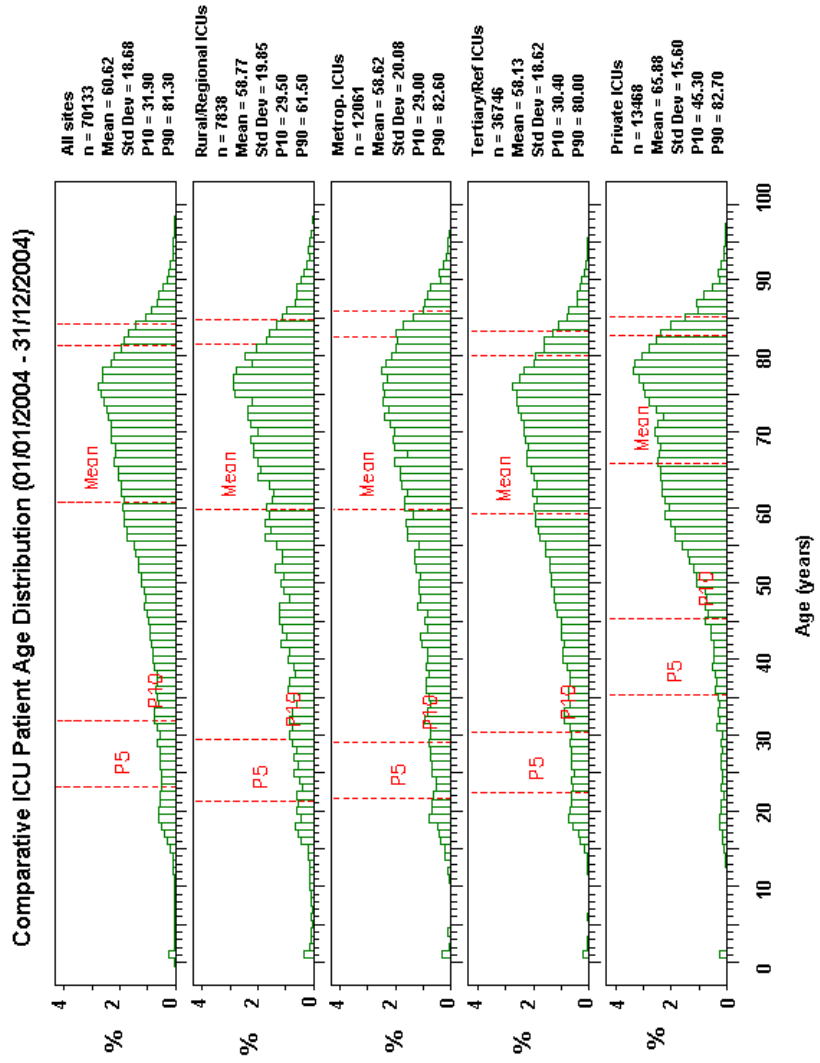
Funnel Plot

Displays graphically the APACHE III-J Standardised Mortality Ratios (SMR) for all units within the same category (Rural/Regional, Metropolitan, Tertiary or Private) plotted against the number of admissions for each site during the reporting period. The plot of a given site will show that site as a solid circle vs. hollow circles for the unidentified comparator sites within the same category. The upper and lower control limits for the SMRs take the shape of a funnel, hence the chart's name. As a comparative report, the funnel plot will quickly compare your units SMR against the SMRs of all units within the same category. This plot quickly identifies an outlier, as it falls outside the control lines.



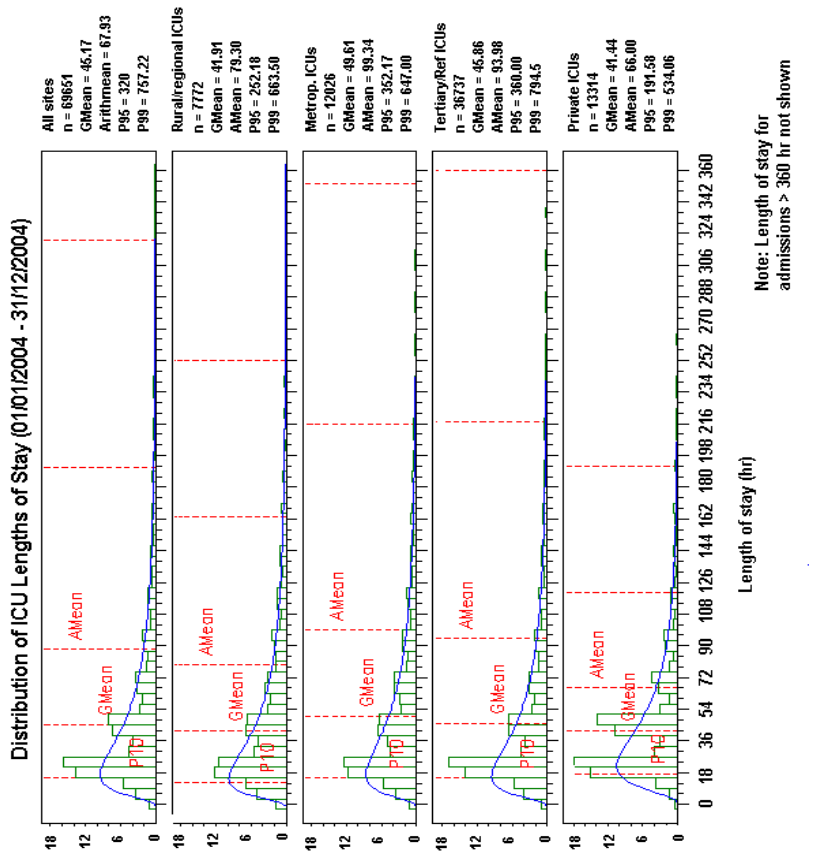
Age Distribution

Displays graphically the age distribution, the mean age of admitted patients, and the ages of the 5th, 10th, 90th and 95th percentile. The number of episodes included in the report is also displayed.



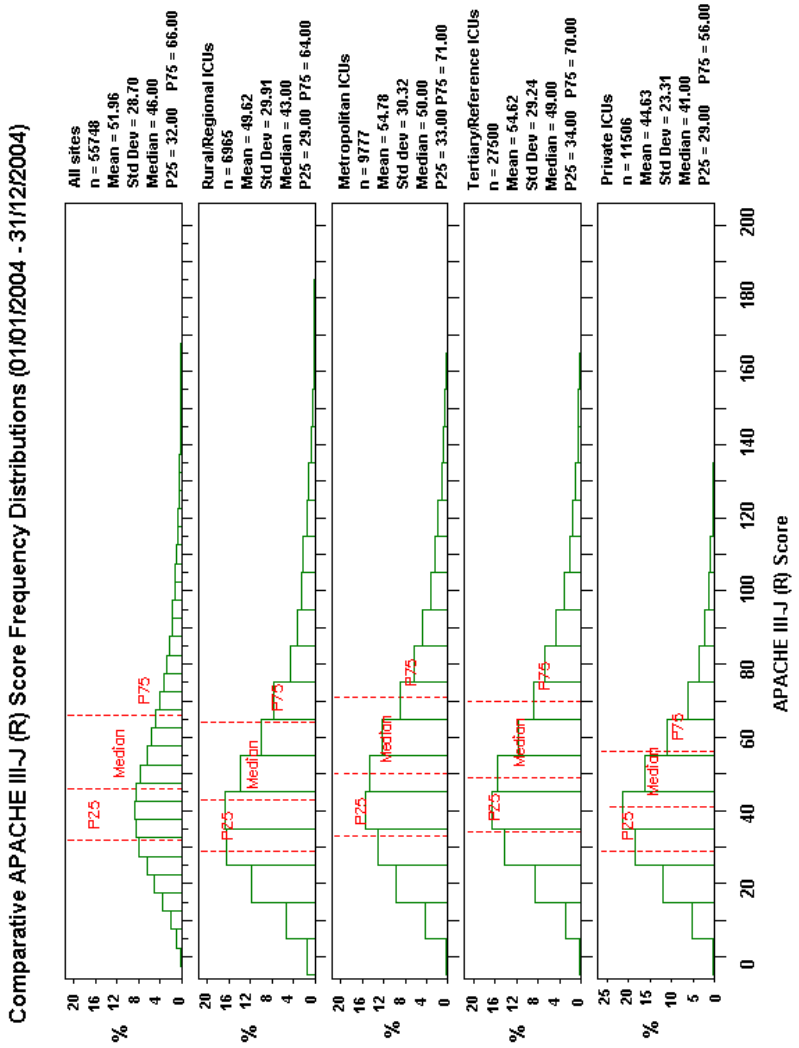
Length of stay distribution

Displays graphically in hours the percentage of episodes with particular lengths of stay. The data for the comparative classifications is also displayed. The main measure reported is the geometric mean. This is a measure of the central tendency of the observed lengths of stay. It is defined as the nth root of the product of the observations. For example if there were four episodes with length of stays 2,3,4,5 hours it would be the 4th root (power 1/4) of the product 2X3X4X5 = 4th root of 120 = 3.31 hours. Also reported is the arithmetic mean (the average). However, the average tends to be higher than the geometric mean in practice, because the observed distribution of lengths of stay is positively skewed - in other words most values are small. The log of the geometric mean is the mean of the log of the observations. Also displayed is the 10th, 90th and 95th percentile of the length of stay.



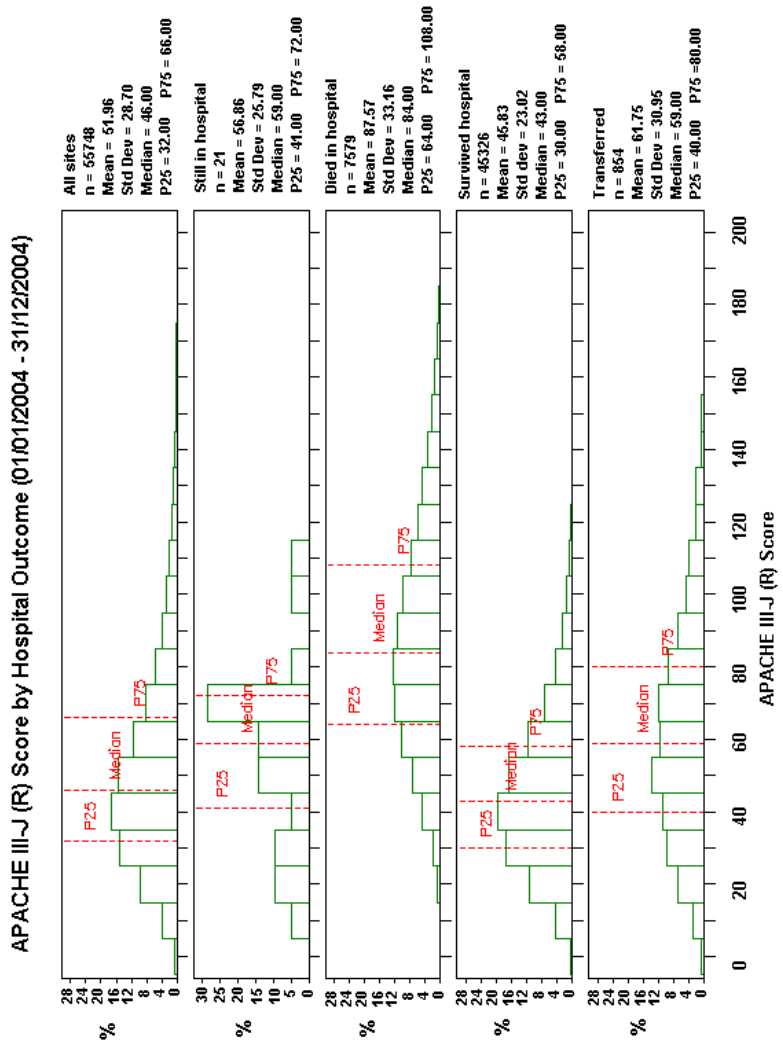
Apache2 /Apache3 /SAPS2 score distribution

Displays graphically the APACHE II, APACHE III-J or SAPS 2 score distribution compared to other hospitals data for the same time period by classification (e.g. rural, metro, tertiary, private). The APACHE III graph shows the 25th and 75th percentiles.

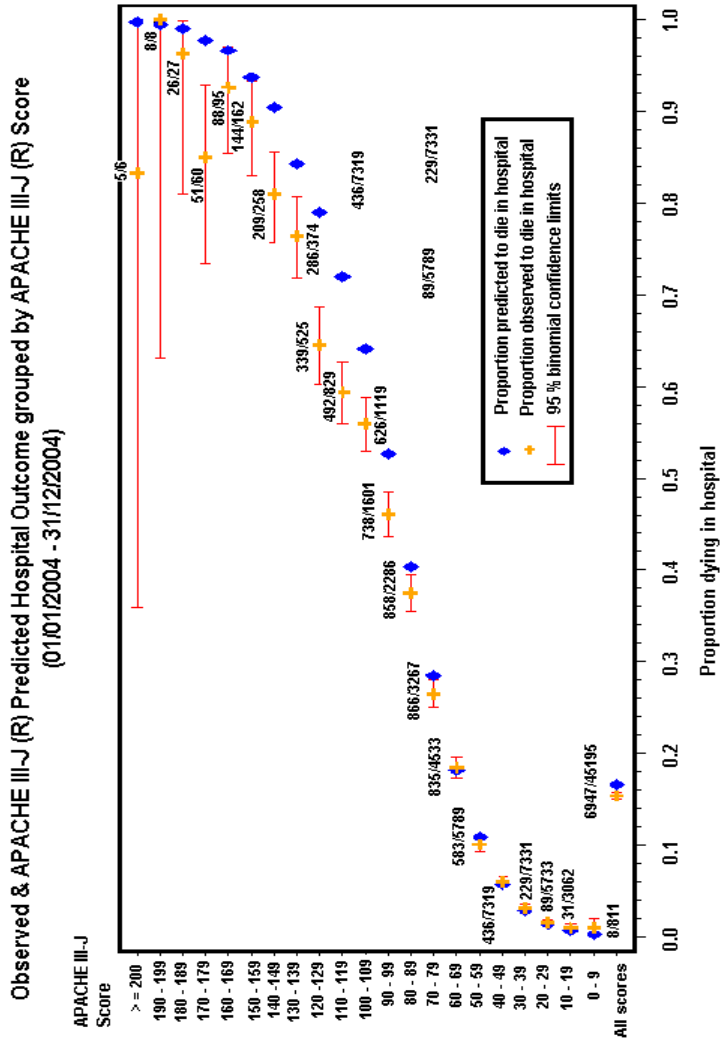


Apache2 score/Apache3 score by hospital outcome

Displays graphically the APACHE II or APACHE III-J score for the various potential outcomes at the particular contributing site. The outcomes include: still in hospital, died in hospital, survived hospital and transferred. The total number of patients in each group is shown along with the 25th and 75th percentiles.

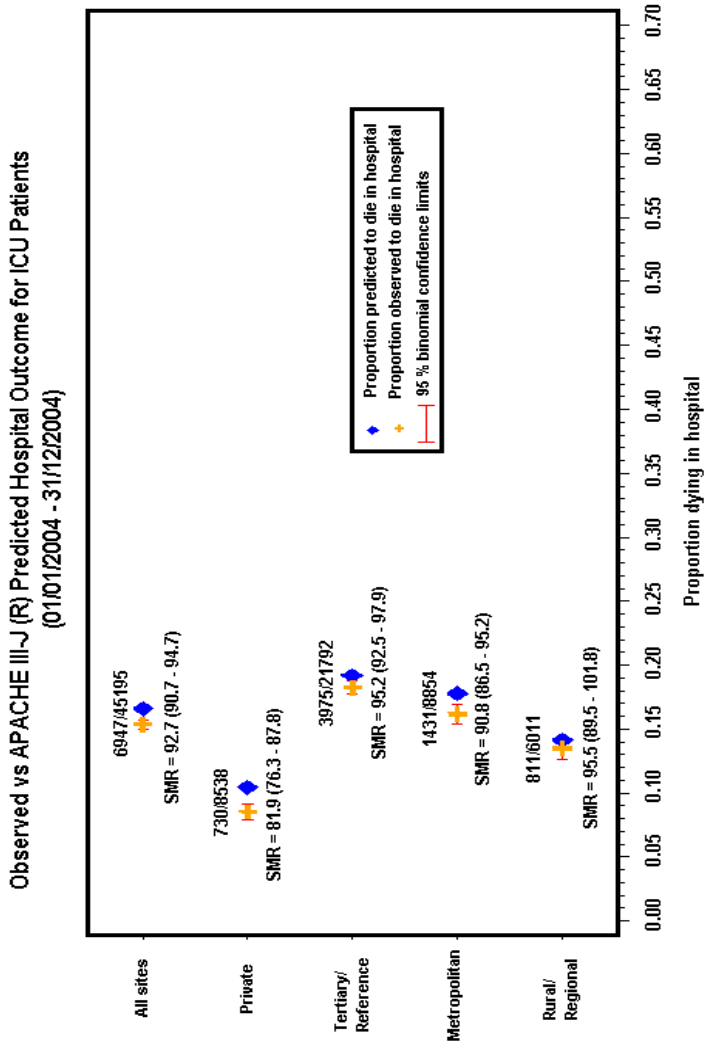


Apache2 score/Apache3 score versus proportion dying in hospital
Displays graphically a range of APACHE III scores (y axis) and the proportion of observed and predicted deaths within each score range (x axis). The bottom figure represents the total population not broken into APACHE II ranges. Note this graph only presents data for the particular contributing site for the particular date range, with no comparative data.



Apache2/Apache3/SAPS2 SMR (By hospital type)

Displays graphically the proportion of observed deaths prior to hospital discharge (cross) and the proportion of predicted deaths prior to hospital discharge (diamond). This is also shown for the various comparative classifications (e.g. rural, metro, tertiary, private). The Standardised Mortality Ratio (SMR) for the individual site and the comparative groups are shown, along with the binomial 95 % confidence interval for the SMR.



Descriptive Reports:

Mortality audit report
Is an electronic print out report of the calculated APACHE II risk of death and SAPS II risk of death of all patients who died in hospital at the contributing site (sorted from lowest APACHE II risk of death to highest).
The file when double clicked should be displayed by your internet viewer.

Data quality detail report
Is an electronic print out report of missing or queried values in the data that was submitted from the site. The data is sorted by ascending date of admission to ICU. The column headed MRN lists the unique patient identifier sent by the contributing site – this is actually the AORTIC patient ID rather than the MRN. For sites using AORTIC, entering this number in the FINDER view will result in the relevant record will be displayed. The file when double clicked should be displayed by your internet viewer.

Data quality summary report
Lists the various data fields and the number of records with OK, missing or queried data in each field.

Section 2: Data Management and Data quality

Privacy Issues

Legislation has been introduced which determines privacy issues with respect to databases which collect identifying patient health information. The NH&MRC guidelines published under Section 95A of the Privacy Act 1988 provide detail on the Australian National Privacy Principles, (now the Australian Privacy Principals APPS) and their application in the collection and use of such patient information.

From 12 March 2014, the Australian Privacy Principles (APPs) replaced the National Privacy Principles and Information Privacy Principles and will apply to organisations, and Australian Government (and Norfolk Island Government) agencies. This privacy fact sheet provides the text of the 13 APPs from Schedule 1 of the *Privacy Amendment (Enhancing Privacy Protection) Act 2012,* which amends the *Privacy Act 1988*. For the latest versions of these Acts visit the ComLaw website: www.comlaw.gov.au.

The minimum dataset collected for the ANZICS Adult Patient Database (APD) has been altered so that it contains no patient-identifying information. As such, advice received from the Department of Human Services Victoria is that written patient consent and Institutional ethics committee approval and monitoring are not required to be sought by ANZICS. Individual ICU units are advised that if they have any concerns relating to patient privacy and government legislation in their own location, should seek advice from their Institutional ethics committee. Of interest:
http://www.nhmrc.gov.au/publications/pdf/e46.pdf
(NHMRC advice on when quality assurance activities require ethical review. Endorsed 20th February 2003).

Quality Assurance

The Adult Patient Database is also a declared quality assurance activity under the Health Insurance (Quality Assurance Confidentiality) Amendment Act 1992. This provides protection to the overseeing committee from subpoena and gives confidentiality for identifying matters which become known through declared QA activities (http://www.health.gov.au/pq/sq/pdf/qadecl.pdf).

Privacy & Security

The ANZICS database records patient data as set out in the core data set. A unique number is assigned to each patient within each ICU unit. Only authorized staff at the sending hospital can identify a patient. Note that this unique number is not the hospital medical record number.

The central ANZICS database is stored on a local PC and is password protected. The ANZICS database is regularly backed up to a network server which also has its own backup system. The server is stored in a locked purpose built cabinet. The database is accessed by authorized ANZICS staff only.

Information requests must be made in writing. Requests may be approved by the ANZICS Adult Patient Database (APD) Director or Committee which also contains ANZICS Board Representation. Each ICU unit may request its own information back

at any time. This request must also be in writing with the signature of the ICU director of the requesting unit.

Security

The following are recommendations in helping you to identify and mitigate potential risks.

Step 1: Identify the Risks

Anything that threatens or compromises the structure, integrity, accuracy and availability of health care information constitutes a risk to the system.

Types of Risks

- Natural or man-made disasters
  - Floods
  - Storm damage
  - Fire
- Environmental
  - Power supply
  - Heat & humidity
- System Penetration
  - Hackers
  - Opportunists & Insiders
- Sabotage
  - Theft
  - Deliberate disruption
  - System Errors and Omissions
  - Most common cause of data disruption
  - Viruses

Step 2: Develop a Security Plan

Logical Level

- Passwords – certain length, alphanumeric, forced change regularly
- Multi-level password security – AORTIC has this functionality
- Multiple logins
- Inactive shut down

Physical Level

- Gate keeping
- Don't identify what the computer is for
- Log for physical entry
- PC not located in general public area
- Data on removable disks should be password protected or encrypted and kept in a locked office
- Smoke detectors
- Uninterruptible power supply
- Prevent power surges and spikes

- Paper records (data collection sheets) should be stored and archived within hospital guidelines. Generally they should be stored in archive boxes in chronological order and kept in a locked room. Paper records are legally required to be kept for 7 years. Check what time is required for your area.

Step 3: Develop a Backup Plan

To protect against data loss, backup ICU Databases including aortic32.mdb. A backup of the application software should also be kept. If an upgrade proves problematic, restoration of the earlier functioning software maybe possible. Installation of effective anti-virus software that is updated regularly should be installed (see your hospital's IT Department).

- Document a security and backup procedure
- Comply with hospital Information Systems Department requirements
- Use hospital server for backups
- Regularly back up to an external media.
- Frequency of backups depending on data entry frequency and amount of data entered. Basic rule; how much data would you be prepared to re-enter if your database was corrupted or lost?
- Backup disks should be tested to ensure that data can be retrieved

Step 4: Develop Security and Confidentiality Policies

Security Policy

Describe the organisation's philosophy for user authentication and access control, data reliability, integrity and availability. Include a description of risk assessments and assign responsibility to specific individuals or groups in regard to the implementation and maintenance of the policy.

Confidentiality Policy

Describe the levels of access available for authorised personnel. Match close as possible to job description.

Unit Confidentiality Policy – access to the data for research purposes

The intensive care unit should have a policy on who has access to the unit's data and where the data can be published. For example, unit-specific data like unit mortality can be quite sensitive and specific permission by the unit's director may need to given before the release of this data. This policy should be reviewed and assessed regularly.

Audit processes and data cleaning

- Develop audit process procedures.
- The data collection and data entry to any database must be audited on a regular basis to ensure data integrity. General rule of thumb is to randomly select 10 % of the entered records and check with the original paper records.
- Paper data collection records should document who collected the data and who entered the data with dates.
- To maintain and improve the collection and data entry, regular training and education sessions should be conducted. Any corrections should be done by the data collectors or data entry persons to reinforce the learning process.
- Several data cleaning reports are included in the reporting tools within AORTIC. Use these reports to clean the data. Logical errors are harder to find i.e.: source of admission matches non-op or post-op diagnostic category. The exception report is an attempt to assist in locating mismatches and missing data.
- Undertaking regular data cleaning close to the time of data entry will improve data quality.
- Use the data. The more the data is reported on and queried, its value as a resource increases. Anomalies or errors in the data are also likely to be identified early.
- Cross reference with other data sources wherever possible.

Information requests

- Create a database to log all internal/external queries of the AORTIC database or other ICU databases.
- Document who authorised the request. There may be types of information that are not as sensitive that can be given out at the data manager's discretion i.e., unit admission numbers.
- Use the unique identifier from this database to name all relevant queries, reports or Word documents to create a trail to link back to the original query. By doing this you can recreate the query if an update is needed.

Data collection and data entry

Data Collectors

The AORTIC data collection can be split between 2–3 types of collectors. Administrative staff can be trained to collect data from data collection sources i.e., nursing charts.

Examples:

Demographic data – Ward Clerk or Administrative Officer
Clinical Management – Doctor
Physiological – Nurse, Clerk/Administrative officer or Doctor

Results from APD Data Audit Program:
The APD data audit program has identified that units with trained, dedicated data collectors have the most reliable data. Dedicated Data collectors are individuals who are trained in data collection and have sole responsibility for data collection.
CORE recommends that, where possible, units use a trained, dedicated data collector for the collection of APD data.

Data Collection Process

The data collection process should be structured to fit in with the data collector's current work practices and work flows. The aim is to visit the data source once. Ongoing training, education and feedback must be given to the data collectors to ensure consistency and accuracy of the data being collected.

Data Standards – Data Dictionary

Contains definition, field size and type, collection and verification rules for all data fields.

- Submission to National Health Management Group.
- Recent additions:
  - Type of ICU admission – HDU/ICU
  - APACHE III-J – number of grafts, redo, thrombolytic therapy (AMI)
  - Pregnancy Status
  - Treatment goals for admission
  - Emergency response admission
  - Thromboembolism prophylaxis
- Current version is 3.2.1

Data Collection Forms

The APD provides a standard data collection form which can then be customised by individual units (current form is version 17). The main design priority is for the form to facilitate the data collection process. The second priority is for the form to facilitate the data entry process. Explanatory notes should be included wherever possible to assist the data collectors and data entry personnel. A version number needs to be included on the forms to assist in the management of the data collection process.

Data Entry Process

To assist in data entry and to support data quality, various features should be designed into the local database used for data collection.
The following features are those built into the AORTIC software.

- Data completeness
- Compulsory Fields
- Range checks
- Physiological range checks
- Invalid data combinations
- On line help
- Context driven dialog boxes at data entry point
- On line data dictionary
- Global data checks
- Missing Values e.g. Hospital outcome, ICU outcome
- Duplicate values
- Unlikely combinations e.g. acute renal failure with normal creatinine levels

Various reports can be generated within the reporting tools in AORTIC to assist in the data checking and data cleaning. The more you use your data, the cleaner and more accurate it will become. Data collection errors can be picked up by data entry personnel and they should be trained to look at the data critically when entering to catch errors i.e., patient ticked as male but actually female; acute renal failure with normal creatinine, excessive chronic health coding.

Creating New Fields (Custom fields)

When creating new fields to collect data, consider:

- Where will it be used?
- Ensure currently not being collected elsewhere
- Where is the data?
- Who will collect the data?
- When will the data be collected?
- Data collected for a specified amount of time?

Each field added to a table should be a single attribute which applies only to that entity, the whole entity and nothing but the entity. **Consideration should be given as to how this data will be analysed and used before it is added.**

Data Audit Program

ANZICS needs to ensure that data submitted to the APD is as accurate as possible.

- There are 3 important data checks used to ensure accuracy of the database:
- Completeness
- Validity
- Reliability

Completeness

- An automated process
- AORTIC can be used to tell units what data is missing
- Submitted data is rejected if greater than 20% is missing
- Where data is accepted units are informed of all missing data

Validity

- An automated process
- AORTIC identifies unlikely combinations
- Following submission units are again informed of any "unlikely" data:
    - Male with pregnancy status
    - Negative LOS
    - ARF with normal creatinine levels

Reliability

- Checked via our data audit program
- The data from randomly selected APD submissions is re-extracted and analysed for reliability

APD Data Audit Program:

- Initial plan to audit at least 50 units throughout Australia and New Zealand.
- The first cycle of the program was completed in 2009, with all jurisdictions visited. The 2010-2013 cycle was recently completed.
- Plan to revisit regions every 3 years.
- Report results back to individual units:
    - Level of missing data
    - Level of correct or 'reliable' data
    - Effect of errors on Apache II score and ROD
    - Main problem areas and how they can be addressed
- Report results back to all ICUs:
    - Main problem areas to focus on
    - How data can be improved in the future

Coding Issues

The choice of diagnosis is dependent upon whether the patient is a 'post-operative' or 'non-operative' admission.

Post-operative admissions:

- All patients with an ICU source of OT/Recovery must be given a post-operative diagnosis that corresponds to the surgical procedure that was performed (even if the admission to ICU was due to an intra-operative or post-operative complication).
- Once the surgical procedure has begun and/or anaesthesia has been administered, the patient should be considered post-operative.
  - **Exception:** Where no operation/no anaesthesia is initiated, the patient can be treated as a non-operative admission. The ICU source of admission will be the patient's location prior to OT.
- Patients admitted post-endoscopy or bronchoscopy should also be given a post-operative diagnosis based on the procedure performed.
- Patients admitted from a procedure room (e.g. cathlab/radiology) should be treated as post-operative **ONLY** if a general anaesthetic was administered. Otherwise such admissions should be treated as non-operative.

Non-operative admissions:

- Patients with an admission source other than OT/Recovery must be given a non-operative diagnosis that corresponds to what is regarded by the clinician, in the first 24 hours of the ICU admission, as the predominant reason for the ICU admission.
- In such cases, the APACHE III-J diagnosis is NOT necessarily the discharge diagnosis.
- The reason for ICU admission may not be the same as the reason for hospital admission.
- Every effort should be made to determine the cause of an event (such as chest pain, shortness of breath, respiratory failure etc), with the first 24 hours of ICU admission being used to choose a diagnosis.
  - **Exception:** Patients transferred to ICU directly from the OT/Recovery at another hospital may be given a post-operative diagnosis even though their ICU admission source will be "other hospital" (if they were admitted directly to ICU), or "Emergency" (if they passed through the emergency department on their way to ICU).

Additional considerations when choosing a diagnosis:

- **Cardiac arrest:** when a non-operative patient is admitted to ICU post-cardiac arrest, the APACHE III-J diagnosis should always be cardiac arrest.
- **Sepsis:** when sepsis is part of the working diagnosis for a non-operative patient it must be selected as the APACHE III-J diagnosis unless definitively ruled out within 24 hours.
- **Trauma:** any patient whose injury or illness is a result of trauma should have a Trauma diagnosis selected. First, identify whether the patient is a post-operative or non-operative admission, then identify all major sites of injury. The selection

of a diagnosis should be that which includes as many sites of trauma as possible. ALWAYS select head trauma when the head has been involved.

Diagnosis hierarchy: can be used to decide on a diagnosis when the working diagnosis has multiple components.

1. Cardiac arrest takes priority over all other non-operative diagnosis codes.
2. Sepsis is the next non-operative consideration.
3. When trauma is present, choose it as the diagnosis, unless cardiac arrest or sepsis is also present.

Patients with a missing APACHE III-J diagnosis are excluded from the APACHE III-J SMR calculations.

Please Note: If a patient has more than one admission into ICU in one hospital admission it is classified as a READMISSION. DO NOT create another hospital admission to enter the subsequent ICU admission details; simply create a new ICU admission within the existing hospital admission.

Frequently asked questions
Also see FAQ from the website **www.anzics.com.au/apd/apd-education**

If a patient is admitted to hospital via the emergency department, when does their hospital admission start?
The emergency triage time should be used as the hospital admission time in these cases.

What ICU admissions should we collect/submit?
All admissions to ICU.
All admissions to other units under the care umbrella of ICU (including HDU)
See Data Dictionary, Introductory Notes for further detail.

If a patient is in ICU for less than 24 hours, is the actual urine volume measured in the shorter time period entered or should the 24 hour volume be estimated?
If there is an incomplete 24 hour urine collection, extrapolate to report a 24 hour urine output. If however the urine collected is for a period of six hours or less, or the patient is terminal, leave the information out and it will be treated as unknown.

What should be recorded if a patient has a cardiac arrest or suffers death in the first 24 hours of admission to ICU?
There has been some confusion as to the most appropriate values to record for patients suffering cardiorespiratory arrest or death in the first 24 hours after admission to ICU. The relevant variables are blood pressure, heart rate, respiratory rate and GCS. The values recorded should be the lowest measured values prior to arrest or death. It is inappropriate to record all variables as zero. See Data Dictionary, Introductory Notes for further detail.

When do I calculate the GCS for drug overdoses?
Glasgow Coma Score for drug overdoses should be calculated at the time of the ICU Admission or just prior to the administration of sedative agents by medical or nursing staff (during transfer/in ED). For iatrogenic overdoses, use the pre-sedation/pre-overdose GCS or leave blank if this can't be found.

How do I code an iatrogenic overdose?
Iatrogenic overdoses should be coded as Other Medical.

If a patient is transferred to our ICU from another hospital after surgery, can we still select a post op diagnosis?
Generally speaking, no. Whether the diagnostic code is post op or non op is determined by the source of patient's ICU admission. An exception would be where a patient was transferred from the one hospital to the second hospital's ICU immediately post-op (for example if there were no ICU beds available in the first hospital). Otherwise identify the cause for admission/transfer.

Cardiac arrest, is it OK to put zero for HR and RR? No.

For the hospital admission source, what is put for patients that have come from their GP or from a roadside accident?
The answer is their place of residence at the time i.e., where they spent the previous night.

Should a post operative code be used when the patient arrives in ICU via the ward, but has only been on the ward for a few hours after an operation?
The reason for admission has to be non-operative and the ICU source 'ward'. The patient was initially transferred from the operating theatre to the ward, so presumably at that point there was no reason for ICU admission.

Section 3: AORTIC Overview

Installation:

Installing full version (New users of AORTIC)
All Aortic installations should be installed as a network installation.

- Network installation:
    - aortic32.mdb on network drive
    - Accessible from multiple computers
    - Automatic back up by hospital IT
        - Two installation disks
        - Use disk one for first PC
        - Use disk two for all other PCs in network (Does not have aortic32.mdb)

Upgrades of AORTIC (Current AORTIC users)
Upgrades are available from the ANZICS website or a CD with the upgrade can be obtained from ANZICS House.

Before you begin installation, perform a backup of the AORTIC Database and exit from every open application so that only Windows is running. There should be no applications listed in the task bar or in floating tool bars.
If you have saved queries, you may take a record of all SQL codes for queries before upgrading Aortic.

For a network environment, the update must be run on each client copy of AORTIC. All end users need to exit the program before commencement of the upgrade. All client applications need to be upgraded before data entry is recommenced.

Note: Installation of the update replaces the front end program files in an existing AORTIC installation. The back end database files (installed on a standalone PC or network) containing patient information are not reloaded.

Passwords:

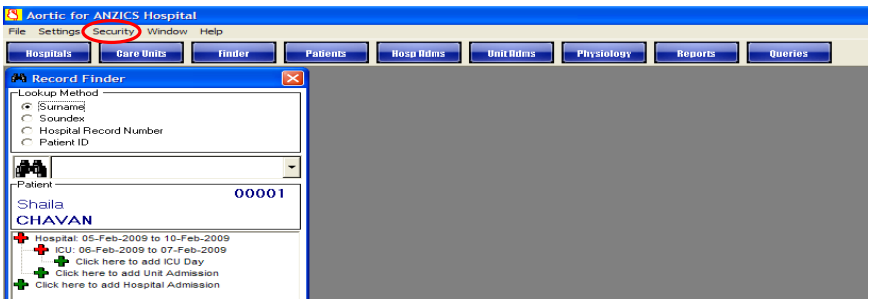
The default username and password for AORTIC are:
Username: aortic
Password: anzics

You can change the login and password details to protect the security of your database. **IMPORTANT:** Once you change your password ANZICS will not be able to help you gain access to your database if the password is lost.

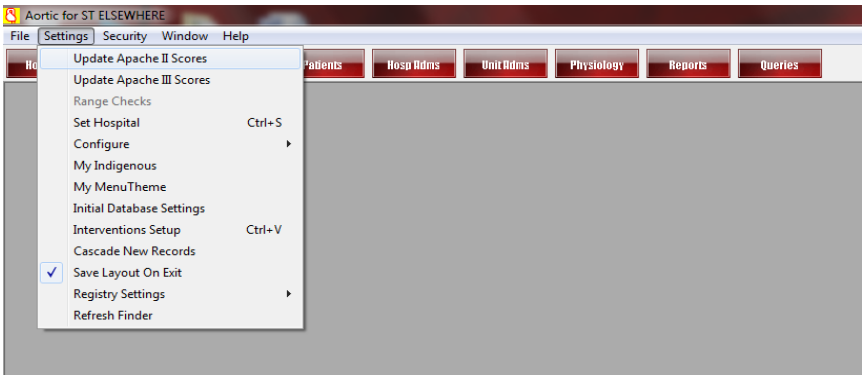
To change your password:
Click on SECURITY (see diagram below) in the top menu and then CHANGE PASSWORD, follow the prompts.

To create different user accounts within AORTIC:
Click on SECURITY and then CREATE OR MODIFY USERS.
Enter the details for the new account and then decide what level of access the new user will have:

- Administrator – unrestricted access
- Data Entry – can add/edit data
- Read Only – can view existing data but can't add/edit data
- Reports – can open reports and run queries



What's available under SETTINGS:

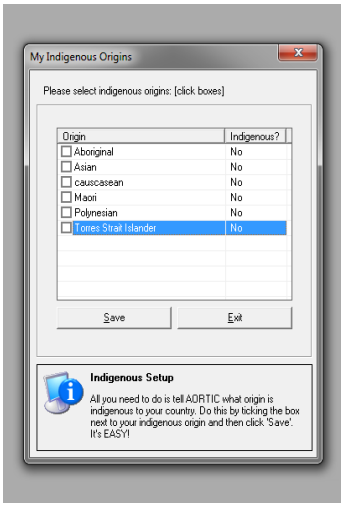


Set Hospital: If the local database has more than 1 hospital contributing to the APD, use this to choose which hospital you want to enter data for.

Configure:

- Custom fields: click here to add custom fields for collecting data not already included in AORTIC (see "custom tabs", page 58).
- Look up defaults: enables the user to choose the default values for several fields on the patient, hospital admission and care unit admission tabs.
    - Example: setting default country to New Zealand
        - Click SETTINGS – then CONFIGURE - then LOOK UP DEFAULTS
        - In Box 1 choose PATIENT
            - In Box 2 choose PATIENT COUNTRY
                - In Box 3 choose NEW ZEALAND
        - Click APPLY, and then OK
- Look up edit lists: enables you to edit the look up lists for countries, states and ethnicities.
    - Example: Can be used when you want to add a new country to your drop down list.

My Indigenous: Enables the user to establish the indigenous ethnicity for their location. A hospital in Australia would choose Aboriginal and Torres Strait Islander as indigenous, while a New Zealand hospital would choose Maori as indigenous.



My menu theme: Enables the user to change the colour and location of the menu bar.

Initial database settings: Enables the user to identify the location of the databases frontend (data entry), backend (data storage - needed for backup), Your Hospital (Reports) and A2A (Queries).

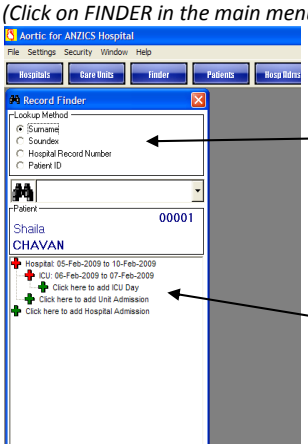
Interventions setup: Enables the user to custom the list of interventions that appear in the interventions drop down list (See page 55). If contributing data to the ANZPIC Registry, please refer to their Episode Collection From to ensure that you have included all of the interventions listed on that form.

Registry Settings: Enables the user to choose the location of the database frontend (data entry), backend (data storage - needed for backup), Your Hospital (Reports) and A2A (Queries). This should only be done by the local IT department or following instructions from the CORE programmer.

AORTIC FORMS:

Finder

(Click on FINDER in the main menu bar)



Enables the user to search for patients by:
-surname,
-soundex (name sounds like)
-Hospital record number
-AORTIC patient ID.

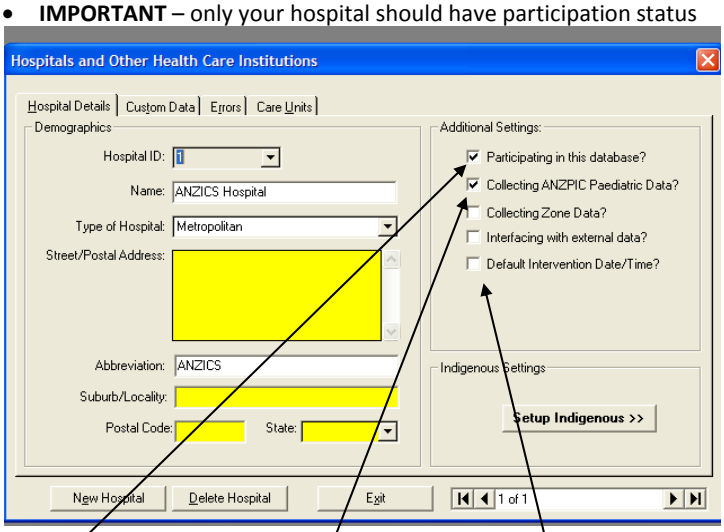
Users can also use the finder to add a new hospital admission, ICU admission or ICU day for a patient by clicking on the green crosses.

Hospital details form

(Click on the HOSPITALS tab in the main menu bar)

To add a new Hospital always click on **NEW HOSPITAL** (bottom left)

- Use this form to add the names of hospitals you receive and transfer patient from/to (once added here these hospitals will appear in the drop down lists for "Hospital transferred from" and "Hospital transferred to").
- **IMPORTANT** – only your hospital should have participation status



Only tick for YOUR hospital

Hospitals that you accept/transfer patient to should be entered here but not ticked as 'participating'.

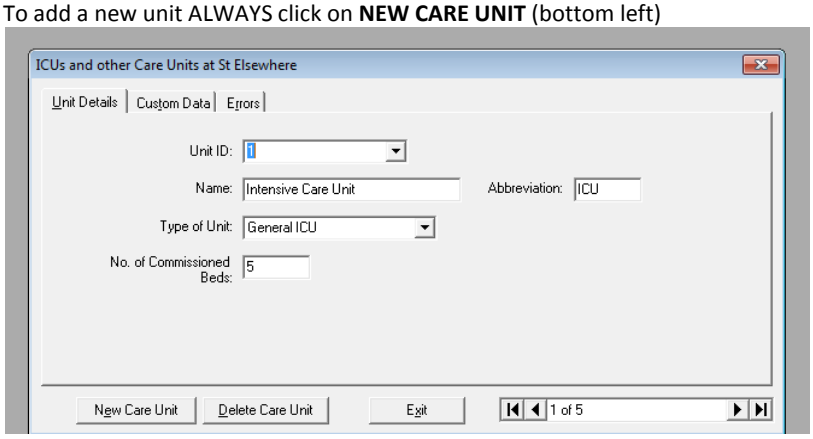
If selected the start date/time for interventions will match the ICU admission date/time

Tick if collecting ANZPIC data

Care Unit Form

(Click on the CARE UNITS tab in the main menu bar)

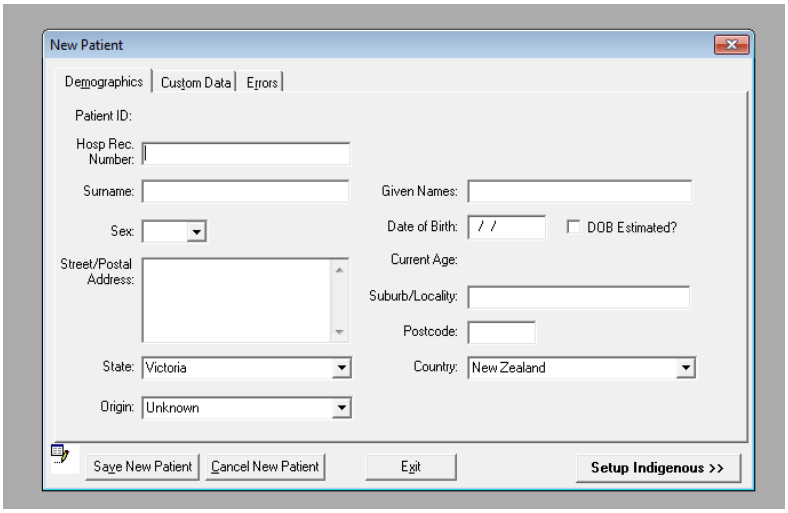
To add a new unit ALWAYS click on **NEW CARE UNIT** (bottom left)



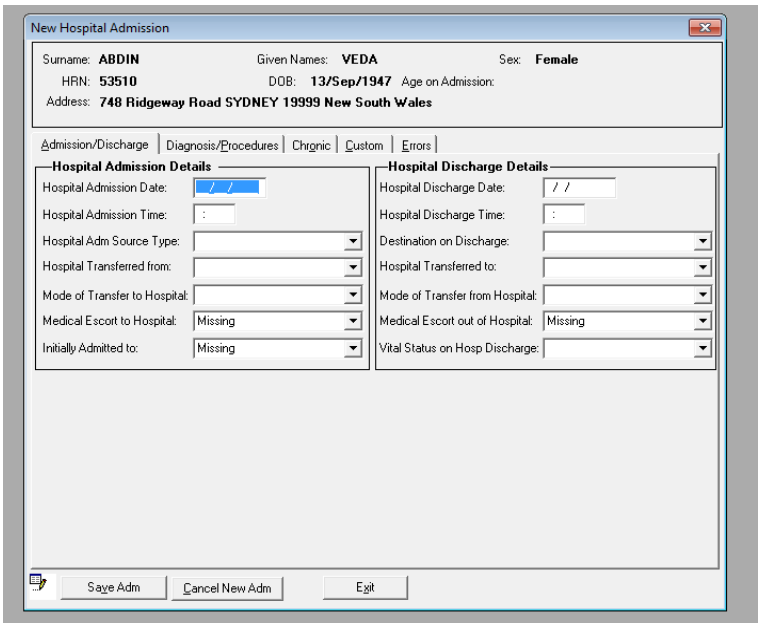
Patient Details Form

(Click on the PATIENTS tab in the main menu bar)

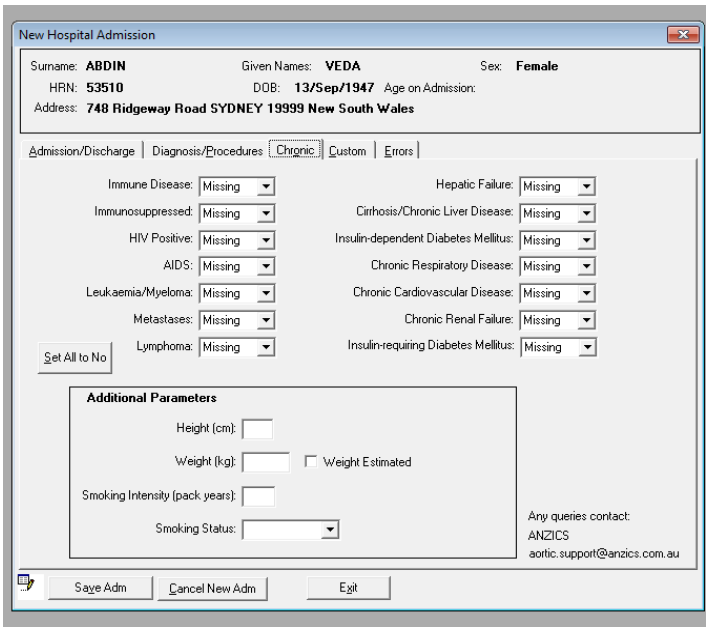
To add a new patient ALWAYS click on **NEW PATIENT** (bottom left)



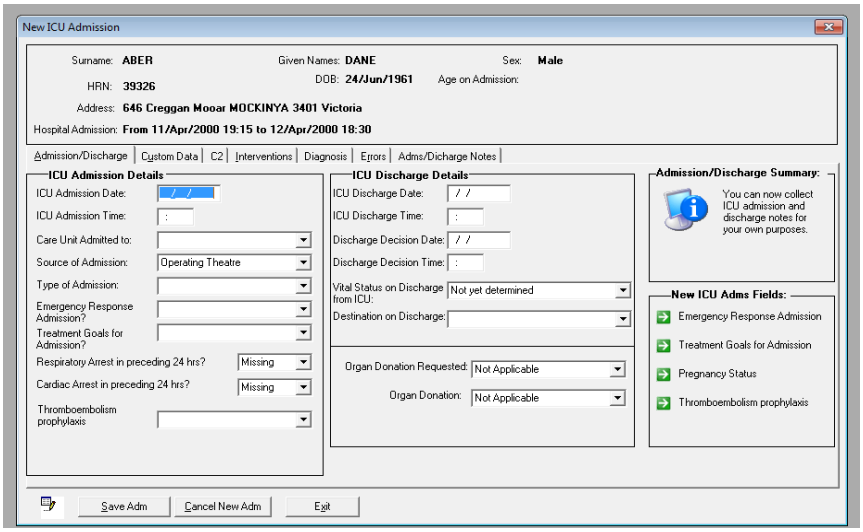
Hospital Admissions Form



Chronic Conditions Form



ICU Admission Form



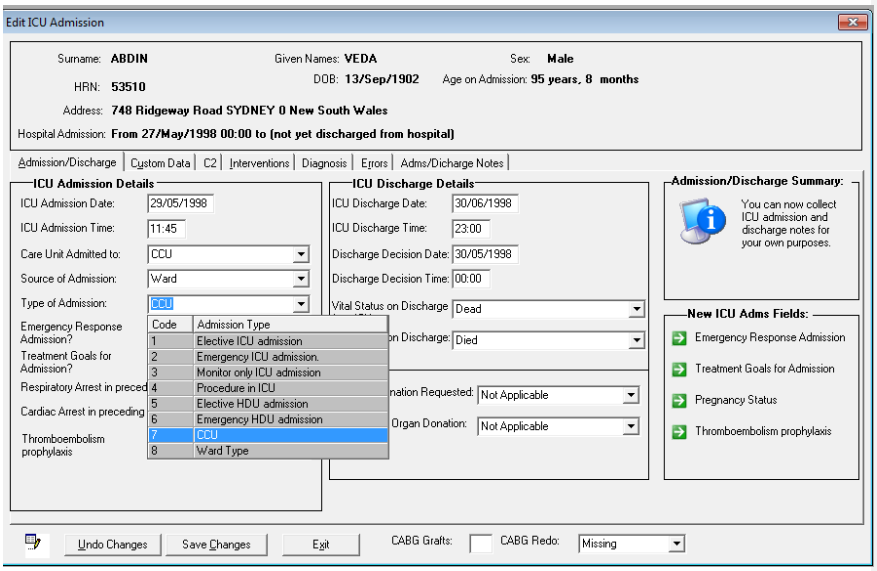
Please note that when selecting from the drop down list 'Care Unit Admitted to' is the geographical unit managed by a dedicated team; for example Intensive Care unit, and 'Type of Admission' maybe HDU/ICU and Elective/Emergency.

Please note exclusions in the APD dataset, for example:

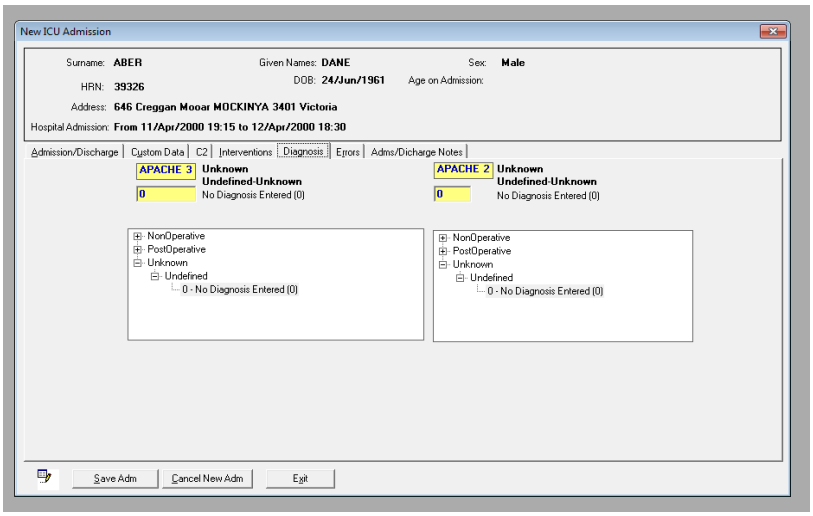
APD Apache 3 Exclusions are

- Age<16
- ICU Length of stay <4 hours
- Readmissions during same hospital stay
- Patients transferred to other ICU
- Patients missing all physiology data
- CCU Patients
- Ward Patients
- Procedure Patients

Patients admitted to the separate CCU care unit are also not included in the ANZICS dataset and should be entered as CCU unit and CCU patient type.

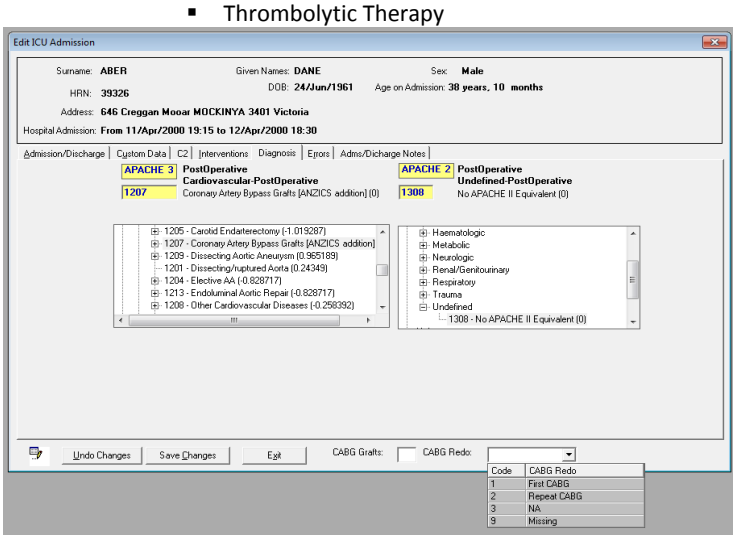


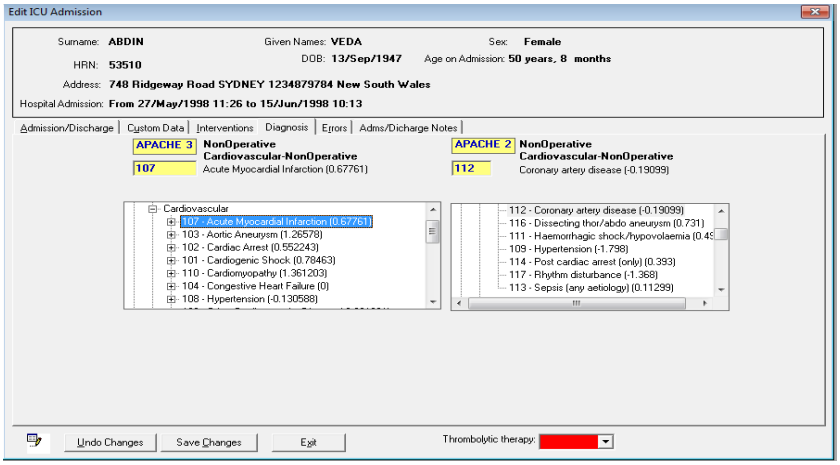
Diagnosis Form



APACHE III – J: mandatory diagnosis fields

- Expanded list to 116 codes
- Some codes have been superseded
- Four new diagnostic categories
- Allows for more specific unit reporting as well as the calculation of the APACHE III-J SMR
- Latest algorithm
- 3 mandatory fields associated with diagnosis:
    - CABG patients
        - Number of CABGs
        - CABG redo
    - AMI patients
        - Thrombolytic Therapy

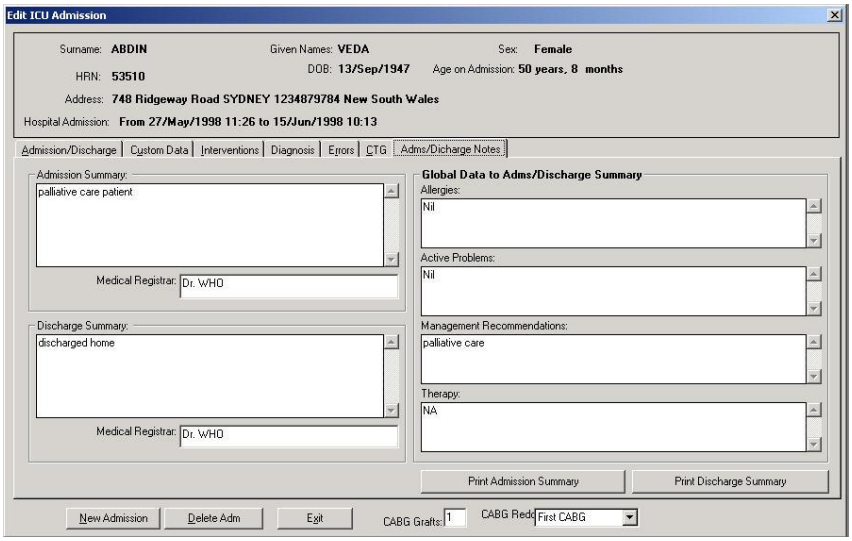




Admission & Discharge Notes

The admission and discharge summary can then be printed off for future use.

The screen below shows what information can be entered for every patient to be included in admission and discharge summary.



Example of Discharge Summary after clicking Print Discharge Summary button

Hospital: ST ELSEWHERE

Discharge Summary

Date Printed: 16/11/2007 2:21:43 PM

Patient Details			
Surname:	ABDIN	**HRN/MRN:**	53510
Given Name:	VEDA	**DOB:**	13/09/1947
Sex:	F	**Age:**	50
Hospital Adms			
Hosp Adms Date Time:	27/05/1998 11:26:00 AM	**Hosp Discharge Date Time:**	15/06/1998 10:13:00 AM
Hospital Adms Source:	Home		
Care Unit Adms			
Care Unit Name	High Dependency		
ICU Admission Date Time:	29/05/1998 11:45:00 AM	**ICU Discharge Date Time:**	30/05/1998 7:25:00 PM
ICU Admission Source:	Other Hospital		
ICU Length of Stay (Hours):	31.67		
ICU Outcome:	[Destination: Ward] / [Vital Status: Alive]		
APACHE II:	1308: No APACHE II Equivalent		
APACHE III:	1207: Coronary Artery Bypass Grafts [ANZICS addition]		

Admission Note

palliative care patient

Discharge Note

discharged home

Allergies

Nil

Active Problems

Nil

Management Recommendations

palliative care

Therapy

NA

Organ Donation Requested:	Not Applicable	**Organ Donation:**	Not Applicable

Intervention	Start Date	Time	End Date	Time	Hours
Central Venous Line	29/05/1998	9:23:00 PM	30/05/1998	5:50:00 AM	8.45
Non-Invasive Ventilation Triple Lumen	29/05/1998	10:00:00 PM	30/05/1998	3:00:00 AM	5
Intubation	29/05/1998	9:30:00 PM	30/05/1998	3:01:00 AM	5.52

Medical Registrar: (Adms) Dr. WHO

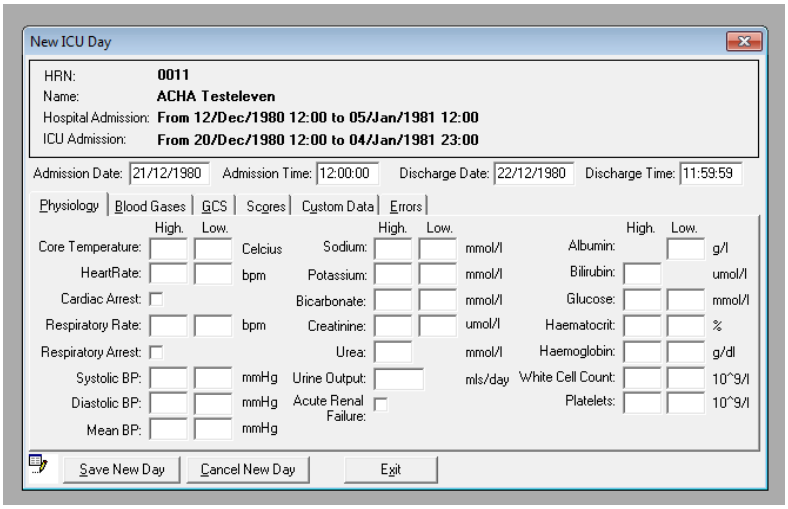
Signature:

Medical Registrar: (Discharge) Dr. WHO

Signature:

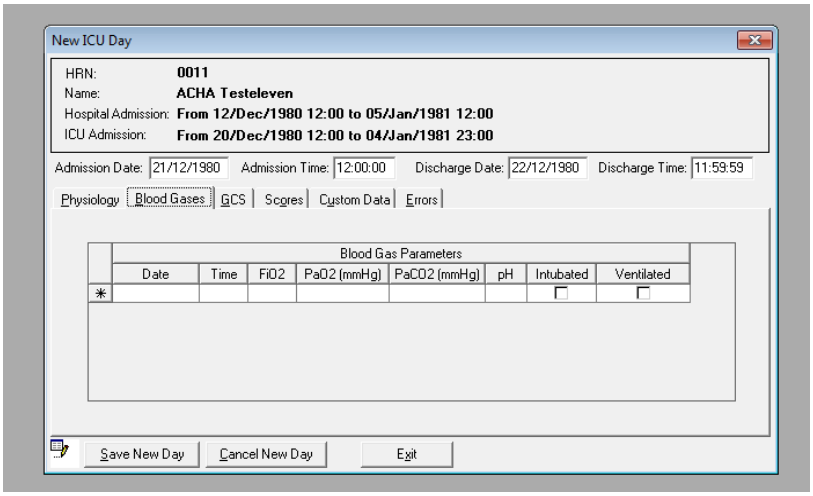
ICU Day Form – physiology data entry

For APD data submission, physiology data only needs to be collected for the first 24 hours in ICU.



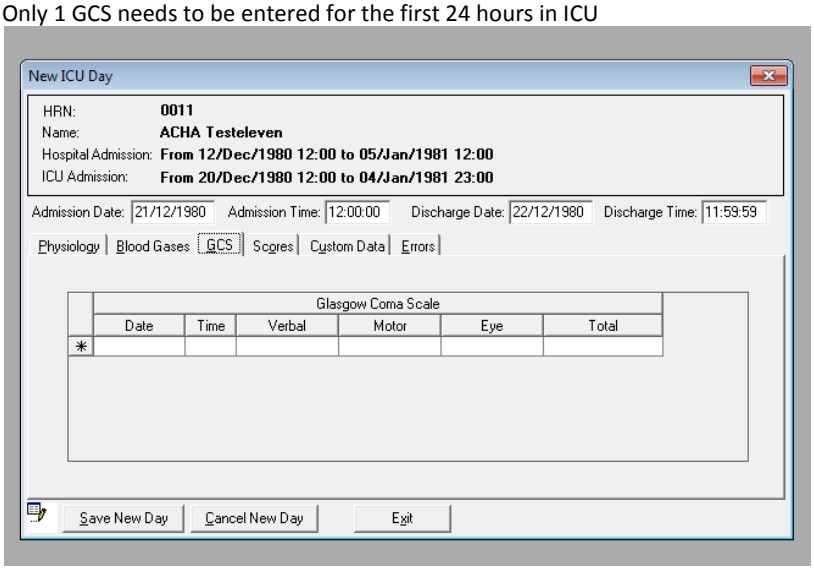
Blood Gas Form

All arterial blood gases taken during the first 24 hours in ICU should be entered into AORTIC – AORTIC will then determine the worst for APACHE II and III.



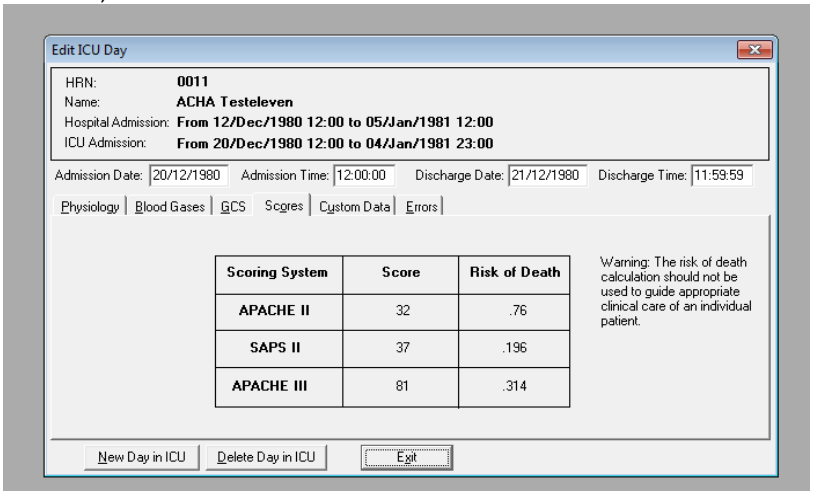
Glasgow Coma Score Form

Only 1 GCS needs to be entered for the first 24 hours in ICU



Scores Form

Once physiology data has been entered for a patient, AORTIC will calculate the APACHE II, SAPS II and APACHE III score and risk of death.

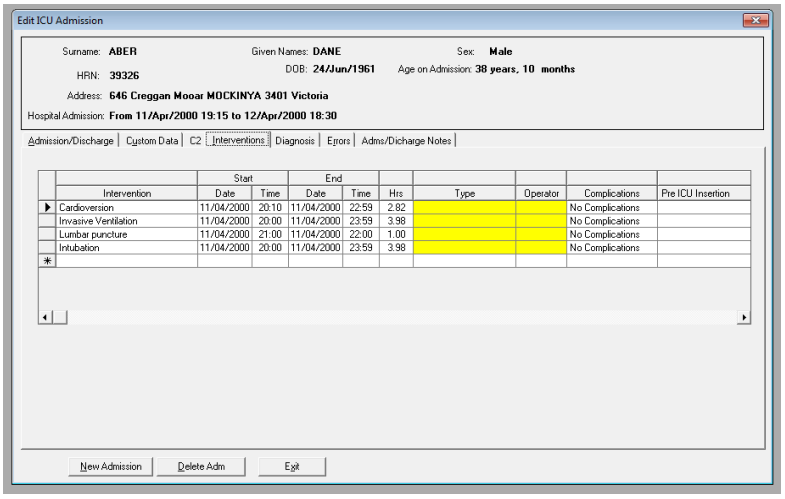


Note: Patients admitted as ward, procedure only and CCU admissions will not receive scores or a risk of death. CABG admissions will not receive an APACHE II risk of death.

Interventions

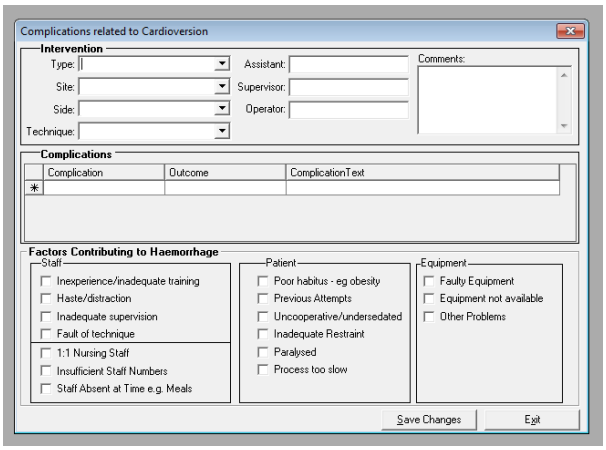
Note: This data is not part of the APD minimum dataset and is therefore not required by the APD. It is, however, mandatory for the ANZPIC Registry, and all interventions on the ANZPICR Episode Collection Form need to be setup within AORTIC.

When entering an intervention the intervention is first selected from a dropdown list.



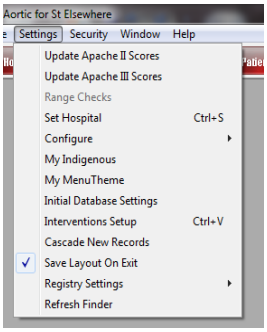
Intervention Complications

Intervention complications can be added by double clicking on the complications button.

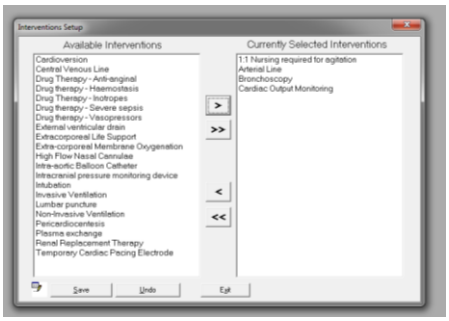


Customising the Intervention List

The list of available interventions can be customised using a new form which is opened from the main menu - Settings / Intervention Setup.

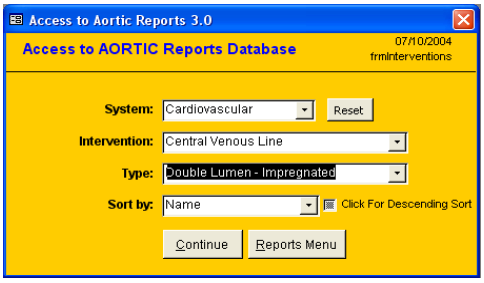


The interventions listed in the right hand pane are those that are displayed. Moving an intervention from the right pane to the left removes that intervention from the dropdown list in the Interventions Data Tab.



Reporting on the Interventions

Aortic now provides the facility to print reports based on the new interventions. Simply select the System, Intervention, Type and Sort by, required from the drop down list boxes.



Interventions and their corresponding types

The following are all the interventions with their corresponding type found in AORTIC

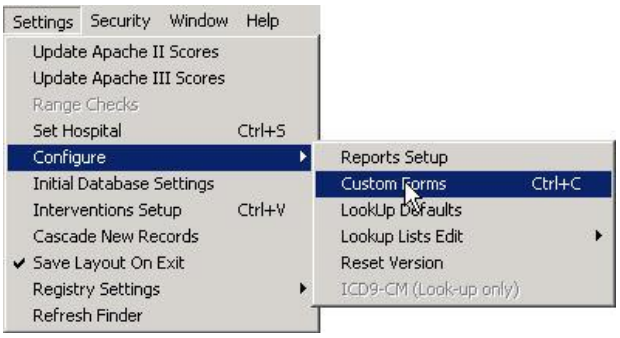
Intervention	Type
1:1 Nursing required for agitation	
Arterial Line	Axillary
	Brachial
	Femoral
	Radial
Bronchoscopy	Fibre optic
	Rigid
Cardiac Output Monitoring	Continuous
	Doppler
	Oximetric
	Picco
	Standard
Cardioversion	
Central Venous Line	22 g
	Double Lumen
	Double Lumen - Impregnated
	Five Lumen
	Hickmans - Double Lumen
	Hickmans - Single Lumen
	Hickmans - Triple Lumen
	Oximetric PA Catheter
	Quad Lumen
	Quad Lumen - Impregnated
	Single Lumen
	Single Lumen - Impregnated
	Thermodilution PA Catheter
	Triple Lumen
	Triple Lumen - Impregnated
	Vas Cath
Drug Therapy - Anti-anginal	GTN
Drug Therapy - Haemostasis	Activated factor VII
	AT3
	Trasylol
Drug Therapy - Inotropes	Adrenaline
	Dobutamine
	Dopamine
	Dopamine - Inotropic
	Dopamine - Renal
	Dopexamine
	Isoprenaline
	Levosimendan
	Milrinone
	Other
Drug Therapy - Severe sepsis	Activated Protein C

Intervention	Type
Drug Therapy - Vasopressors	Metaraminol
	Noradrenaline
	Phemtolamine
	Vasopressin
External ventricular drain	
Extra-corporeal Life Support	
Extra-corporeal Membrane oxygenation	ECMO
High flow nasal cannulae	
Intra-aortic Balloon Catheter	
Intracranial pressure monitoring device	Intraventricular Catheter
	Subarachnoid Bolt
	Parenchymal
	Subdural Catheter
Intubation	Nasotracheal
	Orotracheal
	Tracheostomy
Invasive Ventilation	
Lumbar puncture	
Non-Invasive Ventilation	BIPAP
	CPAP
Pericardiocentesis	
Plasma exchange	Plasmapheresis
Renal Replacement Therapy	CVVD
	CVVHD
	CVVHDF
	EDDF
	IHD
	Peritoneal Dialysis
	SLEDF
Temporary Cardiac Pacing Electrode	Epicardial
	Transcutaneous
	Transvenous

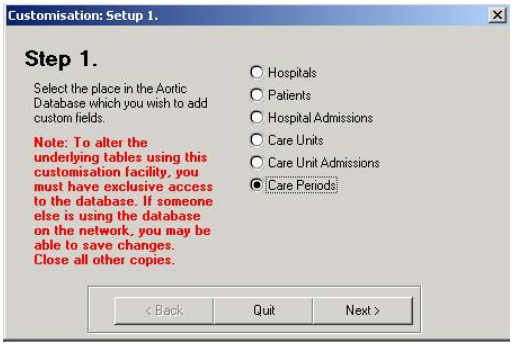
Custom Tabs

- Provides the functionality to create and manage a large number of custom fields.
- Up to 5 tabs can be used.
- It is important to identify where the Custom data should be collected e.g. **Hospitals**, **Care Units**, **Patients**, **Hosp Adms**, **Unit Adms**, **Physiology** etc.
- Click on **Settings > Configure > Custom Forms** to see the **Customisation: Setup 1.** window as shown below.

Please note, no custom data is exported to the APD, it is only available locally.

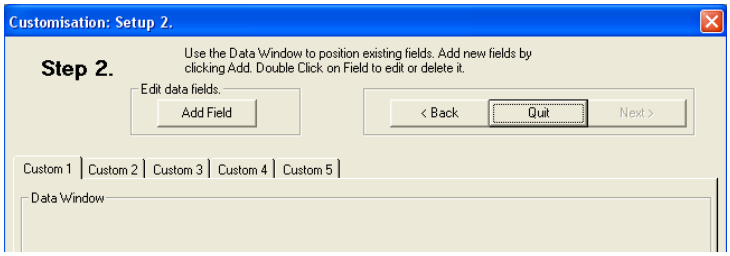


The following screen appears where you can select the location of your **Custom Data** fields – choose the tab that the custom form will be located on.

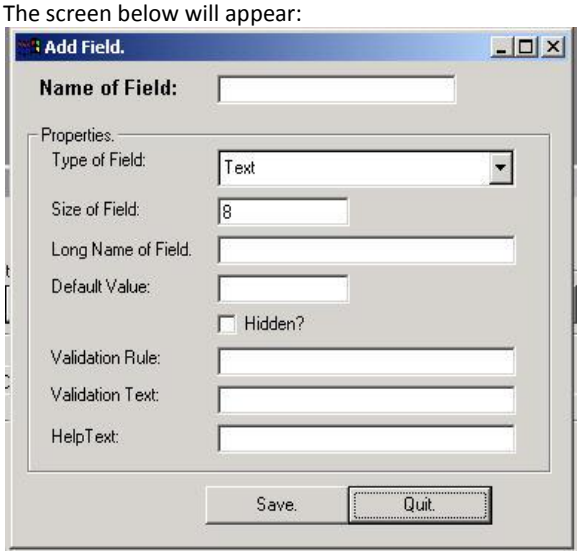


Click **Next** to proceed to **Step 2**

The following Window appears for Step 2. Click on **Add Field**



The screen below will appear:



Name of Field:

- This is the name that will be used in the backend of the database.
- It cannot contain any spaces.
- You will need to make a note of this field name so that you can create queries using this field to extract the data collected.

Properties of the field should be determined as follows:

Type of Field has options as follows:

- **Text** – Appropriate for collecting text data like names, comments etc.
- **Date** – For collecting dates
- **True/False** – Appropriate for collecting Yes/No type of data (creates a tick box).
- **Lookup** – Produces a drop down list of options.
- **Integer** – Appropriate for collecting number data with whole numbers.
- **Decimal** – Appropriate for collecting number data with decimals.

Size of Field:

- Determines how many characters can be entered
- Will vary depending on the information you are trying to collect.

Long Name of Field:

- This is the descriptive name of the field which is displayed on the custom form in AORTIC – it is what people will see when they enter the data.

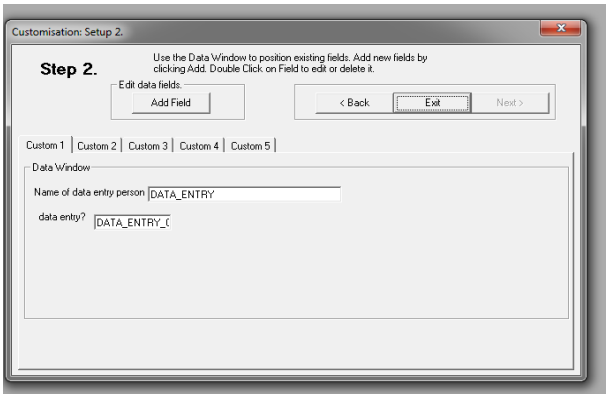
Default Value can be entered if you want to set up the value when this field is displayed every time you access the custom data form.

Validation Rule/Validation Text can be used to create rules for the data collection of the custom field.

Help Text can be entered to help the data entry person to know more about the field. This gets displayed when you move your curser over the Custom Field.

Click **Save** after you enter all the information – make sure the data you have entered in correct, as some fields cannot be changed once saved.

You will see your Custom data Field and the data collection box where data will be entered.



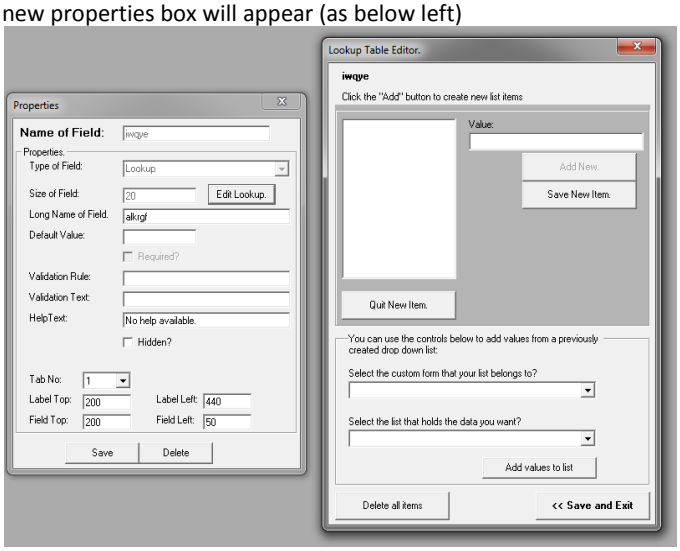
Drag the new field (and data entry box) to the appropriate position in the form.

You can add as many data fields as you can on the form.

Click on **Exit** to exit the Custom Data Form.

The new custom data element will now be available to you on the selected data collection form view.

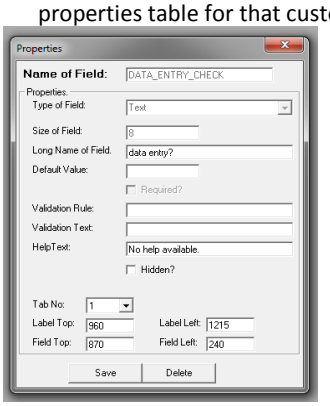
Additional step for lookup custom fields:
Before you exit the customisation screen, double click in the data collection box, a new properties box will appear (as below left)



Click on **Edit Lookup** and the **Lookup Table Editor** will appear (above right)
Click on **Add New**
Enter a list item in the value box, click **Save New Item** (the item will move across to the left)
Continue this process until your list is complete
When finished click **Save and Exit**

Deleting a custom field: 2 options

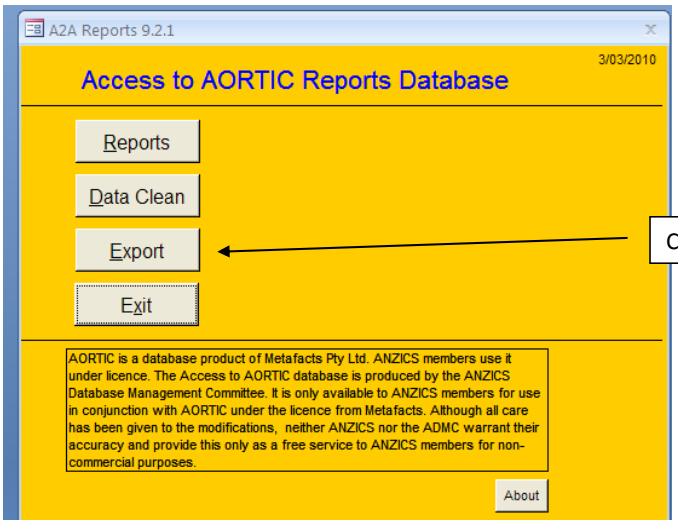
- Click on **Settings > Configure > Custom Forms**
- Choose the tab the contains the custom field you wish to delete and click **Next.**
- Double click on the data entry box for the custom field you wish to delete, the properties table for that custom field will open.



Click **DELETE** to delete the custom field all together – all data associated with this custom field will also be deleted.

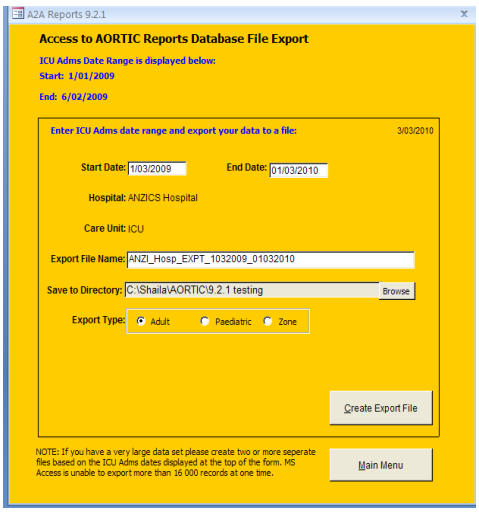
Tick **HIDDEN** if you would prefer to keep the data, but no longer have the custom field appear on the data entry screens.

Creating your data submission file in AORTIC



APD collects data from all the contributing sites on Quarterly basis

- Once the export file is created for the submission please email it to data.submit@anzics.com.au
- Also please remember to create an export for at least one year of the data so that APD central database receives the correct and updated records
- If you have any queries regarding data submission please contact Tamara on 03 93403426 or tamara.bucci@anzics.com.au and / or quarterly reports please contact Shaila on 03 9340 3426 or shaila.chavan@anzics.com.au
- Please refer to the "AORTIC for ANZPIC Registry" section for details on exporting paediatric data submissions.



- Enter data range
- Choose which Hospital and care unit the export file will be for (your hospital and all units will be the default)
- Keep the default export name
- Choose a location to save the export file
- Choose ADULT for export type
- Click CREATE EXPORT FILE
- Locate your saved file and email it as an attachment to ANZICS

To ensure that you have the correct data submission date and admission period required you can review the list on the ANZICS website:
www.anzics.com.au/apd/apd-data-submission

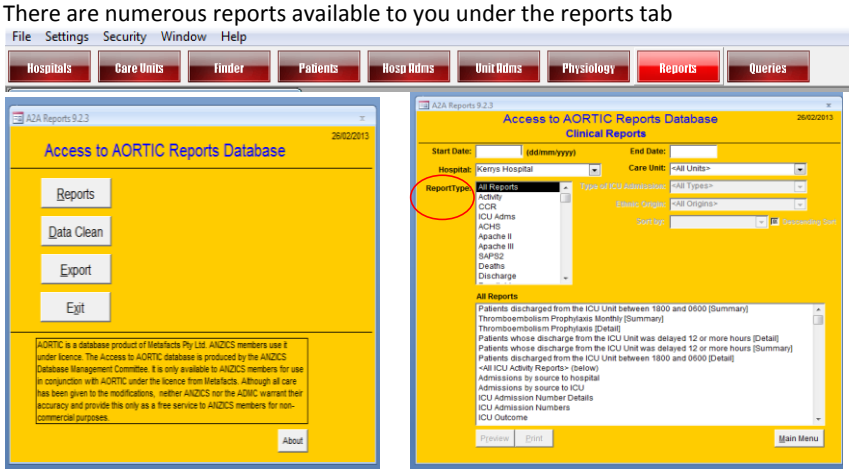
APD Data Submission Schedule

QUARTER	SUBMISSION DATE	ADMISSION PERIOD REQUIRED	REPORTS TO ICUs	REPORTS TO REGIONAL REP's
Q4 2013	Mon 03/02/2014	01/01/2013 – 31/12/2013	07/02/2014	28/02/2014
Q1 2014	Thurs 01/05/2014	01/04/2013 – 31/03/2014	08/05/2014	30/05/2014
Q2 2014	Frid 01/08/2014	01/07/2013 – 30/06/2014	07/08/2014	29/08/2014
Q3 2014	Mon 03/11/2014	01/10/2013 – 30/09/2014	10/11/2014	28/11/2014
Q4 2014	Mon 02/02/2015	01/01/2014 – 31/12/2014	09/02/2015	27/02/2015

N.B. From November 2013 - the APD will only accept 12 months of data per file. If any amendments have been made to data which fall outside these admission dates - please submit this data in a second export file.

Reports available in AORTIC

There are numerous reports available to you under the reports tab



Report TYPE List

Activity

- All Activity Reports.
- Admission by Source to Hospital.
- Admission by source to ICU.
- ICU Admission Number Details.
- ICU Admission Numbers.
- ICU Summary.
- Nature of Admissions.
- Readmissions to ICU.
- Sex of Admissions.
- Intubation.
- Intervention Patient Details.
- ICU Outcome.

ACHS N.B. these reports when used for the current ACHS indicators survey are out of date, however queries are available.

- Patients discharged from ICU Unit between 1800 and 0600 hours [Detail and Summary].
- Patients whose discharge from ICU Unit was delayed 12 or more hours [Detail and Summary].
- Thromboembolism Prophylaxis Monthly Summary and Patient Detail Reports.

CCR (formerly ARCCCR)

- Paediatric ICU Admission Numbers Summary.

- Paediatric ICU Outcome Detail and Summary [Deaths included].
- Number of Paediatric Unit Adms with Invasive Ventilation.
- Number of Unit Adms with Invasive Ventilation ONLY.
- Number of Unit Adms with Non-Invasive Ventilation ONLY.
- Number of Unit Adms with Combined Invasive and Non-Invasive Ventilations ONLY.
- Occupied Bed Days Paediatric.

Deaths

- All Death Reports.
- List of Patients Who Died in ICU.
- Monthly Breakdown of Deaths on Hospital Following ICU.
- Survived ICU, Deceased at Hospital Discharge.

Discharge

- All Discharge Reports.
- ICU Discharge Destination.
- Occupied Bed Days According to Vital Status at ICU Discharge.
- Separation from Hospital.

Casemix

- All Casemix Reports.
- Individual Patient APACHE II Scores.
- Individual Patient APACHE III-J Scores.
- Individual Patient SAPS II Scores.
- Average APACHE II Score.
- Average APACHE III-J Score and Standard Deviation.
- Standard deviation APACHE II Score.
- Standard deviation APACHE III-J Score.
- APACHE III-J Diagnoses.
- APACHE II (ANZICS Modification) Diagnosis.
- APACHE II Score Statistics by Diagnosis with ICU Outcome and Length of Stay.
- APACHE III-J Score Statistics by Diagnosis with ICU Outcome and Length of Stay.
- APACHE II Score Statistics by Diagnosis.
- APACHE III-J Score Statistics by Diagnosis.
- APACHE II Diagnostic Groups.
- APACHE III-J Diagnostic Groups.
- APACHE II SMR.
- APACHE III-J SMR.
- List of Patients who died in ICU.

ICU Adms

- Emergency Response Admissions Monthly Summary and Patient Detail reports.
- Treatment Goals For Admission Monthly Summary and Patient Detail reports.
- Pregnancy Status Monthly Summary and Patient Detail reports.

Stay

- All Stay Reports.
- Average ICU Length of Stay.
- Intubated Days of Care Provided.
- Maximum Length of Stay.
- Minimum Length of Stay.
- Number of Admissions with Stay Greater Than 1 Week.
- Occupied Bed Days.
- Standard Deviation for ICU Length of Stay.
- Average ICU Admission Age.
- Total Number of Patients admitted to hospital based on postcode for a selected state.

Readmissions

- Patients Readmitted to ICU within a Given Number of Hours.
- Readmission List.

Data Clean Report List

- Admission with Missing APACHE II Diagnosis.
- Inconsistent Hospital outcome.
- Missing Hospital outcome.
- Negative length of stay.
- Duplicate ICU admissions.
- Duplicate medical record numbers.
- Data exception check.
- Glasgow Coma Score check.
- Missing ICU Discharge Date/Time.
- Invalid Patient Date of Birth.
- Open ICU Admissions.
- Interventions with no end date.
- AORTIC Errors.
- Patient ICU Admissions without an ICU Day Entry.

Section 4: AORTIC for ANZPIC Registry

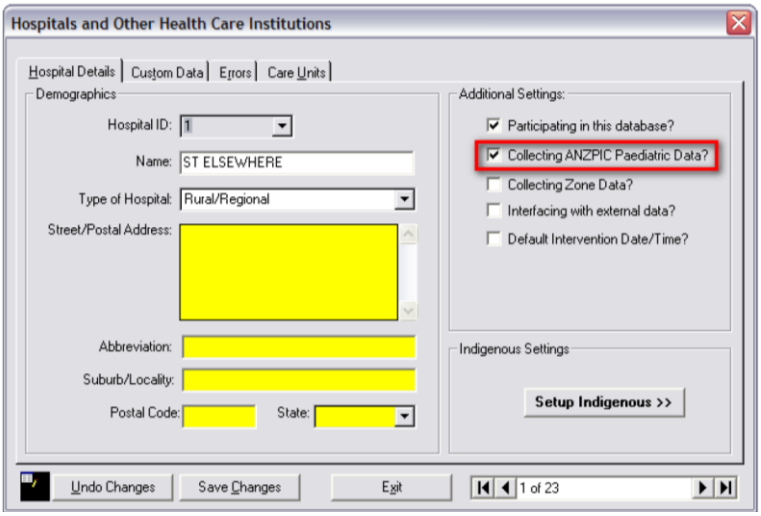
Notable differences between ANZPICR and APD

The main differences between adult and paediatric data collection are the variables collected, the mortality prediction model used and the timing of measurements for that model. The ANZPIC Registry uses the PIM model for mortality prediction. The most recently published model is PIM3, released in 2013.

Paediatric risk of death (PIM) is generated from fields collected from the first measurements taken in the time between ICU staff taking over management of the patient up until the end of the first hour in ICU (different to APACHE where it is based on the worst measurement in the first 24 hours).

Setting up AORTIC to collect and export paediatric data fields

The paediatric data collection fields are slightly different to the APD and therefore the system needs to be set up to include paediatric data. To initiate the paediatric data entry options click on the "Hospitals" tab in the toolbar. Tick the box 'Collecting ANZPIC Paediatric Data', AORTIC will automatically generate paediatric data collection rather than APD forms for any patient less than 16 years of age.



Data submission process

The ANZPIC Registry has 6-monthly submissions of data, although submissions can be made more often if it is easier to submit at the same time as APD. At the moment, our data submission dates are the 1st Sept for January to June data, and the 1st March for July to December data, and submitted to ***anzpic.data@anzics.com.au***

Data cleaning process

The data cleaning process is also different to the APD. After the initial data submission, you are sent a list of queries generated by our checking program. You are then asked to resolve all queries, make any changes to your data, and resubmit your data. It is only when all queries are resolved that we upload your data into our main database. Sometimes this can involve several data submission versions from each site. Please bear with us in the data cleaning process; the number of data queries will probably be quite lengthy to start with as most of our fields are mandatory and we have many range and logic checks. The paucity of numbers in paediatric ICU admissions in Australia and New Zealand makes it important that we receive and record high quality data to support accurate analysis.

Some common errors

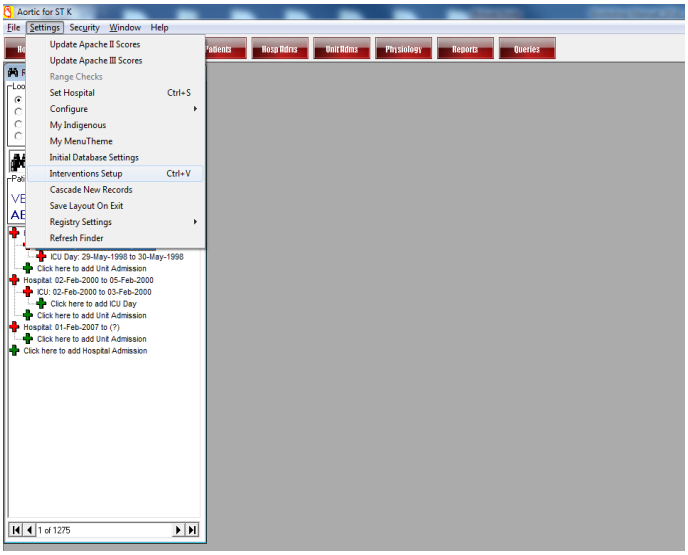
- If a weight is unknown, then its value should be entered as 999.
- If a patient is from overseas, then their postcode should be entered as 9990.
- When collecting episode dates and times (on the Interventions screen), we are only interested in the times during the ICU episode. So if a child is already ventilated prior to their ICU admission, then please use the time of ICU admission as the start time (the same applies if they are discharged ventilated, the end of the episode should be the time of ICU discharge).
- Inconsistency between the code for MechVent and the episodes of ventilation from the Interventions screen. Once a "yes" code has been encountered for MechVent, the checking program will then compare the start time for the first ventilation episode (either invasive or non-invasive) against the time of ICU admission to make sure there isn't a difference of more than 1 hour between the two. If this difference is greater than 1 hour, or if there are no ventilation times, then an error will be generated. Note that an intubation episode is separate to a ventilation episode, and that the MechVent field is being read in conjunction with the first ventilation episode only.
- If a patient is both intubated and ventilated, then <u>both</u> episodes must be recorded in the Interventions screen. Every intubation episode is to be separately entered, while multiple successive ventilation episodes might qualify to be merged into a longer single episode, depending on the rules listed on the ANZPICR Episode Collection Form.
- There are a number of rules around the collection of ventilation episodes. Note the definition of High Flow where the rate has to be >1L/Kg/min or >30L/min to qualify for inclusion. Note however that HFNC does not qualify as “mechanical” ventilation when answering the MechVent field – i.e. if the patient received HFNC within the first hour of ICU admission, then MechVent would be “no”.

Customising the ANZPIC Intervention List

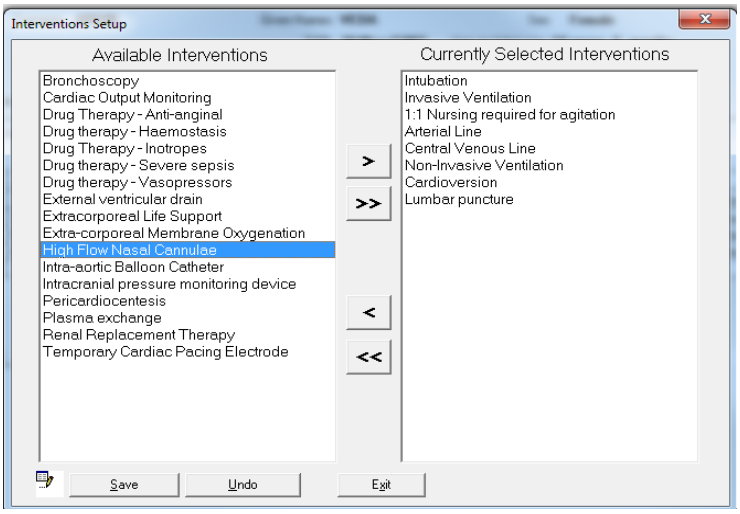
The ANZPIC registry requires collection of data on a detailed set of interventions.

Steps in AORTIC to add HFNC to Interventions list for paediatric data entry

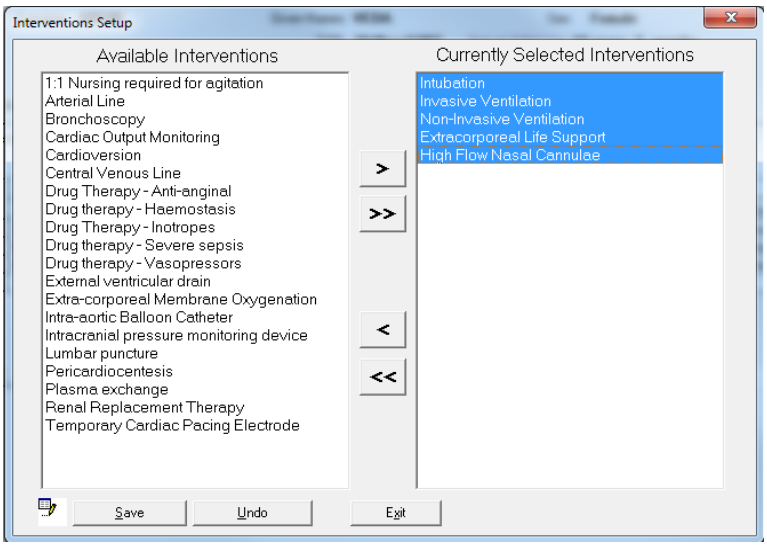
Go to 'Settings' menu; select 'Interventions setup'.



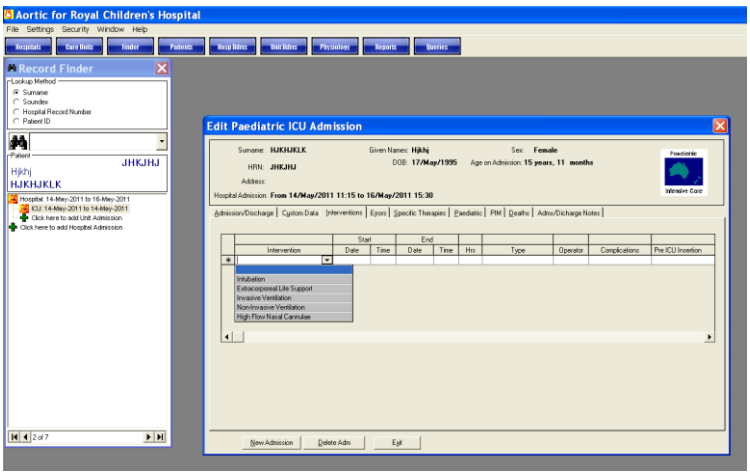
Select 'High Flow Nasal Cannulae' on LHS and click arrow to add to list on RHS.



After included in list, click on 'Save' and 'Exit'. Note for paediatric interventions, all five options on the screen below must be available for selection.



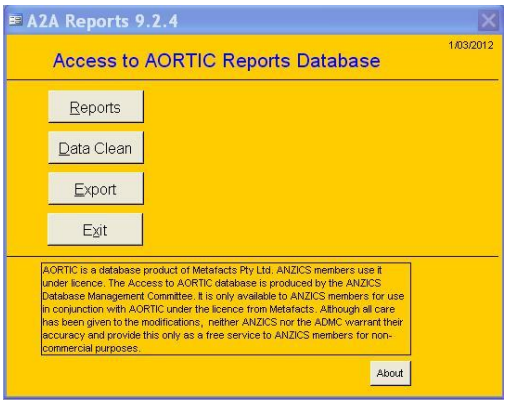
In paediatric ICU admission record, go to 'Interventions' screen. Drop-down list under Intervention should now look like the ANZPICR Episode Collection Form.



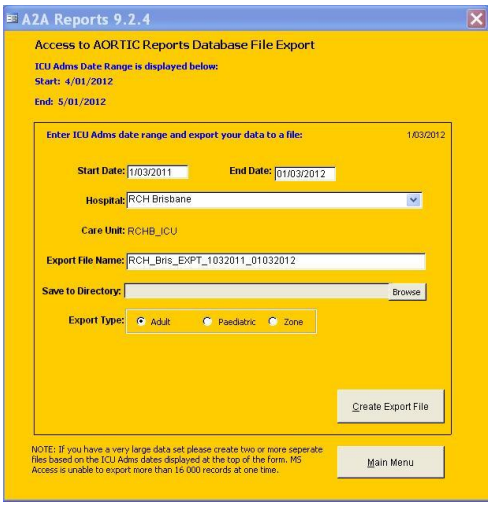
Exporting Data from AORTIC to Paediatric Registry

Unlike the APD export, the data submission to the ANZPIC Registry will consist of 2 files – one which has all information on each admission (and called ANZPIC_ADMISSIONS.TXT), and one which has all individual episodes from the 'Interventions' data entry screen (and called ANZPIC_EPISODES.TXT).

Once data has been entered into AORTIC, click on the 'Reports' icon on the top menu bar. This then opens the Reports window (Access to AORTIC Reports Database).

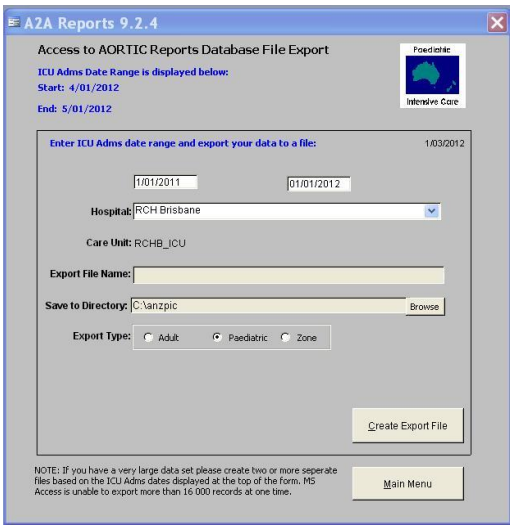


Click 'Export' option.
This then brings up the standard export screen for adult patients.
Click on the "Paediatric" button.

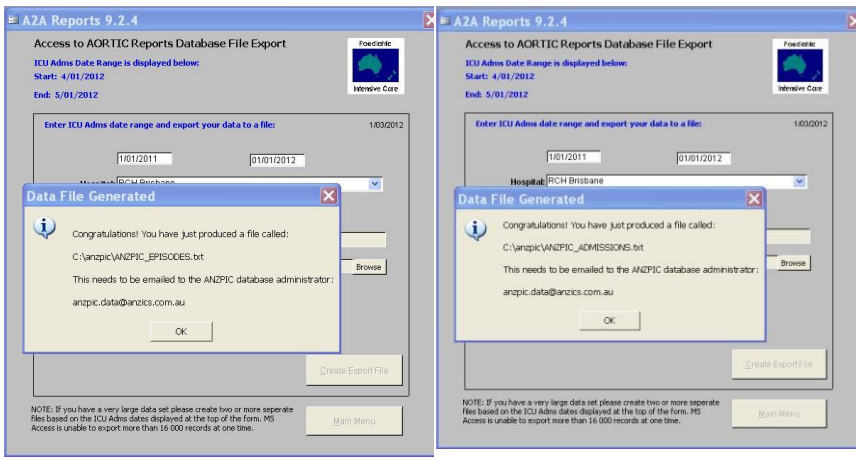


This displays the export screen for the paediatric export.
Enter the start and end dates for the export.
Click on the 'Browse' button to nominate a subdirectory for the export files to be written to **(default assumes a directory called 'anzpic' already exists on C drive).**

Note that, unlike the APD export, nothing can be entered in the Export File Name box.



Click on "Create export file" and the program will generate two notifications screens – one for each of the output files. Click on 'OK' on each screen to complete the export process.



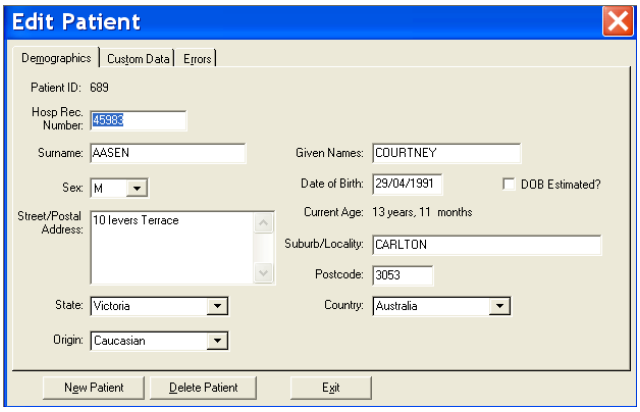
Locate the two files ANZPIC_ADMISSIONS.TXT and ANZPIC_EPISODES.TXT in your nominated directory, and then email to ***anzpic.data@anzics.com.au***

Section 5: AORTIC Fields Mapping For Custom Reports

The purpose of this section is to provide a mapping of the AORTIC data entry screens to the underlying fields in the database to help users create their own queries and reports. In other words, demonstrate where the information for each variable is stored and therefore where to retrieve it from.

Patient Admission Screen

Demographics Tab

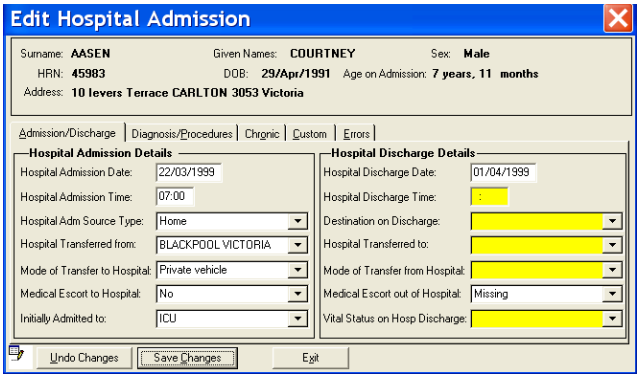


AORTIC Table: PATIENTS

Data Prompt	Field Name	Links to Table
Patient ID	PatientID	
Hosp Rec Number	HospitalRecordNumber	
Surname	Surname	
Given Names	GivenNames	
Sex	Sex	
Date of Birth	DOB	
Street/Postal Address	PatientAddress	
Suburb/Locality	PatientLocality	
Postcode	POSTCODE	
State	PatientStateCode	STATES
Country	PatientCountryCode	COUNTRIES
Origin	OriginCode	ORIGINS
Indigenous	Indigenous	

Hospital Admission Screen

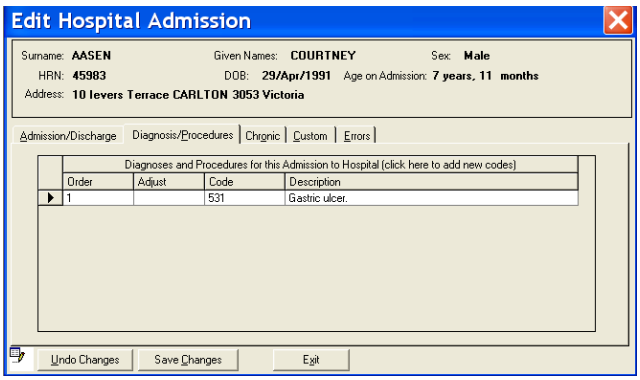
Admission and Discharge Details Tab



AORTIC Table: HOSP_ADMS

Data Prompt	Field Name	Links to Table
Hospital Admission Date	HospAdmDate	
Hospital Admission Time	HospAdmTime	
Hospital Adm Source Type	HospAdmSourceTypeCode	HOSP_ADM_SOURCE_TYPES
Hospital Transferred from	HospAdmSourceHospitalID	HOSPITALS
Mode of Transfer to Hospital	TransferInModeCode	TRANSFER_MODES
Medical Escort to Hospital	MedicalEscortIn	YesNoMissing
Initially Admitted to	DestOnHospAdmCode	DEST_SOURCES
Hospital Discharge Date	HospDisDate	
Hospital Discharge Time	HospDisTime	
Destination on Discharge	HospDisDestTypeCode	HOSP_DIS_DEST_TYPES
Hospital Transferred to	HospDisDestHospitalID	HOSPITALS
Mode of Transfer from Hospital	TransferOutModeCode	TRANSFER_MODES
Medical Escort out of Hospital	MedicalEscortOut	YesNoMissing
Vital Status on Hosp Discharge	HospDisVitalStatusCode	VITAL_STATUSES

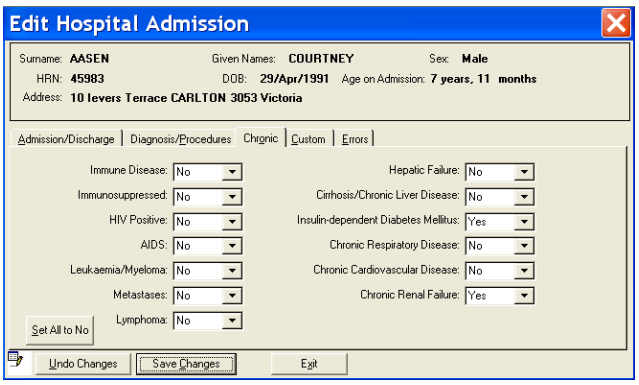
Diagnosis and Procedures Tab



AORTIC Table: HOSP_ADMS_DIAGS

Data Prompt	Field Name
Order	DiagnosisOrder
Code	DiagnosisCode
Description	DiagnosisText

Chronic Conditions Tab

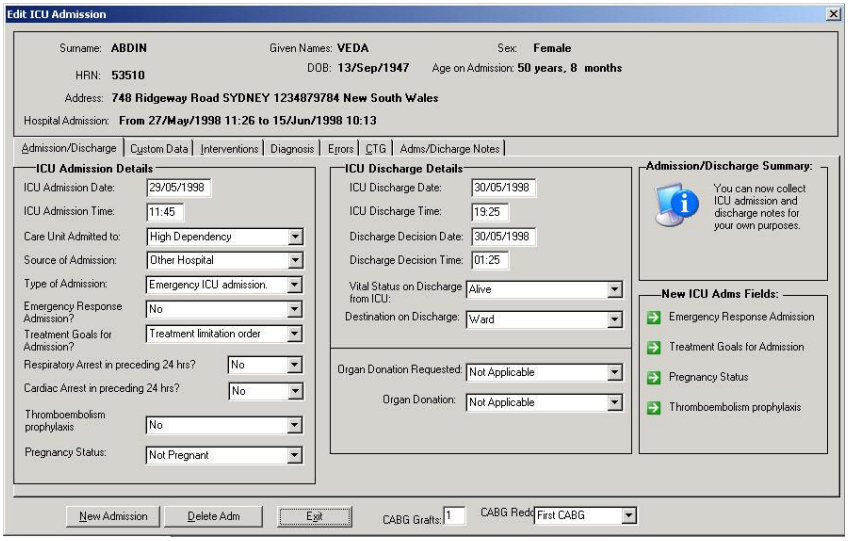


AORTIC Table: HOSP_ADMS

Data Prompt	Field Name	Links to Table
Immune Disease	ImmuneDisease	YesNoMissing
Immunosuppressed	Immunosuppressed	YesNoMissing
HIV Positive	HIVPositive	YesNoMissing
AIDS	AIDS	YesNoMissing
Leukaemia/Myeloma	LeukaemiaMyeloma	YesNoMissing
Metastases	Metastases	YesNoMissing
Lymphoma	Lymphoma	YesNoMissing
Hepatic Failure	HepaticFailure	YesNoMissing
Cirrhosis/Chronic Liver Disease	Cirrhosis/ChronicLiverDisease	YesNoMissing
Insulin-dependent Diabetes Mellitus	IDDM	YesNoMissing
Chronic Respiratory Disease	ChronicRespDisease	YesNoMissing
Chronic Cardiovascular Disease	ChronicCardiovascularDisease	YesNoMissing
Chronic Renal Failure	ChronicRenalFailure	YesNoMissing

Care Unit Admissions Screen

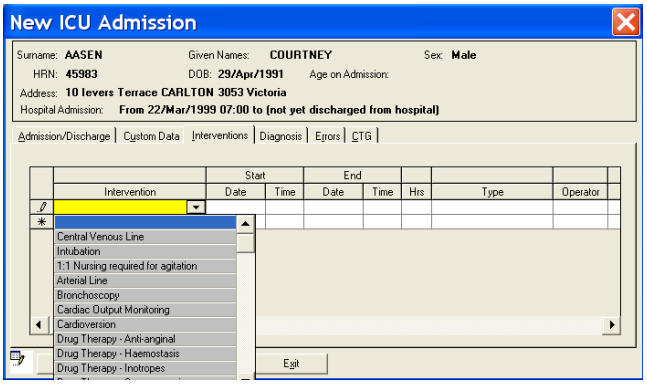
Admission and Discharge Details Tab



AORTIC Table: CARE_UNIT_ADMS

Data Prompt	Field Name	Links to Table
ICU Admission Date	CareUnitAdmDate	
ICU Admission Time	CareUnitAdmTime	
Care Unit Admitted to	CareUnitID	CARE_UNITS
Source of Admission	CareUnitAdmSourceTypeCode	DESTS_SOURCES
Type of Admission	CareUnitAdmTypeCode	CARE_UNIT_ADM_TYPES
Emergency Response Admission	EmergencyResponseAdmission	
Treatment Goals for Admission	TreatmentLimitation	
Respiratory Arrest in preceding 24 Hours	RespArrest	YesNoMissing
Cardiac Arrest in preceding 24 Hours	CardiacArrest	YesNoMissing
Thromboembolism prophylaxis	ThrombProValue	
Pregnancy Status	PregnancyStatus	
ICU Discharge Date	CareUnitAdmDisDate	
ICU Discharge Time	CareUnitAdmDisTime	
Discharge Decision Date	CareUnitDecDisDate	
Discharge Decision Time	CareUnitDecDisTime	
Vital Status on Discharge from ICU	CareUnitDisVitalStatusCode	VITAL_STATUSES
Destination on Discharge	CareUnitDisDestTypeCode	CARE_UNIT_DIS_DEST_TYPES

Interventions Tab

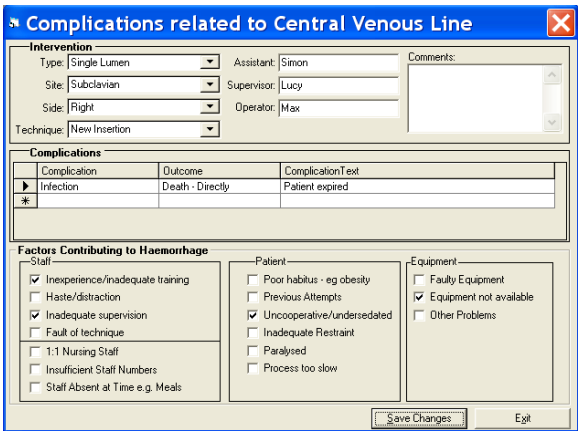


AORTIC Table: Siss

Data Prompt	Siss Field Name	Links to Table
Intubation/Line Insertion Date	SissStartDate	
Intubation/Line Insertion Time	SissStartTime	
Extubation/Line Removal Date	SissEndDate	
Extubation/Line Removal Time	SissEndTime	
Type	Type	SissType
Operator	Operator	
Intervention	Intervention	SissInterventions
Site	Site	
Side	Side	
Technique	Technique	
Assistant	Assistant	
Supervisor	Supervisor	

Note: The Duration field is calculated by AORTIC and is not a field in the Siss table.

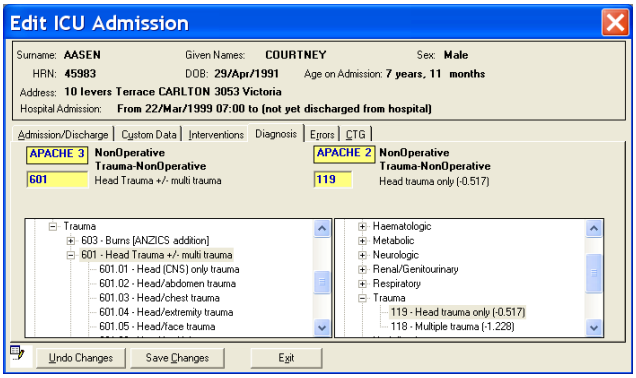
Complications Dialog Box



AORTIC Table: SissComplications

Data Prompt	Field Name
Complication	SissComplication
Outcome	SissOutcome
Complication Text	ComplicationText
Inexperience/inadequate training	Inexperience
Haste/distraction	Haste
Inadequate supervision	PoorSupervision
Fault of technique	FaultyTechnique
1:1 Nursing Staff	NurseRatio
Insufficient Staff Numbers	InsufficientStaff
Staff Absent at Time e.g. Meals	StaffAbsent
Poor habitus – e.g. obesity	BodyHabitus
Previous attempts	PreviousAttempts
Uncooperative/undersedated	Uncooperative
Inadequate restraint	InadequateRestraint
Paralysed	Paralysed
Process too slow	ProcessSlow
Faulty equipment	FaultyEquipment
Equipment not available	MissingEquipment
Other problems	OtherProblems

ICU Diagnosis Tab

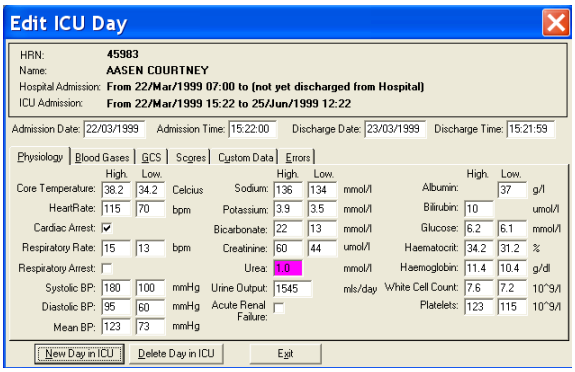


AORTIC Table: CARE_UNIT_ADM_DIAGS

Data Prompt	Field Name	Links to Table
Apache 3/Apache 2	DiagnosticSystem	APACHE3,APACHE2
	DiagnosticCode	
	DiagnosticText	
	DiagnosticCoefficient	
CABG Grafts	CABGGrafts	
CABG Redo	CABGREDO_ID	
Thromboembolism prophylaxis	ThrombolyticTherapy	
Diagnostic subcode	Subcode	

Note: Each ICU Admission record has two related Care_Unit_Adm_Diags records - one for Apache II and another for Apache III. To distinguish between the 2 diagnostic types use the “DiagnosticSystem” field which is set to either “Apache3” or “Apache2”.
Other fields of interest in this table are:
DiagnosticText – text description of diagnosis
DiagnosticCode – code of the corresponding Apache diagnosis

ICU Day Screen - Physiology Tab



AORTIC Table: CARE_PERIODS

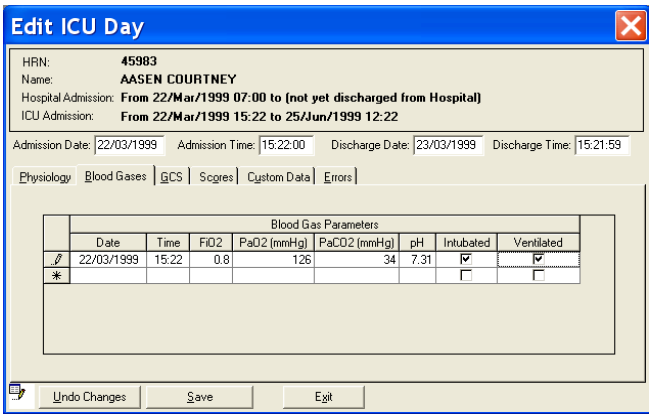
Data Prompt	Field Name
Admission Date	CarePeriodStartDateTime
Admission Time	CarePeriodStartDateTime
Discharge Date	CarePeriodEndDateTime
Discharge Time	CarePeriodEndDateTime

AORTIC Table: CARE_PERIODS (Hi and Low variables)

Data Prompt	Field Name High	Field Name Low
Core Temperature	CoreTempHi	CoreTempLo
Heart Rate	HeartRateHi	HeartRateLo
Cardiac Arrest	CardiacArrest?	na
Respiratory Rate	RespRateHi	RespRateLo
Respiratory Arrest	RespArrest?	na
Systolic BP	SystolicHi	SystolicLo
Diastolic BP	DiastolicHi	DiastolicLo
Mean BP	MAPHi	MAPLo
Sodium	NaHi	NaLo
Potassium	KHi	KLo
Bicarbonate	BicarbonateHi	BicarbonateLo
Creatinine	CreatinineHi	CreatinineLo
Urea	UreaHiOnly	na
Urine	UrineOutputHiOnly	na
Acute Renal Failure	AcuteRenalFailure?	Na
Albumin	na	AlbuminLoOnly
Bilirubin	BilirubinHiOnly	na
Glucose	GlucoseHi	GlucoseLo
Haematocrit	HaematocritHi	HaematocritLo
Haemoglobin	HaemoglobinHi	HaemoglobinLo
White Cell Count	WhiteCellCountHi	WhiteCellCountLo
Platelets	PlateletsHi	PlateletsLo

Notes: All the fields in this table that end with "un" e.g.: SystolicUn contain a text description of the corresponding units e.g.: "mmHg"

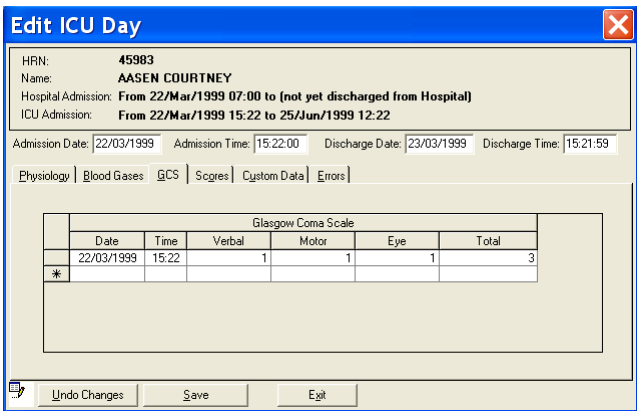
Blood Gases Tab



AORTIC Table: BLOOD_GASES

Data Prompt	Field Name
Date	BloodGasDateTime
Time	BloodGasDateTime
FiO_2	FiO_2
PaO_2 (mmHg)	PaO_2
$PaCO_2$ (mmHg)	$PaCO_2$
pH	pH
Intubated	Intubated
Ventilated	Ventilated

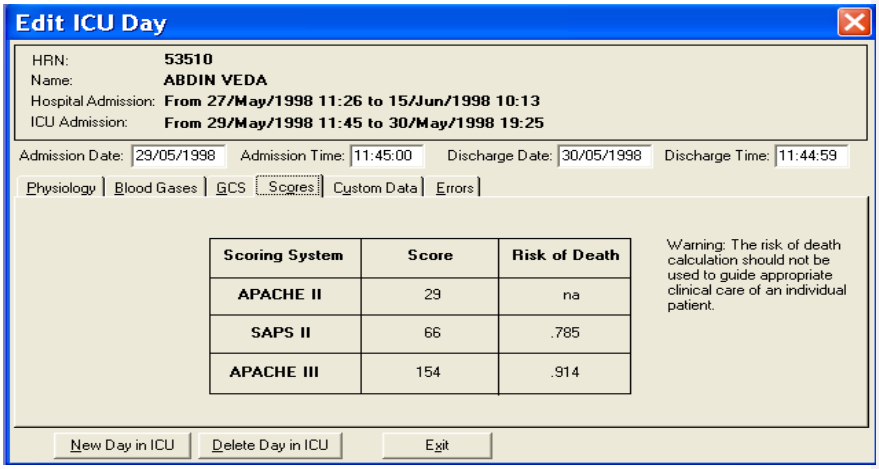
GCS Tab



AORTIC Table: GLASCOW_COMA_SCORES

Data Prompt	Field Name
Date	GCSDateTime
Time	GCSDateTime
Verbal	GCSVerbal
Motor	GCSMotor
Eye	GCSEye
Total	GCSTotal

Scores Tab



AORTIC Table: Scores

Data Prompt	Table Field Name
Apache II,III SAPS II Score	Score
Apache II,III SAPS II Risk of Death	RiskofDeath
Apache II,III and SAPS II	ScoringSystemID
Apache II,III and SAPS II	ScoringSystemName
	AcutePhysiologyScore
	OxygenScore
	pHAcidosisScore
	GCSScore
	AgeScore
	ChronicHealthScore

Note: For every ICU day record 3 score records exist –for Apache II, Apache III and for SAPS2. Use the "ScoringSystem" field in this table to distinguish between the three scoring systems. For Apache II ScoringSystem= 'Apache 2", for Apache III ScoringSystem = "Apache 3", SAPS 2 the ScoringSystem = 'SAPS 2".

Related Tables:

AORTIC Table: APACHE2

Data Prompt	Field Name
Apache 2	AP2DIAGCODE
Apache 2	POSTOP_NON
Scoring System	SYSTEM
Apache 2	DIAGNOSIS
Diagnosis coefficient	A2COEFFICI

AORTIC Table: APACHE3

Data Prompt	Field Name
Apache 3	AP2DIAGCODE
Apache 3	POSTOP_NON
Scoring System	SYSTEM
Apache 3	DIAGNOSIS
Apache 2 Mapping	APACHE2LIN
Diagnosis coefficient	A3Coefficient

Custom Data

The custom field tables are a one to one mapping of their related table e.g.: for each hospital admission in HOSP_ADM there is a corresponding record in CustomHospitalAdmission which contains the custom fields.

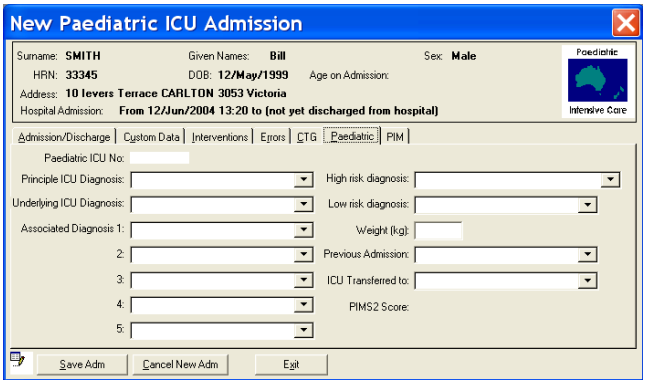
Base Table	Custom Table	Join Field
PATIENTS	CustomPatients	PatientID
CARE_UNITS	CustomCareUnits	CareUnitID
HOSP_ADMS	CustomHospitalAdmission	HospAdmID
CARE_UNT_ADMS	CustomCareUnitAdmissions	CareUnitAdmID
CARE_PERIODS	CustomCarePeriods	CarePeriodID
Siss	CustomSiss	SissID

AORTIC Table: Vital Statuses

Data Prompt	Field Name
	VitalStatusCode
	VitalStatus

Note: Vital Status Code provides a list of 0 (dead), 1 (alive) and 9 (unknown).
Vital Status provides a list of dead, alive, unknown.

Paediatric Tab



AORTIC Table: tblCareUnitAdmsPDiag

Data Prompt	Field Name	Links to Table
Principal ICU Diagnosis	PaedDiag_ID	tblPaedDiag
Underlying ICU Diagnosis	PaedDiag_ID	tblPaedDiag
Associated Diagnosis 1-7	PaedDiag_ID	tblPaedDiag
Associated Diagnosis 1-7	AssocNo	

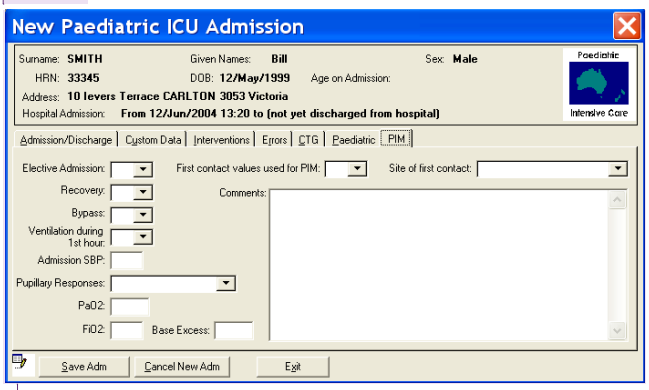
AORTIC Table: CARE_UNIT_ADMS

Commented [s1]: Can this be updated, please? (see Josetin for details) PIM3 with have 3 "risk" conditions

Data Prompt	Field Name	Links to Table
High risk diagnosis	HIGHRISK_ID	tblHighRisk
Low risk diagnosis	LOWRISK_ID	tblLowRisk
Weight	WT	
Previous Admission	PREVAD_ID	tblPrevAd
ICU Transferred to	ICUTO_ID	tblICUTO

Note: The diagnosis fields are stored in the table tblCareUnitAdmsPDiag. The different types of diagnoses can be distinguished using the PaedDiagType_ID field in this table: 1=principal; 2=underlying; 3=associated. The 7 different associated diagnoses can be differentiated by referring to the AssocNo field. AssocNo=1 is the first associated diagnosis; AssocNo=2 is the second associated diagnosis etc.

PIM Tab



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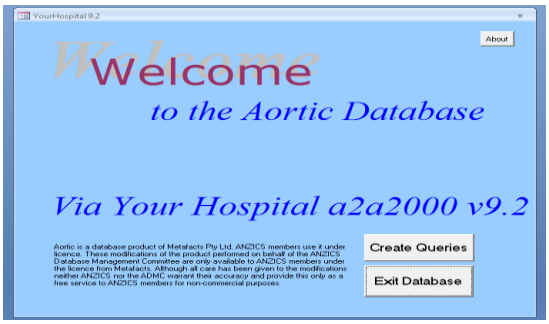
AORTIC Table: CARE_UNIT_ADMS

Data Prompt	Field Name	Links to Table
Elective Admission	ELECTIVE	YesNoMissing
Recovery	RECOVERY	YesNoMissing
Bypass	BYPASS	YesNoMissing
Ventilation during 1st hour	RS_HR124	YesNoMissing
Admission SBP	SBPA	
Pupillary Responses	PUPIL_ID	tblPupils
PaO2	PaO2	
FiO2	FiO2	
Base Excess	BEA	
First contact values used for PIM	PIM_VAL	YesNoMissing
Site of first contact	CONTACT_ID	TblContact
Comments	COMMENTS	

Section 6: ACCESS Queries in AORTIC

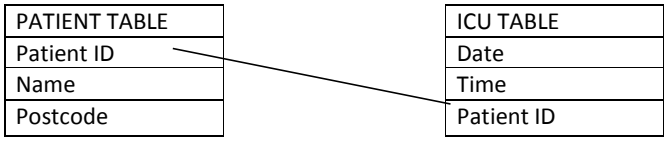


Basic ACCESS Concepts

Database: collection of data related to the same topic. The AORTIC database contains data pertaining to patient's ICU Admission and Discharge. Databases allow this data to be stored and organised in a logical fashion for easy access. The structure of the stored data is defined by the user.

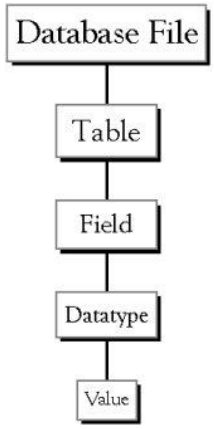
An ACCESS database is a file with an extension of .mdb and it holds all of the database objects.

An ACCESS database is a "Relational" database: data is stored in tables which are related to each other. For example the ICU Admission Table is related to the Patients Table through the Patient ID. This way the data can be stored in a logical and efficient manner without duplicating data amongst the tables.



Database Management System: To develop an efficient database management system (DBMS), data needs to be split into logical groupings and stored into different tables. Example: the patient's name, date of birth and hospital record number need only be entered once and stored in one place. A unique identifier is allocated to this patient and the unique identifier is then used to link the patient to all the other data.

A Visual Breakdown



Database File: This is your main file that encompasses the entire database and that is saved to your hard-drive or floppy disk. Example: a2a2000.mdb

Table: A table is a collection of data about a specific topic. There can be multiple tables in a database.
Example: ICU Admission, Example #2) Patients

Field: Fields are the different categories within a Table. Tables usually contain multiple fields.
Example: Patient LastName ,Example #2) Patient FirstName

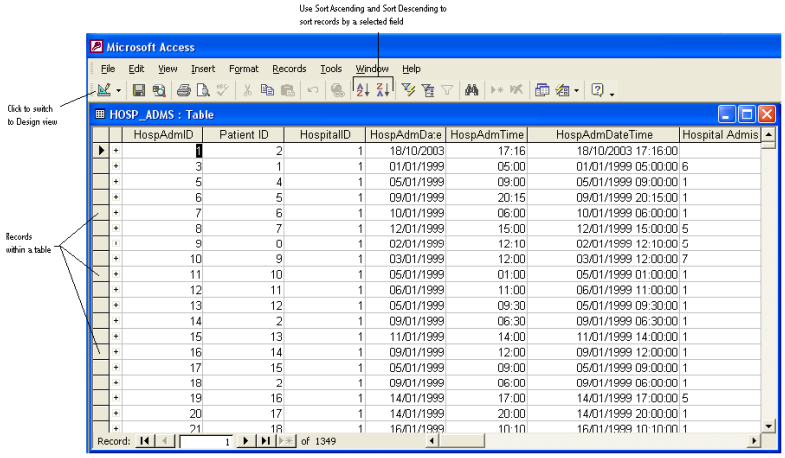
Datatypes: Datatypes are the properties of each field. A field only has 1 datatype.
FieldName: Patient LastName; Datatype: Text

Value: A value is the content of the Field.
FieldName: Patient LastName; Value: Smith

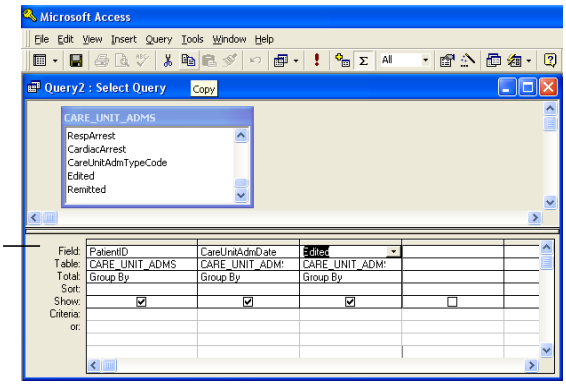
Key ACCESS Terms

Database objects: There are 7 main components of a database: tables, queries, forms, reports, pages, macros and modules.

Table: contains the raw data and stores the data into logical groupings of similar data. For example the Hospital Admissions table contains all of the data pertaining to a patient's hospital admission. Each row of a table contains one record. Records are made up of fields that contain a particular piece of data.



Query: is a set of restrictions placed on database table by specifying criteria to retrieve qualifying records. Queries can also be used to change, add or delete specified records. By using queries, you are safeguarded against the accidental deletion or modification of the AORTIC data.

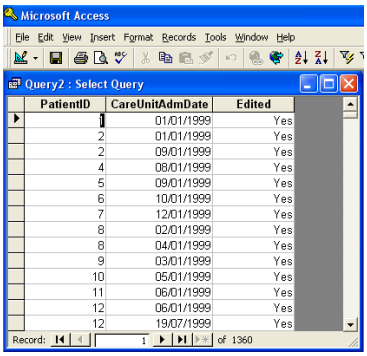


QBE grid (Query By Example)

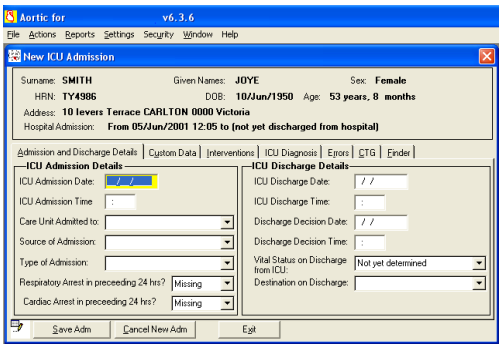
The following are the rows within the QBE grid.
Field: Where field names are added.
Table: Displays the table the field is from.
Total: Where averaging, totals or counts are be defined.
Sort: Ascending or descending: mainly used for numeric values.
Show: Displays or hides the field's results in the dynaset.
Criteria: Where selection criteria and/or calculations are defined.

Output can be used to create a new table, display in a form or report.
When you save a query you save the queries' design, the structure of the query, not the result or the "dynaset".

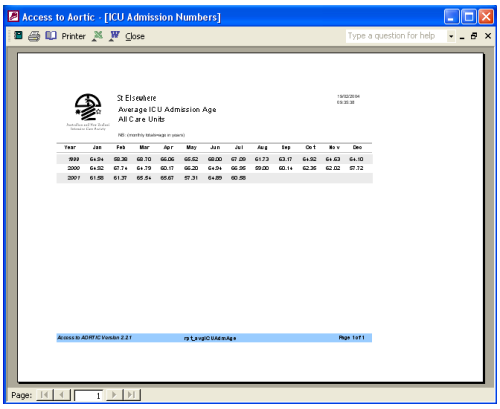
Dynaset: The result of the query. A dynamic set of data that can be used with a datasheet, form or report.



Forms: assists getting the data into the tables in a structured, accurate and easy manner. It allows the viewing of the data in a structured format and can restrict viewing of the data to read only.



Reports: presents data in a printed format. Reports can also be viewed on screen but are mainly designed to be printed. By using queries the reports can calculate, surmise and present data from different tables.



How to run Queries in ACCESS:

A database's main purpose is to store and extract data. To be able to extract this data the database's design and structure must be understood. You must identify all of the database's objects and their contents. To effectively run queries please refer to the Mapping AORTIC Fields section of this manual (Section 4).

Select Query

There are many kinds of query types available in ACCESS. The "Select query" is the default query type and it displays information you select from one or more tables.

Tips for successful queries:

- Build a query up slowly – enables you to easily identify where errors/problems are occurring.
- Make sure your query is logical – ensure you have a clear link from one table to the next.
- Always save queries with a descriptive name OR keep documentation as to what each query does – enables you to come back and run the same queries in the future.

BASIC LEVEL

Exercise 1: Select Query

Task: Produce a list of patient IDs, patient names and DOBs.

1. Click on the Queries button in AORTIC, and then click on the Create Queries button.

2. Click on **Create** in the top menu, and then choose **Query Design** from the top ribbon menu.

3. In the Show Table dialog box, click on PATIENTS and then Add (or simply double click on PATIENTS). Close the Show Table dialogue box.

4. In the PATIENTS table, double click on "PatientID", "Surname" and "DOB". These choices will now appear in the "Field Name" row on the QBE grid.

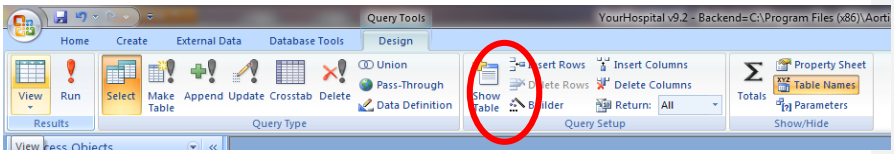
5. Click ! to run the query, or select Query from the menu along the top of the screen, and then Run.

Example 1 continued: Adding additional variables

Now let's add the Hospital Admission date for these patients.

6. Get back to the Design View by clicking on the Design view button or clicking on **View**, followed by **Design View**.

7. Open the **Show Table** dialogue box: either right click on the empty space next to the **PATIENTS** table and choose "Show Table" from the menu OR, click on the "Show Table" icon in the Query Design Toolbar along the top.



8. Add the **HOSP_ADMS** Table and then close the **Show Table** dialogue box.

9. Add the **HospAdmDate** to your Query.

10. Run the Query again.

11. Save the query as Patient List.

Exercise 1 continued: Adding a "criteria"

Task: Run a report to specify only those patients admitted to hospital in 2001.

12. Click on the criteria box under **HospAdmDate**.

13. type: **between 01/01/2001 and 31/12/2001**

14. Run the query again (then save).

Example 1 continued: Adding another variable
Add the ICU admission date for your patients.

15. Add the **CARE_UNIT_ADMS** Table to your query.

16. Add **CareUnitAdmDate** to your Field Names.

17. Run the query.

Example 1 continued: Dealing with ambiguous joins

18. The link between the **PATIENTS** table and the **CARE_UNIT_ADMS** table is causing a problem. The Query doesn't know whether to go from **PATIENTS** to **CARE_UNIT_ADM** or from **HOSP_ADMS** to **CARE_UNIT_ADMS**.

19. Delete the link between the **PATIENTS** table and the **CARE_UNIT_ADMS** table by clicking on the link so it becomes bold and then pressing delete.

20. Run the q uery (then save).

Example 1 continued: Adding Apache 3 scores
Lets Add Apache 3 scores to our query and only show patients with a score between 20 and 40.

21. Add the **SCORES** Table to your query.

22. Add **Score** to your Field Names.

23. Delete the ambiguous join between **HOSP_ADMS** and **SCORES**.

24. Run the query.

ERROR = ambiguous outer joins. ∞ above a join indicates the potential for an ambiguous join. We need to delete all joins with "∞" and recreate the joins.

25. Delete the joins between **PATIENTS** and **HOSP_ADMS**, and between **HOSP_ADMS** and **CARE_UNIT_ADMS**.

26. Create a join: Click on **PatientID** in the **PATIENTS** table and drag it onto **PatientID** in the **HOSP_ADMS** table. This will create a join.

27. Do the same thing for **HospAdmID** from **HOSP_ADMS** table and **HospAdmID** from **CARE_UNIT_ADMS** table.

NOTE: Always try and join left to right (patient – hosp admission – care unit admission – score), and always try and join the **bold** variable from the left table to the same variable in the right table.

28. Run the query = All patient have 3 scores – AP2, AP3 and SAPS. Need to filter for Apache 3 only.

29. Add **ScoringSystemName** to your Field Names. In the criteria section type **Apache 3**.

30. Run the query (and save).

31. To limit our results to those with scores between 20 and 40, in the criteria section under **Scores** type **between 20 and 40**.

32. To stop the column with **Apache 3** appearing in the results, deselect the **Show** box in the ScoringSystemName Column.

33. Run the query (and save).

Summary of what you have learnt:

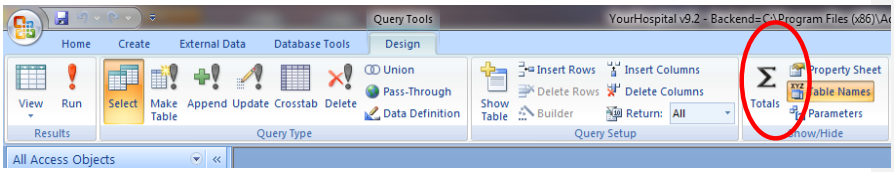
- **Select and join tables.**
- **Add a date criteria.**
- **Deal with ambiguous joins.**
- **Expand a simple query to add further tables.**
- **Expand on numeric codes to give descriptive names in a custom report.**
- **Select a subset of data using criteria .**

MODERATE LEVEL

Exercise 2: Grouping and Calculating

Task: In this example we will group records by ICU Admission Source then count the number of patients for each source.

The total row in the QBE grid is used to group data. To display the total row, click on Totals in the design ribbon menu.

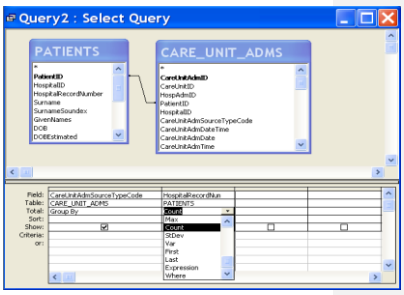


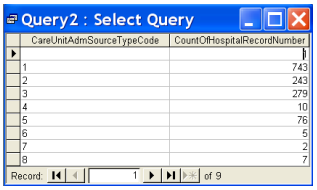
1. Create a new query from the **PATIENTS** table and the **CARE_UNIT_ADMS** table.

2. From the **CARE_UNIT_ADMS** table double click **CareUnitAdminSourceTypeCode**.

3. Click on the **Σ** button and click in the Total cell beneath **CareUnitAdminSourceTypeCode** and select **Group By**.
   To run the query, click This will give a simple list of the ICU Admission Source codes.

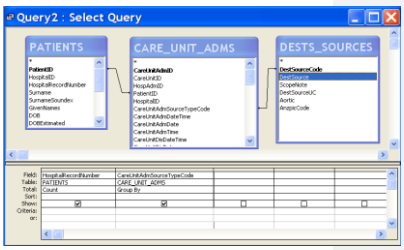
4. From the **PATIENT** table double click **HospitalRecordNumber**. Click in the **Total** cell beneath **HospitalRecordNumber** and select Count.
   To run the query, click 



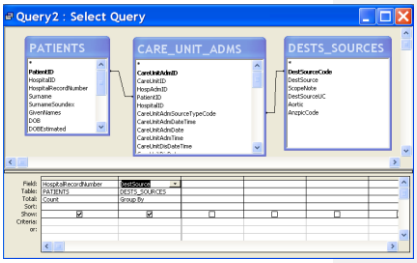


To display the ICU admission source type name instead of a code, go back to Design View and click on the **Show Table** button.

5. In the Show Table dialog box, click **DEST_SOURCES** then Add this table



6. To create the relationship between the **DEST_SOURCES** and **CARE_UNIT_ADMS** tables the linking fields are **DestSourceCode** and **CareUnitAdminSourceTypeCode**. Click once on the **DestSourceCode** and drag across to the **CareUnitAdminSourceTypeCode**. A join line will appear.



7. Delete the field **CareUnitAdminSourceTypeCode** by highlighting and press delete. From the **DEST_SOURCES** table double click to add **DestSource** to the QBE grid below.

To run the query, click Save as Patient Source.

Query2 : Select ...

CountOfHospitalRecordNumber	DestSource
3	Coronary Care
743	Emergency Dept
10	ICU
7	Missing
243	Operating Theatre
2	Other HDU
76	Other Hospital
279	Ward

Record: 1 of 8

N.B: Table DEST_SOURCES is used for source of admission.

<u>Summary of what you have learnt:</u>

- **How to group data.**
- **Count Field totals.**
- **Expand on numeric codes to give descriptive names in a custom report.**

Exercise 3: Using Parameters

Task: Create a query to get patient details, ICU admission period and whether they survived or died, by using a Parameter box so you can alter the date range every time you use the query.

The' select' query with a parameter is called a Parameter Query. It displays one or more predefined dialog boxes that prompt for a parameter value (criteria) whenever the query is accessed. A parameter query saves time by allowing the user to change criteria for queries that are run on a regular basis.

1. Create a query with the **PATIENTS** and **CARE_UNIT_ADMS** tables.

2. Select **HospitalRecordNumber** from the **PATIENTS** table and **CareUnitAdmDate** and **CareUnitDisVitalStatusCode** from the **CARE_UNIT_ADMS** table.

3. Run the query to check for errors.

4. To display the ICU vital status as a description rather than a code, return to the Design view of the query.

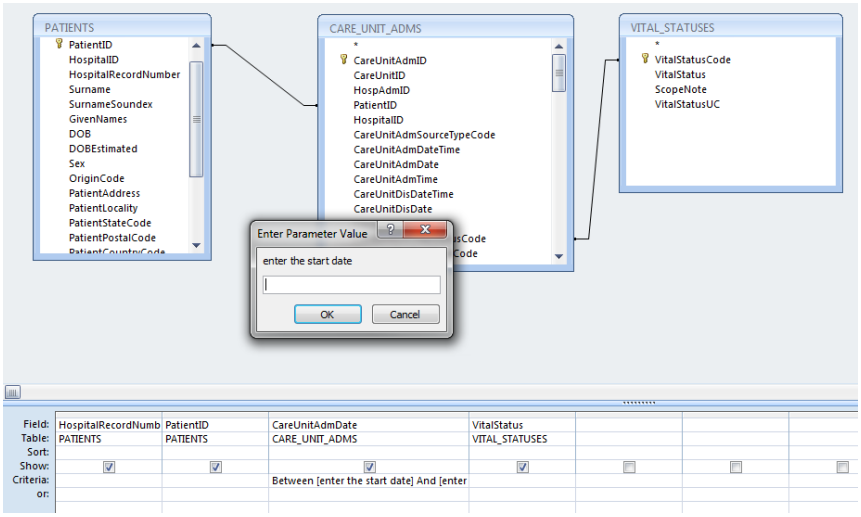
5. Pull up the **Show Table** dialogue box and add the **VITAL_STATUSES** table to your query.

6. Create a link between the **VITAL_STATUSES** table and the **CARE_UNIT_ADMS** table, link **VitalStatusCode** to **CareUnitDisVitalStatusCode**.

7. Add **VitalStatus** (from the **VITAL_STATUSES** table) to your query and delete the **CareUnitDisVitalStatusCode** column from the QBE grid (highlight and delete).

8. Run the query (APD3).

9. To add a date parameter to this query: Click in the criteria cell beneath **CareUnitAdmDate** and type the following parameter: **between [enter the start date] and [enter the end date]**.



10. Run the query – it should prompt you to enter your start date and then your end date.

Summary of what you have learnt:

- **Using a parameter prompt for a commonly used query**
- **Specify a criteria**

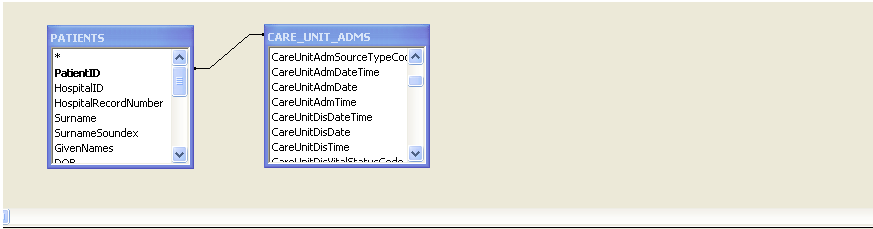
ADVANCED

Please note for advanced queries you may not be told which fields to add to your grid, use the images as a hint.

Exercise 4: Calculating Length of Stay (LOS)

Task: Calculate the LOS for each ICU episode for which an end date and time have been entered within a specified time period.

In Access you can create an expression to calculate the data returned by a query.



Field:	HospitalRecordNumber	CareUnitAdmDateTime	CareUnitDisDateTime	ICU Length of Stay(Hrs): DateDiff("h",[CareUnitAdmDateTime],[CareUnitDisDateTime])
Table:	PATIENTS	CARE_UNIT_ADMS	CARE_UNIT_ADMS	
Sort:				
Show:	☑	☑	☑	☑
Criteria:				
or:				

1. Create a query with the **PATIENTS** and **CARE_UNIT_ADMS** tables. Add **HospitalRecordNumber**, **CareUnitAdmDateTime** and **CareUnitDisDateTime** to your QBE grid.

2. This query uses the Access DateDiff function: in the 4th column type the following:

ICU Length of Stay (Hrs):
DateDiff("h",[CareUnitAdmDateTime],[CareUnitDisDateTime])

This function takes 2 dates or 2 times or, in this case, 2 datetime fields and calculates the number of hours between them. To calculate the number of days change the “h” to a “d” in the expression. For minutes use “n”.

3. In the criteria cell underneath **CareUnitDisDateTime** enter the text **is not null**, this will exclude patients who are missing a discharge date and time.

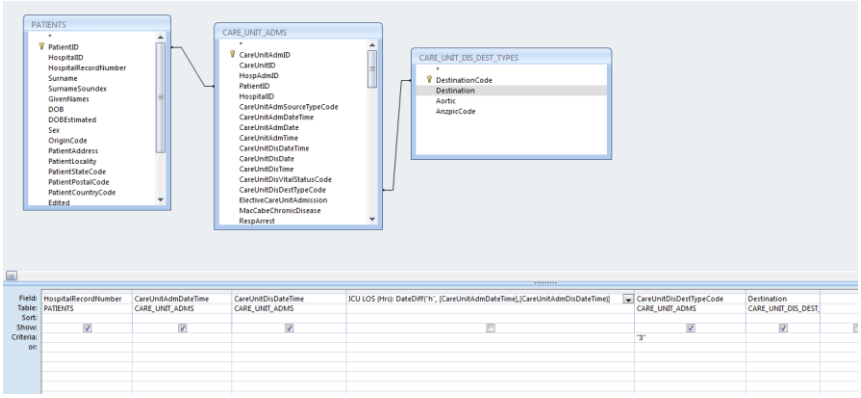
Summary of what you have learnt:

- **Using an expression to calculate a new numerical field for a reporting.**

Optional: Try this yourself

- Specify criteria – patient discharged between 12:00 AM and 6:01 AM and /or between 7:00 PM and 11:59 PM.

- Patients discharged to ward (CareUnitDisDestTypeCode=3).



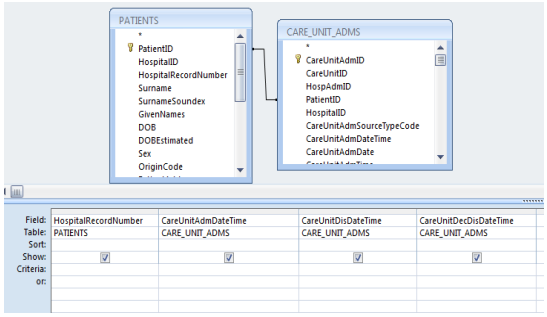
Exercise 5- Bed Block

Please note this is a valuable new exercise for recording bed block.
This will only work at your hospital if you collect the data for discharge decision time (CareUnitDecDisDateTime). N.B using the older dummy data you will generate a report with zero for bed block, which has not collected the decision time.

Task: produce a report that details delayed discharge from ICU more than 6 hours for a given time period.

1. Create a query with the PATIENTS and CARE_UNIT_ADMS tables

2. Add to your OBE Grid
   a. Patient ID
   b. Hospital Number
   c. CareUnitAdmDateTime
   d. CareUnitDisDateTime
   e. CareUnitDecDisDateTime



3. Next build an expression
   Delay between decision time to discharge a patient and the physical time of discharge

   DateDiff("h",[CareUnitDecDisDateTime],[CareUnitDisDateTime])

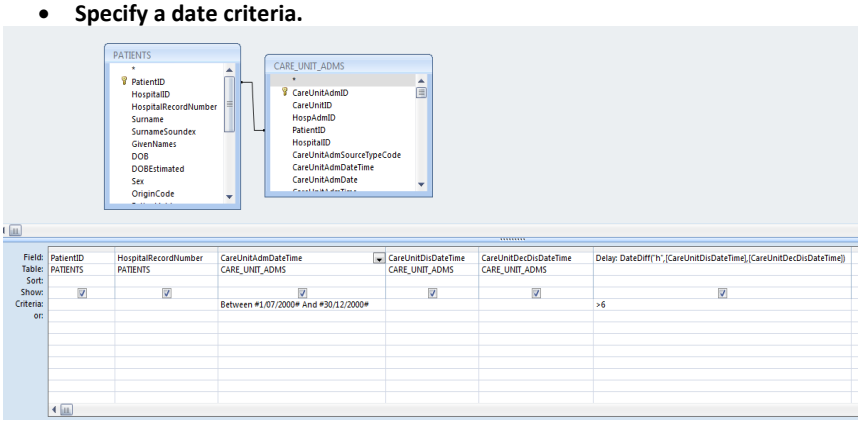
4. Specify a delay time for your report eg greater than 6 hours
   >6

5. Indicate your date criteria for a time period; eg 07 July 2000 and 31 Dec 2000

Summary of what you have learnt:

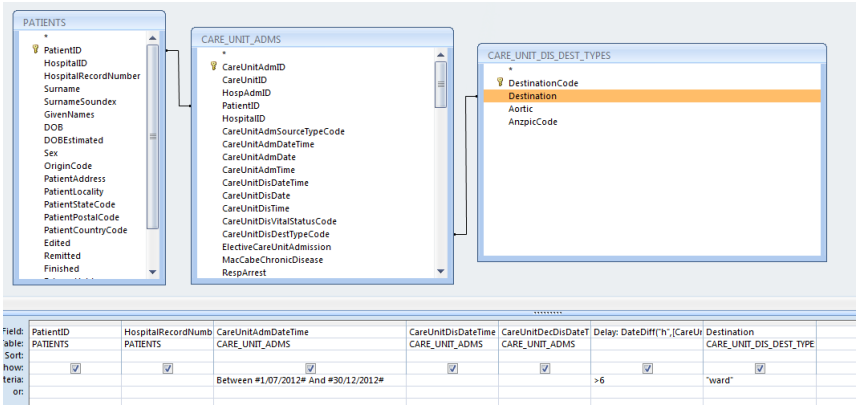
- **How to build and expression to minus one date from another.**
- **From this select a subset of data >6 hours.**

- **Specify a date criteria.**



Optional: try this yourself

- Add another table – CARE_UNITS_DIS_DEST_TYPES.
- Run the report to specify destination – ward.



Additional query tools

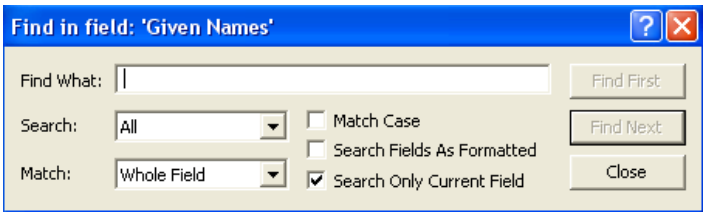
Sorting

Sort on a field by highlighting the column and selecting A-Z from the menu – can be used with names to list them alphabetically from A to Z. Now select Z-A to do a descending sort.

Highlight the surname and given names columns and select A-Z. This will sort by surname and within patients who have the same surname the given names with be alphabetically listed.

Searching

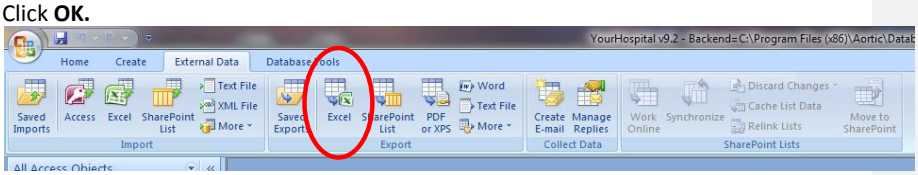
To search for a particular surname, position the cursor in the surname field, then, from the top menu select the find icon  a find dialog box similar to that used by word will appear



Type in a surname and click the "Find Next" button. Access will search that column and position the cursor on the row of the record that has the surname you typed in. Wildcards can be used. For example to search the surname field for surnames that contain the text "williams" type in *williams*. This will return surname names such as Williams, McWilliams, Williamson.

Exporting (Office 2007)

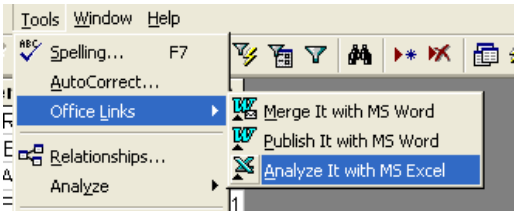
Run the query you wish to export, so the data table is shown
Click on **External data** in the top menu, and then click on **Excel** in the Export section of the ribbon menu (see figure below).
Click **browse** to choose where you want your file to be save.
Choose the file format.
Tick **export data with formatting and layout.**
Click **OK.**



Exporting (Office 2003)

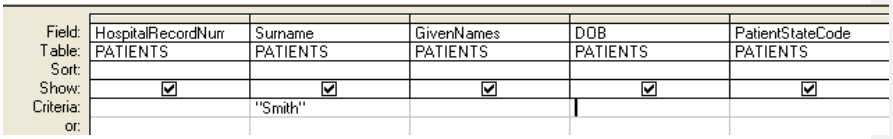
Click on **File**, **Export**.
Export to desktop.
Give the file a name and select excel as the **Save as type** (excel 97-2003).
Click **Export All**.
The file should appear on your desktop.

Alternatively, Access queries can be exported using the Office Links option. Here we are going to export the data to Excel



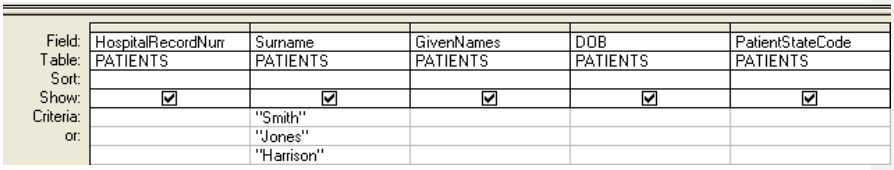
Criteria

This query lists all records from the Patients table. If we want to only list a subset of Patient data we need to add criteria. Let's say we want a list of those patients whose surname is Smith. To do this we need to type in the text Smith in the criteria line of the Surname column thus:



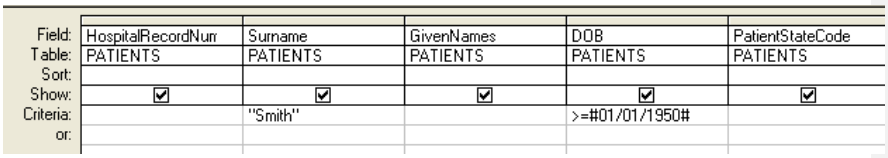
Field:	HospitalRecordNum	Surname	GivenNames	DOB	PatientStateCode
Table:	PATIENTS	PATIENTS	PATIENTS	PATIENTS	PATIENTS
Sort:					
Show:	☑	☑	☑	☑	☑
Criteria:		"Smith"			
or:					

Say we want all the Jones and Harrison's as well:



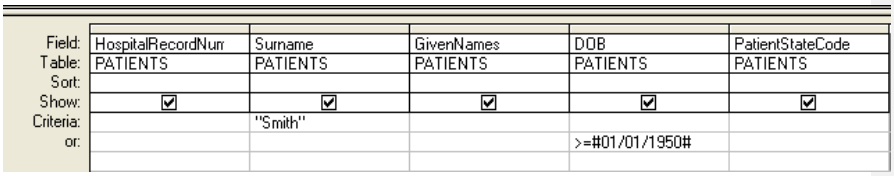
Field:	HospitalRecordNum	Surname	GivenNames	DOB	PatientStateCode
Table:	PATIENTS	PATIENTS	PATIENTS	PATIENTS	PATIENTS
Sort:					
Show:	☑	☑	☑	☑	☑
Criteria:		"Smith"			
or:		"Jones"			
		"Harrison"			

We can add criteria to more than one field. To get a list of all Smiths born after 1950



Field:	HospitalRecordNum	Surname	GivenNames	DOB	PatientStateCode
Table:	PATIENTS	PATIENTS	PATIENTS	PATIENTS	PATIENTS
Sort:					
Show:	☑	☑	☑	☑	☑
Criteria:		"Smith"		>=#01/01/1950#	
or:					

It is important to note that criteria that are on the same line constitute an AND condition. In this case only those patients whose Surname is Smith AND who were born after 1950 will be shown. If I wanted a list of patients whose name was Smith OR who were born before 1950 regardless of whether their surname is Smith, then I need to place the conditions on different lines:



Field:	HospitalRecordNum	Surname	GivenNames	DOB	PatientStateCode
Table:	PATIENTS	PATIENTS	PATIENTS	PATIENTS	PATIENTS
Sort:					
Show:	☑	☑	☑	☑	☑
Criteria:		"Smith"			
or:				>=#01/01/1950#	

If I wanted a list of only those Smith, Jones and Harrison's born after 1950 I need to include the date criteria for each name:

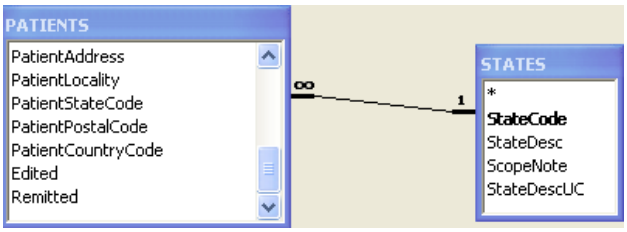
Field:	HospitalRecordNum	Surname	GivenNames	DOB	PatientStateCode
Table:	PATIENTS	PATIENTS	PATIENTS	PATIENTS	PATIENTS
Sort:					
Show:	☑	☑	☑	☑	☑
Criteria:		"Smith"		>=#01/01/1950#	
or:		"Jones"		>=#01/01/1950#	
		"Harrison"		>=#01/01/1950#	

Changing Table joins:
If you ran a query that included **PatientStateCode**, the State/Province field would be a number. Each number refers to a particular state (2 = Victoria). The state descriptions are stored in a separate table called **STATES**:

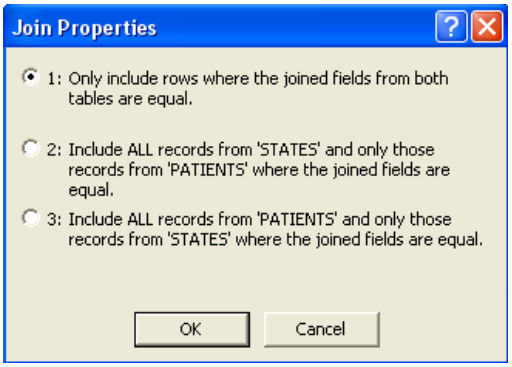
State Code	StateDesc
?	Unknown
1	New South Wales
2	Victoria
3	Queensland
4	South Australia
5	Western Australia
6	Tasmania
7	Northern Territory
8	Australian Capital Territory
9	Other Territories

To add the state description we need to add the **STATES** table to our query and "join" the **PatientStateCode** field in the **PATIENTS** table to the **StateCode** in the **STATES** table.

There is one problem with this query. If a patient doesn't have a state code entered then it won't show up in the list. To list these patients as well we have to change the join type between the 2 tables. If you double click on the line that joins the 2 tables



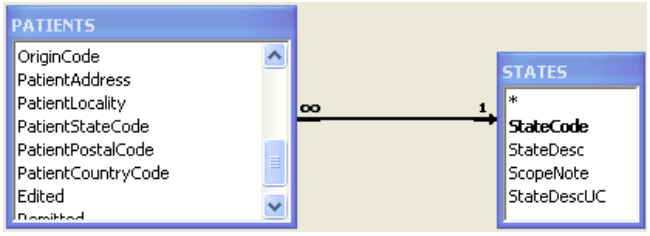
The following dialog box appears:



The particular join type in operation is highlighted. In this case we have a join type that only links tables where the data matches. Here we can see why patients who have no value in the **PatientStateCode** field are not listed. This is because there is no row in the related **STATES** table that has a blank value for **StateCode**.

To get all patients we need to select the third join type:

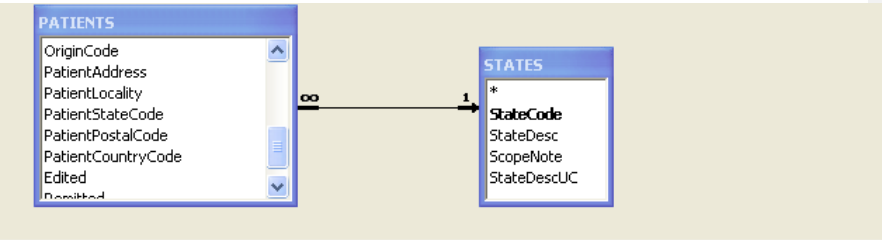
Notice that after selecting this join type an arrow appears in the join line between the 2 tables - this is called a right join.



This is just a visual cue to indicate the particular join type. The query will now list all patients regardless of whether they have a **PatientStateCode** entered or not. Those patients that don't have a state code will show a blank in the **StateDesc** field:

Hosp. Record	Surname	Given Names	Date of Birth	StateDesc
45983	AASEN	COURTNEY	29-Apr-91	
94299	AASEN	ROGER	27-Mar-89	Western Australia
53510	ABDIN	VEDA	18-Sep-47	New South Wales
39326	ABER	DANE	24-Jun-61	Victoria
65773	ABLEMAN	XUAN	05-Feb-64	
27624	ADAS	ALEJANDRO	14-Aug-23	New South Wales
46651	AGUILLON	ARDEN	11-Dec-37	
26983	AHLO	ALFONSO	25-Apr-54	

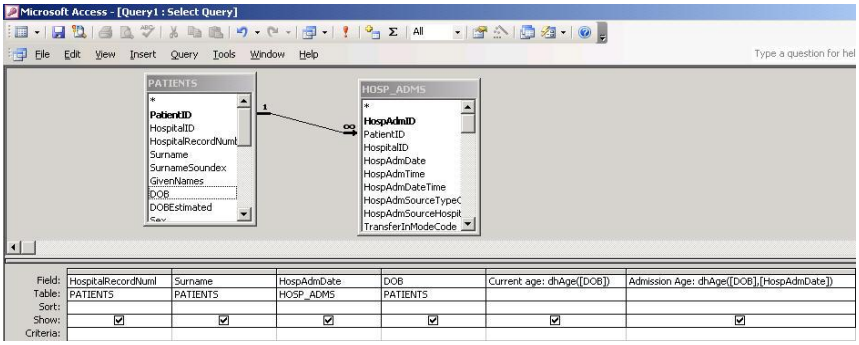
Right join queries are useful for finding records that have missing data in a particular field. In this case we can list patients who don't have a state code entered by typing **Is Null** as a criteria in the **StateDesc** field:



Field:	HospitalRecordNum	Surname	GivenNames	DOB	StateDesc
Table:	PATIENTS	PATIENTS	PATIENTS	PATIENTS	STATES
Sort:					
Show:	☑	☑	☑	☑	☑
Criteria:					Is Null
or:					

Function

This query calls a function called dhAge that calculates an age in years based on the date we pass to it taking into account a patients' birthday. In this query it calculates the age of a patient when they were admitted to hospital as well as the current age as of today.



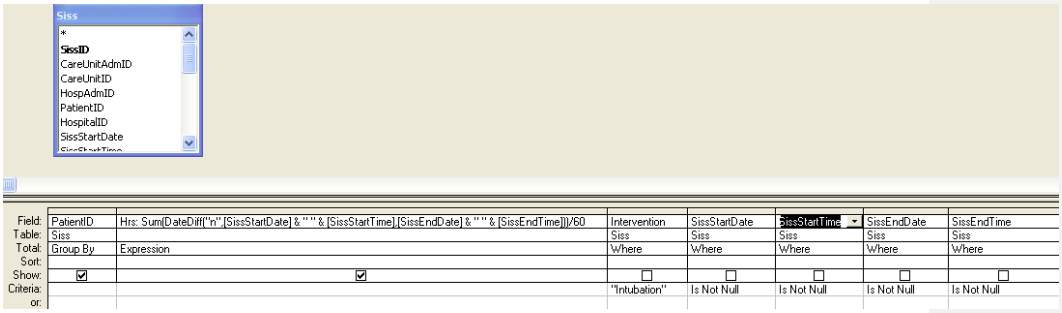
Current age: dhAge([DOB])

Admission Age: dhAge([DOB], [HospAdmDate])

Note that dhAge is not a standard Access subroutine. One of the good things about Access is that you can write your own subroutines and use them for queries. You can examine the code for the dhAge function if you wish by opening the module basFunctions and doing a search for dhAge. To calculate the fractional age (45.23 instead of just 45 for example) use the dhAgeFraction function with the same parameters.

Calculating Totals:

Here is a query that calculates the total number of Intubation hours for each patient. It uses the Sum function to total the number of hours as calculated by the DateDiff function. We can't calculate the length of an intubation unless both the start and end date/times have been entered which is why all those **Is Not Null** criteria are needed.



Field:	PatientID	Hrs: Sum(DateDiff("h",[SissStartDate] & " " & [SissStartTime],[SissEndDate] & " " & [SissEndTime]))/60	Intervention	SissStartDate	SissStartTime	SissEndDate	SissEndTime
Table:	Siss		Siss	Siss	Siss	Siss	Siss
Total:	Group By	Expression	Where	Where	Where	Where	Where
Sort:							
Show:	☑	☑	☐	☐	☐	☐	☐
Criteria:			"Intubation"	Is Not Null	Is Not Null	Is Not Null	Is Not Null
or:							

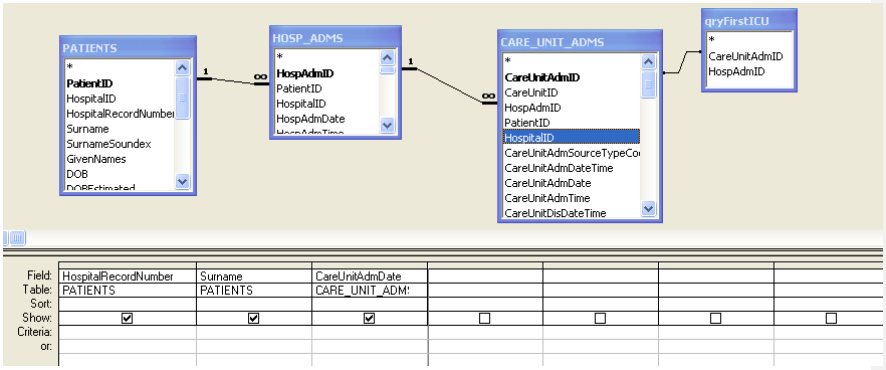
The expression for calculating the total intubation hours is as follows:

Hrs:DateDiff("h",[SissStartDate]&""&[SissStartTime],[SissEndDate]&""&[SissEndTime])

You can change the **Intervention** selection criteria to list data for other interventions by replacing **Intubation** with another intervention name. If you are only interested in interventions that started within a particular date range replace **Is Not Null** with **Between 1/1/1999 and 31/1/1999** in the criteria for **SissStartDate**.

A Query that uses another Query

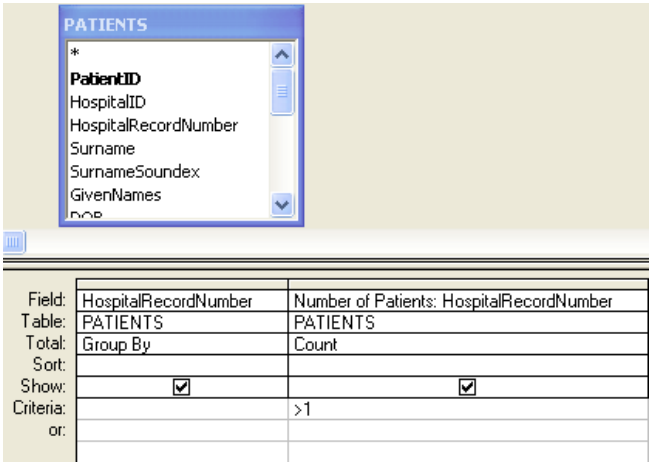
When we create a query in Access we aren't just limited to tables. As well as using tables we can also use other queries. For example, imagine we need to get some patient ICU information and that, if a patient has multiple ICU admissions on a given hospital admission, we only want data from the first ICU admission. First we need to write a query to select out only the first ICU admission for each hospital admission. This query is called qryFirstICU. It's beyond the scope of this document to explain how this query works, suffice to say that you don't have to know how something works in order to make use of it. Here's an example of how you might use it:



This query just lists the MRN, Surname and ICU admission date for each ICU admission. Notice that qryFirstICU has been added and linked to CARE_UNIT_ADMS. This has the effect of only showing the first ICU admission for each hospital admission. You can use qryFirstICU in your own queries to do the same thing.

Identifying Duplicate MRNs

Writing a query to find duplicate MRNs is surprisingly easy. All we need is one table:



First we group by the field we want to count occurrences of and then use the count function to do the counting. Criteria of greater than 1 list those hospital record numbers that have been used more than once.

ACCESS Tools for Expressions, Formatting and Functions

Operators

Operators let you add, compare and create complex relational expressions.

Types of operators:

Mathematical

*	Multiply
+	Add
-	Subtract
/	Divide
\	Integer Divide
^	Exponentiation
Mod	Modulo

Relational

=	Equal
<>	Not equal
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to

String

&	Concatenation
Like	Similar to…

Boolean

And	Logical and
Or	Logical inclusive or
Eqv	Logical equivalence
Imp	Logical implication
Xor	Logical exclusive or
Not	Logical not

Miscellaneous

Between … And	Range
In	List comparison
Is	Reserved word
Is Null	This criteria will select all records that have no value (i.e.: empty) in the specified field. On the converse Is Not Null is the opposite, where all records that have a value in the specified field will be selected.

Wildcards – to be used with the LIKE operator

?	A single character A – Z, 0 – 9
F	Any number of characters 0 – n
#	Any single digit 0 – 9
[list]	Any single character in the list
[!list]	Any single character not in the list

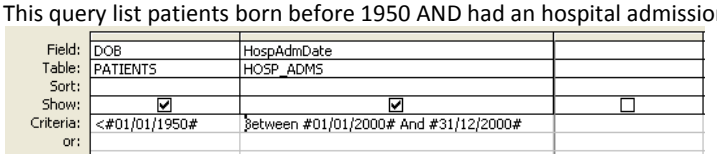
Common Criteria Operators used in Access Queries

Operator	Meaning	Example	Result
=	Equal to	="Apache3"	Finds only those records with "Apache3" as the field value
<	Less than	<10	Finds all records with values less than 10 in that field
<=	Less than or equal to	<=10	Finds all records with values less than or equal to 10 in that field
>	Greater than	>10	Finds all records with values greater than 10 in that field
>=	Greater than or equal to	>=10	Finds all records with values greater than or equal to 10 in that field
<>	Not equal to	<>"Apache 3"	Finds all records with values other than Apache3 in the field
And	Both conditions must be true	See note Below	Finds all records where the conditions in both fields are true
Or	Either condition can be true	2 or 3	Finds all records with either 2 or 3 in the field
Like	Compares a string expression to a pattern	Like "Smith*"	Finds all the values with the values Smith at the beginning of the field
Between	Finds a range of values	Between #1/1/2002# AND #31/12/2002#	Find all records in the 2002 calendar year for a particular field
In	Same as OR. Generally used as a shorthand version of Or	In (4,2,5,3)	Find all records with the value of 4 or 2 or 5 or 3 in the field
Not	Same as not equal	Not "Apache3"	Finds all records with values other than Apache3 in the field
Is Null	Finds Nulls	Is Null	Finds all records where no data has been entered in the field
Is Not Null	Finds all records that are not null	Is not Null	Finds all records where data has been entered in the field

Further examples

AND Statement

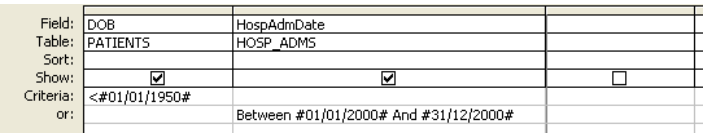
This query list patients born before 1950 AND had an hospital admission in 2002



Field:	DOB	HospAdmDate	
Table:	PATIENTS	HOSP_ADMS	
Sort:			
Show:	☑	☑	☐
Criteria:	<#01/01/1950#	Between #01/01/2000# And #31/12/2000#	
or:			

OR Statement

This query list patients who were either born before 1950 OR had a hospital admission in 2002



Field:	DOB	HospAdmDate	
Table:	PATIENTS	HOSP_ADMS	
Sort:			
Show:	☑	☑	☐
Criteria:	<#01/01/1950#		
or:		Between #01/01/2000# And #31/12/2000#	

Working with Dates in Criteria

Expression	Meaning	Example	Result
Date()	Current Date	Date()	Records with today's date in the field
Day(Date)	The Day of the Date	Day([HospAdmDate])= 1	Lists Hospital Admission records that occurred on the first day of the month
Month(Date)	The month of a date	Month([HospAdmDate]) = 1	Hospital Admission records that occurred in January
Year(Date)	The year of the date	Year([HospAdmDate])= 2002	Hospital Admissions in 2002
Weekday(Date)	The weekday of a date	Weekday([HospAdmDa te])=2	Hospital Admission that occurred on a Monday
Between Date and Date	A range of dates	Between #1/1/2002# AND #31/12/2002#	Hospital Admissions in 2002
DatePart(Interval , Date)	A specific part of a date	DatePart("q",[HospAd mDate])	All hospital admissions in the second quarter

Options for calculations that can be performed are:

Aggregate Function	Used to find the
COUNT	Number of values in a field (not counting null values)
SUM	Total of values in a field
AVG	Average of values in a field
MAX	Maximum values in a field
MIN	Minimum value in the field
STDEV	Standard deviation of values in a field
VAR	Variance of values in a field
FIRST	Field value from the first record in a number, table or query
LAST	Field value from the last record in a number, table or query

Functions
Functions are small programs that return a value based on a calculation, comparison or evaluation that the function performs. Access provides many common functions that can be used in tables, queries, forms and reports.

Types of functions:
Conversion
Changes the data type from one type to another.

Str() returns a numeric as a string.
Val() returns a string as a numeric.
Format() returns an expression according the user-specified format.
Examples:
Format ("Next,""">") returns NEXT
Format ("123456789,""@@@-@@-@@@@) returns 123-45-6789

Date/Time
Date/Time functions work with the date and time expressions.

Now() returns the current date and time.
Time() returns the current time in 12 hour format
Date() returns the current date

Financial
Avg() returns the average sum.
Example:
Avg([Age])

String manipulation
Right() returns the rightmost characters of a string

Left() returns the leftmost characters of a string
Examples:
Right("123456,"2) returns "56"
Left("123456,"2) returns "12"

Len() returns the length of a string
Example:
Len("12345") returns 5

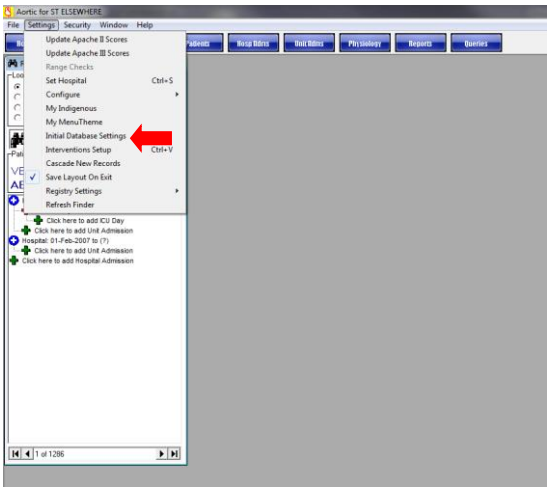
Lcase returns the lowercase of the string
Example:

Lcase ("ANZICS") returns anzics

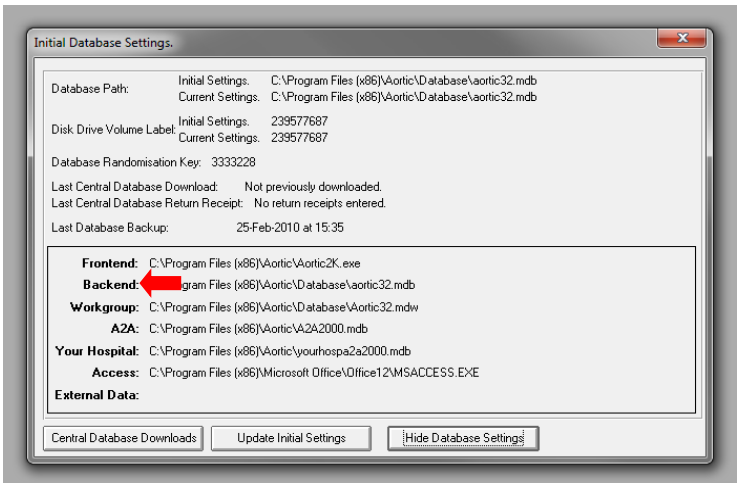
Troubleshooting: Linking Frontend and Backend Databases within AORTIC

If the queries database is not linked to the backend database, an error message will appear when clicking on queries i.e. aortic 32.mdb cannot be found.

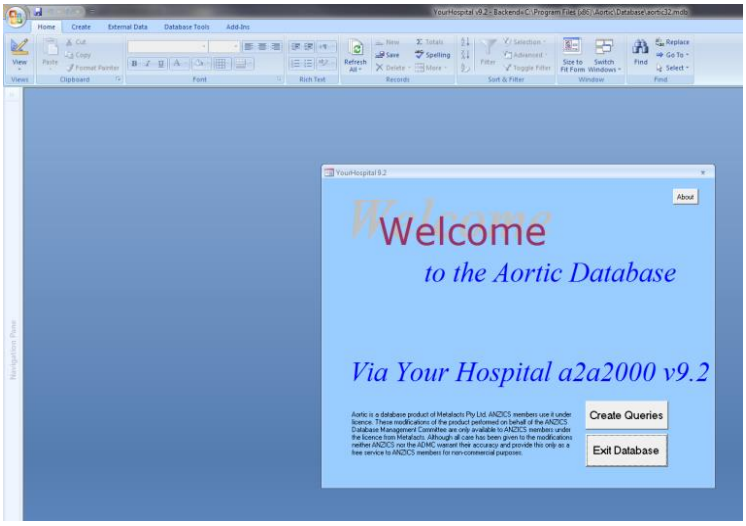
To correct this, find the location of the backend database by clicking on Settings within the AORTIC menu and select Initial Database Settings.



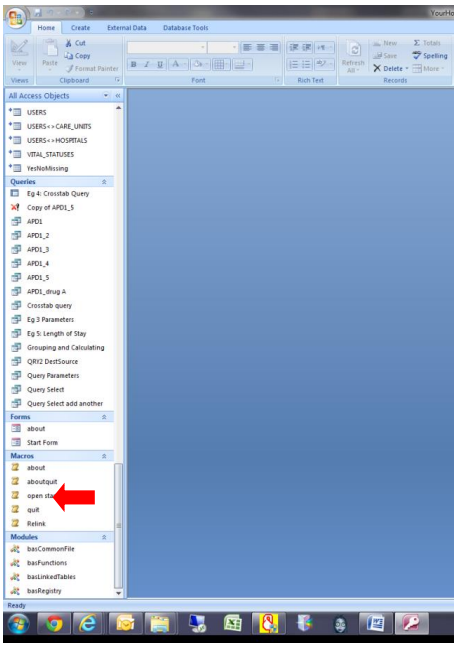
Initial Database Settings box will appear- make a note of the path to the Backend database.



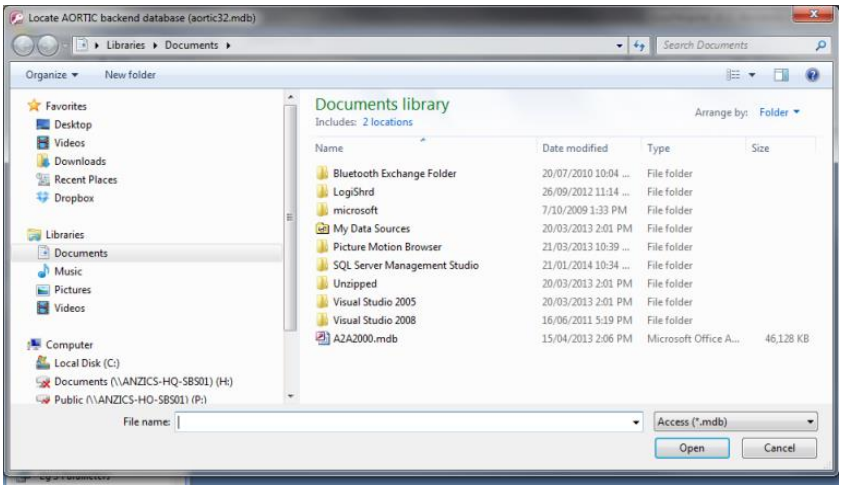
Go back to Queries on the main menu



Scroll down the All Access Objects list of database objects and locate Macros then double-click on Relink.



A file browser dialog will appear- double-click on the file in the backend path from the Initial Database Settings and it should link the queries to the correct backend.



On-line References:

General Tutorials:

Microsoft Access Query Tips and Techniques:
http://www.fmsinc.com/tpapers/queries/

Creating a Simple Query in Microsoft Access:
http://databases.about.com/library/weekly/aa103000a.htm

MS Access Queries:
http://www.sf.edu/tltl/materials/ACCqueries.pdf

Tutorials on specific topics:

The Select Query:
http://its.augustana.edu/documentation/access97/accessqueries.pdf

Creating query parameters with choices:
http://www.meadinkent.co.uk/aquerychoose.htm

Calculating in Access Queries:
http://www.fontstuff.com/access/acctut02.htm

Calculating Totals in Access Queries:
http://www.fontstuff.com/access/acctut04.htm

More Advanced topics:

Crosstab Queries:
http://databasejournal.com/features/msaccess/article.php/3101941

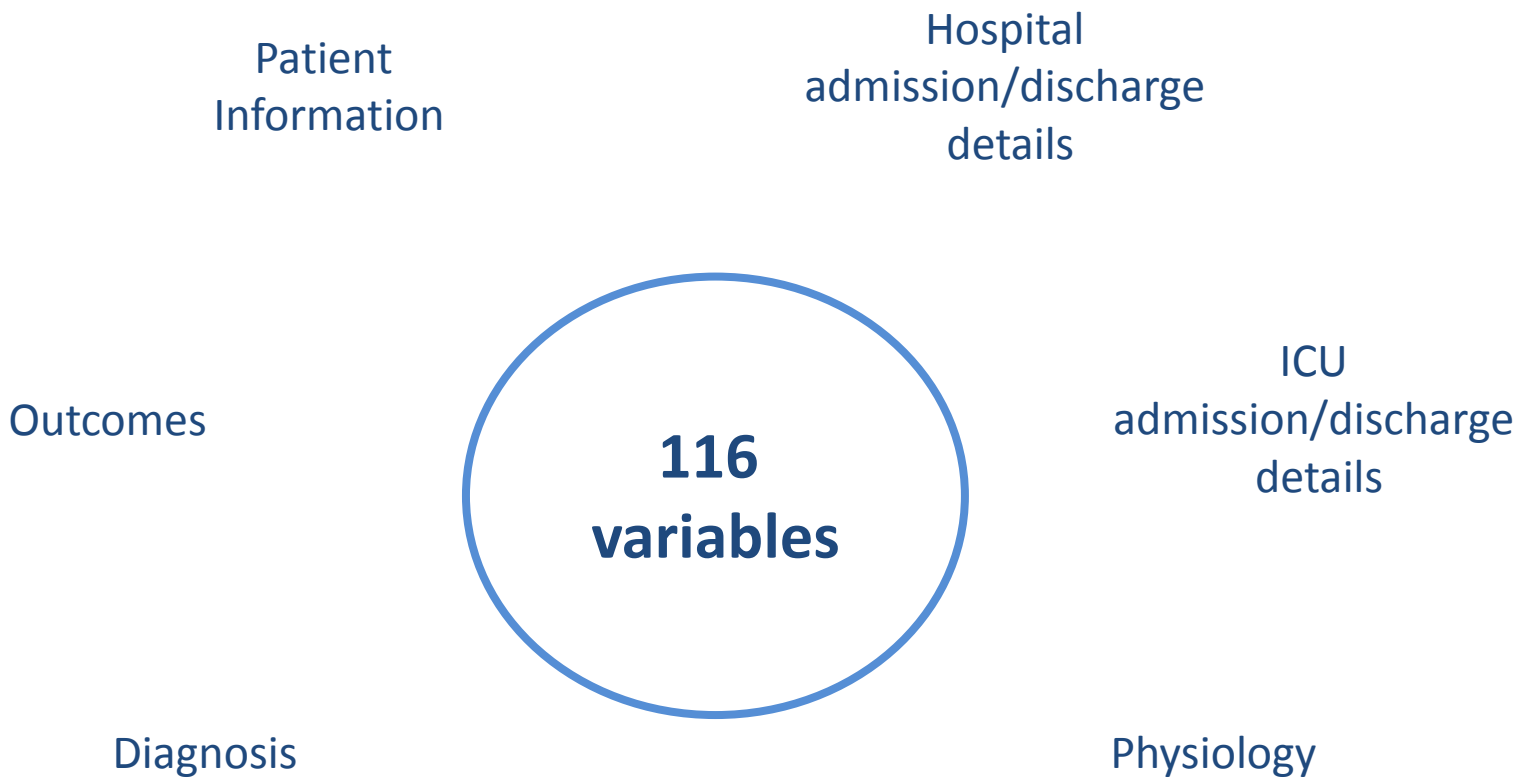
Subqueries:
http://databasejournal.com/features/msaccess/article.php/3112091

Using the Top Keyword:
http://www.databasejournal.com/features/msaccess/article.php/3291181

APD Data Definitions

APD minimum dataset

Data Dictionary – page 134



Postcode

Data Dictionary – page 24

The numeric descriptor for a postal delivery area, aligned with locality, suburb or place for the address of the patient at the time of admission to the hospital

Additional notes

Postcode should be the patient's residential postcode

Hospital Admission Time

Data Dictionary – page 26

Time at which the patient was admitted to the hospital for the episode of care which included the current episode of ICU care.

Additional notes

If a patient enters hospital via the Emergency Department, the triage time in ED should be recorded as the Hospital Admission Time.

Hospital Discharge Date

Data Dictionary – page 28

Date of separation from hospital (separation includes discharge, death, statistical discharges where the patient is no longer admitted as an acute care patient to hospital, or transfer to another hospital).

A patient is considered a statistical discharge when:

- Patient is no longer an acute care patient
- Patient is transferred to a separate rehab facility, palliative care hospice or mental health unit within the same hospital
- This separate unit is geographically separated from the acute wards and is managed by a different team

Type of Admission

Data Dictionary – page 19

Options:

- Elective ICU admission
- Emergency ICU
- Monitor only ICU
- ~~Procedure in ICU~~
- Elective HDU admission
- Emergency HDU admission
- ~~CCU~~
- ~~Ward type~~

ICU is defined as a patient under the care of an intensive care team for whom one of the following is needed:

- Invasive ventilation
- Inotropes
- Non-invasive ventilation (>50% of stay, or continuously for > 6 hrs)
- Needing 1:1 nursing
- Continuous renal replacement therapy

HDU will be all other patients admitted as needing, in the opinion of the treating specialist, the specific expertise of the ICU/HDU environment that do not meet the criteria above (excluding coronary care patients or those admitted solely for specific procedures within ICU)

Elective

Data Dictionary – page 40

An elective admission is a planned ICU admission for potential system failure.

Additional notes

This data element identifies those patients who come to ICU as planned admissions following elective surgery. If a patient had elective surgery where ICU admission was not anticipated and was due to an intra-operative complication then their admission to ICU would not be seen as elective.

Elective surgery + planned ICU/HDU admission = elective

Treatment Goals for Admission

Data Dictionary – page 51

Represents the goals and presence of treatment limitations at the time of a patient's admission to ICU.

Options:

- Full active treatment
- Treatment limitation order → Implies medical treatment would be constrained by patient wishes (eg: Jehovah's witness) or medical futility (not for intubation/CPR). Only patients with treatment limitations on admission to ICU should be included.
- Palliative care of a dying patient → Palliative care is the care given to improve the quality of life of patients who have a serious or life-threatening disease from which they are not expected to survive.
- Potential Organ Donation → Terminally ill patients admitted with the intention of organ donation.

Thromboembolism prophylaxis

Data Dictionary – page 53

A code that represents whether thromboembolism prophylaxis was given to the patient within the first 24 hrs following admission to ICU

Options:

- Yes → Enter **YES** for patients that have received any form of thromboembolism prophylaxis (heparin, low molecular weight heparin, pneumatic compression devices, compression stocking) and patients who are already fully anticoagulated (heparin infusion/warfarin).
  Patients already fully anticoagulated should be entered as **YES**.
- No
- Contraindicated → Enter **CONTRAINDICATED** for patients who are unsuitable for thromboembolism prophylaxis (patient admitted following intra-operative bleed).
- Not indicated → Enter **NOT INDICATED** for patients where thromboembolism prophylaxis is not required (patient has no risk of thromboembolism).
  NOT A USEFUL CODE AND CAN BE IGNORED
- Missing

Chronic Conditions

Data Dictionary – page 116 (APACHE II)

Organ insufficiency and immuno-compromised state in evidence PRIOR to hospital admission

Respiratory:
Chronic restrictive, obstructive disease resulting in ***severe exercise restriction*** (unable to climb stairs or perform household duties); *or* documented chronic hypoxia, hypercapnia, secondary polycythaemia, severe pulmonary hypertension (mean > 40 mmHg); or ventilator dependency.

Cardiovascular:
New York Heart Association Class IV: ***angina or symptoms at rest or on minimal exertion*** (whilst getting dressed or during self-care).

Renal:
Must be receiving chronic haemodialysis or peritoneal dialysis.

Liver:
Biopsy proven cirrhosis and documented portal hypertension; *or* episodes of past upper GI bleed attributed to portal hypertension; *or* prior episodes of hepatic failure, encephalopathy or coma.

Immune suppressive Disease (Immune disease):
The patient has a disease that is sufficiently advanced to suppress resistance to infection: leukaemia, AIDS, lymphoma, severe autoimmune disease or documented diffuse metastatic carcinoma.

Immunosuppressive Therapy (Immunosuppressed):
The patient has received therapy that has suppressed resistance to infection: eg immunosuppression, chemotherapy, radiation, high-dose steroid (E.g. >1.5mg/kg methyl prednisolone or equivalent for 5 or more days, long term treatment with >20 mg/day steroid, chemotherapy within 4 weeks of admission).

Chronic Conditions

Data Dictionary – page 118 (APACHE III)

Organ insufficiency and immuno-compromised state in evidence PRIOR to hospital admission

AIDS:
Clinical syndrome of AIDS - HIV positive with AIDS defining complications *e.g. Pneumocystis carinii* pneumonia, Kaposi's sarcoma, lymphoma, tuberculosis or Toxoplasma infection.

Cirrhosis:
Biopsy proven cirrhosis and documented portal hypertension; *or* episodes of past upper GI bleed attributed to portal hypertension; *or* prior episodes of hepatic failure, encephalopathy or coma.

Hepatic Failure:
Episodes of hepatic failure and/or encephalopathy or coma.

Immunosuppressed:
The patient has received therapy that has suppressed resistance to infection: eg immunosuppression, chemotherapy, radiation, high-dose steroid (E.g. >1.5mg/kg methyl prednisolone or equivalent for 5 or more days, long term treatment with >20 mg/day steroid, chemotherapy within 4 weeks of admission).

Lymphoma*:
Any type of lymphoma.

Leukaemia/Myeloma*:
Leukaemia or multiple Myeloma.

Metastatic Cancer*:
Proven distant metastases (not regional lymph nodes or contiguous spread) by surgery, CT scan or other methods.

* If patient has been in remission for 5 years or more, they should not be coded as chronic. Therefore documented presence or treatment for any type of lymphoma/leukaemia-myeloma/metastatic cancer in past five years will be considered as positive for chronic conditions.

Physiology

Temperature
Heart rate
Respiratory rate
Mean Arterial Pressure
Sodium
Potassium
Bicarbonate
Creatinine
Urea
Glucose
Albumin
Bilirubin
Haematocrit
White cell count
Urine output
Arterial blood gases

High and/or low

Should all be taken from within the first 24 hours of ICU admission

If only 1 set of results – enter as both high and low

If results are not available for the first 24 hours in ICU, then results from 1 hour prior to ICU admission can be used

If there are still no results available – leave blank

If ICU admission <24 hrs, only use results from time in ICU (or 1 hr prior to ICU admission)

Core Temperature

Data Dictionary – page 57

The highest and lowest temperatures measured in degrees during the first 24 hours of ICU admission

Additional notes

Core temperature needs to be assessed when the patient is free from the effects of active cooling. If the patient has been actively cooled, record the worst pre-cooling value if this is within the first 24 hrs of ICU admission or the hour prior to admission. If no pre-cooled value is available then leave blank and it will be treated as normal.

Respiratory Rate

Data Dictionary – page 63

The highest and lowest respiratory rates during the first 24 hours of ICU admission

Additional notes

For ventilated patients, the respiratory rate is the combined total of spontaneous and ventilator/mechanical breaths

Mean Arterial Pressure

Data Dictionary – page 59

The highest and lowest mean arterial blood pressure during the first 24 hours in ICU

Additional notes

Determine the highest/lowest MAP during the first 24 hours

OR

AORTIC will calculate the MAP for you – simply enter the SBP and DBP

Take the highest and lowest systolic blood pressures during the first 24 hours in ICU and the accompanying diastolic blood pressures

Cardiac/Respiratory Arrest During ICU Admission

Heart rate
Respiratory rate
Mean arterial pressure

Cannot record these variables as zero

The values recorded should be the lowest measured values prior to arrest or death

Urine Output

Data Dictionary – page 91

Total urine output (mls) for the first 24 hours in ICU

Additional notes

Only include urine from ICU

If urine collection is incomplete, extrapolate to 24 hrs
(1700 mls collected in 19 hrs: 1700/19 x 24 = urine output)

If urine output is collected for < 6 hrs or patient is terminal – leave blank and it will be treated as normal

If urine is not being collected (pt is free-voiding), leave blank and pt will be treated as normal

Please ensure urine output totals in notes are correct - highly suggested that urine total is recalculated prior to entry.

Acute Renal Failure

Data Dictionary – page 115

ARF is defined as present when the
24 hour urine output is < 410ml
AND creatinine > 133 umol/L
AND patient is not receiving chronic dialysis

Additional notes

If a patient meets the criteria for ARF on admission to ICU but then doesn't meet criteria during first 24 hours in ICU because they receive treatment – such patients can be coded as ARF

ICU discharge decision

Data Dictionary – pages 42 & 43

Date & Time of decision for separation from the ICU for this episode of care

Additional notes

This should be the date & time that medical staff decide the patient is ready for discharge

Glasgow Coma Score

Data Dictionary – page 75

The lowest total GCS during the first 24 hours in ICU

Additional notes

For APACHE III – ensure that separate components of GCS are entered (EVM)

Patient must be free from the effects of sedative/paralysing/neuromuscular blocking agents

Sedated patients – GCS must be taken ***just*** prior to sedation

Post-op patients = pre-theatre

Transfer/retrieval patients = medical/paramedical assessment prior to intubation/sedation (original hospital notes/transfer notes/ED)

Pre-sedation GCS does not need to be from first 24 hours in ICU, can go back as far as needed

Drug overdose patients – take GCS prior to administration of sedative agents

If a GCS cannot be determined – please leave blank and it will be treated as normal

Arterial blood gases and pH

Enter all ABGS into AORTIC and AORTIC will pick out:
Worst APACHE II ABG
Worst APACHE III ABG
Worst APACHE II pH
Worst APACHE III pH/paCO2 combination

	FiO2	paO2	paCO2	pH
AP2 ABG	0.8	152	54	7.34
AP3 ABG	0.21	54	64	7.41
	0.4	80	42	7.25
	0.6	65	52	7.46

AP2 pH

AP3 pH/paCO2

Ventilation

Data Dictionary – page 111

Invasive ventilation status of the patient at the time of a recorded blood gas

Additional notes

Invasive ventilation includes:

PSV

SIMV

VCV

CPAP/BiPAP combined with intubation/tracheostomy

Diagnosis

Data Dictionary – page 122 (APACHE III)

Reason for ICU admission (***not*** Hospital admission)

Additional notes

The diagnostic code should be that which is regarded by the clinician, in the first 24 hrs of ICU admission, as the predominant reason for ICU admission

Won't necessarily be the discharge diagnosis

Choose APACHE III diagnosis and let AORTIC map to corresponding APACHE II diagnosis

Look at the sub-codes (page 145 in Data Dictionary)

Diagnosis should match ICU source: admission from ward/ED = non-operative diagnosis

Admission from OT/Recovery = post-operative diagnosis

ANZICS CORE

Any Questions?

Data Collection & Standard Reports

APD data collection

Data collected at individual sites → 130-140 units

Each site has 2 APD contacts
- Prime
- Data sub

Minimum dataset + additional data
- Interventions
- CCU admissions
- Ward admissions
- Site-specific data

Data at the local site is identified

APD data submission

1. Data submitted to APD every 3 months

Includes: All admissions to ICU/All admissions to units under the care umbrella of the ICU

Excludes:
- Admissions to units remote from the ICU (separate cardiothoracic units not run by intensivists)
- Coronary care patients
- Ward admissions
- Patients admitted for solitary procedures (central lines)

Exported data is de-identified (contains age, sex and postcode)

APD data submission

2. Data checked and loaded to central database

Data Rejected: When >20% of admissions are excluded from the APACHE III SMR analysis due to missing data
- Missing diagnosis
- Missing hospital outcome
-Missing ALL physiology
- Missing CABG graft or redo values

Missing or illogical data is queried – reports sent to sites for amendment

Missing or out-of-range values are treated as normal

Submitted files are converted to SAS

All scores and risk of deaths are recalculated

APD data submission

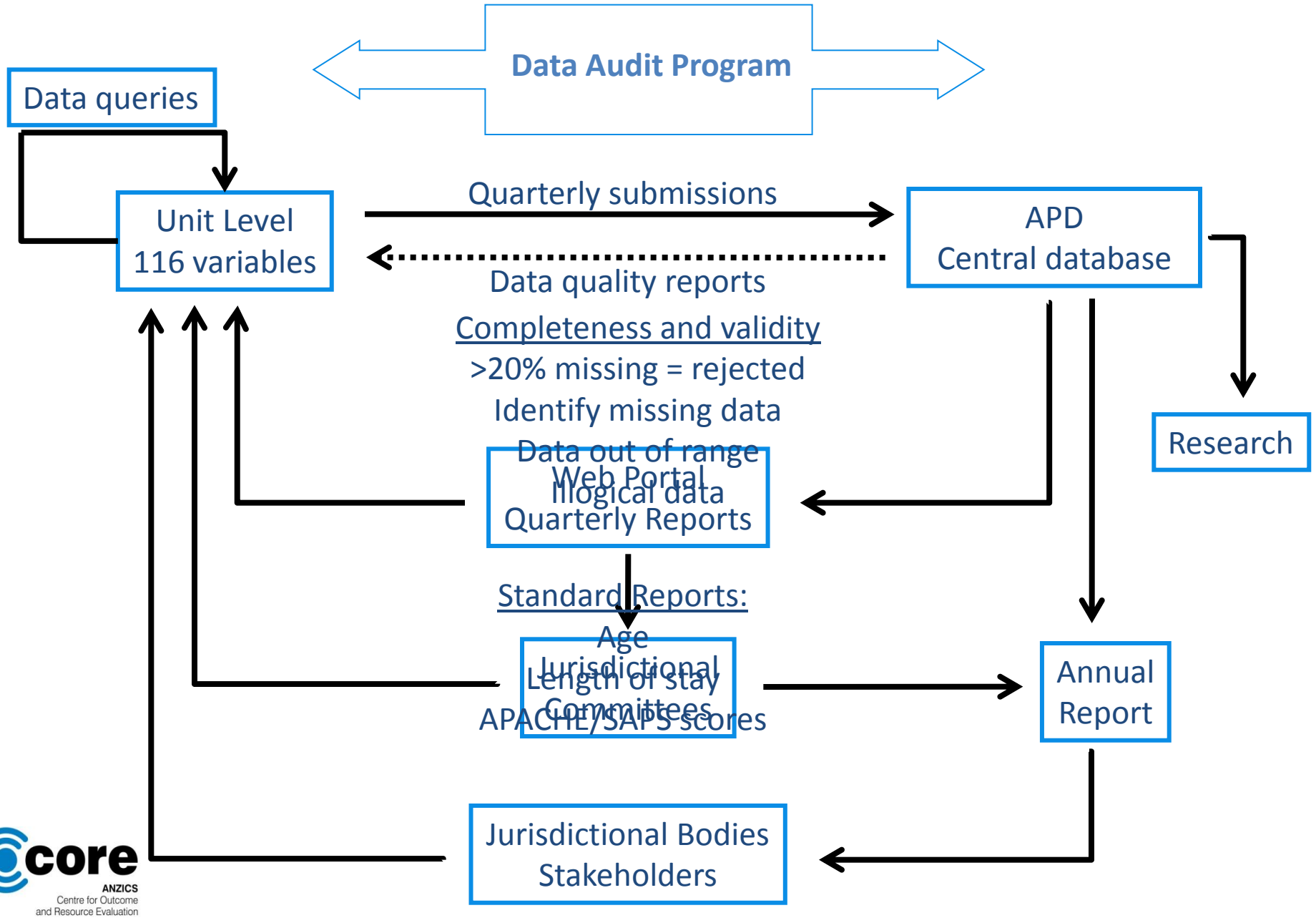
3. APD Standard Reports generated

Quarterly reports are available through the CORE SAS Portal

Logon details are unit-specific

Comparison Groups:
- Rural/Regional
- Metropolitan
- Tertiary
- Private

The Process

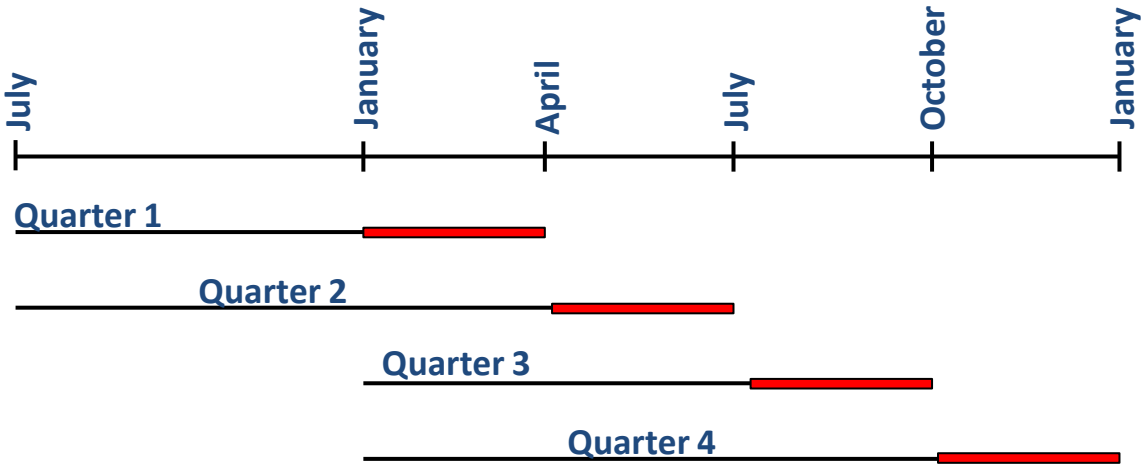


ANZICS

core
ANZICS
Centre for Outcome and Resource Evaluation

APD Reports

Data submission overlap



Changes made locally can be updated centrally:

- discharges/hospital outcomes
- updated data

Primary Validation Report

The data submitted contains 1588 records, with the last admission to ICU 30/09/2010.

A preliminary check of the data set has found the following data quality issues.
Please refer to the Data Dictionary for details of verification rules and the treatment of invalid values.
Where possible, please fix invalid values prior to the next submission.

Patient Id (mrn)	Admission Date	Admisssion Time	Field	Invalid Value
100000000125	05/05/2010	1600	GCSEYE	5
	31/08/2010	38	albumin	3
	05/05/2010	1600	gcs	16
100000000427	01/08/2010	2200	GCSEYE	5
	01/08/2010	2200	gcs	16

Primary Validation Report

The data submitted contains 935 records, with the last admission to ICU 30/09/2010.

A preliminary check of the data set has found the following data quality issues.
Please refer to the Data Dictionary for details of verification rules and the treatment of invalid values.
Where possible, please fix invalid values prior to the next submission.

Patient Id (mrn)	Admission Date	Admisssion Time	Field	Invalid Value
1015253	20/08/2009	1111	hco3Hi	1
1027295	11/06/2009	2330	Pregnancy_Validation_Age	Female age <= 10 or age >= 61 with a PREG_STAT of 1. Currently Pregnant or 2. Not Pregnant or 3.Postpartum Period or 4. Unknown
1035242	05/08/2009	645	albumin	1
	05/08/2009	645	creat	4
	05/08/2009	645	creatHi	4

Secondary Validation Report

We have reviewed your data for the time period 01/01/2010 to 30/09/2010. Secondary findings are as follows:

Missing physiology

No missing APACHE physiological variables.

Duplicates

No records which have duplicate patient ID and ICU admission date and time

Missing hospital outcome

5 records which are missing the Hospital Outcome (Please see exclusion report below). Because of these records, the SMR calculations will be affected. If you are an AORTIC User please note: These records can be identified within AORTIC by running the data clean report: -Missing Hospital Outcome- .

Missing diagnosis

No records which are missing the APACHE III diagnostic code

Missing CABG variables

4 CABGs which are missing a redo value and 4 CABGs which are missing a graft value (lease see exclusion report below). Please note that for this reporting round and in the future, CABG (1207) admissions will be included in the APACHE III-J SMR reports. For a predictive risk of death to be calculated, the number of grafts and whether the operation was a redo must be recorded. If you are an AORTIC User please note: These records can be identified within AORTIC by running the data clean report: -Missing CABG redo and graft values-. Report will be available only in Aortic 9.1 (upon release) or higher versions.

Please fix any errors listed above for the next submission.

Does any missing variable exceed 20%?

This file will be loaded to the central database as the level of errors in the data set is not significant. If your file has in excess of 20% data missingness for any relevant data entry field, it will not be loaded to the central database

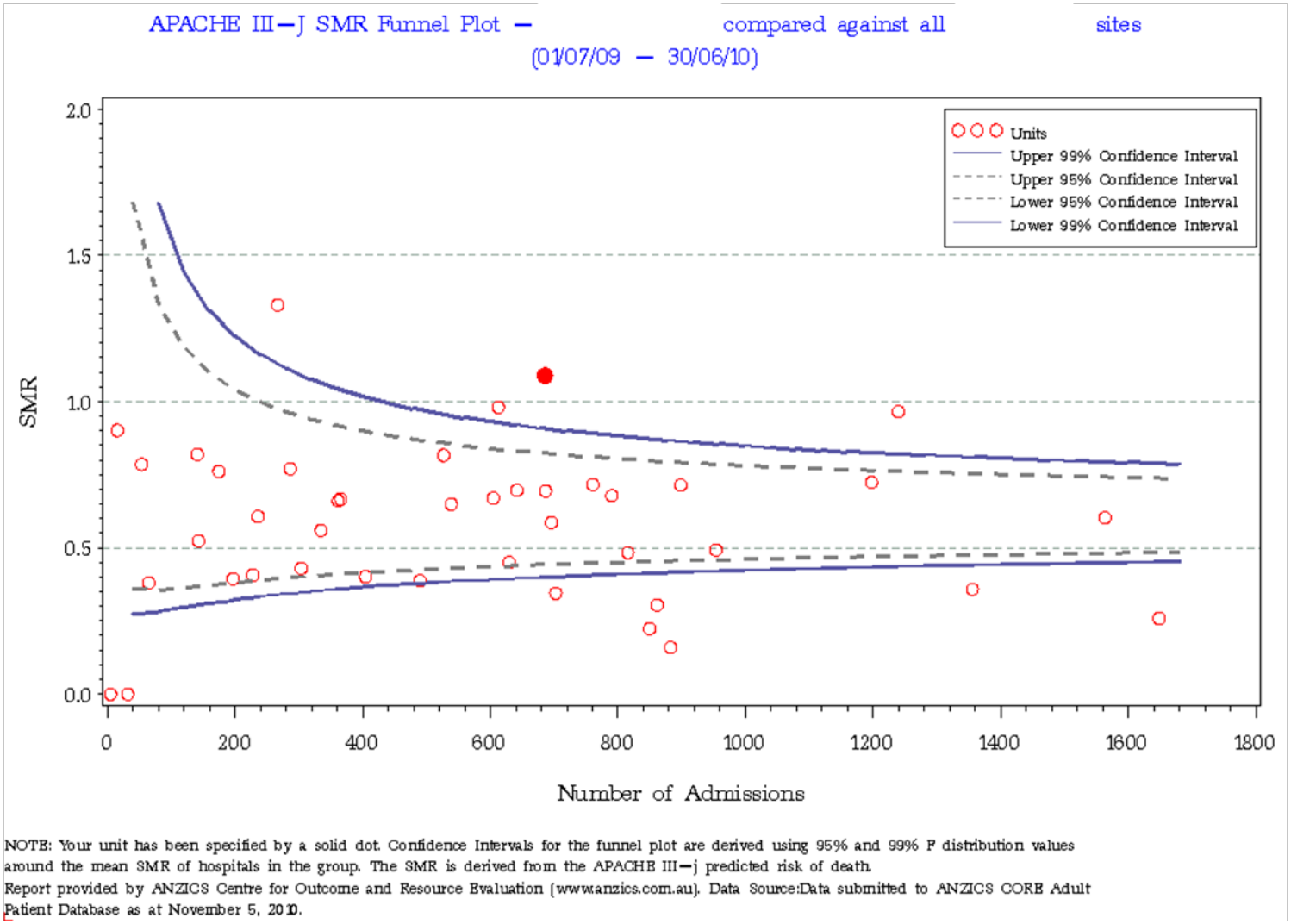
Exclusion Report

Item	Value
Number of records in file	1735
Duplicate Patient ID and ICU Admission Date and Admission Time	0
Invalid Age	0
Number In Age Report	1735
APACHE physiological varaibles not recorded	0
Number in APACHE III-J score reports	1735
APACHE III-J SMR	
APACHE physiological variables not recorded for age 16 or older	0
Age under 16 or Missing	217
Missing Hospital Outcome	3
Transfer to another ICU	0
ICU Stay Less Than 4 Hours	33
Non Scoring APAHCE III-J Diagnosis for those 16 or older	0
Hospital outcome recorded by no ICU discharge date	0
CABG missing a redo value	4
CABG missing a graft value	4
Number in APACHE III-J SMR Report	1481
Non Scoring APAHCE III-J Daignosis Over 16 Breakdown	
Missing Apache III J Diagnosis	0
Other Medical (10002)	0
Total	0

Data quality report

Date of admission to ICU	Patient ID	Exception	Comments
05/08/2002	0002	Missing Haematocrit	
12/01/2003	0006	Unlikely GCS/intubated combination	Comatose but not intubated: GCS<=6 but not tubed.
12/04/2003	0003	Invalid ICU admission	Admitted to ICU from OT/Recovery but non-op Dx

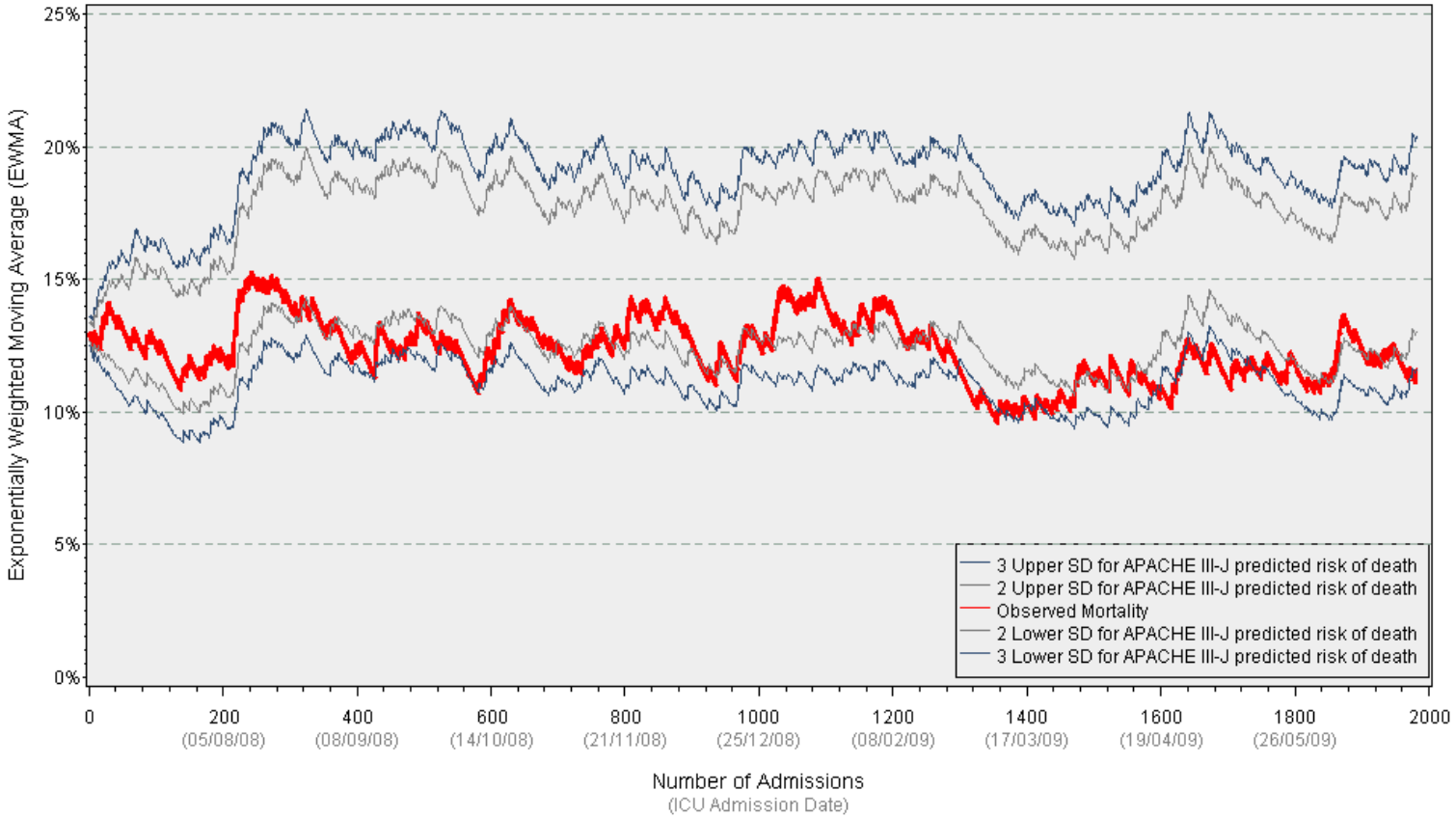
Funnel Plot


APACHE III–J SMR Funnel Plot – compared against all sites
(01/07/09 – 30/06/10)
Units
Upper 99% Confidence Interval
Upper 95% Confidence Interval
Lower 95% Confidence Interval
Lower 99% Confidence Interval
SMR
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
1200
1400
1600
1800
Number of Admissions
NOTE: Your unit has been specified by a solid dot. Confidence Intervals for the funnel plot are derived using 95% and 99% F distribution values around the mean SMR of hospitals in the group. The SMR is derived from the APACHE III–j predicted risk of death.
Report provided by ANZICS Centre for Outcome and Resource Evaluation (www.anzics.com.au). Data Source:Data submitted to ANZICS CORE Adult Patient Database as at November 5, 2010.

EWMA

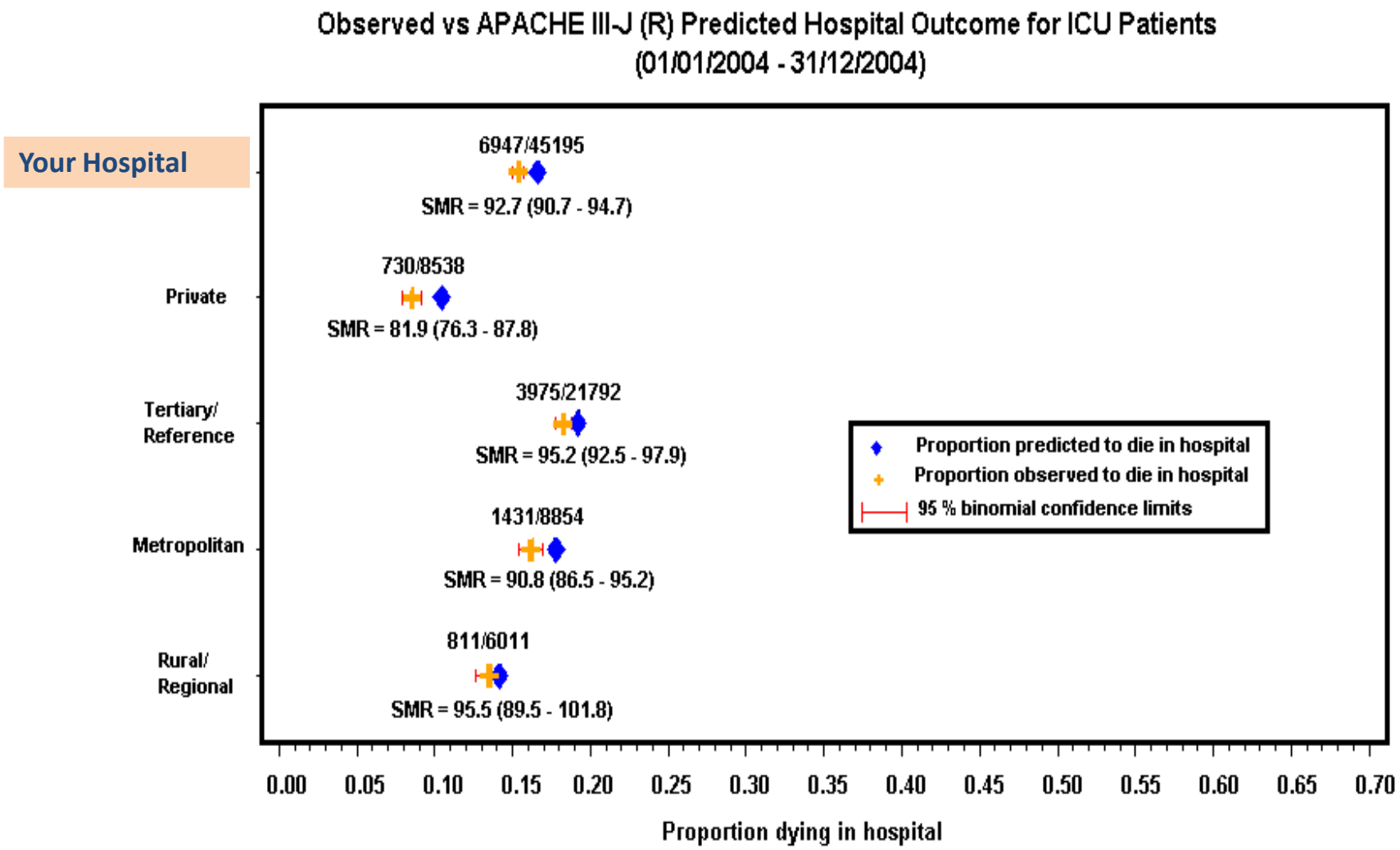
Running comparison between observed mortality rates and predicted mortality rates

Hospital Name (01/07/2008 - 30/06/2009)

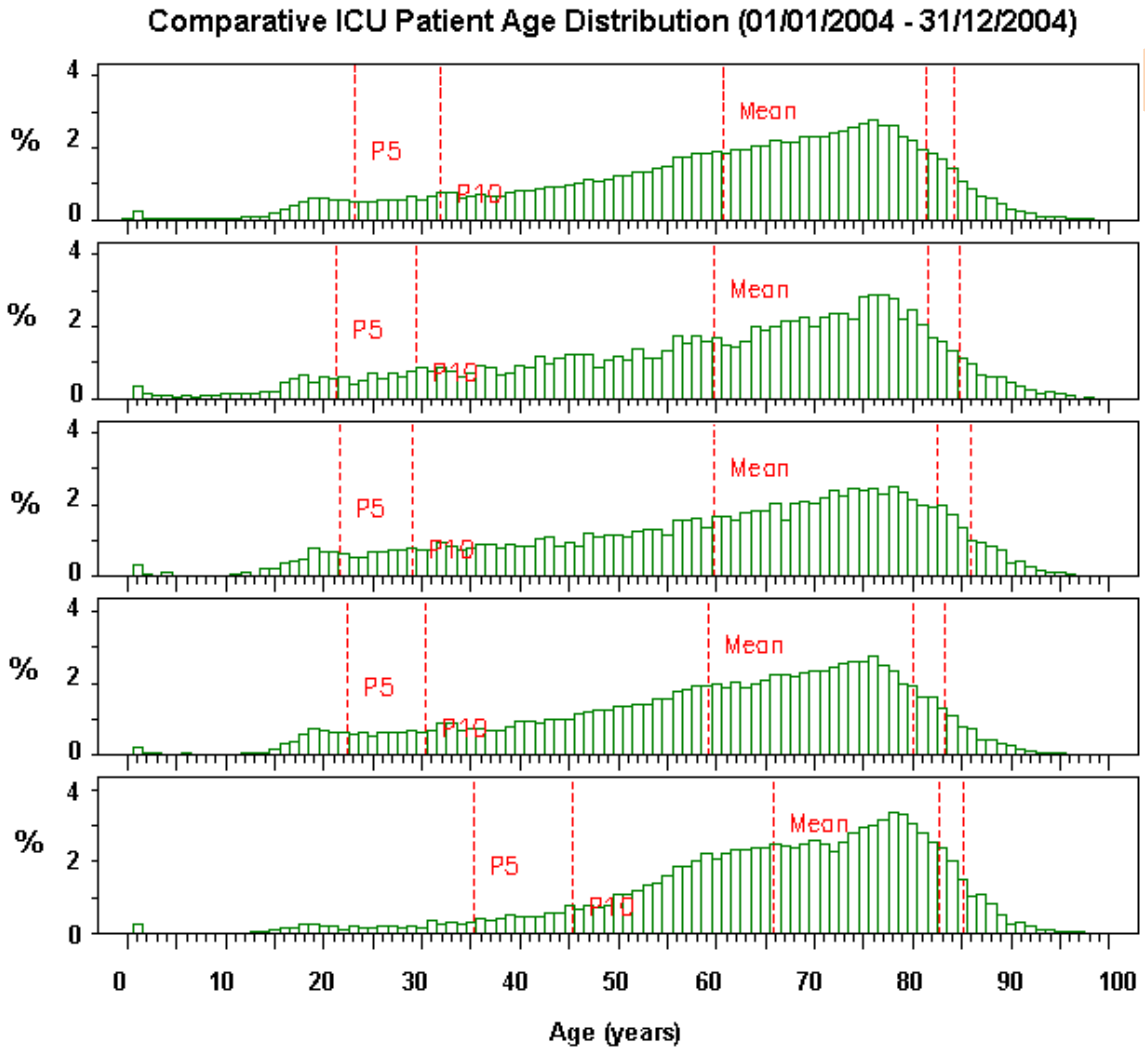


NOTE: Control limits for predicted mortality rates are derived using APACHE III-J; Lines shown are calculated using an exponentially weighted moving average with a weighting of 0.005.
Report provided by ANZICS Centre for Outcome and Resource Evaluation (www.anzics.com.au). Data Source:Data submitted to ANZICS CORE Adult Patient Database as at October 2, 2009.

SMR by Hospital classification



Age distribution



Your Hospital
Mean = 60.62
Std Dev = 18.68
P10 = 31.90
P90 = 81.30

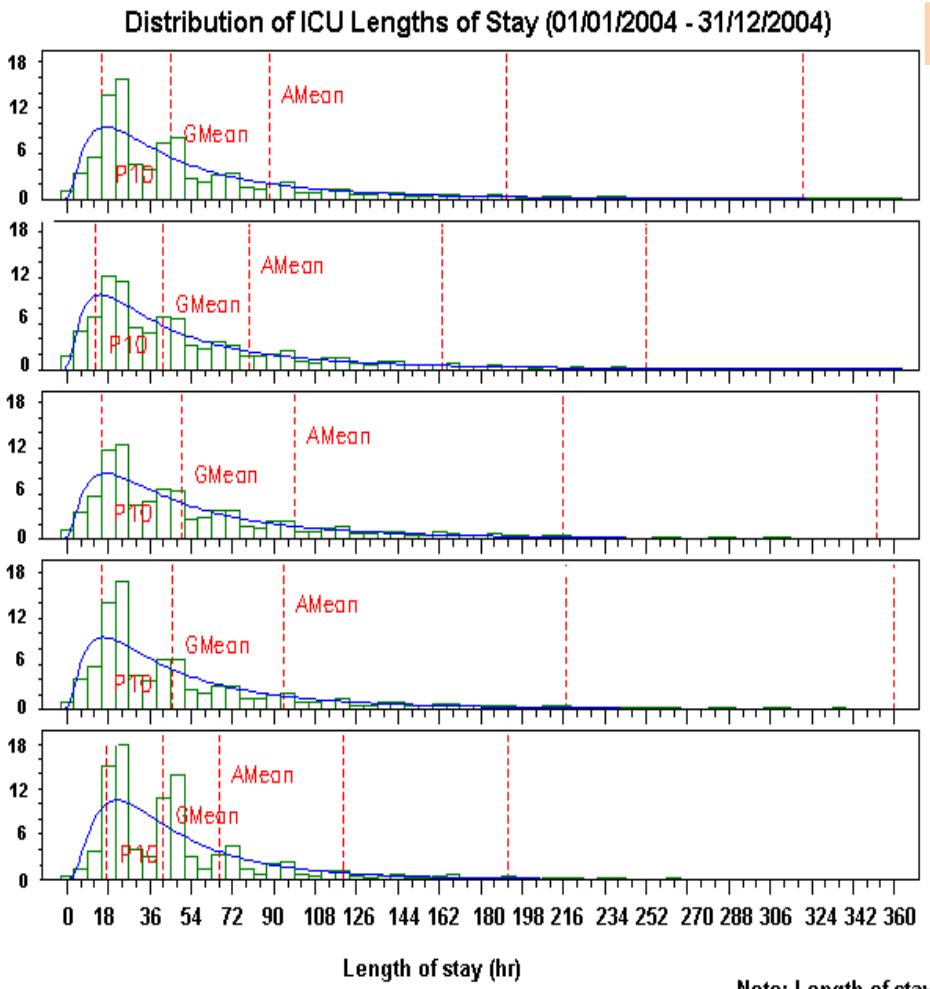
Rural/Regional ICUs
n = 7838
Mean = 58.77
Std Dev = 19.85
P10 = 29.50
P90 = 61.50

Metrop. ICUs
n = 12061
Mean = 58.62
Std Dev = 20.08
P10 = 29.00
P90 = 82.60

Tertiary/Ref ICUs
n = 36746
Mean = 58.13
Std Dev = 18.62
P10 = 30.40
P90 = 80.00

Private ICUs
n = 13468
Mean = 65.88
Std Dev = 15.60
P10 = 45.30
P90 = 82.70

LOS distribution



Your Hospital

n = 69651
GMean = 45.17
Arithmean = 67.93
P95 = 320
P99 = 757.22

Rural/regional ICUs
n = 7772
GMean = 41.91
AMean = 79.30
P95 = 252.18
P99 = 663.50

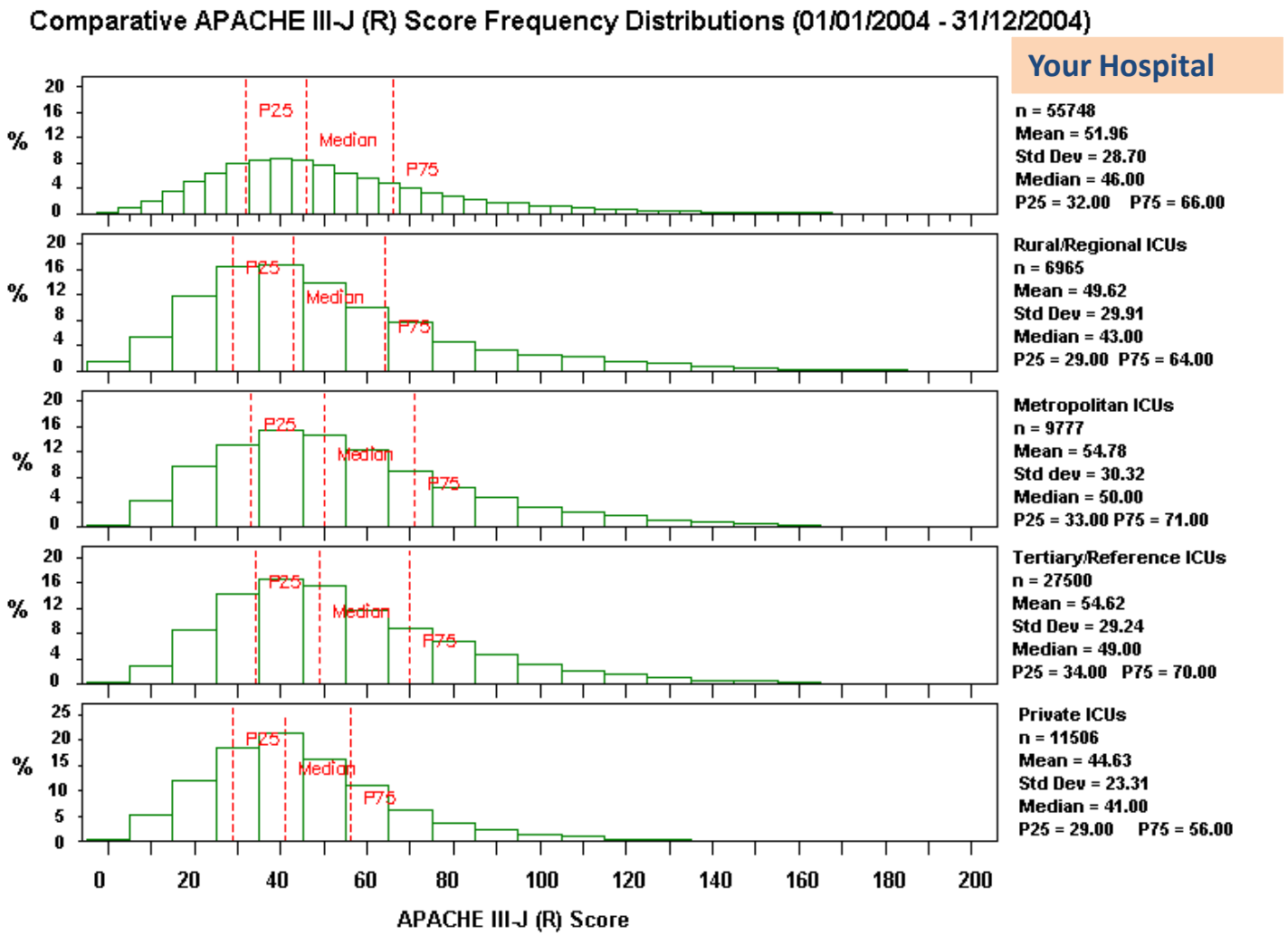
Metrop. ICUs
n = 12026
GMean = 49.61
AMean = 99.34
P95 = 352.17
P99 = 647.00

Tertiary/Ref ICUs
n = 36737
GMean = 45.86
AMean = 93.98
P95 = 360.00
P99 = 794.5

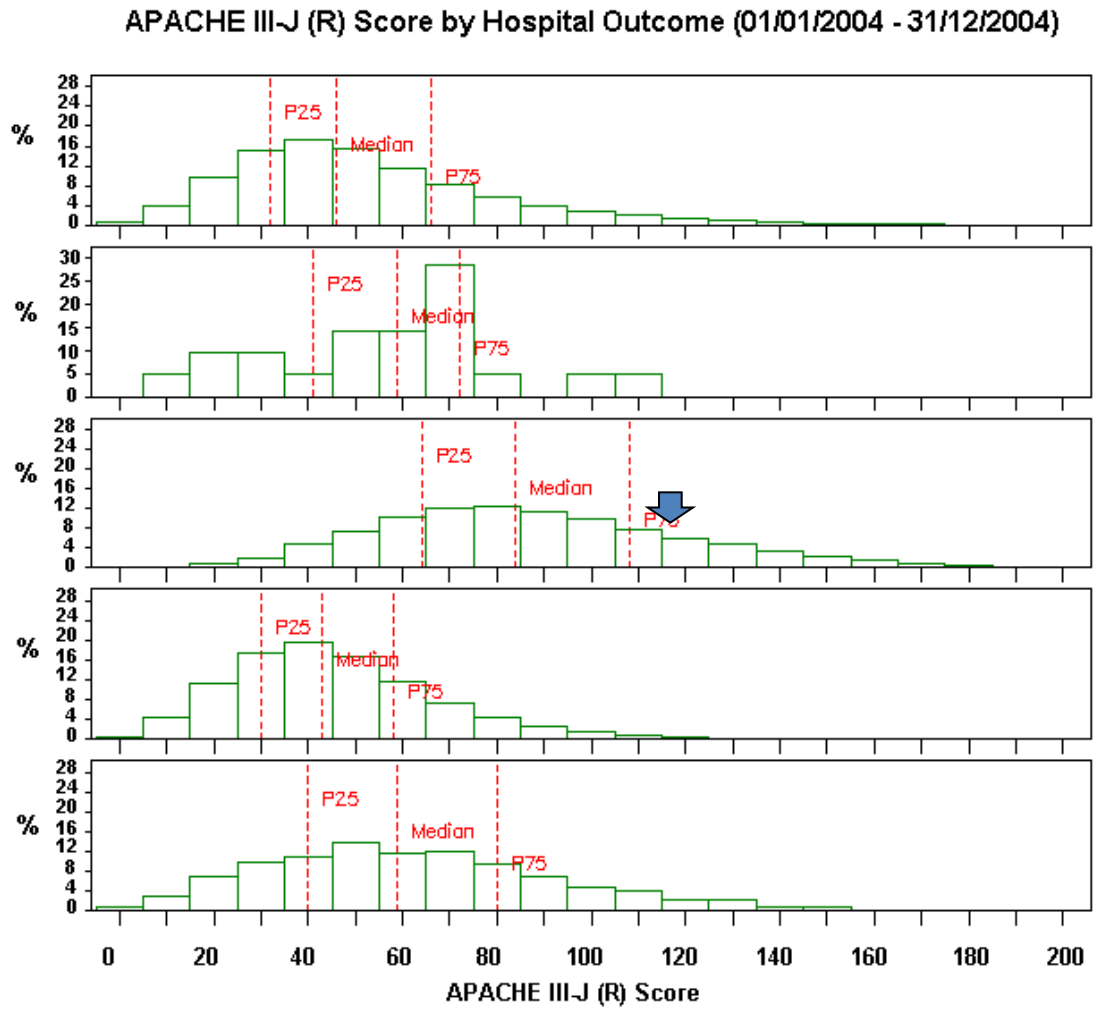
Private ICUs
n = 13314
GMean = 41.44
AMean = 66.00
P95 = 191.58
P99 = 534.06

Note: Length of stay for admissions > 360 hr not shown

Score distribution



Score by Hospital outcome



Your Hospital

n = 55748
Mean = 51.96
Std Dev = 28.70
Median = 46.00
P25 = 32.00 P75 = 66.00

Still in hospital
n = 21
Mean = 56.86
Std Dev = 25.79
Median = 59.00
P25 = 41.00 P75 = 72.00

Died in hospital
n = 7579
Mean = 87.57
Std Dev = 33.16
Median = 84.00
P25 = 64.00 P75 = 108.00

Survived hospital
n = 45326
Mean = 45.83
Std dev = 23.02
Median = 43.00
P25 = 30.00 P75 = 58.00

Transferred
n = 854
Mean = 61.75
Std Dev = 30.95
Median = 59.00
P25 = 40.00 P75 =80.00

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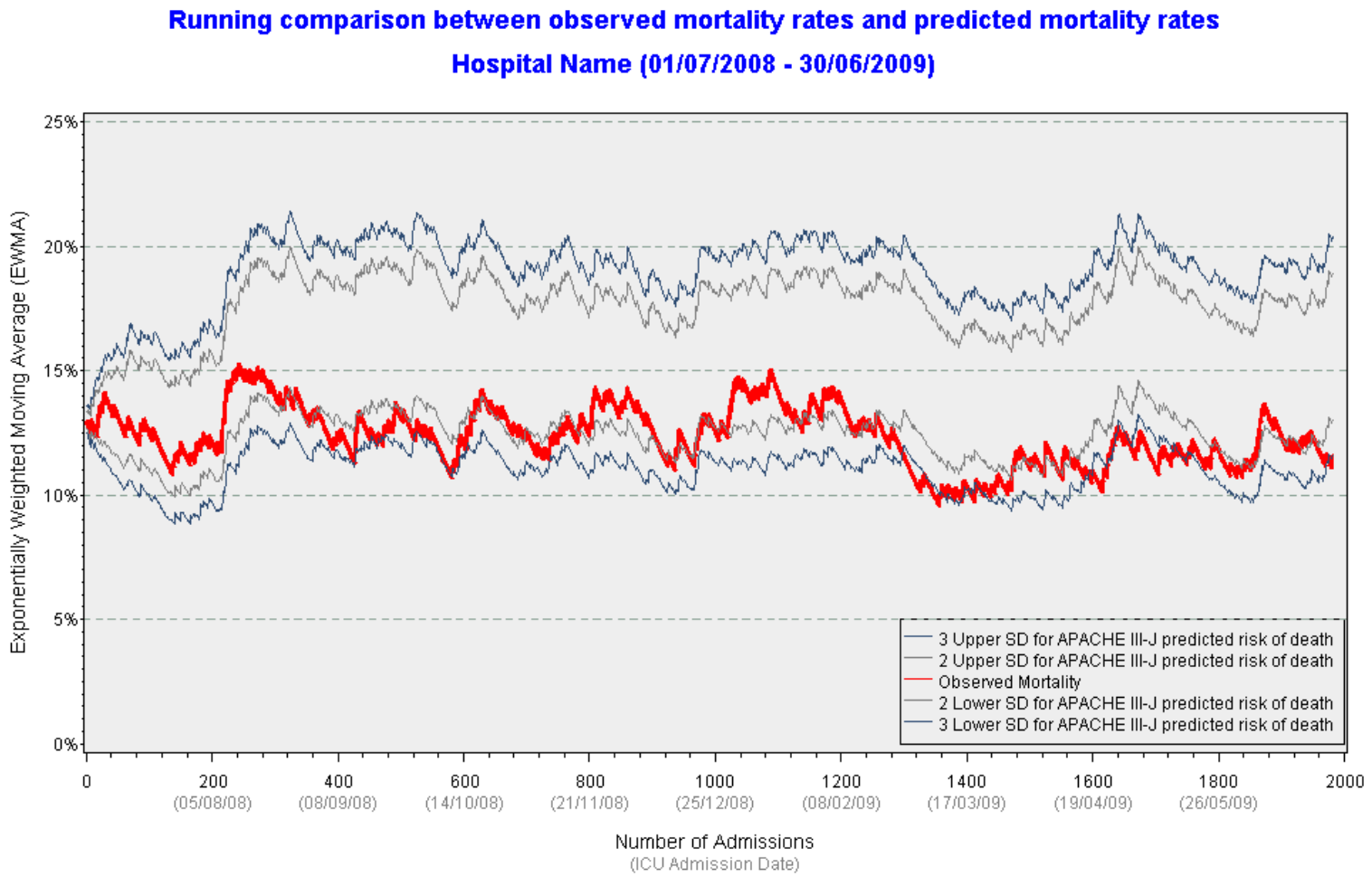
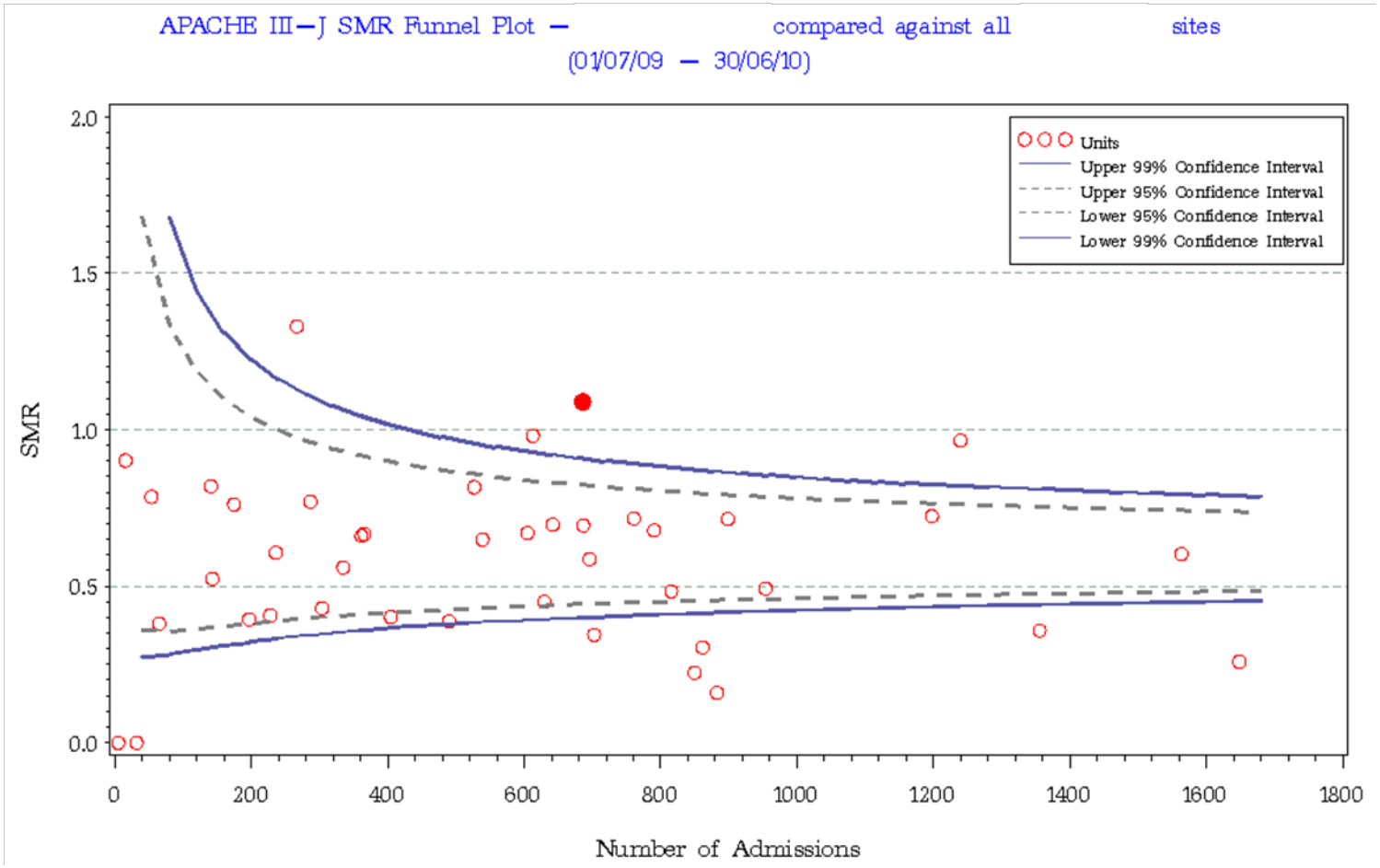
Any Questions?

Data Quality

EWMA


Running comparison between observed mortality rates and predicted mortality rates
Hospital Name (01/07/2008 - 30/06/2009)
Exponentially Weighted Moving Average (EWMA)
25%
20%
15%
10%
5%
0%
0
200
(05/08/08)
400
(08/09/08)
600
(14/10/08)
800
(21/11/08)
1000
(25/12/08)
1200
(08/02/09)
1400
(17/03/09)
1600
(19/04/09)
1800
(26/05/09)
2000
Number of Admissions
(ICU Admission Date)
3 Upper SD for APACHE III-J predicted risk of death
2 Upper SD for APACHE III-J predicted risk of death
Observed Mortality
2 Lower SD for APACHE III-J predicted risk of death
3 Lower SD for APACHE III-J predicted risk of death

Funnel Plot


APACHE III–J SMR Funnel Plot – compared against all sites
(01/07/09 – 30/06/10)
Units
Upper 99% Confidence Interval
Upper 95% Confidence Interval
Lower 95% Confidence Interval
Lower 99% Confidence Interval
SMR
2.0
1.5
1.0
0.5
0.0
0
200
400
600
800
1000
1200
1400
1600
1800
Number of Admissions

Factors that influence an SMR

Data reliability

Data completeness

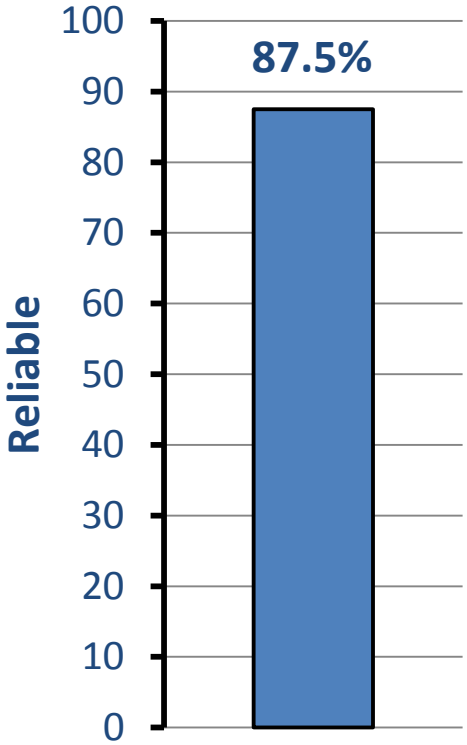
Case mix

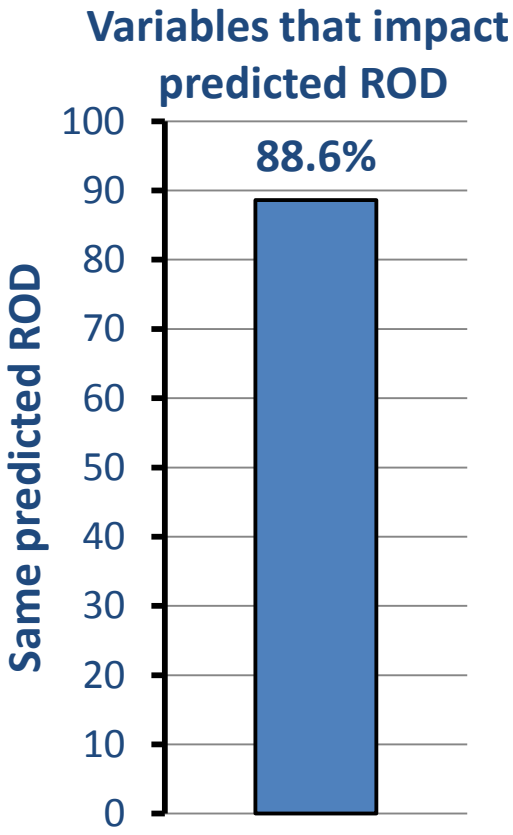
Data reliability

Data Reliability

Audited over 32,000 data entries

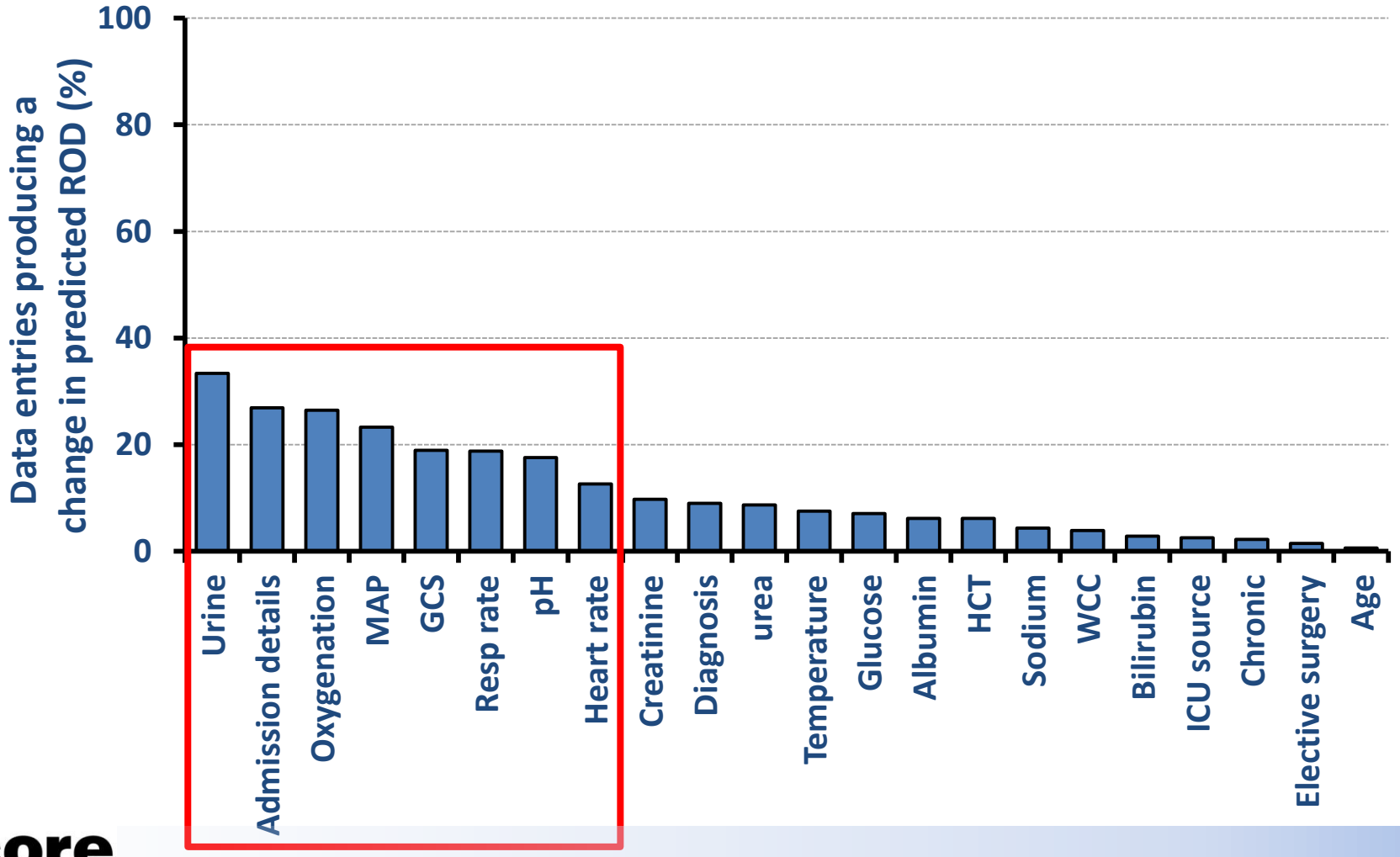
665 admissions to 27 units



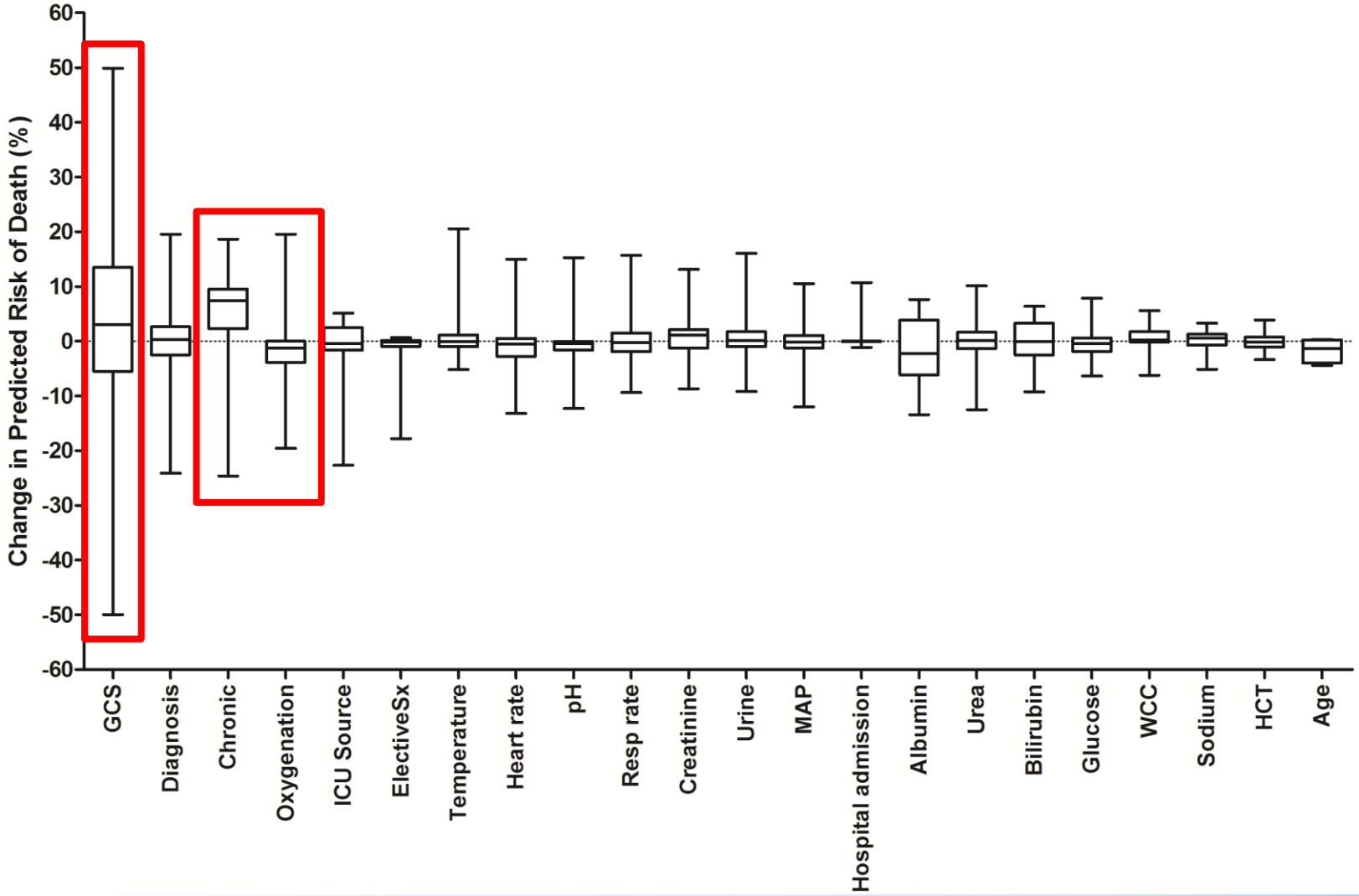


Problematic Variables

11.4% of data entries produce a change in predicted risk of death



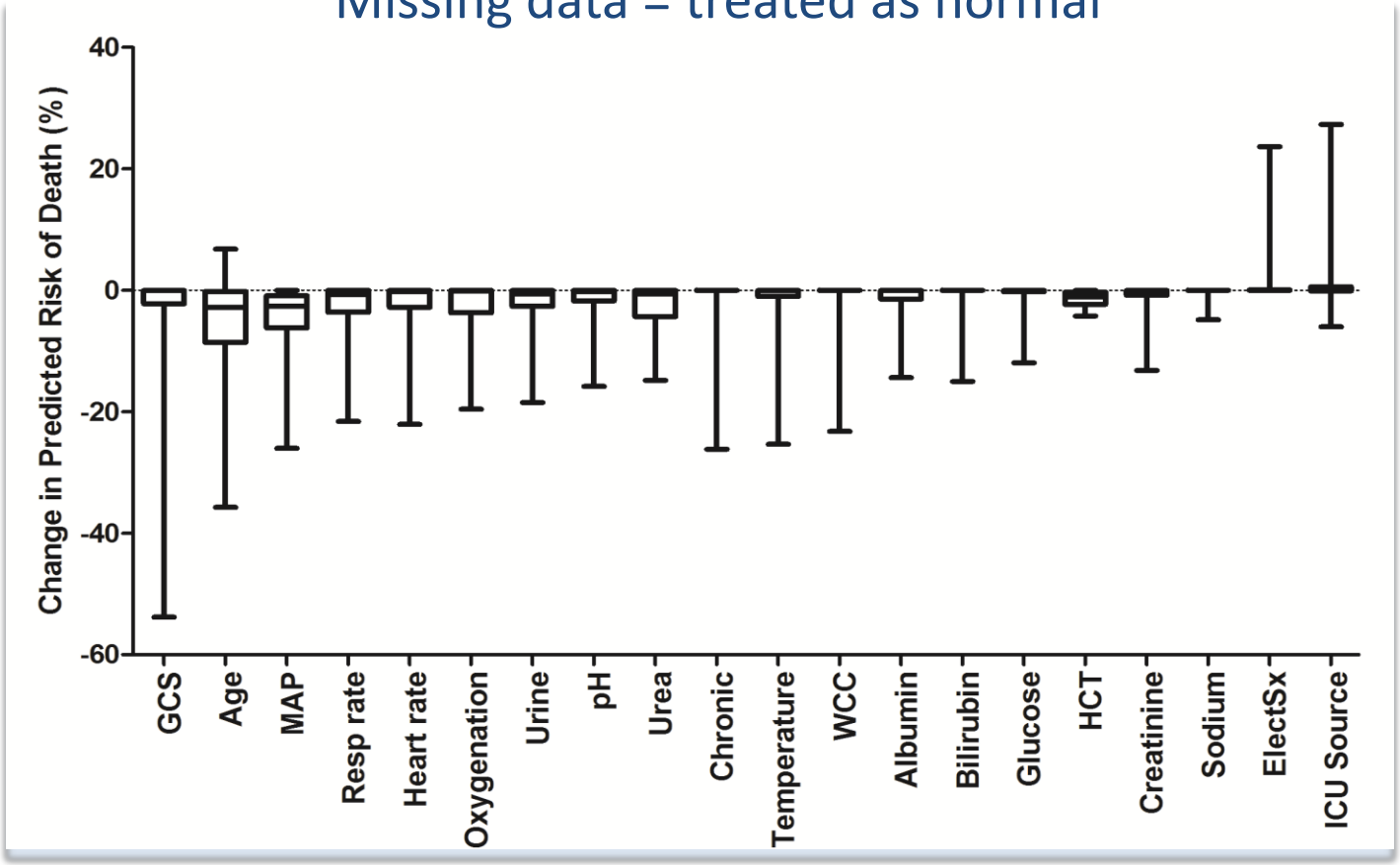
Change in ROD by variable



Data completeness

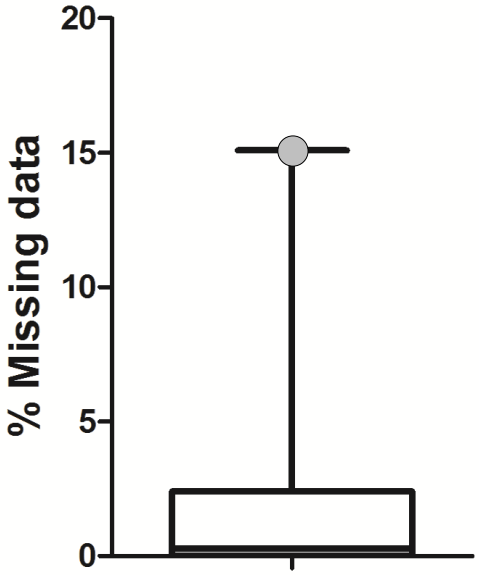
Data completeness

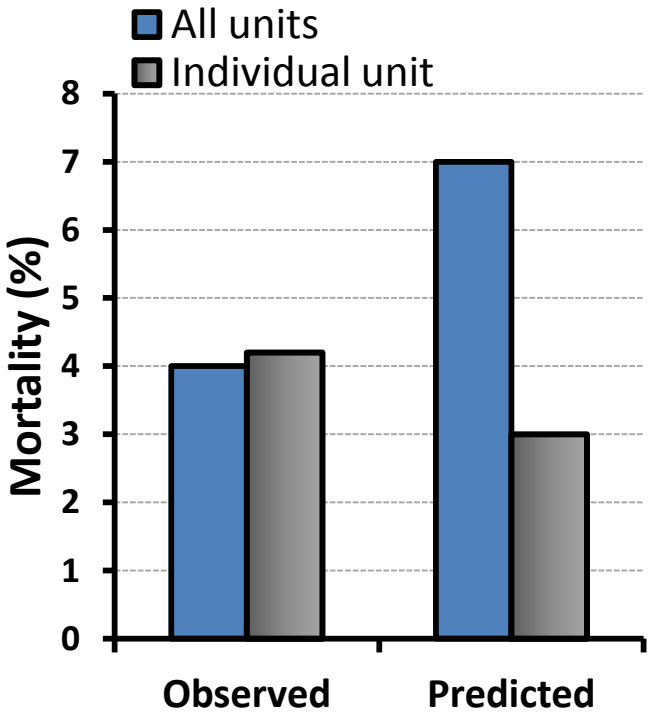
Missing data = treated as normal

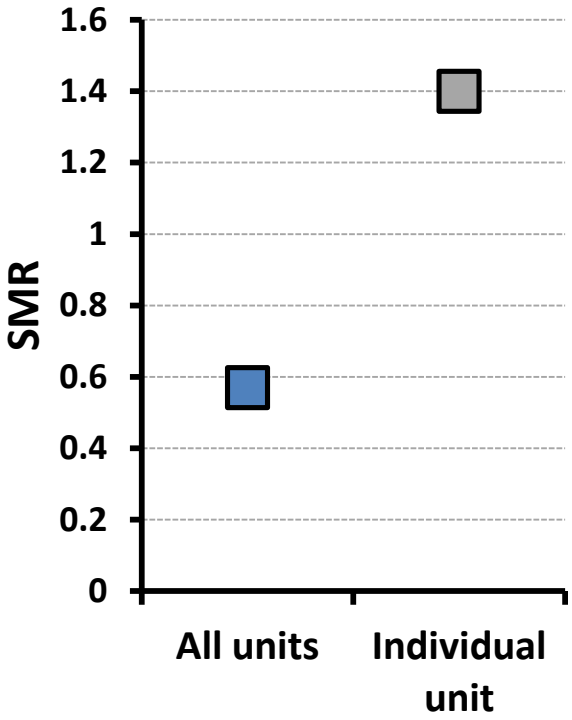


Higher missing data = lower predicted mortality = higher SMR

Data completeness

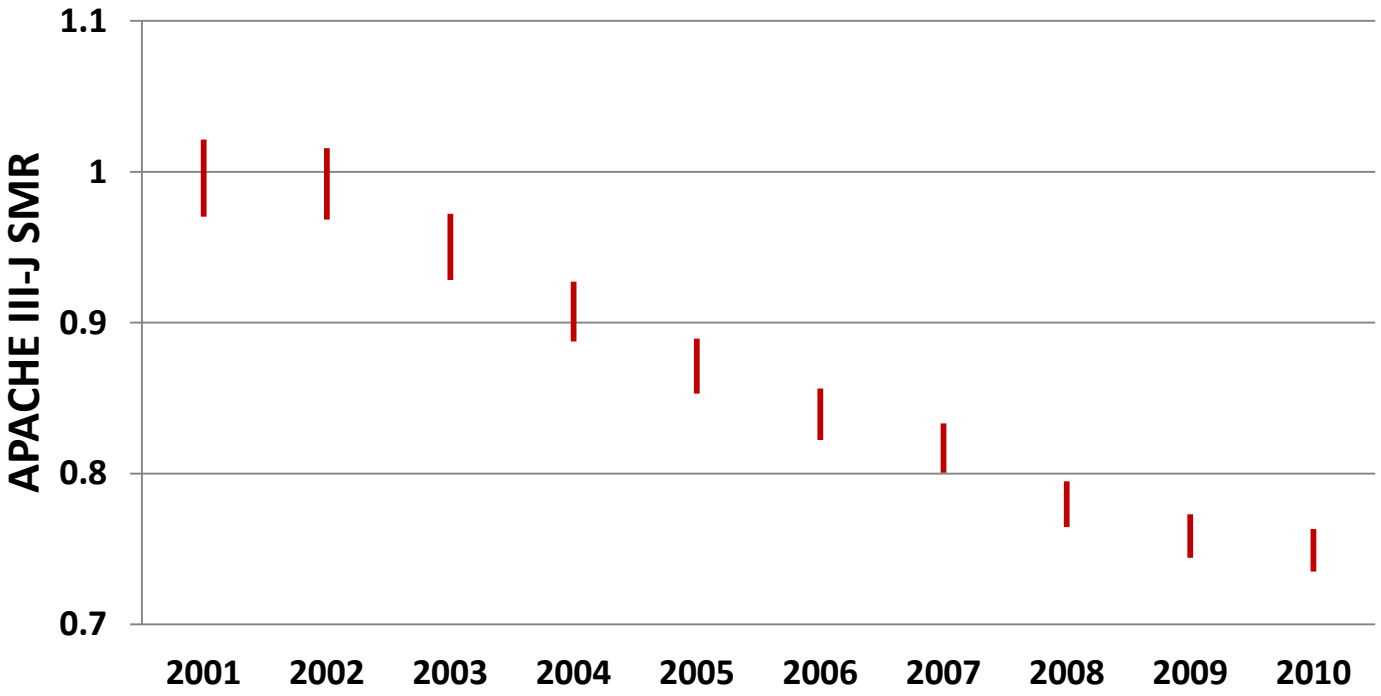




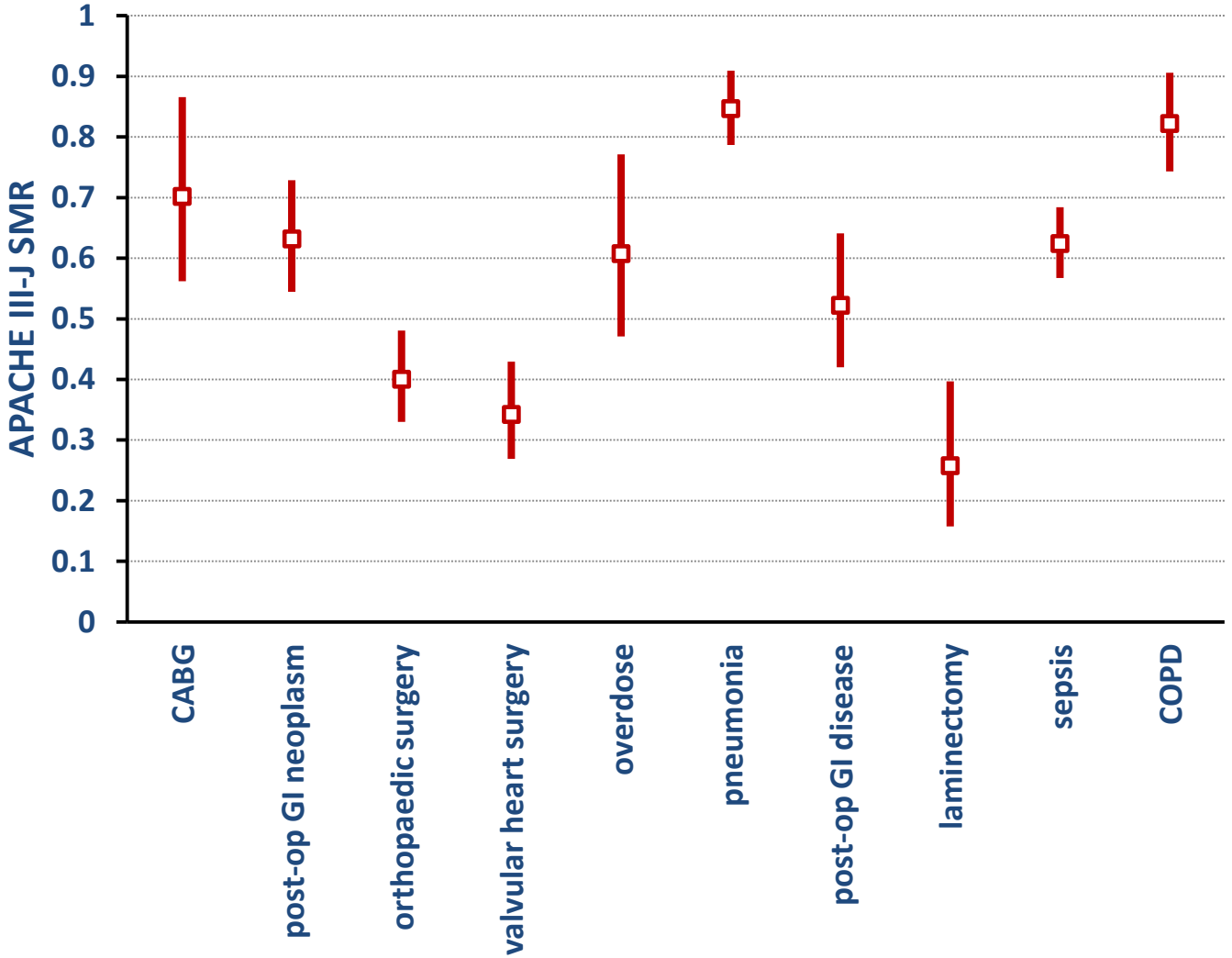


Case mix

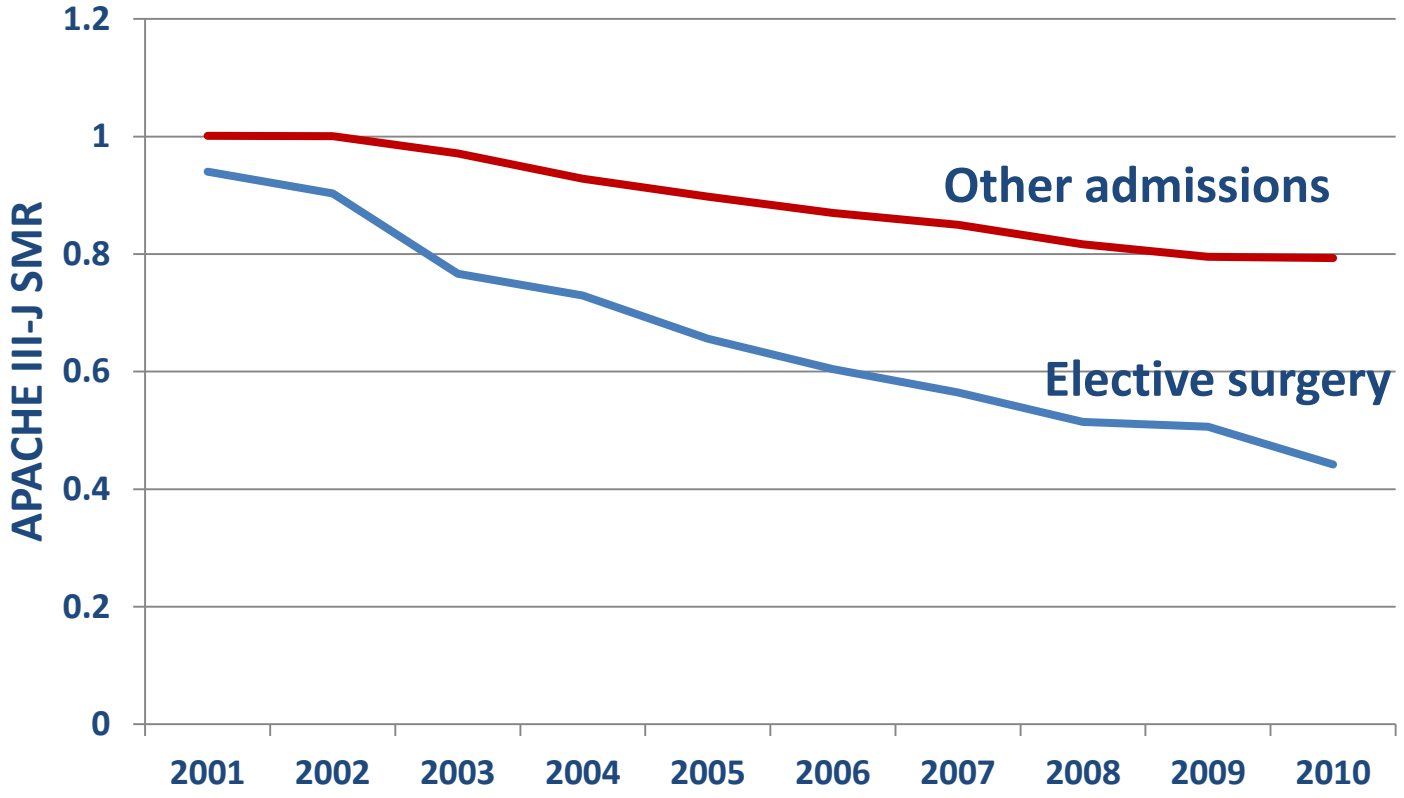
APACHE III-J calibration



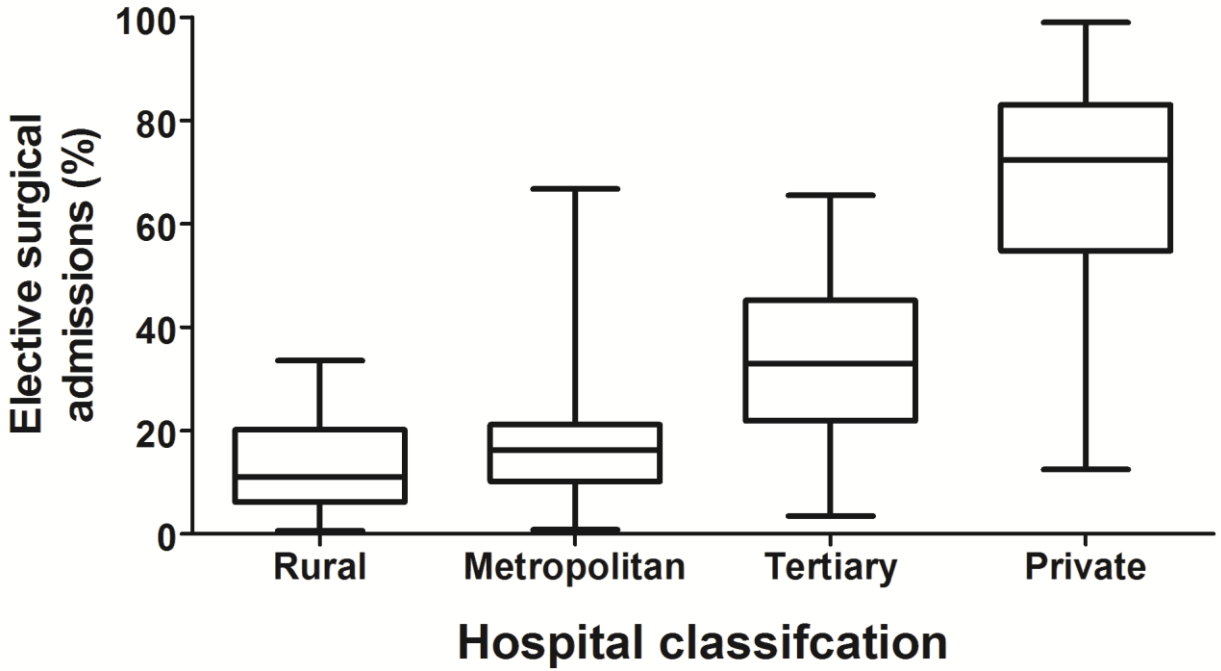
2010 - Top 10 diagnoses



Elective surgical patients



Elective surgical patients



Dedicated data collectors

Impact of dedicated data collectors

Do you have a trained, dedicated data collector?

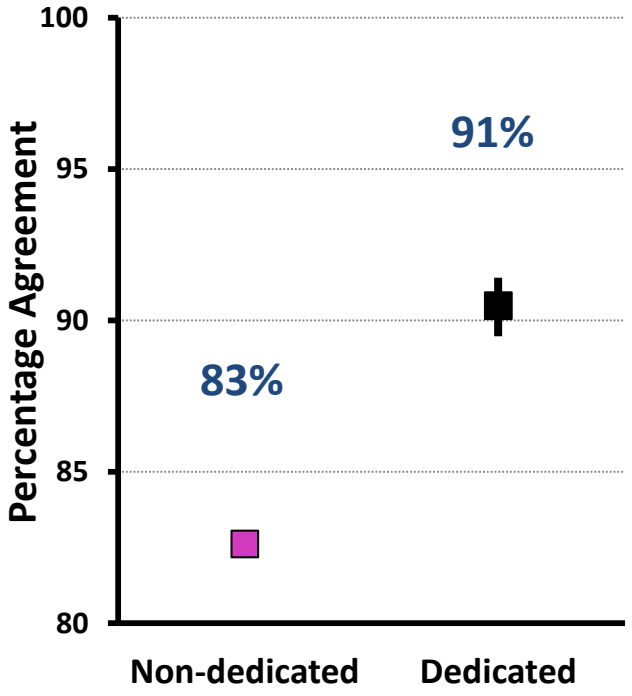
29,450 data entries

3,572 data entries

What impact does having a trained, dedicated data collector have on data quality?

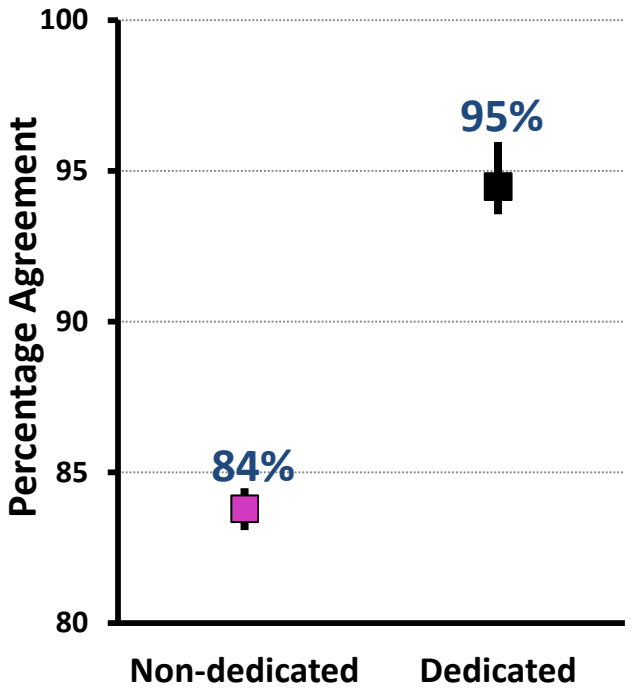
Variable Agreement

Hospital admission
ICU admission & discharge
Sex
ICU source
Elective
Apache 2 Diagnosis
Age
Temperature
Heart rate
Respiratory rate
Mean arterial pressure
Sodium
Potassium
Creatinine
Haematocrit
White cell count
Oxygenation
pH
Chronic conditions
Glasgow coma score (GCS)

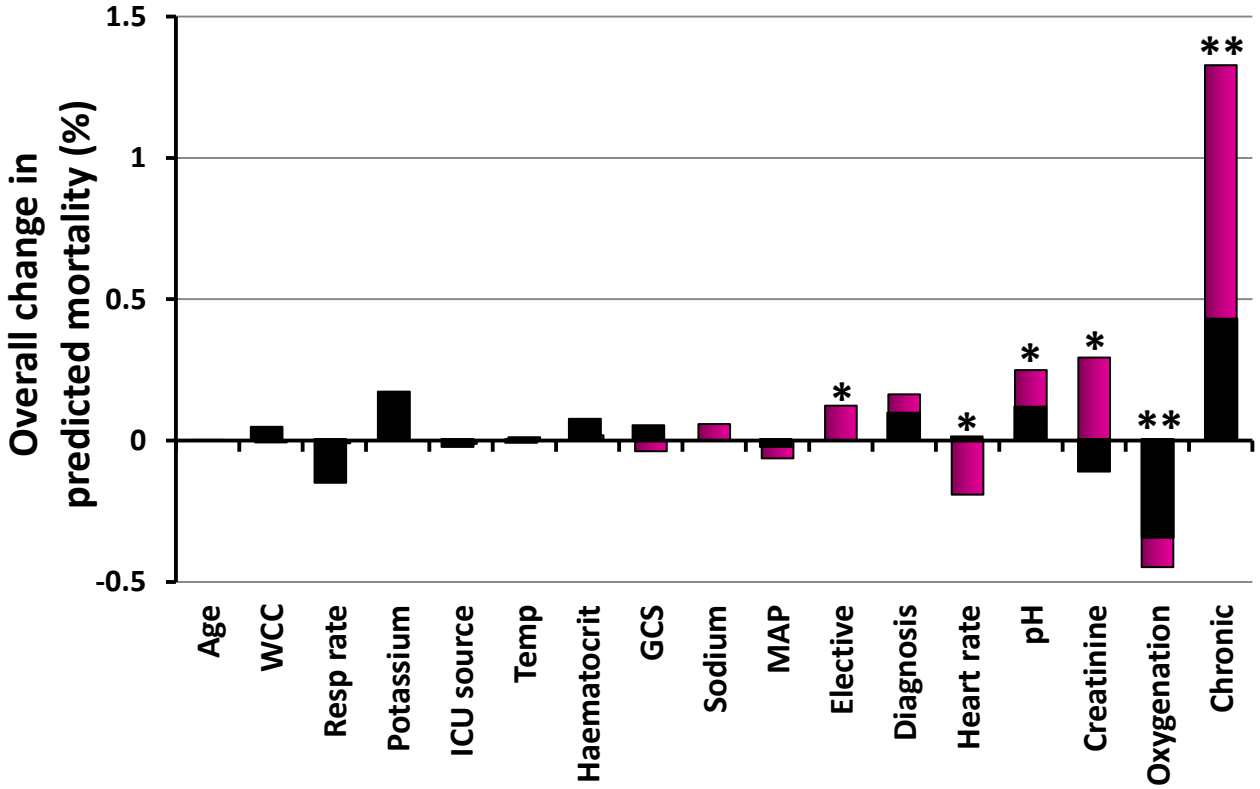


Score Agreement

Age
Temperature
Heart rate
Respiratory rate
Mean arterial pressure
Sodium
Potassium
Creatinine
Haematocrit
White cell count
Oxygenation
pH
Chronic conditions
Glasgow coma score (GCS)



Predicted Mortality



Non-dedicated

Dedicated

* = p<0.01

** = p<0.0001

Moving forward

Data Quality

- Redevelopment of APD data dictionary
- Increased training
- Data audit program

New Risk adjusted model

New reporting system

- admission type
- diagnostic group
- Move beyond risk-adjusted mortality:
  - length of stay
  - occupancy
  - readmissions
  - after hours discharge rates

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Any Questions?