Cardiac Surgery Report

2010

Division of Cardiothoracic Surgery
Department of Surgery
It is admirable to observe that, year after year, with unswerving tenacity and indubitable determination, the Prince of Wales Hospital at the Chinese University of Hong Kong confirms its scientific and social persevering commitment in the publication of the results of its medical community and principally, of course, its group of cardiothoracic surgeons.

A report of this nature enables the Cardiothoracic Surgery Division of the Department of Surgery to know where it stands with regards to its results in the international world of cardiothoracic surgery as well as enabling the international scientific community to appreciate the place of the Prince of Wales Hospital within its folds. The report shows that the progress in knowledge and new techniques of the last few years has been fully integrated by the surgeons at the Prince of Wales Hospital.

I believe congratulations and thanks should be extended to the surgeons of the Prince of Wales for having joined the European Association for Cardiothoracic Surgery (EACTS) in this domain which
means that their data and results can be incorporated in the EACTS Adult Cardiac Surgical Database Report 2011 when there are many teaching hospitals in Europe that have not made the same effort. In particular I would like to thank Professor Malcolm J. Underwood for his invitation to present this foreword and to congratulate him and colleagues on this achievement.

Professor Francis Fontan
Honorary Professor of Cardiac Surgery,
Founding Father and First President of EACTS,
Bordeaux University, France.
Introduction

This is the fourth annual report for the Division of Cardiac Surgery, Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, New Territories, Hong Kong.

We began data collection as part of a quality assurance programme for patients undergoing cardiac surgery in our Institute from November 2005. Since that time we have moved purposefully from basic outcome analysis described in the first report to comprehensive ‘international benchmarking’ for a cumulative period of 3 years mentioned last year.

In this report, we highlight our trend towards ‘real-time’ monitoring of mortality, morbidity and other areas of quality provision. One of our goals has been public transparency and again this report is published and freely available on the internet (1).

http://www.surgery.cuhk.edu.hk/surgical-audit/

Our data collection, methodology and principles have remained unchanged but have undergone refinement to ensure continued accuracy and quality. Our support personnel and infra-structure has been significantly reduced with regard to Departmental costs and we now only have a single research person who contributes to data collection, validation of data accuracy and database maintenance. They remain financed by our own ‘Team’ fund with monies generated by donations and private work. It will be a challenge for us to maintain this in the future and it is intuitive that in the absence of central support that however committed we are as a Division to these processes they will become unsustainable.

Despite this, a major achievement, briefly documented in the last report was the invitation for us to contribute data for ‘benchmarking’ of activity and outcomes against the United Kingdom (UK) Society of Cardiothoracic Surgeons Database. We were offered the chance to participate in this venture following publication of our first report
and it is gratifying that we have ‘followed through’ and fulfilled our commitment. We therefore contributed our data for a comparative time period of analysis and this was independently extracted from our server and analysed by Dendrite in conjunction with experts running the UK database. The UK Society has subsequently incorporated this analysis and published it in the form of the ‘Blue Book’.


This initiative, dedicated to demonstrating quality, was the recipient of the ‘Best Quality Improvement Initiative’ in the group awards held by the British Medical Journal in the United Kingdom earlier this year. It was instituted to provide recognition to teams who were making measurable improvements to the quality and safety of healthcare and we were privileged to be partners in this (Appendix 1).

http://groupawards.bmj.com/winners/winners#best

We have also in the last year contributed to an initiative by the European Society of Cardiothoracic Surgery (EACTS) and have submitted data for inclusion in their report. Our outcomes were used by this Society to provide an example of how ‘international benchmarking’ may be achieved and the results of this will be published on our website. The ‘Asian’ contribution to this initiative also included data from over 50 cardiac centres in mainland China and we are pleased to have facilitated this in some small way. After the initiative with the European Society some very interesting differences were apparent between our local practice and that in Western Countries but it seems clear that our workload is changing rapidly to mirror them with increasing number of urgent cases and higher risk patient profiles as noted below. This current report was delayed this year so we can highlight some of the European data published and its pertinence to our unit.
In terms of clinical activity our patient population continues to change. The risk of the patients we are operating on has increased for a fourth consecutive year. A significant change has been the increase in patients referred for urgent and emergency surgery which now constitute nearly a third of our workload; triple that in comparison to our data for 2006. There have also been changes in the complexity of operations undertaken with significant increase in the number of double and triple valvular operations and a maintained increase in the number of re-operative and combined surgeries. This has wide implication for future resource usage and service provision.

Our access to a full day of cardiac operating theatre for three days a week in real terms gives us a maximum capability of performing just under 300 cases per year (after losing sessions for holidays, staff pay-back time etc), assuming we can undertake two cardiac cases per day. This is not always possible with the changing complexity of operations undertaken as we have documented. The fact therefore that despite these changes, last year was our greatest recorded activity to date with over 340 cases performed is testament to the dedication of our associated colleagues in anaesthesia, intensive care, perfusion and nursing staff of all disciplines whose flexibility allowed us to ensure we provided adequate service for clinical demand despite the resource restraints. We are looking forward to an increase in fixed facility with our move to the new hospital later this year but without an increase in absolute resource and operative time our reported levels of activity for 2009 will be impossible to sustain in ‘safe’ fashion.

With these changes there is an inherent risk of increases in mortality and morbidity but we can be assured that all our outcomes fall well within ‘international’ norms and in most cases are actually better than expected. With the changes we have implemented with regard to data collection we are also now well established with our ‘real time’ monitoring initiative and will be able to recognise changes in outcomes
and practice and investigate before any area reaches a critical level. We remain committed and focused on safety and provision of quality care as a part of our future development and as stated following our international benchmarking project in the UK Society Blue Book:

‘These data should provide reassurance for patients, clinicians, managers and commissioners of services at the Prince of Wales Hospital that the cardiac surgery programme is safe, and that the unit is actively looking to monitor and improve its standards.’

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   Reproduced with permission: Dendrite Clinical Systems Ltd, UK.

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   Reproduced with permission: Dendrite Clinical Systems Ltd, UK.
1. The Division of Cardiothoracic Surgery

The Division of Cardiothoracic Surgery, the Chinese University of Hong Kong (CUHK) is based at the Prince of Wales Hospital (PWH), an acute regional hospital as well as the teaching hospital associated with CUHK. It is situated in the New Territories and hosts the Regional Trauma Centre as well as other acute surgical specialties. The Division of Cardiothoracic Surgery provides complete services within the specialty for a population of approximately 3-4 million people, excluding paediatric cardiac surgery, cardiac transplantation and esophageal surgery.

Within the Division of Cardiothoracic Surgery there are 30 designated beds in wards 4c and 4a and b (Level 4, PWH). Ward 4c provides exclusive use of 4 High-Dependency beds and 12 ward beds for cardiac surgery. The Intensive Care Unit (ICU) provides 25 intensive care beds and is located on Level 3 adjacent to the operating suite. 2 beds on intensive care are for the exclusive use of cardiac surgery patients for three days per week. To maintain our level of activity however there needs to be close co-operation with colleagues in intensive care to allow flexibility in this arrangement. Cardiac surgical patients are looked after by accredited intensivists whilst on ICU with surgical input where appropriate. Patients transferred from ICU to the HDU are looked after by the cardiac surgical team with input from other support specialties when requested. We have one dedicated theatre (Theatre 11) solely for the purpose of cardiac surgery which is currently funded for use 3 days a week. A pre-operative cardiac assessment clinic is currently held on alternate weeks. There has been no change in these facilities first described in our report in 2006, although we are anticipating an increase in ‘fixed’ capacity with the new hospital build, due for completion in October 2010.

This would increase our bed capacity in ICU to 4, HDU to 8 and maintain 30 on the ward. It will provide access to 2 cardiac theatres, one of which is in preparation as a ‘hybrid’ theatre following the kind
donation of funds from a private source to sponsor this. An increase in associated resource would also be required however in order to maximise use of these facilities and increase output whilst maintaining efficiency.

2. Outcome Reporting

The outcomes presented in this report have again been ‘benchmarked’ against the national cardiac surgical database report from the United Kingdom (UK) (United Kingdom Cardiac Surgical Register, UKCSR) (2). We recognize that the populations treated may be inherently different but interestingly the pre-operative risk profiles are very similar and the UK publication remains one of the most authoritative and comprehensive documentations of national cardiac surgical practice available anywhere worldwide and as such has been used here as the ‘gold standard’ for comparison. It is also the most current source of international cardiac surgical activity.

In our report we have also used our own ‘risk-adjusted’ data and reported ‘observed’ versus ‘expected’ outcomes. We have focused on cumulative activity over 4 years with highlights of the last twelve month activity.

3. Overall Cardiac Surgical Activity

During the last twelve months of activity 340 patients had cardiac surgical procedures in our institution. This means that over the last four year period we have a total of 1271 patients accumulated in the database. Our resource covers an anticipated annual workload of fewer than 300 cases.
Figure 1 shows the relevant percentages of the operations by type for the last year. Patients with descending aortic disease have been excluded from this analysis as previously noted and are subject to a separate review of activity and outcomes.

There have been changes in our local case-load over time as shown in Figure 2 with slight reductions in the proportion of patients undergoing isolated coronary surgery and increases in valvular surgical procedures.

There has been a reduction over time of patients undergoing elective surgery and an increase in patients who require urgent and emergency operations (Figures 3 and 4). Last year, nearly one quarter of cases were urgent or emergency and this has had serious resource and organisational impact on the Division.

All case mortality (defined as death during the same hospital admission) for the four year period was 2.3 % for all surgical activity (30 deaths) and 1.2 % for isolated coronary artery bypass surgery (CABG) (8 deaths). There were no differences in annual crude or risk-adjusted mortality rates for either group. These outcomes compare favourably with non-risk adjusted crude mortality figures from the UK (UKCSR, all cases 3.5%, isolated CABG 1.5%).

![Figure 2. Activity over time](image)

![Figure 3. Operative Priority](image)

![Figure 4. Changes in Emergency/Urgent Workload over time](image)
In terms of valve operations over the four year period, Figure 5 shows the distribution of procedures performed. A significant number of patients underwent double valve replacement, usually for rheumatic disease and increasing numbers required a triple valve procedure. Figure 6 shows the nature of the valve pathologies we saw in the group of patients; this has remained constant in terms of aetiology over time.

A group of patients required closure of acquired ventricular septal defects (n=14). We have had one death in the latter group (crude mortality 7.1%). As stated in the last report, these numbers are far too small to make any sustainable comment, but the reported UK mortality for this universally catastrophic condition is approaching 35%.

A total of 32 patients underwent re-operative cardiac surgery (6 patients had a third cardiac operation), 2.5% of the total workload but numbers show a five fold increase over the last two years. This, as we have mentioned before is fitting with the development of the Unit, which has been performing open-heart surgery for nearly 10 years now, the time when re-operation becomes required with increasing frequency.

Activity for surgery of the ascending aorta +/- aortic arch has remained relatively static over time. Seventy three cases in total have been performed with 8 deaths (9% UKCSR 12.9%). 75% of these cases were emergencies for acute Type A aortic dissection and 5 were re-operative surgeries.
Figure 7 shows the operative procedures carried out. With a preponderance of cases involving acute type A dissection, the commonest procedure was interposition tube graft replacement of the ascending aorta with valve-leaflet preservation. This distribution is very similar to UK data. In 54 cases overall, circulatory arrest was used to perform reconstruction of the aortic arch +/- hemi-arch replacement. Mean arrest time was 26 minutes (range 12-44).

Stroke is a particular risk in this group of patients and in our cohort we had 3 transient neurological deficits and 3 permanent strokes (4.1%).

4. Waiting Lists for Cardiac Surgery and Referral Patterns

Figure 8 shows the centres we provide a service for and their contribution to our workload. There was no major change in pattern of referral over the four year period. Our current waiting list stands at over 100 patients, the longest in Hong Kong. As of December 2009, 61% of these patients were waiting for ‘early’ surgery ie surgery ideally within 3 months of being placed on the ‘at home’ waiting list. With the increase in referral of emergency and urgent in-hospital cases, provision of this ‘early’ surgery and also limiting the wait for elective patients is difficult if not impossible without an increase in absolute resource. We are currently, at a national level looking at this issue, its implications and resolution.
5. Patient Demographics

Sixty nine percent (69%) of patients were male, 31% female. Mean patient age was 61 years (range 19-83) which has been reasonably consistent over the four year period but in the last 12 months we have seen significant increases in the number of patients over the age of 70 and also those into their eighth decade. In our last report we mentioned that in Hong Kong this recorded age may not reflect the ‘true’ age of the patient, many of whom may actually be chronologically older than stated on their official record. This remains an important consideration when advancing age has a major influence on operative risk and is an important component of many of our risk-stratification models. The changes in recorded age range of our patients are shown in Figure 9 and tend to be younger than seen in the UK.

6. Risk-Stratification and Presentation of Outcome

Introduction

A detailed discussion of risk stratification and outcome analysis can be found in our previous reports and also the first UK Society ‘Blue Book’ (1, 3). We have continued to use the logistic EuroSCORE as our risk model for overall surgical activity (4). We do this however; with the recognition that there is continued ‘drift’ in its accuracy and it is currently being re-evaluated in a venture by the EuroSCORE group. With this in mind we have also presented some outcomes which have used the re-calibrated EuroSCORE (based upon the UK population). As for our previous reports we have used a variety of graphical means to depict outcome, each having its own merits.
Risk Profiling

Before presenting mortality as a risk-adjusted outcome it is useful to have some idea of the ‘spread’ of patients within the variously designated risk groups. For comparison over the last four years we have used the logistic EuroSCORE and found the mean score for our population has increased from 4.5 to 5.9. We can see in Figure 10 that this reflects a consistent reduction in the number of patients in the lower risk group and an increase in the number of patients scoring as high (4-8) and very high (>9) risk. This has been a universal finding in international cardiac surgical practice and in our Division represents we believe a true reflection of the changing workload.

Outcome Presentation: Mortality

We have presented overall outcome data (mortality) in our usual graphical formats.

1) Comparative to the UK in the format of ‘funnel’ plots which provide a strong visual indication of any divergent performance or specific cause variation.

For this report, we have used the plot generated using the EuroSCORE as the risk-model accessed via the SCTS UK website (Figure 11). The control limits refer to those generated by submission of data from all cardiac units in the UK to the SCTS, mortality (light blue dot) represents PWH data within these control limits. Comparative graphs were also published in our report last year.
2) As a plot of cumulative events against time (CUSUM chart plot). To incorporate adjustment for risk the statistical analysis is complex and utilizes odds ratio’s to produce risk-adjusted CUSUM charts (RA-CUSUM). This provides a clear graphical depiction of risk-adjusted performance over time with comparative ‘observed’ versus ‘expected’ outcomes.

![Figure 12. Risk-adjusted CUSUM for All Case Mortality](image)

Figure 12 shows our RA-CUSUM plot for all cases over the four year period, again using the logistic EuroSCORE as our predictive tool. We should note however that with the potential change in the applicability of the risk model, most competent cardiac surgical units reporting data using this tool are performing better than predicted.

3) As presented publicly for UK cardiac surgery by the UK Healthcare Commission, now Quality Care Commission (4). Explained simply, the chosen risk scoring system is used to generate a percentage range of patients who would be ‘expected’ to survive taking into account their specific risk factors. This is indicated by the ‘2’ in Figure 13. This range can then be plotted along with the ‘observed’ survival for that patient group, indicated by the ‘1’ in Figure 13. If the ‘observed’ survival percentage falls anywhere within the ‘expected’ survival range then we can suppose that this reflects entirely adequate performance with respect to the calculated risk profile of that patient group. An ‘observed’ survival percentage that falls to the left of the ‘expected’ range (towards the 70 mark) would indicate a worse outcome than that predicted by the risk scoring system and an ‘observed’ survival percentage which falls outside the ‘expected’ range to the right hand side (towards the 100 mark) indicates better than predicted performance.
Figure 13 shows the chart plot for our cumulative four year data for all patient groups.

In essence, all these methods demonstrate the same outcomes but in slightly different ways and we have used all three in previous reports. We can be reassured that our performance is currently better than expected when using risk modelling for our local patient population and comparable to international standards set in the UK using recalibrated scoring systems.

**Outcome Presentation: Morbidity**

As well as the presentation of outcome in the form of mortality, it is important to recognize that a ‘poor’ outcome not only includes death, but also a variety of events which may lead to significant morbidity and be detrimental for the patient. It is difficult to collect data on every single possible complication and in cardiac surgery a number of outcomes are used as ‘markers’ of morbidity.

These are: re-operation for haemorrhage, permanent stroke, need for new dialysis post-operatively, need for post-operative intra-aortic balloon support (IABP) (CABG only), and early re-operation for mediastinitis. In Table 1 we have indicated crude percentage occurrence for all morbidities for the full four year period of our activity.

All crude figures fall well within expected and reported international standards.

**7. Bleeding and Transfusion**

As mentioned in the last report, we have chosen the area of re-operation for bleeding, blood transfusion and blood loss for detailed investigation.
since they represent important areas of potential morbidity for an individual patient. Another reason is that re-operation rates for bleeding can potentially be used as ‘quality’ indicators and we can easily compare our outcomes in graphical form as a CUSUM chart, with comparative indices taken as ‘fixed’ values from international data. For example, Figure 14 shows the CUSUM chart for re-operation for bleeding with the reported UK figure of 5% (estimated) set as the ‘gold-standard’ for comparison for our activity during 2009.

In last year’s report we looked at the increase rate of blood loss and thought it could be explained by a variety of factors including the increase risk profile of the patient population, the increase in number of patients presenting for urgent operation whilst still on anti-platelet and anti-coagulant drugs and the increase in re-operative surgery. We also wondered whether the withdrawal of aprotinin (a haemostatic agent) which we previously used in ‘high risk’ cases may also have had an impact. Our re-operation rate for bleeding as shown previously is well within acceptable limits but again we wanted to monitor aspects of blood loss for this current report. Figure 15 shows the increase has been sustained. On further investigation it seems more likely in urgent and emergency cases (Figure 16) and also in more ‘complex’ procedures
such as aortic surgery and combined coronary and valve operations Figure 17, which have increased in incidence in our practice. Also, further investigation has shown that the patients likely to bleed the most are (as suspected) on pre-operative tablets or infusions of drugs which increase the risk of bleeding following surgery (Figure 18 and 19). With an increase in urgent surgeries, many patients do now need to be treated with these drugs to reduce their risks of a myocardial event prior to operation and again is a surrogate reflection of the changing population. This is an area we will continue to focus on in the next year.

We have looked closely at our blood transfusion practice over the last four years and we can see that the reduction in red cell transfusion previously reported has been sustained in the ICU (Figure 20). We have looked at this in context of the blood loss groups mentioned above and found the reduction in transfusion is seen in both the ‘high’ loss (>500mls/24hrs) and
‘low’ loss groups (<500mls/24hrs) (Figure 21 and 22) but the marked improvement has been limiting transfusions in low blood loss patients. Transfusion of blood products such as fresh frozen plasma and platelets has mirrored red cell transfusion practices.

8. Valvular Surgery

We have used our four year data to look at our valvular surgery in more detail, in particular our mitral valve practice as we see a preponderance of mitral valve disease due to the residual impact of rheumatic valve disease in the region (Figure 23). Rheumatic disease accounted for nearly 60% of mitral interventions (30% in the UK).
Patients undergoing mitral surgery presented in NYHA Class III or IV in 45% of cases overall (Figure 24) although Figure 25 shows this is accounted for mainly by a significant increase in more severe symptoms over the last year. Mitral valve replacement was the commonest intervention for all groups except patients with degenerative and ischemic mitral disease. In this group of 71 patients, 52 underwent valve repair (73%). Associated tricuspid surgery, usually placement of an annuloplasty ring was performed along with other interventions in 26% of cases (77 patients), a significant factor being an increase in the last 12 months.

Along with coronary artery bypass grafting, aortic valve replacement has been considered as a ‘marker’ operation for monitoring outcomes. 182 aortic valve procedures (including associated coronary artery bypass grafting) were performed in our Unit with 5 deaths (2.7%) and a mean logistic EuroSCORE of 7.55 for this patient population. UK mortality was 3.8% for comparative groups. As previously, mortality for this period was plotted on a funnel plot and control limits set using current UK data. This is shown in Figure 26. This plot is for clarity only as it has been plotted using UK data based on valvular surgery data from 2004-5 but it does illustrate along some of the advantages and disadvantages of using funnel plots for data monitoring and confirms continued satisfactory performance with this group of patients.
As our patient population undergoing valve replacement is comparatively young, we have noted a predominance of mechanical valve prosthesis used but with a gradually aging population, particularly those presenting for replacement of the aortic valve due to age related aortic stenosis we have seen an increasing number of biological valves being implanted over time (Figure 27). This is a common international trend and is also consistent with reports of improved durability of certain types of biological valve resulting in their use in younger patients.

9. Coronary Artery Bypass Grafting

Coronary artery bypass grafting has been chosen by the UK Society as the ‘marker’ operation for outcomes since it has been analyzed in-depth, it is commonly performed and the outcomes are reproducible and well delineated. We have again looked at this sub-group of patients in detail.

Patient Demographics

Eighty percent (79%) of patients were male which is comparable to UK series where women have consistently represented around 20% of the cohort group undergoing coronary artery bypass grafting (UKCSR). 27% of our patient population are over 70 years of age, with the
proviso mentioned previously about the unique position in Hong Kong in determining exact chronological age. This has been a consistent finding mirrored in the last report and sustained over the four year period of data collection.

In terms of pre-operative symptoms, 36% of our patients have class III/IV angina, which is lower than the UK. Overall, 13% of our cohort underwent urgent or emergency operation but we can see in Figure 28 that over time there is an increasing trend towards non-elective surgery, particularly within the last twelve month period.

55% of the patients operated on overall had suffered a previous myocardial infarction. This is higher than in the UK (just over 40%). Over eight percent of our patients had suffered 2 or more myocardial infarctions. In general terms, the sooner after a myocardial infarction patients undergo coronary artery bypass grafting, the higher the potential risk. Figure 29 shows the change in the timing of surgical intervention we have seen over the past 4 years. There are still very few patients who require surgery within 6-24 hours of myocardial infarction, but we have seen a dramatic increase in the number of patients operated upon within 1-30 days. This fits with the observation that as a whole, our population requiring coronary revascularisation seems to be presenting with more severe symptoms and hence require earlier surgery despite a theoretical increase in risk which we have noted in previous reports. This trend has continued.
Overall, 17% of our patients had undergone prior percutaneous coronary intervention.

70% had hypertension (defined using the EuroSCORE classification) (UKCSR 62%) and the number and type of patients with diabetes is shown in Figure 30. This incidence has remained relatively stable over the last 4 years and remains high in comparative terms (UKCSR 23%).

Stroke is a cause of major post-operative morbidity following CABG and the risk is increased in patients with a history of neurological disease. In terms of pre-operative neurological problems, 9% of our patients had had a previous neurological event either a transient event (2.2%) or a full stroke with either a full recovery (5.5%) or a residual neurological deficit (1.6%). The incidence of this pre-operative morbidity has remained constant over the four years.

As mentioned, many patients with severe coronary disease are prescribed protective drugs such as aspirin and clopidigrel which however beneficial can cause problems with post-operative bleeding by interfering with the coagulation cascade in patients undergoing surgery. Ideally, these medications should be stopped prior to surgery but the trend we have shown is a reflection of the increasing severity of coronary disease in the patients we are treating and in whom it
is thought to be ‘unsafe’ to discontinue this medication despite the additional risks posed during revascularization. This is also demonstrated by the increasing numbers of patients who undergo surgery whilst being treated with intravenous nitrates or heparin either within one week of such treatment or even whilst such treatments are continuing which we have noted in Section 7 above (Figures 18, 19).

**Coronary Disease and Heart Function**

Just over 73% of our cohort had triple vessel coronary disease, a constant finding over the four years with little variation. Similarly, the incidence of left main stem (LMS) stenosis has remained constant (38%) but higher than in UK series (21%). Heart function (ejection fraction) remains one of the most important predictors of post-operative outcome. Overall, 27% of our patients undergoing CABG had moderate or poor left ventricular function.

**Conduits for CABG**

Over 95% of our patients receive one or more arterial graft, usually the left internal mammary artery (LIMA) to the left anterior descending artery. This is an important factor in long term outcome and compares well with the UK national figure (UKCSR 94%) and has remained constantly high over the four year period of activity.

**Summary**

We have demographic data regarding the patient population we are referred for surgical revascularization and the complex changes which we have noted previously have continued during the last year. The incidence of co-morbidities like diabetes and hypertension have remained static as has the incidence of left main stem stenosis, but all are still much higher than in other international series. This has been a consistent finding over four years.

Patients we are now referred have more severe symptoms, are more likely to have had previous myocardial infarction, and within this
cohort the number of patients suffering with 2 or more infarctions has increased. Due to severe symptoms we have to operate on patients sooner after their myocardial infarction and whilst they are being treated with clopidigrel or aspirin and also whilst receiving nitrates or heparin. All of these factors will result in an increase in the risk profile of this patient population and each indices has steadily increased in proportion over time. This has been reflected in changes in the risk scores using the complex (9-factor) Bayes Score (Figure 31) (see below). Over time, there have been reductions in the number of patients in the ‘low’ score (<1 – 2.9) and increases in the proportion of patients scoring more highly, particularly scores of > 9.9.

10. CABG Outcomes: Mortality and Bleeding

Our overall crude-mortality for coronary artery bypass grafting was 1.2 %. There has been no significant change over time despite the increasing risk profile. A trend towards increasing risk but reduced mortality has been recognised internationally in this cohort of patients (2).

In the UK, a complex Bayes score has been demonstrated to be a valid and accurate risk-profiling score for the sub-group of patients undergoing coronary artery bypass grafting (Appendix 2) and we have previously validated the applicability of this scoring system for our CABG population.
Figure 32 shows outcomes in our CABG population for the period of data collection in the format previously described using ‘observed’ survival and ranges of ‘expected’ survival. This time the complex Bayes score was used as the risk scoring system and performance again is shown to be entirely acceptable.

As previously we have also looked at our outcomes using a risk-adjusted funnel plot. This is shown in Figure 33.

In view of the changing risk profile of our CABG population and the increasing number of patients on drugs which may increase the risk of post-operative bleeding we looked at our blood transfusion and re-operation rates in this sub-group of patients as we did last year but now with a four year period of comparison. Figure 34 shows the CUSUM plot for re-operation using a reported 3% ‘fixed’ comparator from international (UK) data and despite the increased potential risk we are still performing well.
In terms of blood loss, we have noticed similar trends reported for our overall activity in that we have noted an increase in the number of patients in the ‘higher’ blood loss group. Despite this, nearly 75% of our patients do not receive a blood transfusion although we have noticed interesting trends over the last year. The number of patients receiving blood in ICU noted in last years report has increased a little in the last year (Figure 35) most probably as a consequence of the increased bleeding risk our patients now present with. The trend in this sub-group of patients is almost certainly in line with the trend we saw in our overall activity in terms of transfusion practice. Transfusion of blood products again mirrored whole blood usage.

11. Data Quality and Validation

We continue to collect our data and adhere to the principles of the most accurate collection being at the point of clinical care, sharing responsibility for data collection amongst professionals responsible for patient well-being and using an independent party for direct data entry and data checking on completion of the patient journey. Our quarterly ‘spot-check’ of missing data for random fields continues and at the time of writing we have 100% data on outcomes and risk-scores presented in the report. A validation process has been instigated whereby every outcome reported as a death is double-checked for all data entry fields and cross-checked with patient and perfusion records.
along with computerised patient clinical records and data requested by our mortality and morbidity Departmental process. We have also now had some ‘external’ validation of data completeness in the form of publications from the UKSCTS following the benchmarking exercise last year and the EACTS following the benchmarking exercise this year which is described in more detail below.

12. Quality of Care for Cardiac Surgical Patients

As mentioned in previous reports, overall provision of quality care for cardiac surgical patients extends beyond mortality. To start, we have focused on the population of patients undergoing coronary surgery and developed ‘quality bundles’ described in more detail last year. One main focus for this group of patients has been the percentage prescription of aspirin or statins to patients following coronary artery surgery upon their discharge. We progressed from no available data for these variables during 2006 to 100% data collection for these end points in 2007. Monitoring of these factors up until and including 2009 is shown in Figures 36 and 37.

Our operative and in-hospital non-mortality indicators benchmark well with UK reference points.
We measure length of stay (as well as incidence of prolonged stay) as a quality indicator; our median length of stay for all patients is 6 days. However, as we have stated previously, we must always look at this in the context of discharge facility within our local area. Whilst we have some capability to transfer patients back to their referring centre, just fewer than 50% of our patient group are referred locally and we have no other facility to discharge them to except home. Discharge may be delayed as primary care facility for patients at home is limited in our region.

13. Real-Time Monitoring of Outcomes

In establishing our data collection process and developing the ‘audit trail’ we have been setting the infra-structure to allow us to monitor in ‘real time’ a variety of outcomes, documenting trends which would allow divergent performance to be detected early and allow appropriate intervention to take place to maintain optimum outcomes for our patients. We have instigated monitoring at 3 monthly intervals in the last year for: mortality, re-operation for bleeding, blood transfusion on ICU and use of LIMA in CABG. Figure 38 shows an example of this for blood transfusion magnified over a four year period. In essence, for all variables we now generate these performance curves and have a set of criteria which define ‘divergence’ for each and a set of responses such divergence would trigger. For example, in any 3 months sampling period, if our transfusion rate in ICU increases over the plotted median (70% transfusion free) by 10%, or if there is a 5% increase in two consecutive periods we will instigate a formal audit for a 3 month period and perform risk assessment of case-mix. These monitoring curves are automatically generated using our database analysis module.

‘Benchmarking’ plays a central role in quality improvement (6) and has been defined as the identification of ‘industry leaders’ so that the leaders’ practices may be understood and emulated (7). Last year, we had opportunity to benchmark some outcomes using the UK Database as a reference. The European Association for Cardiothoracic Surgery (EACTS) exists to promote and support all aspects of care for those patients treated by cardiothoracic surgeons, encompassing surgical training, education, and research and quality improvement. The EACTS has established a database project whereby information on patients from across Europe is collated and analysed to provide information and feedback for all stakeholders. The current report is published on the EACTS website, and contains information regarding the most recent cohort of patients undergoing adult cardiac surgery, with contributions from 29 countries, 366 hospitals and comprising over 1,000,000 patients (8). Whilst EACTS is based in Europe, in line with a membership policy not constrained by geographical boundaries it has encouraged global submissions. The report now includes data from the Asian Region (represented by China, including our Unit in Hong Kong, Figure 39). This is a significant achievement and for the first time presents opportunity to look at differences in case presentation and management on a global scale.

It allows us insights into differences in practice and workloads overall (Figure 40) and an opportunity to look in more detail at some patient
groups. For example, Figures 41 and 42 emphasises the data we have already presented in this report that our CABG population has a comparatively high incidence of diabetes and left main disease. In the time frame benchmarked, in association with units from Mainland China our CABG population were more likely to be elective cases in comparison to other countries (Figure 43) but we have shown in this report that for our practice there have been significant changes.
with large increase in urgent and emergency cases in the last twelve months. Figure 44 shows how we can also benchmark outcomes such as hospital stay. There are many areas of interest and this exercise has again confirmed the younger age of patients we see with valvular disease (Figure 45) and the lower incidence of associated coronary artery disease (Figure 46).
Part of this benchmarking exercise included a data completeness check and we were gratified to be the only contributing unit with over 90% complete data for all the selected database questions used in the analysis (Figure 47) and also have complete mortality outcomes (Figure 48).

EACTS have also offered each submitting association a confidential, bespoke report containing a description of data quality, crude mortality and risk-adjusted mortality, benchmarked against the database standard for the time period in question. We were chosen as a ‘representative’ unit to showcase this process which we have included in Appendix 3.

![Figure 47. Data Completeness](image-url)
This project has completed a step-wise journey for our Unit in terms of audit and quality assurance with a variety of processes being introduced over time as shown in Figure 49. The challenge for the future is not only to continue to develop these processes along with international standards and for the benefit of patients but most crucially, ensure sustainability.

Figure 48. Mortality: Missing Data

Figure 49. Development of Quality Initiatives at PWH/CUHK Cardiac Surgery
Summary

1. In the fourth year of data collection we have benchmarked our outcomes using data from the UKSCTS and EACTS.

2. We have shown that we are performing in line with international standards for all cardiac surgical activity and all operative subgroups.

3. Outcomes other than mortality are also excellent and well within international standards.

4. We have confirmed previous observations that there are inherent differences between our patient population and that of the UK and Europe but despite this, very similar risk profiles.

5. We have shown that in terms of overall activity we still perform fewer coronary artery bypass grafting operations and more valve operations than comparative units in the United Kingdom and Europe but this continues to change.

6. We have seen a continued change in overall surgical practice with an increasing risk profile of our patients when assessed using the logistic EuroSCORE and Bayes Score for coronary patients.

7. We have again recorded excellent outcomes for mitral and aortic valve operations.

8. We have again seen significant changes in the demographics of our CABG population who are now more likely to have a previous myocardial infarction, have more severe symptoms and be taking anti-coagulant medication.
9. The demographic changes in the CABG population have resulted in surgery continually being required earlier after previous myocardial infarction and in many instances whilst the patient is still on intravenous treatment with heparin and nitrates with a suspicion of subsequent increased blood loss and transfusion requirement.

10. Despite demographic changes resulting in increasing risk, we have shown risk-adjusted outcomes for the subset of patients undergoing CABG is excellent and sustained over a four year period.

11. We have contributed to a benchmarking initiative by EACTS along with over 50 units from Mainland China and have been a reference centre for detailed outcome analysis.

12. We have introduced ‘real time’ monitoring of selected outcomes with mechanisms to address divergent practice.
References


11. www.eacts.org
Acknowledgements

Multidisciplinary team work is required to provide a comprehensive cardiac surgical service. Much attention is naturally given to the surgical arm of this effort but as we noted in previous reports and must continue to affirm:

‘The activity and outcomes presented here demonstrate par excellence the benefits of teamwork. None would have been possible without a wide range of associated personnel, including cardiology, anaesthetic and intensive care colleagues, junior medical colleagues, ward, intensive care and theatre nurses, perfusionists, physiotherapists, pharmacists, blood bank technicians, laboratory technicians and many other support personnel. Outcomes and service provision in this and future reports reflect the dedicated effort of all these professionals’.

All of their efforts are crucial in maintaining our excellent outcomes particularly in the face of changing and increasing patient risk profiles. We continue to face many pressures as we seek to deliver even higher quality care for our patients; all of the above mentioned professional groups have worked and continue to work above and beyond expectations to ensure that our standards are consistently maintained. This is particularly pertinent when we are stretching the limits of current resource.

We continue to acknowledge all of the doctors, nurses, perfusionists and associated personnel who have contributed to data collection and enable us to do so prospectively and at the point of clinical care. We believe all personnel involved in care also have a duty to collect data and ensure quality and this has been taken on with vigour by the majority. The research personnel we are employing on the database project have contributed more than just validation and data entry and are now an integral part of a well established team.
Acknowledgements

Our anaesthetists and intensivists have embraced our efforts and actively contribute to the thought processes involved in monitoring outcomes and implementing changes in practice. Our nursing staffs have been active as well and have sustained their first project, nurse-led defibrillation whilst embarking on a nurse-led follow-up clinical service for post-operative cardiac patients.

We thank surgical colleagues represented by the Cardiothoracic Specialty Group in Hong Kong for their support and we look forward to collaborative efforts as we extend this process to a national level. None of this would have been possible without support from Dr Fung Hong, Chief Executive, New Territories East Cluster, and the Department of Quality and Safety at the HA, particularly Dr Pang, who has facilitated discussions to develop the process further. We are also grateful to Dr NT Cheung and all the HA IT team who continue to make a contribution.

We would like to thank Professor Sir Bruce Keogh, Medical Director of the National Health Service in the UK, Mr L Hamilton, past-President of the Society of Cardiothoracic Surgeons of Great Britain and Ireland and Mr B Bridgewater, Consultant Cardiac Surgeon, Clinical Director of Cardiac Surgery, Trust Director of Clinical Audit, Wythenshawe Hospital Manchester UK and Chairman of the UK Cardiac Surgery Database Committee for embracing and supporting our international benchmarking initiative.

We are humbled at being allowed such access to the world’s foremost cardiac surgical database. We would again like to thank Dendrite Clinical Systems for their continued support and particularly Robin Kinsman who extracted and compiled our data and performed the analysis for both the UK and EACTS benchmarking initiatives.
Appendix 1

The Society for Cardiothoracic Surgery in Great Britain & Ireland

Sixth National Adult Cardiac Surgical Database Report 2008

Demonstrating quality

Prepared by

Ben Bridgewater PhD FRCs
Bruce Keogh OBE DLIRD FRCS FICP
on behalf of the Society for Cardiothoracic Surgery in Great Britain & Ireland

Robin Kinsman BSc PhD
Peter Walton MA MBChB FRA
Dendrite Clinical Systems
Appendix 1

The Society for Cardiothoracic Surgery in Great Britain & Ireland
Sixth National Adult Cardiac Surgical Database Report

Outcomes at the Prince of Wales Hospital at the Chinese University of Hong Kong
An example of international benchmarking against the SCTS national standard

Key findings

Patients undergoing cardiac surgery in the Prince of Wales Hospital (PoWH), Hong Kong are different from those in the United Kingdom with a smaller proportion of patients undergoing coronary artery bypass surgery, but more patients undergoing isolated valve surgery.

Patients undergoing isolated coronary artery bypass surgery in Hong Kong are younger and more likely to have diabetes than those in the United Kingdom. They are less likely to have impaired left ventricular ejection fraction or to undergo non-elective surgery. However, the overall predicted mortality of these patients using the logistic EuroSCORE is similar.

The mortality for all cardiac surgery at the Prince of Wales Hospital was 15 out of 743 patients (2.1%); a further 17 patients did not have their post-operative status recorded, which was lower than, but not significantly different from the United Kingdom mortality of 3.4%. The mortality for isolated CABG was 4 of 404 patients (1.0%; another single CABG entry had no post-operative status data), which again is not significantly different from the United Kingdom mortality. These similarities remain after adjusting for predicted operative risk.

These analyses suggest that cardiac surgical outcomes at the Prince of Wales Hospital are similar to those in the United Kingdom and should provide reassurance to patients, clinicians, managers and commissioners of cardiac surgery in Hong Kong.

Introduction

The Cardiac Surgery unit at the Prince of Wales Hospital at the Chinese University of Hong Kong started a quality assurance program in November 2005. The aims were to collect data to optimise local quality improvement and provide information about clinical quality compared to other organisations, both nationally and internationally. The unit now collects high-quality, validated data via a computerised database. The dataset is identical with that of the SCTS in Great Britain and Ireland.

There have been two annual reports about cardiac surgery at the Prince of Wales Hospital, which are available at www.surgery.cuhk.edu.hk/cardiothoracic/default.htm. We recognise that there will be many organisations across the world that will be collecting data on their cardiac surgical programs, but few countries have a national cardiac surgery audit program and fewer still have complete coverage from all units and surgeons. To understand the quality of care and perform true audit it is necessary to compare outcomes in the dataset against an accepted standard. Here we have compared cardiac surgery outcomes at the Prince of Wales Hospital with those in the SCTS national database.

Comparison of casemix

Patients undergoing surgery in Hong Kong are different from those in the United Kingdom and Ireland. There is a higher proportion of isolated valve disease and a smaller proportion of coronary artery bypass surgery affecting both the proportion of isolated CABG and combined valve & CABG surgery. There is also a markedly higher proportion of other surgery undertaken in Hong Kong.

Comparison of risk factors

As well as undertaking different types of surgery, the incidence of risk factors within different operative groups is different in Hong Kong; patients undergoing coronary artery bypass surgery are likely to be younger, more likely to have diabetes and less likely to have impaired left ventricular function or to undergo non-elective surgery.
Appendix 1

The Society for Cardiothoracic Surgery in Great Britain & Ireland
Sixth National Adult Cardiac Surgical Database Report
19/03/2009

A comparison of casemix in Hong Kong and the UK & Ireland
financial years 2006-2008 (n=726 & n=111,397 respectively)

Percentage of patients

A comparison of risk factors in Hong Kong and the UK & Ireland:
financial years 2006-2008

Risk factor

0% 10% 20% 30% 40% 50% 60% 70%

Percentage of patients with the risk factor
Appendix 1

The Society for Cardiothoracic Surgery in Great Britain & Ireland
Sixth National Adult Cardiac Surgical Database Report
19/03/2009

Mortality

There are no significant differences in either observed or predicted mortality (by logistic EuroSCORE) between practice in Hong Kong and that in Great Britain and Ireland, for any operative group.

Mortality and procedure for the financial years 2006-2008

<table>
<thead>
<tr>
<th>Procedure group</th>
<th>Hong Kong</th>
<th>United Kingdom</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Observed rate</td>
</tr>
<tr>
<td>CABG alone</td>
<td>404</td>
<td>1.0</td>
</tr>
<tr>
<td>AVR</td>
<td>47</td>
<td>4.3</td>
</tr>
<tr>
<td>AVR and CABG</td>
<td>8</td>
<td>0.0</td>
</tr>
<tr>
<td>MVR</td>
<td>49</td>
<td>0.0</td>
</tr>
<tr>
<td>MVR and CABG</td>
<td>5</td>
<td>0.0</td>
</tr>
<tr>
<td>All surgery</td>
<td>709</td>
<td>2.1</td>
</tr>
</tbody>
</table>

1 Predicted as per the logistic EuroSCORE

A comparison of observed and predicted, procedure-specific mortality rates in Hong Kong and the UK & Ireland: financial years 2006-2008

Mortality rate
Appendix 1

The Society for Cardiothoracic Surgery in Great Britain & Ireland
Sixth National Adult Cardiac Surgical Database Report

Funnel plots
We have benchmarked outcomes for all surgery, isolated CABG and isolated AVR surgery against the contemporary re-calibrated logistic EuroSCORE, as described elsewhere in these appendices. For simplicity we have simply used 0.5 of the logistic EuroSCORE for the all surgery comparison. We have used the exact calibration factors of 0.44 and 0.34 respectively for isolated AVR surgery and isolated CABG.

Outcomes at the Prince of Wales Hospital fell comfortably within the control limits for all operative groups, showing satisfactory quality.
Appendix 1
Appendix 1

The Society for Cardiothoracic Surgery in Great Britain & Ireland
Sixth National Adult Cardiac Surgical Database Report
19/03/2009

Other post-operative outcomes
In general the other post-operative outcomes seen at the Prince of Wales Hospital are excellent, with a lower incidence of all complications than in the remainder of the SCTS database.

Other post-operative outcomes; the upper numbers represent the crude percentage mortality rate and the lower numbers the count within the sub-group; financial years 2006-2008

<table>
<thead>
<tr>
<th>Operation group</th>
<th>Outcome</th>
<th>Re-operation for bleeding</th>
<th>New post-operative stroke</th>
<th>New post-operative HF / dialysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PoW HK</td>
<td>UK &amp; I</td>
<td>PoW HK</td>
<td>UK &amp; I</td>
</tr>
<tr>
<td>CABG alone</td>
<td>1.5</td>
<td>3.3</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>462</td>
<td>56,657</td>
<td>396</td>
<td>57,632</td>
</tr>
<tr>
<td>AVR alone</td>
<td>0.0</td>
<td>5.5</td>
<td>2.1</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>47</td>
<td>9,683</td>
<td>47</td>
<td>10,234</td>
</tr>
<tr>
<td>AVR &amp; CABG</td>
<td>0.0</td>
<td>6.9</td>
<td>0.0</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>7,101</td>
<td>8</td>
<td>7,808</td>
</tr>
<tr>
<td>MV repair alone</td>
<td>0.0</td>
<td>3.8</td>
<td>0.0</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>1,905</td>
<td>9</td>
<td>1,942</td>
</tr>
<tr>
<td>MV repair &amp; CABG</td>
<td>33.3</td>
<td>6.0</td>
<td>0.0</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1,141</td>
<td>2</td>
<td>1,190</td>
</tr>
<tr>
<td>MVR alone</td>
<td>4.2</td>
<td>5.3</td>
<td>0.0</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>1,786</td>
<td>46</td>
<td>1,875</td>
</tr>
<tr>
<td>MVR &amp; CABG</td>
<td>0.0</td>
<td>8.5</td>
<td>20.0</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>992</td>
<td>5</td>
<td>721</td>
</tr>
<tr>
<td>All</td>
<td>1.9</td>
<td>4.7</td>
<td>1.5</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>700</td>
<td>94,636</td>
<td>688</td>
<td>97,170</td>
</tr>
</tbody>
</table>

Summary
This analysis describes methodology that will enable any organisation, or group of organisations, in the world to compare their outcomes against a comprehensive national dataset derived from complete coverage of all operations in NHS hospitals in the United Kingdom. There are systematic differences in case-mix between the Prince of Wales Hospital in Hong Kong and the pooled United Kingdom data, but on both crude and risk-adjusted mortality the outcomes are in line with United Kingdom standards, as are the complication rates. These data should provide reassurance for patients, clinicians, managers and commissioners of services at the Prince of Wales Hospital that the cardiac surgery programme is safe, and that the unit is actively looking to monitor and improve its standards.
Appendix 2

PWHCUHK - Cardiac Surgical Database

Date of Operation: 03 April 2006

SCTS complex CABG Bayes Score

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Response</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Greater than 75</td>
<td>1.24655954244086</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Yes</td>
<td>1.17651073927826</td>
</tr>
<tr>
<td>Left main stem disease (LMS)</td>
<td>Yes</td>
<td>1.43207459189736</td>
</tr>
<tr>
<td>Left Ventricle Size (LVS)</td>
<td>Fair (EF 30-40%)</td>
<td>1.184715154651594</td>
</tr>
<tr>
<td>Priority</td>
<td>Elective</td>
<td>.703648663005286</td>
</tr>
<tr>
<td>Renal system</td>
<td>No Renal Disease</td>
<td>.84694164332257</td>
</tr>
<tr>
<td>Diabetes</td>
<td>No</td>
<td>1.29981755938518</td>
</tr>
<tr>
<td>Previous operations</td>
<td>None</td>
<td>.02571307468544</td>
</tr>
<tr>
<td>Patient weight(Kg)</td>
<td>62 Kg</td>
<td>62 Kg</td>
</tr>
<tr>
<td>Patient height(cm)</td>
<td>157 cm</td>
<td>157 cm</td>
</tr>
</tbody>
</table>

SCTS complex CABG Bayes Score: 19.08
Appendix 3

The European Association for Cardio-Thoracic Surgery

Fourth
EACTS Adult Cardiac Surgical Database
Individual Country Report for Hong Kong, China
2010

Ben Bridgewater & Jan Gummert
The European Association for Cardio-Thoracic Surgery
Robin Kinsman & Peter Walton
Datadine Clinical Systems

reveal • interpret • improve
Appendix 3

Message

EACTS is delighted to have received so many submissions to its adult cardiac surgery database, from such a large number of hospitals and countries. The full report contains summary statistics along with trends in activity and outcomes, and gives a number of interesting messages. At EACTS we fully recognise that different countries are at various stages in their data collection and benchmarking initiatives, which are supported by varying levels of resource. Until we have complete data, and we are confident in their validity, we do think it is right to publicly disseminate country-specific mortality outcomes data, and so we have not done so in the fourth EACTS database report.

We do, however, believe that each country should be given the opportunity to review its data completeness and mortality outcomes against the database average, and we have therefore produced these bespoke reports to be considered alongside the full publication. We have offered these back to any country that has submitted data in the latest round of data submissions, for them to use as they wish. We hope that this will be seen as a useful service by EACTS to its membership that will help support improvements in data quality and give better understanding of local mortality rates.

Pieter Kappetein

General Secretary, European Association for Cardio-Thoracic Surgery
Appendix 3

The European Association for Cardio-Thoracic Surgery
Bespoke report for Hong Kong, China - September 2010

Hong Kong, China

Introduction
The recent Fourth EACTS Adult Cardiac Surgical Database Report contains information on over one million patients undergoing cardiac surgery in the period up to the end of December 2008. The submissions are from 366 hospitals in 29 countries across Europe and China (including Hong Kong).

Because of issues around variable data quality and the sensitivities that surround the publication of mortality data, neither crude nor risk-adjusted mortality rates by country have been included in the full report. EACTS have however, contacted each submitting association to offer them a confidential, bespoke analysis containing a description of their activity, data quality, crude mortality and risk-adjusted mortality, benchmarked against the database standard. We feel these reports are of importance to help drive improvements in local data completeness where needed, to reveal possible errors in data transmission or analysis, and to understand variations in mortality rates. Further thoughts on these issues are given on page 20, 60-61 and 150-151 of the main report.

The analysis of data for Hong Kong, China is included on the following pages.

for the purposes of this report we have, as in the full analysis, subdivided the database into geographical zones, Northern Europe, Central Europe, Southern Europe and Asia.

The data for Hong Kong, China is included in the Asian zone and as well as benchmarking the data against the full database, we have also compared against the relevant zone on the following pages.

Northern European zone:
- Denmark
- Latvia

Central European zone:
- Austria
- Belgium
- Czech Republic
- England
- France
- Germany
- Luxembourg
- The Netherlands
- Northern Ireland
- Poland
- Republic of Ireland
- Scotland
- Switzerland
- Wales

Southern European zone:
- Armenia
- Croatia
- Cyprus
- Greece
- Italy
- Portugal
- Spain
- Turkey

Asian zone:
- China
- Hong Kong, China

---

Appendix 3

The European Association for Cardio-Thoracic Surgery
Bespoke report for Hong Kong, China - September 2010

Entries in the EACTS database
The number of submissions to the database from Hong Kong, China from the period 2006-2008 and for the
total time period since the database was established in 1995 are shown below, along with the total number of
submissions to the database as a whole and the submission from the Asian zone. The proportion comprised by
the contributions from Hong Kong, China are also given:

<table>
<thead>
<tr>
<th>Time period</th>
<th>Entries in the database</th>
<th>The Asian zone</th>
<th>Entire EACTS database</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong, China</td>
<td>2006-2008</td>
<td>891</td>
<td>25,059</td>
</tr>
<tr>
<td>All years</td>
<td>940</td>
<td>25,108</td>
<td>1,074,618</td>
</tr>
<tr>
<td>Percentage of entries within the period</td>
<td>2006-2008</td>
<td>3.6%</td>
<td>0.2%</td>
</tr>
<tr>
<td>All years</td>
<td></td>
<td>3.7%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

The proportion of the data made up by submissions from Hong Kong, China
for the calendar years 2006-2008

- Percentage of the entries within the Asian zone: 3.6%
- Percentage of all the entries in the database: 0.2%
Appendix 3

The European Association for Cardio-Thoracic Surgery
Bespoke report for Hong Kong, China - September 2010

Data completeness

Completeness rates are shown in the following table. Some countries have >90% completeness of all important variables, others have submitted only age & gender. We would not wish to be in any way critical of those countries that are embarking on collection initiatives but cannot yet submit complete data.

<table>
<thead>
<tr>
<th>Database question</th>
<th>Armenia</th>
<th>Austria</th>
<th>Belgium</th>
<th>China</th>
<th>Croatia</th>
<th>Cyprus</th>
<th>Czech Republic</th>
<th>Denmark</th>
<th>England</th>
<th>France</th>
<th>Germany</th>
<th>Greece</th>
<th>Hong Kong, China</th>
<th>Italy</th>
<th>Latvia</th>
<th>Lithuania</th>
<th>Luxembourg</th>
<th>Netherlands</th>
<th>Northern Ireland</th>
<th>Norway</th>
<th>Poland</th>
<th>Portugal</th>
<th>Republic of Ireland</th>
<th>Scotland</th>
<th>Spain</th>
<th>Sweden</th>
<th>Switzerland</th>
<th>Turkey</th>
<th>Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>85</td>
<td>1,595</td>
<td>78,739</td>
<td>24,768</td>
<td>3,543</td>
<td>1,829</td>
<td>23,088</td>
<td>25,090</td>
<td>344,342</td>
<td>30,271</td>
<td>244,216</td>
<td>12,470</td>
<td>940</td>
<td>58,524</td>
<td>2,007</td>
<td>2,858</td>
<td>3,110</td>
<td>3,004</td>
<td>4,130</td>
<td>62,123</td>
<td>64,191</td>
<td>7,259</td>
<td>9,242</td>
<td>31,209</td>
<td>16,029</td>
<td>6,019</td>
<td>4,752</td>
<td>12,214</td>
<td>15,483</td>
</tr>
</tbody>
</table>

Data only partially compatible with the EACTS database.
Appendix 3

The European Association for Cardio-Thoracic Surgery
Bespoke report for Hong Kong, China - September 2010

For data to be deemed correct and complete in this report, it must be collected fully in the local hospital, exactly according to the definitions in the EACTS database (see pages 234-246 of the full report) and there must be no errors in data submission, transfer or import between the hospital, the national society and the EACTS database. We would hope that these tables will be helpful in facilitating local understanding of these issues and driving more complete data collection in future.

Data completeness for selected database questions and contributor country

<table>
<thead>
<tr>
<th>Country</th>
<th>Database question</th>
<th>Count</th>
<th>Ejection fraction</th>
<th>Left main coronary disease</th>
<th>Number of diseased vessels</th>
<th>Pre-operative ventilatory support</th>
<th>Minutes ventilatory support</th>
<th>Operative mortality</th>
<th>Previous cardiac surgery</th>
<th>New post-operative stroke</th>
<th>New post-operative death</th>
<th>In-hospital mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armenia</td>
<td></td>
<td>85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td></td>
<td>1,595</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Belgium</td>
<td></td>
<td>78,739</td>
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<td>China</td>
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<td>24,168</td>
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<tr>
<td>Croatia</td>
<td></td>
<td>3,543</td>
<td></td>
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<td>Cyprus</td>
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<td>1,820</td>
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<td>Czech Republic</td>
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<td>23,688</td>
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<tr>
<td>Denmark</td>
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<td>25,090</td>
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<tr>
<td>England</td>
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<td>344,342</td>
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<td></td>
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<tr>
<td>France</td>
<td></td>
<td>30,271</td>
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<tr>
<td>Germany</td>
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<td>244,216</td>
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<td>Greece</td>
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<td>12,470</td>
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</tr>
<tr>
<td>Hong Kong, China</td>
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<td>940</td>
<td></td>
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<tr>
<td>Italy</td>
<td></td>
<td>58,524</td>
<td></td>
<td></td>
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<tr>
<td>Latvia</td>
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<td>2,007</td>
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<tr>
<td>Lithuania</td>
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<td>2,858</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Luxembourg</td>
<td></td>
<td>3,110</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>The Netherlands</td>
<td></td>
<td>3,094</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Northern Ireland</td>
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<td>4,190</td>
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<td></td>
<td></td>
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<tr>
<td>Norway</td>
<td></td>
<td>62,123</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Poland</td>
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<td>64,191</td>
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<td></td>
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<tr>
<td>Portugal</td>
<td></td>
<td>7,259</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Republic of Ireland</td>
<td></td>
<td>9,242</td>
<td></td>
<td></td>
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<tr>
<td>Scotland</td>
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<td>31,200</td>
<td></td>
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<td></td>
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<tr>
<td>Spain</td>
<td></td>
<td>16,600</td>
<td></td>
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<tr>
<td>Sweden</td>
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<td>6,819</td>
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<tr>
<td>Switzerland</td>
<td></td>
<td>4,752</td>
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<td></td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
<td>12,214</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wales</td>
<td></td>
<td>15,483</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3

The European Association for Cardio-Thoracic Surgery
Bespoke report for Hong Kong, China - September 2010

The data completeness for the various fields is given in the following table, for the period 2006 to 2008, compared to both the database average and the average of the relevant geographical zone. The rank order for the completeness of each database field is also given compared to the completeness rates reported for the other contributor countries.

<table>
<thead>
<tr>
<th>Database question</th>
<th>Hong Kong, China</th>
<th>Asian zone</th>
<th>Database as a whole</th>
<th>Hong Kong, China's Rank</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.26%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.02%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Height &amp; weight</td>
<td>1.7%</td>
<td>0.1%</td>
<td>6.7%</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Angina</td>
<td>1.1%</td>
<td>0.0%</td>
<td>23.9%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>1.1%</td>
<td>0.0%</td>
<td>26.3%</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>0.4%</td>
<td>0.0%</td>
<td>46.8%</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.1%</td>
<td>0.0%</td>
<td>45.3%</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Renal failure</td>
<td>0.7%</td>
<td>0.0%</td>
<td>51.1%</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Neurological dysfunction</td>
<td>0.0%</td>
<td>95.4%</td>
<td>16.7%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Extra-cardiac arteriopathy</td>
<td>0.0%</td>
<td>95.4%</td>
<td>18.5%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ejection fraction</td>
<td>0.1%</td>
<td>0.0%</td>
<td>9.6%</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Left main stem disease</td>
<td>7.5%</td>
<td>0.3%</td>
<td>17.5%</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Number of diseased vessels</td>
<td>7.0%</td>
<td>0.2%</td>
<td>21.0%</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Number of valves treated</td>
<td>1.0%</td>
<td>0.0%</td>
<td>16.0%</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pre-operative ventilation</td>
<td>0.0%</td>
<td>95.4%</td>
<td>28.6%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Nitroprussine pre-operatively</td>
<td>0.0%</td>
<td>0.0%</td>
<td>13.2%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Operative priority</td>
<td>0.0%</td>
<td>1.3%</td>
<td>8.5%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>1.6%</td>
<td>0.1%</td>
<td>16.3%</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>New post-operative stroke</td>
<td>2.2%</td>
<td>96.5%</td>
<td>44.6%</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>New post-operative dialysis</td>
<td>1.7%</td>
<td>96.5%</td>
<td>25.8%</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.4%</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Number of entries</td>
<td>891</td>
<td>25,059</td>
<td>404,721</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 The rank shows the country's rate of missing data relative to the rates of missing data for all the other countries with data in the period. A rank of 1 indicates the lowest missing data rate of all the countries with data in the period. A rank of 2 indicates the second lowest missing data rate of all the countries with data in the period. A rank of 3 indicates the third lowest missing data rate of all the countries with data in the period. A rank of 4 indicates the fourth lowest missing data rate of all the countries with data in the period. Tied ranks are preceded by an = symbol.
Appendix 3

The European Association for Cardio-Thoracic Surgery
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Type of operation
There are marked differences in casemix by operation type between countries submitting to the database. Historically, isolated coronary artery surgery has been the predominant operation performed by cardiac surgeons. Probably the two most important factors underpinning these data are the relative burden of valvular and ischaemic heart disease, and the proportion of ischemic heart disease that is treated by coronary artery surgery rather than percutaneous coronary intervention. The following data needs to be interpreted against a local understanding of these issues.

<table>
<thead>
<tr>
<th>Case in the EACTS database for Hong Kong, China; calendar years 2006-2008</th>
<th>Proportion of procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hong Kong, China</td>
</tr>
<tr>
<td>Isolated CABG</td>
<td>50.3%</td>
</tr>
<tr>
<td>CABG &amp; valve</td>
<td>4.2%</td>
</tr>
<tr>
<td>CABG, valve &amp; other</td>
<td>0.3%</td>
</tr>
<tr>
<td>CABG &amp; other</td>
<td>1.7%</td>
</tr>
<tr>
<td>Isolated valve</td>
<td>26.2%</td>
</tr>
<tr>
<td>Valve &amp; other</td>
<td>3.8%</td>
</tr>
<tr>
<td>Other</td>
<td>7.6%</td>
</tr>
<tr>
<td>Unspecified</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Number of entries 891 25,059 404,721

1 The rank shows the country’s position in an ordered distribution of the procedure grouping under consideration, with rank 1 representing the greatest proportion of total workload and rank 23 the lowest proportion calculated.
Appendix 3

The European Association for Cardio-Thoracic Surgery
Bespoke report for Hong Kong, China - September 2010

Mortality
Some countries have submitted complete mortality data, some have returned no data, as shown opposite. Considering specifically the most recent time period 2006-2008, for the in hospital outcome field:

- Hong Kong, China has 0.0% missing data.
- In the Asian zone, the rate of missing data is 0.0%.
- For the database as a whole, 9.4% of these data were missing.

All operations: Missing mortality data for Hong Kong, China; calendar years 2006-2008 (n=404,721)
Appendix 3

The European Association for Cardio-Thoracic Surgery
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All operations: Missing mortality data and contributor country
(n=1,674,168)

Contributor country

Percentage of entries with missing mortality data

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Appendix 3

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Issues around mortality analysis, and their publication are considered on pages 20, 60-61 and 150-151 of the main report. Great caution should be given when interpreting crude mortality analyses, or any presentation that is not performed on fully validated data.
Appendix 3

However, the following funnel plots present the crude mortality for all cardiac surgery, isolated CABG surgery, isolated AV surgery and combined AV & CABG surgery compared to the database average. These data should be considered against aspects of data completeness, and a local understanding of casemix.
Appendix 3

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EuroSCORE

It is not possible to make robust conclusions about mortality data in the absence of effective adjustment for casemix. Further thoughts on these issues are given on pages 130-131 of the full report. The data required to risk adjust using the EuroSCORE model are of variable completeness. The data for Hong Kong, China benchmarked against zone and the database as a whole are given in the following tables:

<table>
<thead>
<tr>
<th>EuroSCORE variables</th>
<th>Rates of missing data</th>
<th>Hong Kong, China Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Gender</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Chronic pulmonary disease</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Extra-cardiac arteriopathy</td>
<td>0.0%</td>
<td>94.3%</td>
</tr>
<tr>
<td>Neurological dysfunction</td>
<td>0.0%</td>
<td>94.3%</td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>1.6%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Serum creatinine</td>
<td>0.2%</td>
<td>94.3%</td>
</tr>
<tr>
<td>Critical pre-operative state</td>
<td>0.4%</td>
<td>94.3%</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>LV dysfunction</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Recent myocardial infarction</td>
<td>53.8%</td>
<td>41.2%</td>
</tr>
<tr>
<td>Pulmonary hypertension</td>
<td>0.0%</td>
<td>86.6%</td>
</tr>
<tr>
<td>Emergency</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Number of entries</td>
<td>592</td>
<td>8,774</td>
</tr>
</tbody>
</table>

For a data item to be reported as 100% complete in this table, it must be collected in full for each patient undergoing surgery, and these data need to be transmitted to the EACTS database according to the methodology described on pages 44-45 of the main Fourth EACTS Adult Cardiac Surgical Database Report. Furthermore, the definitions and options used in the local hospital and national society register must be identical with the EACTS dataset, given on pages 232-240 of the main report. Any error in transmission or inconsistency between the datasets can lead to an incidence of missing data in this table.

For example, any contributor that uses the Adult Cardiac Surgical Minimum Dataset published by the Society for Cardiothoracic Surgery in Great Britain & Ireland will appear to have missing data for the timing of the Most recent myocardial Infarction in the EACTS Registry, because of an inconsistency in the data structure and definitions for this question between the United Kingdom and EACTS datasets. The locally defined UK and EACTS versions of this database question have entirely incompatible response options, so it is not possible to import such a contributor’s data into the EACTS database. This means that while the hospitals in the United Kingdom & Ireland may well be collecting fairly complete data on the timing of their patients’ recent myocardial infarctions according to their own dataset definitions (as demonstrated in the last iteration of their published database report), they will appear to have a large proportion of patient-entries with this data-item missing in the central EACTS database.

We would hope that the data presented here will be of use in helping countries to understand any issues with their data quality, or to uncover transcription issues that can be rectified for future submissions.

1 The rank shows the country’s rate of missing data relative to the rates of missing data for all the other countries with data in the period. A rank of 1 indicates the lowest rate of missing data and a rank of 23 the greatest rate of missing data. Where ranks are tied the lowest applicable rank is given to all the countries with the same rate of missing data; for example, if three countries have no missing data, they are assigned the rank of 1; the next country in the ordering is given a rank of 4, and so on. Tied ranks are preceded by an ‘*’ symbol.

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Appendix 3

Logistic EuroSCORE
An analysis of the logistic EuroSCORE calculated according to the methodology outlined in the Fourth EACTS Adult Cardiac Surgical Database Report for the period 2006-2008 (see page 156 of the main report) gives average values of:

- 2.3% for Hong Kong, China (n=502),
- 2.1% for the Asian zone (n=8,714),
- 3.3% for the database as a whole (n=194,710).
Appendix 3

The European Association for Cardio-Thoracic Surgery Bespoke report for Hong Kong, China - September 2010

Isolated CABG: EuroSCORE groupings for Hong Kong, China for the calendar years 2006-2008

<table>
<thead>
<tr>
<th>Percentage of entries</th>
<th>Hong Kong, China</th>
<th>Asian zone</th>
<th>Database as a whole</th>
<th>Hong Kong, China’s rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2.0</td>
<td>40.6%</td>
<td>35.4%</td>
<td>22.5%</td>
<td>16</td>
</tr>
<tr>
<td>2.0-3.9</td>
<td>31.7%</td>
<td>36.4%</td>
<td>29.2%</td>
<td>15</td>
</tr>
<tr>
<td>4.0-5.9</td>
<td>16.7%</td>
<td>18.8%</td>
<td>26.9%</td>
<td>2</td>
</tr>
<tr>
<td>6.0-7.9</td>
<td>7.2%</td>
<td>7.2%</td>
<td>13.8%</td>
<td>2</td>
</tr>
<tr>
<td>8.0-9.9</td>
<td>1.8%</td>
<td>1.7%</td>
<td>5.6%</td>
<td>3</td>
</tr>
<tr>
<td>&gt;9.9</td>
<td>0.9%</td>
<td>0.4%</td>
<td>3.3%</td>
<td>8</td>
</tr>
<tr>
<td>Number of entries</td>
<td>502</td>
<td>8,774</td>
<td>194,710</td>
<td></td>
</tr>
</tbody>
</table>

Isolated CABG: Logistic EuroSCORE distributions and contributor country: calendar years 2006-2008 (n=194,710)

1 The rank shows the country’s proportion within the risk group relative to the proportions of data in the same risk group for all other countries with data in the period. A rank of 1 indicates the lowest proportion and a rank of 25 the greatest. Where ranks are tied the lowest applicable rank is given to all the countries with the same proportion; for example, if three countries have a zero rate, they are assigned the rank of 1; the next country in the ordering is given a rank of 4, and so on. Tied ranks are preceded by an = symbol.
Appendix 3

The following funnel plot displays a risk-adjusted in-hospital mortality for CABG according to the methodology described on page 156 of the full report. There are numerous limitations inherent with this methodology, and the results need to be interpreted against those limitations.
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Bespoke report for Hong Kong, China - September 2010

Post-operative stay
The length of post-operative in-hospital stay after CABG surgery is not a normal distribution and these issues are considered more fully on page 60 of the full report. It is useful to give summary statistics in several ways; the average length-of-stay, which is can be useful for assessing the duration of stay for economic reasons and in reference to discussions around cost constraint and a non-parametric analysis (median, inter-quartile ranges and adjacent), which is probably more useful for clinical benchmarking.

An analysis of the post-operative stay data for the period 2006-2008 reveals:
- Hong Kong, China reports an average post-operative stay of 6.7 days (n=502).
- In the Asian zone, the average post-operative stay is 12.6 days (n=8,768).
- For the database as a whole, patients stay an average of 10.0 days after their surgery (n=208,156).

Isolated CABG: Post-operative stay distributions and contributor country; calendar years 2006-2008 (n=208,156)
Appendix 3

The European Association for Cardio-Thoracic Surgery

Submission of data
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Scope of this appendix
This appendix outlines the basic requirements for data submission from hospitals or from national registries for successful import into the EACTS Central Adult Cardiac Surgical Registry. It covers:

1. Minimum requirements for file formats
2. Minimum requirements for each row of data
3. Minimum requirements for supporting documentation

File formats
Individual anonymised patient records are required, not aggregate data analyses.

In many cases the data must be viewed and manipulated in third-party software prior to import. This allows for detailed examination of the data so that the final import database is the best fit to the database structure of the central registry. It also allows some pre-import manipulation of the data to create the cleanest final import possible. The data also have to be transmuted into a file format that is suitable for import to a tab-delimited text file.

The most common acceptable source data formats include:

- Microsoft Access™
- Microsoft Excel™
- Tab-delimited text files

However, any file that can be demonstrated to be compatible with standard Microsoft packages would also be acceptable. Comma-delimited files are not generally acceptable as the comma is used to sub-delimit fields where more than one response option may be selected. Comma-delimited files may be accepted as long as there are no multiple-response fields with comma delimiters or sub-delimiters other than commas.

Where there is more than one table of source data to be imported, it is essential that the tables of data required in the final import product are identified, and that the inter-relationships between those tables are recorded explicitly, including the indices that are used to link between the tables. This requirement applies most frequently to Access™ databases, but also applies to other file formats where data from multiple files are to be migrated into the EACTS central registry database.
Appendix 3

The European Association for Cardio-Thoracic Surgery

Minimum requirements for each row of data
The minimum requirements for data submitted to the EACTS database are:

- The first row in each data file or table must contain headers
- Each row of data in each file or table must include a unique patient identifier 1
- Each row of data in each file must include a key-date such as an index (admission, operation, etc., for the EACTS database the key-date is the date-of-operation) 2
- Numbers containing decimals should be presented with a decimal point (.) signifying the decimal position and without comma thousand separators e.g., 1,000,245
- Dates should be presented in long date format: dd/mm/yyyy.
- Date-time fields should be presented in dd/mm/yyyy hh:mm format using the 24-hour clock.
- Where a data item may contain multiple responses each of those responses must be separated by a comma only.
- It is important that soft carriage-return are removed from the data before delivery to the EACTS Registry. These control characters cause configuration problems when the data are transferred into the file format that acts as the substrate for the import process as the carriage return is reserved as a row (record) delimiter.

Requirements for supporting documentation
A full dictionary is required, particularly where abbreviations or encoding systems have been used. This dictionary should include supporting information on the relationship between the individual data-items and patient’s progress (i.e., the data pre-operative, post-operative etc.

Where data are maintained in a language other than United Kingdom English, a full translation of all the headers and data items must also be provided. It is important to have full explanations for all headers:

- The meaning of the header
- The type of data 3

Where data items are coded (0, 1, Y, N, etc.) a comprehensive set of data definitions should be supplied with, and at the same time as, the data to be imported 4.

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1 If the data file lacks an unique identifier such as a Hospital number or a Department number, then there must be sufficient patient-specific data to be able to generate an unique identifier. An indication of the nature of the unique identifier is very important, i.e., is the identifier a hospital number, a national number or a database row ID. The minimum data fields would be the patient’s Surname, Forename, Date-of-birth and Gender. In such cases, if an examination of the data demonstrates that there are a number of duplications then this methodology and the whole data submission will be rejected. The unique patient identifier may be absent in individual data files from a multiple file suite as long as there is a database key that allows the patient records to be linked back to an unique identifier in one of the data-files.

2 Any row of data that lacks a key-date will not appear in the final import. Null values in this field will be treated as missing and, as such, removed at the time of import.

3 Type of data should include the clinical sense of the data (pre-operative, operative, post-operative, etc.), the scope of the data (usually exclusive data, multiple-choice data, date data, free text etc.).

4 Any data point that contains data options not included in the accompanying data definition documentation will be treated as an error and, as such, removed at the time of import.
The EACTS database report 2010: towards global benchmarking

Bespoke report for Hong Kong, China

The European Association for Cardio-Thoracic Surgery (EACTS) exists to promote and support all aspects of care given to patients suffering from cardiothoracic surgical disease. EACTS has established a database project in which data on risk factors and outcomes for patients can be collected and analysed to provide information for all stakeholders. In line with a membership policy of EACTS, non-commercial, and geographical barriers, we have also encouraged submission of data from hospitals outside Europe.

This EACTS adult cardiac surgery database report is an analysis of over one million patients’ records, from 29 countries, and 366 hospitals, in Europe and China (including Hong Kong). The report includes analyses of patient characteristics, type of surgery, operative risk factors and post-operative outcomes, including in-hospital mortality and length-of-stay. We have analysed the pooled data to show trends over time and compared the incidence of risk factors and outcomes between countries. We have set these analyses against data on populations, health status and economic statistics from the World Health Organisation.

The main report represents one of the largest clinically driven international benchmarking report ever produced. It is testament to the professional societies representing cardiac surgery in these countries, along with the hospitals and surgeons involved, that data from so many patients have been collected in cardiac surgical registries.

The main report demonstrates a widespread culture amongst cardiac surgeons of a willingness to become involved in active clinical benchmarking to improve the quality of care they deliver for patients. It also contains some fascinating findings, with major variations between countries in almost every risk factor and outcome analysed.

This bespoke report for Hong Kong, China contains a specific analysis of national data completeness, along with crude and risk-adjusted mortality data compared to the database as a whole. We have also given an analysis of post-operative length-of-stay. We hope that this information will be useful in helping to improve data quality and foster better understanding of local outcome rates.

We have provided in the report a framework for risk-adjusted benchmarking of mortality, and offered all countries a bespoke data completeness and mortality analysis to feedback issues of quality alongside this report.