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Comparison of hospital episode statistics and central cardiac audit database in public reporting of congenital heart surgery mortality

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ABSTRACT

Objective To verify or refute the value of hospital episode statistics (HES) in determining 30 day mortality after open congenital cardiac surgery in infants nationally in comparison with central cardiac audit database (CCAD) information.

Design External review of paediatric cardiac surgical outcomes in England (HES) and all UK units (CCAD), as derived from each database.

Setting Congenital heart surgery centres in the United Kingdom.

Data sources HES for congenital heart surgery and corresponding information from CCAD for the period 1 April 2000 to 31 March 2002. HES was restricted to the 11 English centres; CCAD covered all 13 UK centres.

Main outcome measure Mortality within 30 days of open heart surgery in infants aged under 12 months.

Results In a direct comparison for the years when data from the 11 English centres were available from both databases, HES omitted between 5% and 38% of infants operated on in each centre. A median 40% (range 0-73%) shortfall occurred in identification of deaths by HES. As a result, mean 30 day mortality was underestimated at 4% by HES as compared with 8% for CCAD. In CCAD, between 1% and 23% of outcomes were missing in nine of 11 English centres used in the comparison (predominantly those for overseas patients). Accordingly, CCAD mortality could also be underestimated. Oxford provided the most complete dataset to HES, including all deaths recorded by CCAD. From three years of CCAD, Oxford's infant mortality from open cardiac surgery (10%) was not statistically different from the mean for all 13 UK centres (8%), in marked contrast to the conclusions drawn from HES for two of those years.

Conclusions Hospital episode statistics are unsatisfactory for the assessment of activity and outcomes in congenital heart surgery. The central cardiac audit database is more accurate and complete, but further work is needed to achieve fully comprehensive risk stratified mortality data. Given unresolved limitations in data quality, commercial organisations should reconsider placing centre specific or surgeon specific mortality data in the public domain.

INTRODUCTION

The inquiry into congenital heart surgery deaths in Bristol was widely publicised, became a political issue, and has had a profound effect on surgical practice in the United Kingdom.[1] Irrespective of the intense controversy generated by public reporting of mortality statistics in the American healthcare system, the Department of Health has insisted on a similar policy for cardiac surgical outcomes in the UK.[2 3]

The Bristol inquiry used hospital episode statistics (HES) to compare outcomes with those of other congenital cardiac surgical units in the UK.[1] In 2004 the *BMJ* published a paper from the "Dr Foster" Unit at Imperial College, London, which described HES for mortality in congenital heart surgery.[4] The paper suggested that one unit, Oxford, had significantly higher mortality than the national average for open operations in infants.

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A paper based on the central cardiac audit database (CCAD) had found no detectable difference in 30 day or one year survival between any of the 13 UK tertiary centres for congenital heart disease for the first year the database operated nationally.[5] In contrast, the *BMJ* paper suggested that Oxford had outlying mortality for open procedures between 1991 and 2002 in infants less than 1 year, with a probability of this happening by chance of less than 0.0002.[4] A multidisciplinary team carried out an investigation to establish the difference between the mortality reported in the *BMJ* paper and carefully verified death rates for Oxford and other centres. We now report the findings of this investigation.

METHODS

Dr Foster epidemiologists obtained HES fourth revision (OPCS4) codes for open cardiac operations in children from the 11 centres in England between April 1991 and March 2002. For several complex paediatric cardiac surgical procedures, no OPCS4 codes were available. HES recorded only deaths that occurred at the hospital where the operation took place and during the same admission as the surgery. Procedures that were difficult to define by OCPS4 codes were excluded from the analysis.

The aim of the investigation instigated by Thames Valley Strategic Health Authority here was to compare mortality as reported by the administrative HES database and the clinically based CCAD for infants aged under 12 months who had cardiac operations with cardiopulmonary bypass in the UK.[6] Both datasets provided comprehensive statistics between 1 April 2000 and 31 March 2002, and this was the period used for comparison.

The minimum dataset used by the CCAD includes date of death and tracks mortality irrespective of place of death. In the CCAD, most cases with unknown outcomes were patients recorded as non-UK residents. These patients were predominantly coded as private patients and lost to follow-up after leaving the UK.

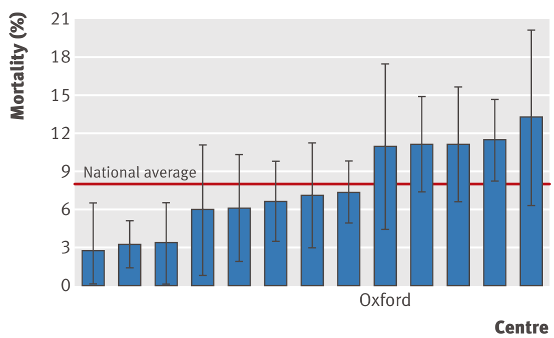
The clinicians from all 13 UK centres collected information for the CCAD dataset on a prospective basis. The data are validated by annual multidisciplinary team visits. Overall data provision for the CCAD dataset against benchmarked procedures was 96.8%. When CCAD outcome data could not be recorded or verified the data point was recorded as missing.

The findings presented are a comparison between HES and CCAD statistics for the number of patients operated on and mortality within 30 days. We also provide the CCAD recorded mortality statistics for all the centres between 1 April 2000 and 31 March 2003 compared with the national average.

Comparison of completeness of hospital episode statistics (HES) and central cardiac audit database (CCAD) data for open cardiac operations in infants in contributing congenital cardiac centres during study period 1 April 2000 to 31 March 2002

Centre	Statistic	HES data	CCAD data	Missing CCAD outcomes (%)	Shortfall in operations recorded by HES relative to CCAD (%)	Shortfall in deaths recorded by HES relative to CCAD (%)
A	Operations*	242	389		38	
	Deaths†	7	26	4		73
B	Operations*	121	138		12	
	Deaths†	3	4	12		25
C	Operations*	303	355		15	
	Deaths†	14	18	23		22
D	Operations*	167	225		26	
	Deaths†	3	10	19		70
E	Operations*	177	234		24	
	Deaths†	9	24	12		63
F	Operations*	133	156		15	
	Deaths†	4	11	0		64
G	Operations*	87	94		7	
	Deaths†	7	9	1		22
H	Operations*	220	239		8	
	Deaths†	5	9	2		44
I	Operations*	87	92		5	
	Deaths†	5	5	8		0
J (Oxford)	Operations*	70	78		10	
	Deaths†	8	8	0		0
K	Operations*	138	182		24	
	Deaths†	9	15	8		40
All‡	Operations*	1745	2182		17	
	Deaths†	74	139	8		38

*Number of recorded open cardiac operations in infants aged <12 months.
†Number of deaths within 30 days of operation reported in cohort.
‡All centres in England.



Thirty day mortality (with 95% confidence intervals) for infants aged under 12 months who had surgery with cardiopulmonary bypass in all 13 UK centres between 1 April 2000 and 31 March 2003

RESULTS

In the study period 2000-2, CCAD data included between five and 147 more operations for each centre than the HES data (median 23). Compared with CCAD data, HES omitted between 5% and 38% (median 15%) of infants operated on in each centre (table). The system used for reporting of postoperative deaths by HES resulted in a median shortfall of 40% (range 0-73%). In centre A, with the largest number of operations, 38% of all patients were missed by HES and only 27% of the total deaths were recorded. HES failed to track between 44% and 70% of deaths in four other centres. As a result, HES underestimated the mean 30 day hospital mortality at 4% compared with the CCAD derived figure of 8%.

In CCAD, between 1% and 23% of outcomes were missing in nine of the 11 English centres. From the CCAD outcome information, Oxford reported all deaths and had 98% and 100% completeness for all data points over the two year period. The 10% mortality for open heart surgery in infants for 2000-2 was not different from the mean for all centres (8%). The missing deaths from other centres in HES led to the suggestion that Oxford had an outlying mortality because of the artefactually low national mortality produced from HES data (figure).

DISCUSSION

Principal findings

Hospital episode statistics (HES) did not provide reliable patient numbers or 30 day mortality data. On average, HES recorded 20% (5-38%) fewer cases than the CCAD and captured only between 27% and 78% of 30 day deaths in nine of the 11 centres in England. HES did not record operations on non-UK residents and detected only deaths that occurred in the hospital where the operation took place and during the same admission as the surgery.

The non-verified HES information was an unsuitable platform on which to base sophisticated statistical analysis. The Dr Foster paper did not present an accurate account of cardiac surgical activity or mortality in infants.

Strengths and weaknesses of the study

Aylin and colleagues stated that Oxford had excessive mortality on the basis of data collected between 1999 and 2000 and adjusted for procedure. Given that CCAD validated data were available only after 2000, we can refute that claim only from that time onwards. We did not adjust our data comparison for procedure.

The Thames Valley Strategic Health Authority review highlighted previous CCAD reviews of independently validated data, which show that all UK units produce similarly acceptable results.[6] Although it provides the gold standard for collection of cardiac data in the UK, CCAD was imperfect in that some non-UK residents were lost to follow-up. CCAD now makes increasingly strenuous efforts to verify data at each congenital heart centre. Providing an accurate description of a complex cardiac operation on an unusual heart defect can sometimes be very difficult. Clinicians must enter the information of best fit. In contrast, clerical staff involved in HES submission are disadvantaged by less specialised knowledge and motivation to provide comprehensive and accurate data.

Strengths and weaknesses in relation to other studies

Aylin and colleagues suggested that HES data were of "significant quality to be used for analysis."[4 7] They have also stated that "patients where the outcome was unknown made little difference to the overall mortality." Information from our study indicates that these statements are wrong. Shahian and colleagues compared clinical and administrative data sources on coronary artery bypass graft surgery in hospitals in Massachusetts.[8] They found a 27.4% disparity in the volume of isolated coronary artery bypass graft surgery, and a significant difference in observed in-hospital mortality. Various statistical methods produced different risk adjusted mortalities, and the administrative dataset was more prone to errors.

Meaning of the study

Data management requires resources, but most of the units were not funded to collect and validate data effectively. If mortality statistics are to be released, their quality must be beyond reproach. Precise database definitions, uniform training of data managers, and periodic external audit are essential.

Government agencies and the media increasingly use administrative data for hospital profiling because they are inexpensive and available in a short time frame. Marshall and Spiegelhalter have questioned the reporting of performance indicators to provide explicit ranking of institutions.[9] They conclude that league tables are unreliable statistical summaries of performance.

Uncertainty about the public reporting of unit specific mortality statistics

We believe the UK to be the first country to follow some American states by placing non-risk stratified statistics for cardiac surgical mortality in the public

WHAT IS ALREADY KNOWN ON THIS TOPIC

Hospital episode statistics have been used to compare activity rates and mortality between centres, but their reliability has been questioned

WHAT THIS STUDY ADDS

The congenital cardiac audit database is more accurate and complete than hospital episode statistics, but individual centres need further investment to improve completeness of data

The value of placing unit or surgeon specific mortality statistics in the public domain is in doubt, given the poor quality of data, imprecision of risk stratification, and confrontational media agenda

arena.[10] The public reporting of mortality statistics in isolation cannot increase the safety of cardiac surgery but may reduce mortality if the system discards high risk patients. We do not believe that surgeons wish to take this route, but many will follow their self preservation instinct.[11] Given the problems with data quality, the imprecision of risk stratification models, and the confrontational agenda in the media, we question the value of placing mortality statistics in the public domain.

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Preventing childhood obesity: two year follow-up results from the Christchurch obesity prevention programme in schools (CHOPPS)

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ABSTRACT

Objective To assess the long term effects of an obesity prevention programme in schools.
Design Longitudinal results after a cluster randomised controlled trial.
Setting Schools in southwest England.
Participants Of the original sample of 644 children aged 7-11, 511 children were tracked and measurements were obtained from 434 children three years after baseline.
Intervention The intervention was conducted over one school year, with four sessions of focused education promoting a healthy diet and discouraging the consumption of carbonated drinks.
Main outcome measures Anthropometric measures of height, weight, and waist circumference. Body mass index (BMI) converted to z score (SD scores) and to centile values with growth reference curves. Waist circumference was also converted to z scores (SD scores) .
Results At three years after baseline the age and sex specific BMI z scores (SD scores) had increased in the control group by 0.10 (SD 0.53) but decreased in the intervention group by −0.01 (SD 0.58), with a mean difference of 0.10 (95% confidence interval −0.00 to 0.21, P=0.06). The prevalence of overweight increased in both the intervention and control group at three years and the significant difference between the groups seen at 12 months was no longer evident. The BMI increased in the control group by 2.14 (SD 1.64) and the intervention group by 1.88 (SD 1.71), with mean difference of 0.26 (−0.07 to 0.58, P=0.12). The waist circumference increased in both groups after three years with a mean difference of 0.09 (−0.06 to 0.26, P=0.25).
Conclusions These longitudinal results show that after a simple year long intervention the difference in prevalence of overweight in children seen at 12 months was not sustained at three years.

INTRODUCTION

Numerous studies have been conducted with the aim of preventing obesity in children, many based in