Further Reports based on Local Sources of Data

for the Bristol Royal Infirmary Inquiry

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Prepared by Professor Stephen JW Evans

Quintiles
Glengorse
Battle
East Sussex
TN33 0TX

Executive Summary

This report has been commissioned by the Bristol Royal Infirmary Inquiry to examine further aspects of the sources of data available within Bristol. It has three major sections. The first uses data from the sources described previously to examine ill-health (morbidity) in children who received cardiac surgery. The intention is to examine those conditions that result from the surgery and can be regarded as complications. The second examines Mr Wisheart's own log as entered onto computer by him. Comparisons with other sources are made. The third describes a new source of data from the Cardiac Perfusionists (who operate the heart-lung machines for by-pass during surgery).

Morbidity

In the first report on Hospital Episode Statistics [INQ 0013] higher proportions of central nervous system (1.6%) and renal complications (2.6%) were found in Bristol than elsewhere. These results were for all children, including those who died. The overall levels found in the Patients Administration System were of this order of magnitude, and somewhat higher in the Clinical Coded Records (CCR). The Clinical Case Note Review (CCNR) report found a level of recorded disability of about 6% (using the estimate for all children) in those who were alive, but half were believed to be unrelated to the medical care received. The absolute numbers in the CCNR were very small.

Published work where special study of complications has been done suggests much higher rates, in the range 10-30% for neurological injury. The routinely collected data do not detect anything like these rates. They cannot be used to estimate disability rates accurately, partly because of problems of definition. There is therefore uncertainty in whether Bristol had a higher or a lower rate of post-operative complications compared with other UK centres.

Mr Wisheart's log

The Inquiry has coded both Mr Wisheart's and Mr Dhasmana's logs, and the results from these (SL) have been reported previously. Mr Wisheart has entered his own log onto computer, using his own words and abbreviations to describe the diagnoses and operations. There is good concordance in the total numbers and the death rates between the different sources. Comparisons within operation groups are more difficult, but there is a general consistency. The overall death rate in the "early" period was 15.5%, with a further 6.6% in those who survived the early period. Some groups of diagnoses have death rates over 40%. In children aged 0-3 months the death rate was just over 50%, and in children 4-12 months was 20% (overall 34% in those under one).

The overall results are consistent with those found in the other local sources of data. Exact comparisons on an individual or finely-grouped basis are difficult because of the variety of terms used by Mr Wisheart.

Cardiac Perfusionists' log

This log (CPL) covers 1346 operations during the whole period of the Inquiry. It records basic information about each operation including age, surgeon, operation type and whether a child died on the operating table. It has two aspects where it adds to the information for the Inquiry. Firstly the deaths on the operating table are specifically recorded, and as all children in the log definitely had open heart surgery it provides a "gold standard" for classification.

The overall death rate on the operating table was just over 2%, but was about 20% for switches. The overall number of operations showed very close agreement with the numbers classified as open in the other local sources. The agreement with the other sources of data using the 13 groups of operation was close except for Atrial Ventricular Septal Defect (AVSD) and Aortic & pulmonary valve procedures where

the CPL coding had too few of the first group and too many of the second. In particular the agreement with the PAS was generally very close.

Table of Contents

Section One: Report on Morbidity

1. Introduction

1. The previous report on the analysis of data from local sources concentrated on mortality. This is partly because mortality is recorded better than morbidity. Mr Langstaff in the evidence introducing day 75 of the Inquiry remarked on some of the problems. He stated -

   "inevitably mortality is sadly easy to identify and morbidity may not be. There are problems of definition, problems of degree that arise, and thankfully the incidence is not as obvious nor as great, it appears, as is mortality"

2. The three main local sources of data [see INQ 0012] are the Patient Administration System (PAS), the computer files of the clinically coded (for the Inquiry) medical records (CCR) and the Inquiry's coding of the two Surgeons' logs (SL). Each of these has some clinically coded information relating to the post-operative medical condition. The information from PAS is the basis for the returns from Bristol to the national system of Hospital Episode Statistics (HES). The analysis of these data allowed for a comparison between centres in the coding of post-operative complications. Mr Langstaff at day 75 also said –

3. "it is apparent that there is a difference between Bristol, when compared with the rest of the country and other centres, on the basis of the hospital episode statistics as to the incidence of neurological problems and to an extent renal and respiratory problems following surgery. [INQ0013 0028, section 2.3.7] As we explained, it is difficult on the basis of those statistics alone to know whether those problems arose before, during or consequent upon the operation, or were indeed consequent upon the underlying condition"

4. Possible problems in the efficiency of recording of deaths between different centres has been mentioned in the previous reports [e.g. INQ 0014 0010,section 3.11 & INQ 0014 0033, section 6.4 xxiii]. There are clearly even more

problems in relation to the efficiency of recording of post-operative complications [INQ0013 0031, section 2.4.9].

5. In spite of the problems, it is important to examine the data in relation to morbidity as far as is possible. The SL was not used for long term follow-up though immediate problems were recorded. The PAS only has diagnoses that relate to the current admission/discharge. We have linked the different admissions so that we can track diagnoses that are recorded at a later date, but the PAS data only covers admissions for heart problems. The CCR was intended to cover the entire medical history from the complete medical records for each child so that post-operative complications should be recorded even if they were not noticed as such, at the time.

6. The local sources all used the International Classification of Disease version 9 (ICD9) for coding of diagnoses. In addition, the PAS used ICD10 for part of 1995. Complications are strictly defined as being those with the first three digits of the ICD code being 996-999. (Appendix B1 lists the meaning of these codes). In all cases the codes relating to complications have no more than four digits. The classification of post-operative complications does not allow for fine distinctions between, for example, different types of neurological complication. The codes that are of most interest are those that refer to neurological and renal complications; these are 997.0 and 997.5 respectively.

7. In the results, each source of data is described separately, with a final section examining the concordance between them in individual cases. The emphasis is on those children who did not die but had complications.

2. Results - Morbidity

2.1 Surgeons' Logs – Post-Operative Complications

8. The preliminary report on the surgeons' logs did not discuss details of post-operative factors other than death. The form for abstracting the data from the

original logs referred to "Post-operative Complication". However, the surgeons themselves made comments on the logs that covered more than just complications. The descriptions of the surgeons' own view of their logs, in particular the post-operative comments, are at WIT 0120 0256-0262, and WIT0084 0001-0005. Mr Wisheart stated that he recorded "Post-operative Complications", and Mr Dhasmana said that he entered "Any significant post-operative event".

9. There were 2246 procedures in 1244 children [INQ 0012 0027, section 4.31]. Of these, 182 children had at least one complication diagnosis recorded by the coders. The complications are related to a child rather than to a particular procedure or an admission. The rules for coding complications may require more than one code to be used to refer to a single complication. The "E" codes in particular are used to describe the procedure that led to the complication.

10. The numbers of complication codes per child are given in Table 1.1, but it must be realised that the number of codes may be greater than the number of complications.

11. Most (150) of the complications occurred in children who subsequently died. Among the children who lived, there were 12 with one complication code, 16 with two and five with three. There are therefore 33 children out of 1017 children who were recorded as alive in the SL (3.2%) with a complication code recorded.

12. These complications have been coded using the ICD 9 coding system. This coding system, as noted above and explained in the previous report, [INQ 0012 0012, section 3.11], is a very general system for classifying diseases and is not optimised for describing paediatric cardiac surgery. Section B1 of the appendix lists all those codes that are described in the ICD manual as relating to operative complications. When the Surgeons' logs were coded describing the comments written in the logs, many of the coded values did not refer to the codes that are strictly complications, but described them using other ICD codes, such as

"Convulsions". It can be seen from Table 1.2 that the coding does not list very many neurological problems (5 with 997.0 = 0.5%) or renal problems (1 with 997.5) that were recorded in the surgeons' logs for those who survived. There were a total of 19 complications recorded with 997 codes for those who were alive, ten of which were cardiac. There are a further four with 996.* and eight with 998.* codes, most of them being infections. These 31 complications occurred in 28 children; three children had two complication codes in the range 996-999 recorded. Although other codes were used for descriptive purposes, it is clear that most of the children who were alive and had a diagnosis coded, did have at least one code in the range of the strict diagnosis of complication.

13. Table A1 (Appendix) lists all the complications that occurred to all children, with the outcome.

14. Table 1.2 is similar to table A1, but is restricted to those children who did not die. It can be seen that there are two diagnoses in the "300" series (which includes neurological terms), neither of which is a recognised outcome of surgery, and there is one diagnosis with a cerebral artery occlusion (this child also had a code of 996.7 recorded).

Conclusions – SL Morbidity

15. The surgeons' logs record those complications that occur at the time of, or very shortly after, the operation. Many of these are associated with a fatal outcome. Longer-term problems that are not immediately obvious are not recorded in the logs.

16. The surgeons' logs, as might be expected, are not good sources of information on long term complications of paediatric cardiac surgery. The overall level of 3.2% of children with a recorded code, 2.2% with a recorded complication (codes 996-999), and only 0.5% with a neurological complication is very low, and is likely to reflect under-reporting in the original logs.

2.2 CCR – Post-operative complications

17. The CCR was coded to include all post-operative diagnoses. This is a broader approach than that used in the SL, and covers the entire time span of the medical records available to the Inquiry team. The post-operative diagnosis may include a new diagnosis that only came to light as a result of the operation. It may also include a diagnosis associated with the underlying illness, as opposed to an adverse effect caused by the operation.

18. Among the 1875 children in the CCR within the terms of reference [see INQ 0012 0025, section 4.25] there are 714 children who have records of post-operative diagnoses. These are not necessarily all post-operative complications. Of those with diagnoses, 426 were recorded as alive and 288 as having died. Those who died had, on average 1.6 diagnoses recorded per child, one more than those who were alive (mean of 0.6). Table 1.3 shows the number of diagnoses recorded per child with a maximum of 11 diagnoses for a child who died and eight for one still alive. The most important complications are those coded with a 997 code. The number of these per child for the CCR is shown in table 1.4.

19. Among those who were alive, there were a total of 987 diagnoses recorded. Those diagnostic codes beginning with 997 are regarded as being true complications resulting from an operation. These are marked in bold in table 1.5, together with the other 99* codes of relevance. There are a total of 27 "996" codes used there, with 16 being mechanical or infection complications, and 112 "998" codes. As was seen in the SL, most of these codes refer to infections or other complications that do not necessarily have long term sequelae. Table 1.4 gives the number of code "997" diagnoses per child, which can be regarded as true "complications" resulting from a cardiac operation. Again, those who died had more complications than those who are alive.

20. Table 1.5 shows the ICD code and text description for the more frequently occurring diagnoses (those where the ICD code occurred at least 5 times). A

small number (11) of the recorded diagnoses did not map to an exact ICD code, though none were in the area of most relevance to the Inquiry. They may be errors in data entry or in writing on the coding from. From table 1.5, it can be seen that there were 18 children still alive who had central nervous system complications, and 26 with urinary complications. No children had both of these. The severity or duration of the effects of these complications is unknown from the coding. In order to study these complications in any detail, a further exercise of examining those particular clinical medical records in detail would be required.

21. A number of the diagnoses are E or V codes, which are not extra diagnoses, but explanations of the non-E code recorded (as noted under section 2.1 above, for the SL). The E codes add information about the 997 codes to explain the type of operation that led to the complication. The V codes refer to a previous history rather than to the current operation. In the Appendix the complete table (A2) of diagnostic codes is shown for those who died and for those who were alive, based on the CCR.

22. There are some diagnostic codes that refer to neurological problems that are not necessarily recorded as complications, but there are a small number of these. ICD 9 codes in the range 315 to 359 in Appendix table A2 show a total of 13 codes with neurological problems. Eight of the diagnoses could be forms of stroke or other serious complications, while the others (encephalitis, mononeuritis etc) seem less likely to be neurological complications of the type associated with surgery. However, even including all 13 diagnoses, these are in 10 children, five of whom also have post-operative complications coded, two of which are recorded as neurological complications. Thus there are the 18 children recorded with neurological complications and a further eight who have a diagnosis with a neurological element recorded. This diagnosis may or may not be a result of the heart surgery. One of the children with a hemiplegia has this recorded as a pre-operative diagnosis as well as a post-operative one.

23. Thus of 1520 children recorded as alive in the CCR there are at most 26 (1.7%) recorded with neurological complications. Some of these children had closed operations coded so that the rate in children with open operations who were still alive is 26/1388 (1.9%).

CCR Conclusion – Morbidity

24. Although there were more complication diagnoses recorded in the CCR for those who were alive than in the surgeons' logs, the numbers of children with serious neurological or renal complications appears to be relatively small. The ICD-9 coding system does not lend itself to a distinction between long-term and short-term problems, nor does it readily distinguish the seriousness of the complications. ICD9 and earlier versions of the coding system were intended for analyses of mortality rather than morbidity. It is possible that ICD-10 will in the future be more suitable for analysis of morbidity; it has been in use since April 1995.

25. The Clinically Coded Records were coded with a view to include the post-operative complications, but it is possible that the key problems were not obvious from the medical records. However it is clear that the numbers of children with recorded complications who were still alive is very much less than the numbers of children who died.

2.3 PAS – Post-operative complications

26. The PAS allows for a number of diagnostic codes to be recorded at the end of an episode of care. This is usually on discharge from hospital. The PAS data that have been provided to the Inquiry relate to episodes of care classified as cardiology or cardio-thoracic surgery [INQ0012 0012, sections 3.9 & 3.11: INQ0012 0019, sections 4.2, 4.3 & 4.5]. It is possible that there were other admissions for these children that could relate to a complication, but there would need to be a new set of data obtained from UBHT to study these, and it is not a simple matter for these data to be extracted. Comment about the potential

utility of such an exercise is made in section 4.

27. The consequence is that it is only sensible to examine diagnoses that are coded as post-operative complications. These are, for ICD9 codes, those diagnoses that have "997" as part of the code. There are some ICD10 codes that have been used for the last year of relevance to the inquiry and the codes relating to these are somewhat different. These codes (N99, G97, J95, I97, K91) have been used in this analysis. The ICD9 codes in the PAS are prefixed with the letter A. There are a total of nearly 600 different ICD codes that have been used to describe discharge diagnoses in those children who were still alive. Nearly half are only used once but some codes (those that relate to congenital heart problems) are used a very large number of times. Table 1.6 lists those codes that have been classed as complications with their frequency.

28. The PAS data do not relate to the whole period of the Inquiry, but only from 1st January 1988 onwards. It is likely that the full coding of all the medical information was not complete in the earlier years.

29. Complication codes occur in less than 9% of the admissions, but for 15% of the children they have a complication code recorded following at least one of their admissions. Of the admissions, less than 1% (29) had renal and less than one per cent (24) had neurological complications recorded. There were three admissions with both recorded. In terms of children, there were 28 with renal complications and 22 with neurological complications recorded after at least one of their admissions; there were three children with both recorded. About half of these children were recorded in the PAS as alive, so that of these there were 14 children with only renal complications, ten with neurological complications and one child with both.

PAS Conclusions – Morbidity

30. Post-operative complications that are immediately obvious may be recorded on the PAS, and with linkage of subsequent admissions there is a possibility that

complications only recognised as such at a later stage will be recorded. From the PAS data it is clear that the level of complications recorded in those children who survived was at a low level.

3. Linkage of individual cases

3.1 PAS and CCR

31. The linkage has used the ICD codes 997.0 and 997.5 for neurological or renal complications in those children recorded as alive in the relevant database. There were 25 children with one or both of these diagnoses recorded in the PAS and 36 children in the CCR for the period after 1st January 1988. The overlap between CCR & PAS is that about 14 children are recorded as having at least one of these complications in both, though there is disagreement between them in nine instances over exactly which complications are present. One of these children has a different surname in the two databases, but is clearly the same child (same BRI and BCH numbers and first name). There are 11 children recorded in the PAS as having one of those complications, but not so recorded in the CCR.

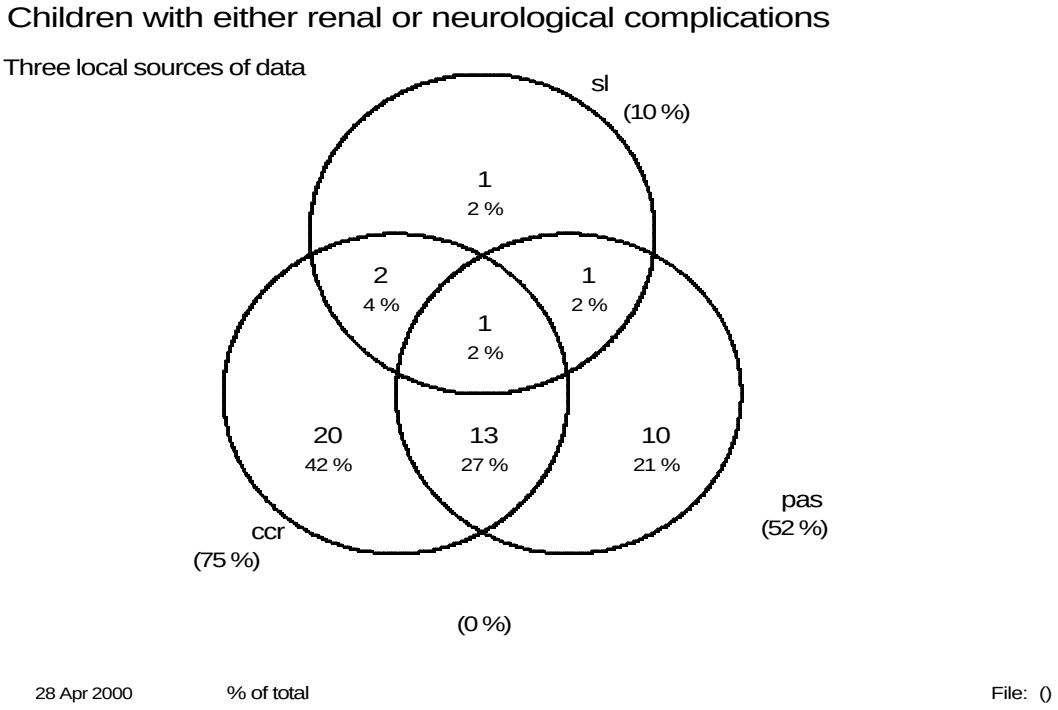
3.2 PAS, CCR and SL Linkage

32. There is little overlap with the SL since there are only five cases recorded there with renal or neurological complications who were still alive, and whose operations were after 1st January 1988. One was in both PAS and the CCR, two in CCR not in PAS, one in PAS not CCR and one in neither.

33. Figure 1 (a Venn Diagram) illustrates the overlap between the total of 48 children identified in the three sources as having one of these complications. A circle represents each of the three sources. The top circle refers to the SL, the lower left refers to the CCR and the lower right to the PAS. The numbers within the boundary of the circle shows the total number recorded for that source. Where the circles overlap it shows that the same cases are recorded in each of the relevant sources. For example, there are two cases in the SL and in the CCR,

but not in the PAS, and a single case only in all three sources. It is clear that there is a level of disagreement in the three sources. The SL is expected to be poor, but the detailed agreement between the CCR and PAS is also poor. The individual children do appear in most instances in the different databases, but there are a few who only appear in one or two of the sets of data. In some instances they appear with different names or record numbers.

Figure 1 Overlap of cases with neurological or renal complications in the PAS, CCR and SL



4. Comparison with the Clinical Case Note Review

34. The Clinical Case Note Review (CCNR) examined 80 cases very carefully. Forty were alive 30 days after surgery, and among these there were four cases where disability was noted by the review team. All four were classed as "moderate" disability (as opposed to "mild" or "severe"-the other options). Two of them were probably unrelated to surgery, including one child with Down syndrome. Two of them did have disability probably associated with their medical care.

35. Although 4/40 is 10%, because the CCNR was weighted towards younger, high-risk operations the reweighted estimate is 89/1473 (estimated number with disability in whole sample/estimated number who were alive at 30 days), an overall rate of 6%. However, all the children with recorded disability were aged under one year at the time of operation and had open heart surgery. In this group the rate is estimated to be 89/348 a rate of 20%. This includes all the children, with disability, not just those whose disability may be related to their medical care. Of the four noted in the CCNR to have disability, two had a post-operative complication recorded in the CCR and one had one in the PAS (one of the four was not in the PAS since their operation was before 1988 when the PAS came into use).

5. Overall Conclusions on Morbidity

36. In the first HES report where complications are discussed [INQ 0013, pages 0028, 0031 & 0058], the proportions with neurological (central nervous system) complications with open procedures was 1.6% and 2.6% for renal (urinary) complications. These have not distinguished those who were alive and those who died. The overall level of complications found in the PAS and CCR are of this order of magnitude. The CCR has recorded more of the complications than the PAS, but it is possible that diagnoses that are a result of surgery may not be recorded in the PAS if they are not noticed immediately.

37. It seems likely from published work that there is severe under-recording of complications in HES in centres other than Bristol. Recording there is at a high level when compared with other centres, but probably under-estimates the rate of neurological complication. Jonas et al "Brain Injury and Pediatric Cardiac Surgery" 1995, following a 1993 conference at the Children's hospital, Boston, suggest that neurological injury after cardiac surgery is 10-30%. A paper from the UK Institute of Child Health by Fallon et al described a survey where about

6% of children had some adverse neurological event. Not all of these were survivors.

38. The CCNR had rates of disability in children under one that are of the same order of magnitude as other studies, but only half in the CCNR were believed to be related to the medical care. It is also likely that very mild forms of disability have not been recorded. Agreement about disability is poor in the absence of a defined protocol that enquires about specific disability. The studies that use a careful protocol are likely to obtain higher rates, and more consistent results.

39. A recent paper from the Brompton Hospital by Menezes AM and Shinebourne EA (Heart 1998;80:286-91) suggests that the consequences for families of brain injury are very severe and there was evidence that families had not felt prepared for the possibility, and "did not receive information, support and practical assistance as early as they needed it".

40. It seems that the use of routine data to make between centre comparisons of post-operative complications is fraught with difficulty. It is possible to link non-cardiac admissions to cardiac surgery admissions and hence to pick up other diagnoses through routine data. It seems that this will not be helpful in the particular instance of Bristol, since the CCR has the potential to link non-cardiac admission data, but did not find many more cases. It is even less likely to be worthwhile for comparative purposes.

41. The evidence from local sources suggests that Bristol routine data collection gives a more reasonable estimate of complications following surgery, rather than that it is genuinely at a higher rate there.

Section Two: Report on Mr Wisheart's database of his Surgeon's Log

1. Overall Contents

42. Full descriptions of the original surgeons' logs have been given by Mr Wisheart [WIT 0120 0256-0262] and in a previous report by Prof. Evans [INQ 0012]. The Inquiry produced a computer database of the logs (referred to as SL), coding the diagnoses and operations using national and international codes. Mr. Wisheart supplied the Inquiry with his own computer version of his own log (WL). This was supplied as an Access database, but with a very simple structure, with a single table of records, one per operation. There are 722 records of operations for children less than 16 years old. There are a further 97 records for adults and children 16 and over. The earliest operation is on 5th January 1984, and the latest is 22nd August 1996.

43. This analysis of the database has been restricted to the 722 records of children. The database has the variables shown in Table 2.1. Most of the labels are obvious. The majority of the fields are simply text.

44. The definitions of early and late outcomes have not been given, but are simply alive or died. Further comment on the definitions appears later when comparison of WL with other sources on an individual record basis is made. The early deaths appear to be mainly up to 30 days after operation, but there are some with up to 90 day delays. It is likely that a 30 day cut-off was the intention, but perhaps Mr Wisheart intended to make sure that all deaths were included and some later deaths were classified as early. There are 112 early deaths (16%), and a further 40 late deaths (5.6%), with one case where the outcome is unknown.

2. Diagnoses

45. The diagnoses are classified relatively simply. Table 2.2 lists all of the 22 terms used with the number of deaths and the death rate. There are 493 children with

additional diagnoses recorded, and there are 410 different terms used. There are 15 children with "Downs" as the only extra term, but there are a further 19 children with a mention of "Downs" in the additional diagnosis. There are 11 with "PDA" as the only additional term, and 38 with a mention of PDA. No other single term occurs more than 7 times on its own. The spelling of terms and the punctuation between diagnoses is inconsistent.

46. The death rates are notably high (over 40%) among those described as C-AVSD, PTA and TAPVD. It may be noted that the Bristol rates in groups 4 and 5 of the Inquiry's grouping (corresponding to TAPVD & C-AVSD respectively) are much higher both under and over one year of age. Tables 18 & 19 of Professor Murray's report on the UKCSR [INQ 0014 0055-0056] show this very clearly. The rates reported by Bristol to the UKCSR seem slightly lower than these, nevertheless the difference over the whole period of time from 1984 to 1995 would show this clearly, had the UKCSR been examined in this way. It may be noted that a category "MISC", presumably miscellaneous, with 88 children has a death rate of 33%. All but one of these has an additional diagnosis. Eleven of the 34 children with a mention of "Downs", died in the early period (32%) and two (8.7%) of the 23 survivors died later.

3. Operations

47. There were a very large number of different descriptions of the operations, but some of these were spelling mistakes or punctuation that was inserted incorrectly. A considerable amount of time has been spent on editing the data on operations in order to be able to provide useful data. After editing, there were 245 different descriptions (originally there were 274, 233 of them only occurring once).

48. After editing (which is incomplete), there are 196 operations which occur once, and 24 which occur twice. Those operations that occur more than twice are listed in Table 2.3, with the number of early deaths and the death rate as a percentage. There is one case where the early outcome is labelled "N/A".

49. Those operations that occur once or twice have been grouped (though of course, they represent very different risks of operation and the grouping is merely for the sake of completeness rather than analysis). The rates of overall death are given in Table 2.4 for the less frequent operations.

50. The previous report [INQ 0012] did not provide a full analysis of the surgeons' logs by individual surgeon. The only table (5.4 of INQ0012 on page 0041) related to those operations classified in the 13 groups. For these the overall 30-day mortality was 13% in 606 operations. This is lower than that of the early rate based on Mr Wisheart's own data.

4. Age

51. The pattern of total mortality by age is similar to that seen in the surgeons' logs. Table 2.5 gives the data by age in completed years. With the infants, (those aged under one year) the pattern of mortality is as seen previously.

52. Using approximately the same grouping of age as in Table 4.11 of the first report on the Surgeons' logs – SL- report [INQ 0012 0039], the results for early deaths are as shown in Table 2.6. The table in INQ0012 refers to both surgeons, while this table refers to Mr Wisheart's cases alone. The mortality is somewhat higher in Mr Wisheart's own computerised version of his log (WL) than in the SL at all ages as well as overall.

Mr Wisheart's database individually matched with the Inquiry SL

5. Methods and matching of administrative data

53. The 722 records from Mr Wisheart's database (WL) have been matched with the 729 records from the surgeons' logs (SL) recorded as being from Mr Wisheart, as coded by the Inquiry team.

54. The first matching was done by BRI number and date of operation. This resulted in 666 matches. One of these matches was from what is essentially a duplicate

record in the WL database. One child appears twice in WL with identical records, except that the age is given as 36 or 42 months and the spelling of the first name differs.

55. A second matching was done using surname and date of operation. This gave a further 21 matches, which were checked to see if the forenames matched. This results in 687 records definitely relating to the same children and dates of operation.

56. From the WL and SL, 35 and 43 records, respectively, were not matched. Inspecting these by hand, there were 20 that matched on name (though the spelling could be different), but the dates of operations differed. There were at least a further three children where the SL had more dates of operations for a child than the WL. They agreed on at least one of the dates for those children. Hence it is likely that about 710, of the 722 records in the WL, are matched by similar records in the SL.

57. Where there were discrepancies in dates, it was not always possible to determine which was correct from the original log, and other independent sources of operation date (e.g. PAS or CCR) have proved useful for checking on dates. Where the name & date agreed with either SL or WL, then this was assumed correct.

58. In 11 of the 20 records which match on names (and BRI number) but not on dates the date is correct in WL and not in SL. In some instances, there were two dates on the original SL. The choice of date seems to have been made correctly for WL but not necessarily for SL. The dates are correct in the SL in nine cases.

59. Of the 15 records in WL but not in SL, there are at least 13 that are in other sources (not all with the same dates). Two were not found in other sources. Of the 23 in the SL but not in WL; 17 are in other sources, though two were noted to be under other surgeons. Most of the dates in the SL for these were not confirmed as correct.

60. Most of the errors in the SL appear to be in the abstraction of data from the records rather than in data entry to the database. A few errors are clearly in the typed version of the SL (e.g. one operation said to have occurred on 13th Aug with death noted as being on the 12th Aug).

61. Where checking with the original of the SL was possible, there were errors in both the WL and the SL in abstracting the data from the written record or in the entry onto the computer database.

6. Operation codes

62. Mr Wisheart has described the operations done using textual phrases and abbreviations. The SL has used OPCS 4 codes to describe the operations. As noted above (paragraph 47), there are a few types of operation with terms that are used frequently in the WL. Using the 687 records that have been merged unambiguously and the most frequently occurring terms in the WL, the OPCS codes from these have been compared with the verbal descriptions. The results are set out in Table 2.7 below. It must be emphasised that this table is restricted to those operations that occur frequently in WL.

63. This process is not expected to be perfect, since a single SL record of the operation was selected for the comparison. (The first procedure recorded in the SL for an operation was selected. It needs to be noted that the structure of the SL has procedures rather than operation as the basic record – see Annex 1 of INQ 0012, 0047-0049).

64. Ideally, it would be best to create an SL record for each operation for this process. This has not been able to be done in the time available. For the analysis by operation in INQ0012, a single procedure was selected on an hierarchical basis. This would not help in the matching process since Mr Wisheart has not applied a hierarchy in his descriptions. In fact the results are remarkable in their consistency at least. Of the 59 operations classed as "Closure" 57 are coded as K10. This is defined in the OPCS manual as-

K10 Closure of defect of interatrial septum

65. Of the 43 "Corrections", 31 are classed as K09, defined in the OPCS manual as-

K09 Closure of defect of atrioventricular septum

66. Of the 48 "Senning", 44 are classed as K05, which is:-

K05 Atrial inversion operations for transposition of great vessels

67. The 113 "total corrections" have been classified less consistently, with 69 as K04 and 27 as K07, which are: -

K04 Correction of tetralogy of fallot

K07 Correction of total anomalous pulmonary venous connection

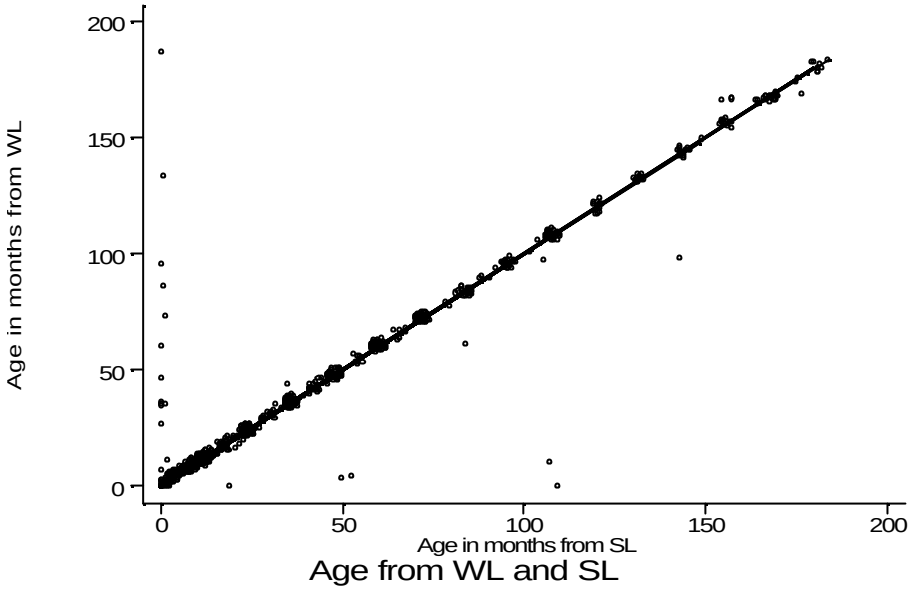
68. Mr Wisheart has three operations coded as "Switch" and two as "Arterial Switch" in WL. All five of these of these have "K06" as one of their operation codes in SL and there are no other children in the SL with this code. In this sense, the agreement on arterial switch operations appears to be perfect.

7. Ages

69. The age in the SL is recorded in years, months, weeks and days; in WL, it is in months only. Converting the ages in SL to completed months comparison is possible.

70. Figure 2 shows the relationship between them, with a line of identity also drawn. A slight "jitter" has been put on the points so that points that overlay one another can be seen.

Figure 2: Age from the two sources of data



71. It is clear that the agreement is close to perfect for most children, but there are a few points that are in error. A number of children have age recorded as zero months in the SL that have higher ages in the WL, and a few for whom the reverse is true.

7. Comparison with CCR

72. An individual case by case merge of WL has been done with the CCR. Of the 721 records (excluding the duplicate record referred to at 5.13 above) 604 match exactly using BRI number and date of operation, using only those cases in the CCR that are classified within the 13 groups. Of these 604, 20 are classified as closed surgery in the CCR.

73. Among the matches, there are 38 with a diagnosis in the WL using the term "Fontan". In the WL itself, 17 of these have an operation where Fontan is mentioned and 21 have TCPC mentioned. Of these 38, 29 are classified in group 9 (Fontan) using the Inquiry's analysts' grouping in the CCR. There are four

each in groups 6 and 12 (Closure of ASD & Closed shunts, respectively). One is classed in group 1 (Tetralogy of Fallot).

74. There are 79 operations with a mention of "Senning" in WL. Most (66%) of these are classed in group 2, with 16% in group 6(closure of secundum and sinus venosus ASDS) and 9% in group 7 (Closure of VSD). In the WL, most of the mentions of Senning (67%) are of Senning alone, while the remainder have additional text.

75. The correspondence between the WL and the CCR at an individual record level is reasonably good, but is by no means perfect.

8. Death

76. Using the overall deaths from each of the sources, the results for the 687 records are shown in Table 2.8. There was one record with unknown vital status from WL. It was presumed that all those who were not recorded as dying were alive for the SL.

77. Mr Wisheart has also noted that he has updated his database with additional data beyond those that he retrieved from the original logs. This means that there are a number of records where WL has a death recorded but the SL does not have.

78. In 665 cases there is agreement. The one unknown in the WL is recorded as dying in the SL. There is one case that is recorded as alive in WL but dying in the SL, and 20 for whom the reverse is true. The one case does not have a date of death recorded and seems to be an error in the SL. The child is recorded as alive in the CCR and PAS.

79. The child with unknown status in WL has a date of death 5 days after the operation in both the SL and the CCR. The PAS has the date of death recorded as one day later, but this was only entered onto the PAS nearly two years later.

80. For early mortality in WL (for which the definition is not certain), there is agreement with the SL in 578 cases that the children were alive, and in 88 cases that they had died. The WL has an additional 20 cases recorded as early deaths, of which 17 were recorded in the SL as having died. Of these 17, 10 had an unknown date of death and the others survived between 32 and 102 days according to the SL It seems possible that Mr Wisheart was using a definition of "early" death as being nearer 90 days than 30 days.

81. Mortality comparison with the CCR shows the same pattern. There are (in the 604 matched cases), agreement about early death in 83. There are three cases in the CCR that record a death that is not a WL (one where the outcome is missing as noted above). There are 9 cases where the WL has a death ut the CCR does not.

Conclusions on Mr Wisheart's log

82. It is clear that the data from Mr Wisheart's database (WL for short) reflect the previous analysis of the surgeons' logs very closely. Exact comparison is impossible given the different ways of classifying operations.

83. It is very clear that mortality in the SL has not been exaggerated, and if anything is rather less than that in WL, though this may be because of different definitions.

84. Though there are minor differences in the demographic data, some of which seem to be errors in Mr Wisheart's database, the overall pattern is very similar. It is also likely that the different descriptions of the operations are consistent in many cases. The agreement on mortality is very high, but the survival times show some minor disagreement.

85. The SL and WL, as is to be expected, have very similar results indeed. The Correspondence with the CCR is also good.

Section Three: Report on Clinical Perfusionists' Logs

1. Introduction

86. Clinical perfusionists are responsible for providing the artificial circulation of the blood (cardiopulmonary bypass) while the surgeon operates on the heart, when it has been stopped. This artificial replacement for the pumping function of the heart and the oxygenation of the blood carried out in the lungs is complex, particularly so for children, and those who prepare, operate and monitor the perfusion system (heart-lung machine) require considerable skill.

87. The Clinical Perfusionists' Logs (CPL) have been described in witness statements [WIT 0169 0001-0031 and WIT 0143 0001-0016 & 0040-0042]. The purpose of the log was to provide a list of the type and number of open-heart surgery cases the perfusionists had carried out. It is also noted in those witness statements that a set of records was also created in addition to the logs [WIT 0169 009 section 48]. The log does not seem to have been used for recording medical outcomes in general though it is stated [WIT 0143 0026 section 7], that Dr Bolsin used the perfusionists' records as the starting point for an audit. The records covered patients of all ages and the whole period when open-heart surgery was carried out.

88. The Inquiry team has transcribed the data from these logs, for those children who had operations within the terms of reference of the Inquiry, on to an Excel spreadsheet. The data consist of one line per operation and they record surgeon, child demographic data and description of the operation. Death on the operating table and whether the operation was an emergency or a repeat has also been recorded. The OPCS4 operation code has been coded by one of the senior coders from the Inquiry team. Detailed comments on each of the fields in the spreadsheet are at Appendix C.

89. A further exercise to combine the information from the Operating Theatre logs (OTL) with the CPL has been carried out, and this includes some extra children and also some extra information on times of entry to the anaesthetic room, the start and end of the operation. There is no entry on the spreadsheets for time spent on by-pass. The data from the combined OTL and CPL will be described in a later section of this report.

90. This report will cover the description of the data, including the groupings as applied in the other statistical reports. It should be noted that the CPL was not available to the Inquiry's analysts at the stage when these groupings were being decided. A section will cover a comparison of the Inquiry's coding of the Surgeons' logs with the CPL, and of Mr Wisheart's own log.

2. The Results from the CPL

2.1 Demography & Numbers of Operations

91. There are 1346 records in the CPL, that cover the period from 1st January 1984 to 31st December 1995. Each of the 1346 records refers to a single operation done on a child. There are some children who have multiple operations, so that the total number of children is 1280. The distribution of the number of operations each child received is shown in Table 3.1. Over 95% have a single operation. Some of the operations are not described in terms that can classify the operation using the coding system, and a few have no entry for the description of the operation. There are ten children, one with two operations, for whom an operation code could not be assigned. Some had a diagnostic description instead of an operation description, which did not unequivocally identify an operation. Females comprised 547 (43%), males 658 (51%) and unknown or no entry for 75 (6%); of those of known sex, 46.5% were female and 53.5% male.

92. Up to 24 October 1991, age as years plus days or weeks or months was recorded. Subsequently date of birth is recorded, though there are two children with no entry for either age or date of birth. For the purpose of keeping these data as complete as possible, the dates of birth of these children have been changed from being missing to the correct value, based on the data from two other local sources that agreed. One child has an entry for a date of birth three months after the date of the operation. The date has been corrected to the date of birth that appears consistently in the PAS and CCR. The distribution of age in years for the complete database is shown in figure 3, and the age in months for those less than three years is shown in figure 4. (these figures appear after Table 3.8 and before the Appendix). The sharp fall immediately beyond one year of age has been noted in the other sets of data, but as age is not precisely estimated in these data, the pattern should not be relied on.

93. There are 33 children who died on the operating table. The distribution of these by year of operation is given in Table 3.2. The numbers are small are strong conclusions about year to year variation should not be drawn.

2.2 Surgeons

94. There are 49 different sets of initials for the surgeons. Some of these refer to the same surgeon. For example W (with 43 entries) JW (47) and JDW (514) presumably all refer to Mr Wisheart (604). JD (62), JDD (2) and JPD (455) presumably all refer to Mr Dhasmana (519). There are 24 instances of "No entry" recorded in the database for surgeon; one of these has "Martin" entered as consultant, the others are blank. There are 11 named surgeons (other than JDW & JPD) who are recorded as having done at least five operations. Mr Pawade is recorded as having done 45 operations. There are 28 operations where the surgeon is JDW or JPD but another consultant (one of six) is listed as responsible for the patient. Eight of these operations are where JPD is the surgeon but JDW is the consultant, and one the converse. JDW is involved in 677 operations, JPD in 580 operations, both of them in a further nine and neither is listed in 80 operations.

95. Mr Wisheart's own log (WL) recorded 721 children aged less than 16 years old as having been operated on by him (+ 1 duplicate record). (There were 729 records from the Surgeons' Logs (SL) coded by the Inquiry team as being on Mr Wisheart's log). Using the CPL, it has been possible to match 621 (86%) of these records using full name or surname and date of operation. Failure to match seems largely because of minor misspellings of names. BRI record numbers are not recorded consistently enough in the CPL to allow for matching on hospital number. Of the 621 that are matched, 591 (95%) have Mr Wisheart recorded as either surgeon or consultant in the CPL. Eleven have "no entry", 16 have "JD" or "JPD", while there are single entries of "JH", "JWD" and "Mulay". It is clear that there is considerable agreement between the CPL and WL in the children included, but it is interesting to see that the CPL does not have Mr Wisheart as the surgeon or consultant for 100% of the operations.

96. In the 621 operations, there were 11 deaths on the operating table recorded in the CPL, all of these are recorded as early deaths in WL.

2.3 Coding of operative procedures

97. There are up to five procedure codes per operation recorded in the database. The distribution of the number of procedures per operation is given in Table 3.3. It is clear that all of these operations are in fact open-heart operations in that there was a by-pass requiring perfusion. However, the limitations of the OPCS-4 coding system and our interpretation of it in terms of type of operation do not result in all the operations being classified as open. In addition, the written description of the operations in the logs may not enable clear coding to be carried out. In the 1346 operations, 1887 operative procedures were coded of which 1631 procedures were K or L codes (K is the OPCS-4 code letter used for heart operations and L is for Arteries and Veins). Quite a number of operations had more than one K or L procedure coded. For each operation a single highest ranked procedure was chosen to describe the operation, as was done for the previous reports [see INQ 0013 0024-0025, sections 2.2.2 to 2.2.4]. There were 1332 operations that had a K or L code; one child had two operations each

recorded as a separate line in the CPL, both with K codes, on the same day. One child had two entries for operations that could not be coded. For purposes of analysis these were counted as a single operation, since the other sources of data would not be able to distinguish them. This gives a total of 1331 operations used for analysis. Two of the operations were done on children for whom no age was recorded. The 14 operations that did not have a K or L code have their descriptions listed in Appendix C2.

2.4 Totals of operations grouped in 13 groups and as open or closed

98. The numbers of the operations classified into the thirteen groups is given in Table 3.4. There are 80 operations that are not put into any of the 13 groups, in addition to the 14 that were not coded with a K or L code. There are a total of 10 operations, in groups 12 and 13, that are not classed as "open" operations in the groupings used by the Inquiry reports. Thus, using the Inquiry's methods of coding, 1241 operations out of 1346 are correctly classified as open operations using groups 1 to 11. This is a correct classification rate of 92%.

99. Table 3.5 gives the number of operations grouped as "open" or "closed" using the two group classification used by the Inquiry team [see INQ 0013 0025, sections 2.2.5 to 2.2.7 and INQ0013 0082]. Some codes did not appear in the list used by the experts and others were excluded since they could not be unequivocally classified as open or closed. In the CPL, there were 23 procedures with codes (12 different codes) that did not map to the codes used in open/closed grouping, and a further 27 procedures that were in the "Excluded list" as described at INQ 0013 0082. These are listed in Appendix C3, Tables C3.1 and C3.2. In terms of the "open/closed" classification, of the 1346 entries (1344 operations on different days) in the CPL there are 1297 classified as "open". This is a correct classification rate of over 96%.

2.5 Deaths

100. Table 3.6 shows the number of deaths by the "open/closed" classification. It may be noted that there are 5 deaths (12%) among the 41 operations that are not classified using the open/closed classification.

101. Table 3.7 gives the numbers of deaths that occurred on the operating table, with the death rates. It can be seen that though the overall death rate was just over 2%, it was 22% for "Other TGA's (switch) and 19% for AVSDs. No other sources of data have whether a death occurred on the operating table. The local sources (except WL) have the date of death, so that deaths that occur on the day of operation can be reported. The national HES could also be used for this purpose, but the data have not been reported. In the SL, 27% of those who die, do so on the day of the operation. The overall mortality on the day of operation was 27% for group 3 (switches), and for groups 8 and 11 (Truncus & Mitral valve procedures) it was about 35 or 30%. There are rather more unknown dates of death in the PAS, so comparison here is less robust. In the CCR over 30% of those who die, do so on the day of an operation. Groups 3 and 8 again have the highest rates.

3. Comparison with other data sources

102. It is easiest to compare the different sources using equivalent periods of time, and the succeeding tables are produced using epoch 2 and 3 only. These cover the period from 1st January 1988 (when the PAS came into operation) to 31st March 1995 (close to when Mr Pawade started and also when the data for some of the non-local sources had a natural break point).

103. Table 3.8 shows equivalent data for each of the four local sources. These have been updated to include corrections for the way that Fontan operations were coded, and multiple procedures within an operation were coded. It gives the corrections to the table at INQ 0012 0051 (it may be noted that every correction leads to data that are more consistent across the different data sources).

104. The CPL has much lower numbers of deaths and typically about one third to one half of the death rate of the other sources. This is because the CPL only records those deaths that occurred on the operating table.

105. The overall numbers in this time period for open operations range from 820 (for the SL) to 865 for the CCR. The numbers of operations are very similar for most of the 11 open groups. AVSDs are much lower in the CPL but similar in the other three. There are more "Aortic, pulmonary valve procedures" in the CPL, with the other sources being similar, though the SL has slightly lower numbers. There are a total of 45 operations coded as K37.8 and 18 with a code of K37.1 that have a comment in the CPL database that states that they could also be coded with a K09 code. K37 procedures fall into the "Aortic, pulmonary valve procedures" group in the coding system, so that explains the apparent discrepancy. Both the SL and the CPL have lower numbers of mitral valve procedures than the other two sources.

106. Merging the CPL with the PAS records and comparing the coding finds that of 499 records with exact matches on names and dates there were only 9 operations classified in the PAS as closed operations. There were 461 classified as open operations, and 29 were not put into one of the groups. This is a strong indication that the coding of truly open operations is of a high standard in the PAS. There are also operations that are classed as open in PAS that are not matched in the CPL. There are three possible reasons for this failure. Firstly the matching has failed (many of the names are inconsistent, there is no consistent record number in the CPL so matching is inevitably imperfect). Secondly the coding of an open operation in PAS is mistaken; thirdly the coding system based on OPCS may have errors in the way that the grouping is allocated. From a merge exercise of the complete 2283 records in PAS, there are 1785 that do not match. Most of these (1642) are ungrouped or dassified as closed operations. A maximum of 143 are in error. This is only 6% of the original number, and there could be further detailed matching that could be done by hand. It is clear that the quality of the coding of "open" operations in the PAS is high.

4. Overall conclusions

107. It is clear that the vast majority of those operations that were definitely open, requiring by-pass, are classified as such using the coding methods of the Inquiry.

108. The total numbers of open operations are very similar across each of the local data sources. It is clear that some operations are misclassified, both those that were truly open being left out or a very few classified as closed, and also some of those that are truly closed, being classed as open operations. The net effect is that the totals are rather similar. If some closed operations, which have a very low mortality rate, are classed as open, then this will lead to the overall estimate of mortality in the open group being reduced from its "true" value. Similarly with truly open operations classed as closed, the effect is that the observed mortality rate in the closed group will be increased. Misclassification tends to lead to a levelling out of mortality rates.

109. The CPL is most useful as a "gold standard" for defining the open operations. It seems to be largely complete in terms of the open operations that were carried out. It is inevitably limited in the mortality information included. The detail of exactly what operation was done also has some limitations. The codes used would not necessarily all be exclusive to open operations carried out elsewhere. The CPL could have been helpful in defining those codes that should be grouped as open or closed operations, but it is clear that a reasonable accuracy has been obtained with the existing groupings.

110. The extra information included in the log does not add any great value in itself to the Inquiry. It does not include the time spent cross-clamped, and the logs do not include time spent on by-pass until December 1995. While this information is of importance, in oral evidence to the Inquiry on Day 71, Dr Macrae stated that this was not as good an indicator of adequacy as may be thought. He said – [transcript day 71 , section 92] -

111. *"….. you cannot just take a cross-clamp time as a statistic, meaning short is good and long is bad, because I think a lot depends on what a surgeon is doing during the cross-clamped period. For instance, a slow surgeon may well be handling the heart far more gently and being far more effective in doing a procedure than perhaps a fast surgeon who gets in there, puts in lots of stitches and gets out quickly: the heart may have been stretched and pulled and damaged in other ways. So I think it is not possible to say that a slow surgeon is necessarily a bad surgeon; however, a surgeon who does some work and then stops for two or three minutes, thinking about what to do next, is wasting time and is not being efficient. So from the other side of what we sometimes called the blood/brain barrier, the other side of the anaesthetic screen, I like to see a surgeon who does not stop and waste time, but I am not too worried about someone who just works slowly and methodically."*

5. Acknowledgements

The work of Pat Annesley in assembling the data is gratefully acknowledged, and the continual supportive help and comments from Ruth Chadwick have been invaluable.

Tables

1 Tables for section on Morbidity

Table 1.1 SL - Number of complication codes per child

No. of codes	Freq.	%
1	56	31
2	77	42
3	31	17
4	12	6.6
5	4	2.2
6	2	1.1
Total	182	100

Table 1.2 SL – ICD9 codes and text for the complications for children still alive

Number of children	ICD code	Text for ICD Code
1	312.8	DISTURBANCE OF CONDUCT NOT ELSEWHERE CLASSIFIED, OTHER
1	358.9	MYONEURAL DISORDERS, UNSPECIFIED
2	416.0	PRIMARY PULMONARY HYPERTENSION
2	420.9	OTHER AND UNSPECIFIED ACUTE PERICARDITIS
1	423.9	OTHER DISEASES OF PERICARDIUM, UNSPECIFIED
1	426.9	HEART CONDUCTION DISORDER, UNSPECIFIED
1	434.9	OCCLUSION OF CEREBRAL ARTERIES, UNSPECIFIED
1	457.8	OTHER NONINFECTIVE DISORDERS OF LYMPHATIC CHANNELS
2	518.4	ACUTE OEDEMA OF LUNG, UNSPECIFIED
2	518.5	PULMONARY INSUFFICIENCY FOLLOWING TRAUMA AND SURGERY
2	780.3	CONVULSIONS
1	**996.6**	**INFECTION DUE TO INTERN. PROSTHETIC DEVICE, IMPLANT OR GRAFT**
3	**996.7**	**OTHER COMPL OF INTERNAL PROSTHETIC DEVICE, IMPLANT AND GRAFT**
1	**997.**	**COMPLICATION AFFECTING SPECIFIED BODY SYSTEMS, NOT ELSEWH SP**
5	**997.0**	**CENTRAL NERVOUS SYSTEM COMPLICATIONS**
10	**997.1**	**CARDIAC COMPLICATIONS**
1	**997.2**	**PERIPHERAL VASCULAR COMPLICATIONS**
1	**997.3**	**RESPIRATORY COMPLICATIONS**
1	**997.5**	**URINARY COMPLICATIONS**
2	**998.1**	**HAEMORRHAGE OR HAEMATOMA COMPLICATING A PROCEDURE**
1	**998.2**	**ACCIDENTAL PUNCTURE OR LACERATION DURING A PROCEDURE**
4	**998.5**	**POSTOPERATIVE INFECTION**
1	**998.8**	**OTHR SPEC COMPLICATIONS OF PROCEDURES, NOT ELSEWHERE CLASS**
1	E870.0	ACCIDENT CUT/PUNCTURE/PERFORAT/HAEM DUR SURGICAL OPERATION
11	E878.2	SURGICAL OPERATION WITH ANASTOMOSIS, BYPASS OR GRAFT

Table 1.3 CCR Number of post-operative diagnoses per child

Number of diagnoses	Died	Alive	Total
(0)	(67)	(1094)	(1161)
1	64	138	202
2	78	140	218
3	53	76	129
4	40	40	80
5	22	19	41
6	16	7	23
7	5	4	9
8	7	2	9
9	2	0	2
11	1	0	1
Sub-total*	288	426	714
Total	355	1520	1875

*The Sub-total is for those with post-operative diagnoses recorded.

Table 1.4 CCR- Complications (ICD9 code 997.*) per child

Number of Complications	Died	Alive	Total
1	149	156	305
2	73	43	116
3	17	9	26
4	3	0	3
5	1	0	1
1.1.1.1 Total	243	208	451

Table 1.5 CCR- Diagnoses occurring at least 5 times in those still alive

ICD9 code	Text for ICD Code	Freq.
008.6	ENTERITIS DUE SPECIFIED VIRUS	6
041.0	STREPTOCOCCUS, BACTERIAL INFECTION	6
041.1	STAPHYLOCOCCUS, BACTERIAL INFECTION	22
041.5	HAEMOPHILUS INFLUENZAE, BACTERIAL INFECTION	5
041.7	PSEUDOMONAS, BACTERIAL INFECTION	12
041.8	BACTERIAL INFECTION, OTHER	6
401.9	ESSENTIAL HYPERTENSION, UNSPECIFIED	9
428.0	CONGESTIVE HEART FAILURE	6
429.3	CARDIOMEGALY	5
429.4	FUNCTIONAL DISTURBANCES FOLLOWING CARDIAC SURGERY	22
457.8	OTHER NONINFECTIVE DISORDERS OF LYMPHATIC CHANNELS	7
458.9	HYPOTENSION, UNSPECIFIED	7
481.	PNEUMOCOCCAL PNEUMONIA	5
511.9	PLEURISY WITH EFFUSION WITHOUT MENTION OF CAUSE	39
518.0	PULMONARY COLLAPSE	6
518.8	OTHER DISEASES OF LUNG, OTHER	7
558.	NON-INFECT GASTRO-ENTERITIS&COLITIS,NO ULCER	6
780.3	CONVULSIONS	7
780.6	PYREXIA OF UNKNOWN ORIGIN	16
996.0	**MECHANICAL COMPLICATION OF CARDIAC DEVICE, IMPLANT & GRAFT**	**6**
996.6	**INFECTION DUE TO INTERN. PROSTHETIC DEVICE, IMPLANT OR GRAFT**	**10**
996.7	**OTHER COMP OF INTERNAL PROSTHETIC DEVICE, IMPLANT & GRAFT**	**11**
997.0	**CENTRAL NERVOUS SYSTEM COMPLICATIONS**	**18**
997.1	**CARDIAC COMPLICATIONS**	**94**
997.2	**PERIPHERAL VASCULAR COMPLICATIONS**	**6**
997.3	**RESPIRATORY COMPLICATIONS**	**119**
997.4	**GASTROINTESTINAL COMPLICATIONS**	**5**
997.5	**URINARY COMPLICATIONS**	**26**
998.1	**HAEMORRHAGE OR HAEMATOMA COMPLICATING A PROCEDURE**	**21**
998.2	**ACCIDENTAL PUNCTURE OR LACERATION DURING A PROCEDURE**	**11**
998.3	**DISRUPTION OF OPERATION WOUND**	**10**
998.4	**FOREIGN BODY ACCIDENTALLY LEFT DURING A PROCEDURE**	**5**
998.5	**POSTOPERATIVE INFECTION**	**60**
998.8	**OTHR SPEC COMPLICATIONS OF PROCEDURES, NOT ELSEWHERE CLASS**	**5**
E870.0	ACCIDENT CUT/PUNCTURE/PERFORAT/HAEM DUR SURGICAL OPERATION	8
E878.1	SURGICAL OPERATION WITH IMPLANT OF ARTIFICIAL INTERN DEVICE	6
E878.2	SURGICAL OPERATION WITH ANASTOMOSIS, BYPASS OR GRAFT	117
E878.8	OTHER SURGICAL OP. AS CAUSE OF ABNORM.REAC. OR LATER COMPL.	36
E879.0	ABNORMAL REACTION OR LATER COMPL OF CARDIAC CATHETERIZATION	13

Table 1.6 Frequency of ICD9 codes (A prefix) and ICD10 codes (prefixes G, I &J) used to describe complications in the PAS

ICD	Freq.	Percent
A997.0	10	5.15
A997.1	55	28.35
A997.2	4	2.06
A997.3	100	51.55
A997.4	2	1.03
A997.5	15	7.73
A997.9	2	1.03
G97.8	1	0.52
I97.1	1	0.52
J95.1	1	0.52
J95.8	3	1.55
Total	194	100.00

Tables for section on Mr Wisheart's Log

Table 2.1 Fields recorded in WL

Field label in database	**Comment by SJWE**
ID	Record number in database
Reg No	BRI Number
Name1	Surname
Name2	First name
1ST A CONF	A Status always "Y" except for 1 "YY"
Diagnosis	
Additional Diagnosis	
Date of Op	
Age (mths)	
Operation	See below
Early Outcome	A or D or N/A
Late Outcome	A or D for survivors
Major Complications	
Comment	

Table 2.2 Diagnoses, early deaths & death rates as % in WL

Diagnosis	Freq.	Early deaths	Rate %
AR	1	0	0
AS	35	2	6
AS/AR	1	0	0
ASD	102	2	2
C-AVSD	29	16	55
COA	8	1	12
Fallot	96	18	19
Fontan-SV	25	6	24
Fontan-TA	15	5	33
I-AVSD	1	0	0
MISC	88	29	33
P-AVSD	18	1	6
PA+IVS	20	1	5
PA+VSD	13	1	8
PS	28	0	0
PTA	15	9	60
TAPVD	29	13	45
TGA	57	1	2
TGA+PS	2	0	0
TGA+VSD	3	0	0
VSD	91	2	2
VSD+PS	45	5	11
Total	722	112	16

Table 2.3 Operations, early deaths and death rates of operations which occurred more than twice in WL

Operation	Number operations	Early Deaths	Death rates %
Closure	62	0	0
Closure-patch	25	0	0
Correction	44	14	32
Fontan	10	3	30
Patch Closure	55	1	2
Patch Closure; Reconstr PA	19	4	21
Patch Closure; Repair AV	3	0	0
Patch Closure; lig PDA	4	0	0
Patch repair	6	1	17
Reconstr RVOT	3	2	67
Relief Sub-V sten	4	0	0
Relief sub-V PS	3	0	0
Relief sub-V sten	4	0	0
Repair	5	1	20
Senning	49	1	2
Suture Closure	7	0	0
Switch	3	1	33
TCPC	19	3	16
Total Correction	115	32	28
Total Correction; RV>PA cond	12	1	8
Total Correction; T/A patch	12	3	25
Valvotomy	11	1	9
pul valvot	3	0	0
Total	478	68	14

Table 2.4 Frequency, early deaths and death rates of operations that are classified only once or twice in WL

	Number of operations	Early Deaths	Death rates %
Operations/combinations occurring once	195	40	21
Operations/combinations occurring twice	48	4	8
Total	243	44	18

Table 2.5 Age in years, total numbers of deaths and death rates in WL

Age in years	Number of operations	Total Deaths	Death rates %
0	164	56	34
1	76	18	24
2	67	15	22
3	77	17	22
4	55	7	13
5	62	5	8
6	43	7	16
7	32	6	19
8	25	6	24
9	26	5	20
10	14	0	0
11	17	2	12
12	15	2	13
13	15	1	7
14	23	5	22
15	11	0	0
Total	722	152	21

Table 2.6 Early deaths by age in months - WL

Age	Number operations	Deaths	Death rates %
0-3 months	39	20	51
4-12 months	125	29	20
13+ months	558	63	12
Total	722	112	16

Table 2.7 Operations classified in WL and SL for the same operations – For terms which occur frequently in WL

Operation						
OPCS code	**Closure**	**Correction**	**Patch Closure**	**Senning**	**Total correction**	**Total**
K04	0	1	0	0	69	70
K05	0	0	0	44	1	45
K07	0	0	0	0	27	27
K09	0	31	0	0	0	31
K10	57	4	2	3	1	67
K11	2	1	45	1	1	50
K31	0	1	0	0	1	2
K53	0	0	1	0	0	1
K55	0	0	0	0	1	1
L01	0	1	1	0	6	8
L02	0	2	0	0	3	5
L06	0	2	0	0	0	2
L10	0	0	0	0	2	2
Z94	0	0	0	0	1	1
Total	59	43	49	48	113	312

Table 2.8 Death at any stage according to WL and SL in 687 records that are unambiguously matched

	Died early or late from the WL			
Died from SL	Alive	Died	Not known	Total
No	539	20	0	559
Yes	1	126	1	128
Total	540	146	1	687

Tables for the perfusionists' log

Table 3.1 Number of operations per child for 1280 children in CPL who received 1346 operations

No. of operations	Freq.	Percent
1	1220	95.3
2	55	4.3
3	4	0.3
4	1	0.1
Total	1280	100

Table 3.2 Number of operations that resulted in the death of a child on the operating table by year of operation for 1346 operations in CPL

Year	No-alive	Yes-Died	Total
1984	59	0	59
1985	86	0	86
1986	94	0	94
1987	117	1	118
1988	107	2	109
1989	137	3	140
1990	114	4	118
1991	125	7	132
1992	131	5	136
1993	119	6	125
1994	118	4	122
1995	106	1	107
Total	1313	33	1346

Table 3.3 Number of procedures coded per operation for 1346 operations in CPL

No. of procedures	Frequency	Percent
0	11	0.8
1	924	69
2	301	22
3	83	6
4	23	2
5	4	0.3
Total	1346	100

Table 3.4 Total (1984-1995) number of operations from CPL by 13 groups used for the Inquiry analyses. *Groups in italics are "closed".*

Group	No. of Operations	Percent
Ungrouped but K or L codes	81	6.1
Tetralogy of Fallot	176	13.2
Interatrial TGA	111	8.3
Other TGAs	41	3.1
TAPVD	52	3.9
AVSD	26	1.9
Closure of ASD	237	17.8
Closure of VSD	271	20.4
Truncus Arteriosus	20	1.5
Fontan type	75	5.6
Aortic, pulmonary valve procedures	211	15.8
Mitral valve procedures	20	1.5
Closed shunts	*7*	*0.5*
Coarctation procedures	*3*	*0.2*
Total	1331	100

Table 3.5 Number of operations classified as open or closed by epoch

	Open	Closed	Total
Epoch			
Jan 84-Dec 87	350	1	351
Jan 88-Dec 90	361	2	363
Jan 91-Mar 95	513	4	517
Apr 95- Dec 95	73	1	74
Total	1297	8	1305

Table 3.6 Numbers of deaths on the operating table, numbers of procedures & death rate (%)for the CPL, 1984-1995, classified as "Open" or "Closed"

Group	Deaths/operations (Death rate %)
Open	28/1297 (2)
Closed	0/8 (0)
Total	28/1305 (2)

Table 3.7 Numbers of deaths on the operating table, numbers of procedures & death rate (%) by the 13 groups for the CPL, 1984-1995

Group	**Deaths/operations (Death rate %)**
Ungrouped but K or L codes	3/81 (4)
Tetralogy of Fallot	2/176 (1)
Interatrial TGA	1/111 (1)
Other TGAs	9/41 (22)
TAPVD	2/52 (4)
AVSD	5/26 (19)
Closure of ASD	1/237 (.4)
Closure of VSD	0/271 (0)
Truncus Arteriosus	1/20 (5)
Fontan type	2/75 (3)
Aortic, Pulmonary valve procedures	4/211 (2)
Mitral valve procedures	0/20 (0)
Closed shunts	1/7 (14)
Coarctation procedures	0/3 (0)
Total	**31/1331 (2.3)**

Table 3.8 Numbers who died/total operations for the four local data sources – Epochs 2 & 3 only; procedures coded as open only

	PAS		CCR		SL		CPL	
Group	Died/all	Death rate %	Died/all	Death rate %	Died/all	Death rate %	Died/all	Death rate %
Tetralogy of Fallot	15/101	15	14/104	13	13/105	12	2/112	2
Interatrial TGA	7/66	11	5/64	8	4/67	6	1/63	2
Other TGAs	16/40	40	18/42	43	18/40	45	9/41	22
TAPVD	12/34	35	11/37	30	11/39	28	2/35	6
AVSD	20/79	25	20/75	27	23/87	26	5/25	20
Closure of ASD	7/138	5	2/142	1	4/145	3	1/152	1
Closure of VSD	12/181	7	14/188	7	11/174	6	0/198	0
Truncus Arteriosus	7/15	47	9/14	64	7/16	44	1/15	7
Fontan type	8/67	12	13/77	17	9/55	16	2/65	3
Aortic, Pulmonary valve procedures	6/92	7	7/90	8	3/79	4	3/120	3
Mitral valve procedures	7/36	19	9/32	28	6/13	46	0/12	0
Total	117/849	14	122/865	14	109/820	13	26/838	3

Figure 3 Age of children in years from CPL at time of operation

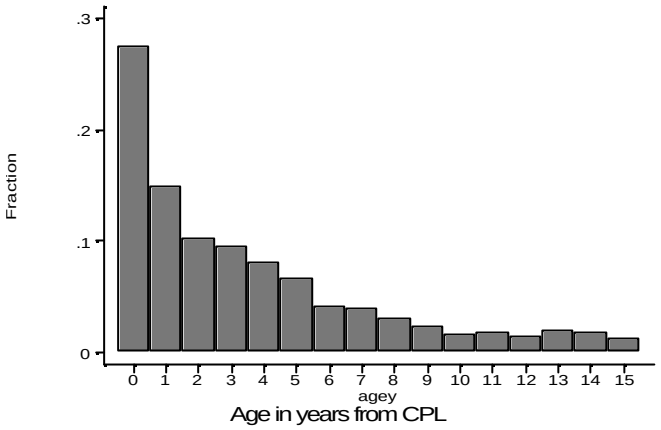
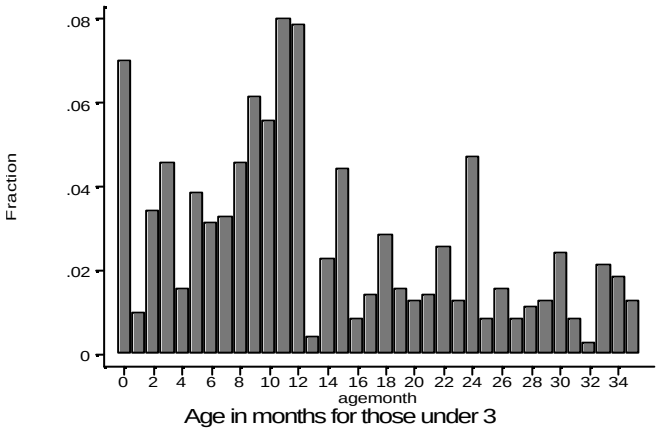


Figure 4 Age of children in months for those under three years of age



Appendix - Appendix tables for section on morbidity

Table A1 SL- Complication codes (ICD 9) for all children

ICD	Alive	Died	Total	Text for ICD Code
038.	0	1	1	SEPTICAEMIA
041.1	0	1	1	STAPHYLOCOCCUS, BACTERIAL INFECTION
041.5	0	1	1	HAEMOPHILUS INFLUENZAE, BACTERIAL INFECTION
041.7	0	1	1	PSEUDOMONAS, BACTERIAL INFECTION
117.3	0	2	2	ASPERGILLOSIS
253.8	0	2	2	OTHR DISORDER OF THE PITUITARY & DIENCEPHALOHYPOPHYSEAL ORIG
286.6	0	3	3	DEFIBRINATION SYNDROME
312.8	1	0	1	DISTURBANCE OF CONDUCT NOT ELSEWHERE CLASSIFIED, OTHER
325.	0	1	1	PHLEBITIS AND THROMBOPHLEBITISOF INTRACRANIAL VENOUS SINU
348.1	0	1	1	ANOXIC BRAIN DAMAGE
348.5	0	1	1	CEREBRAL OEDEMA
358.9	1	0	1	MYONEURAL DISORDERS, UNSPECIFIED
410.	0	5	5	ACUTE MYOCARDIAL INFARCTION
414.8	0	1	1	OTHER FORMS OF CHRONIC ISCHAEMIC HEART DISEASE, OTHER
415.1	0	3	3	PULMONARY EMBOLISM
416.	0	1	1	CHRONIC PULMONARY HEART DISEASE
416.0	2	5	7	PRIMARY PULMONARY HYPERTENSION
420.9	2	0	2	OTHER AND UNSPECIFIED ACUTE PERICARDITIS
421.0	0	4	4	ACUTE AND SUBACUTE BACTERIAL ENDOCARDITIS
422.9	0	1	1	OTHER AND UNSPECIFIED ACUTE MYOCARDITIS
423.9	1	1	2	OTHER DISEASES OF PERICARDIUM, UNSPECIFIED
426.9	1	1	2	HEART CONDUCTION DISORDER, UNSPECIFIED
427.5	0	2	2	CARDIAC ARREST
431.	0	1	1	INTRACEREBRAL HAEMORRHAGE
434.9	1	8	9	OCCLUSION OF CEREBRAL ARTERIES, UNSPECIFIED
457.8	1	0	1	OTHER NONINFECTIVE DISORDERS OF LYMPHATIC CHANNELS
458.9	0	1	1	HYPOTENSION, UNSPECIFIED
466.0	0	2	2	ACUTE BRONCHITIS
485.	0	2	2	BRONCHOPNEUMONIA,UNSPECIFIED
486.	0	1	1	PNEUMONIA, ORGANISM UNSPECIFIED
511.9	0	1	1	PLEURISY WITH EFFUSION WITHOUT MENT OF CAUSE
518.4	2	4	6	ACUTE OEDEMA OF LUNG, UNSPECIFIED
518.5	2	6	8	PULMONARY INSUFFICIENCY FOLLOWING TRAUMA AND SURGERY
519.1	0	1	1	DISEASE OF TRACHEA AND BRONCHUS, NEC, OTHER
535.0	0	1	1	ACUTE GASTRITIS
570.	0	1	1	ACUTE&SUBACUTE LIVER NECROSIS
578.9	0	2	2	HAEMORRHAGE OF GASTROINTESTINAL TRACT, UNSPECIFIED
775.7	0	1	1	LATE METABOLIC ACIDOSIS OF NEWBORN
777.5	0	1	1	NECROTIZING ENTEROCOLITIS IN FETUS OR NEWBORN
780.3	2	0	2	CONVULSIONS
784.2	0	1	1	OTHER SPECIFIED SYMPTOMS NEC
995.8	0	1	1	OTHER SPECIFIED ADVERSE EFFECT NOT ELSEWHERE SPECIFIED
996.6	**1**	**8**	**9**	**INFECTION DUE TO INTERN. PROSTHETIC DEVICE, IMPLANT OR GRAFT**
996.7	**3**	**7**	**10**	**OTHER COMPL OF INTERNAL PROSTHETIC DEVICE, IMPLANT AND GRAFT**
997.	**1**	**1**	**2**	**COMPLICATION AFFECTING SPECIFIED BODY SYSTEMS, NOT ELSEWH SP**
997.0	**5**	**15**	**20**	**CENTRAL NERVOUS SYSTEM COMPLICATIONS**
997.1	**10**	**86**	**96**	**CARDIAC COMPLICATIONS**
997.2	**1**	**1**	**2**	**PERIPHERAL VASCULAR COMPLICATIONS**
997.3	**1**	**11**	**12**	**RESPIRATORY COMPLICATIONS**
997.4	**0**	**3**	**3**	**GASTROINTESTINAL COMPLICATIONS**
997.5	**1**	**17**	**18**	**URINARY COMPLICATIONS**
998.1	**2**	**9**	**11**	**HAEMORRHAGE OR HAEMATOMA COMPLICATING A PROCEDURE**
998.2	**1**	**3**	**4**	**ACCIDENTAL PUNCTURE OR LACERATION DURING A PROCEDURE**
998.5	**4**	**9**	**13**	**POSTOPERATIVE INFECTION**
998.7	**0**	**1**	**1**	**ACUTE REACTION TO FOREIGN SUBST ACCIDENT LEFT DURING PROCED**
998.8	**1**	**3**	**4**	**OTHR SPEC COMPLICATIONS OF PROCEDURES, NOT ELSEWHERE CLASS**
998.9	**0**	**7**	**7**	**UNSPECIFIED COMPLICATION OF PROCEDURE, NOT ELSEWHERE CLASS.**
E870.0	1	4	5	ACCIDENT CUT/PUNCTURE/PERFORAT/HAEM DUR SURGICAL OPERATION
E876.2	0	1	1	FAILURE IN SUTURE AND LIGATURE DURING SURGICAL OPERATION
E878.1	0	2	2	SURGICAL OPERATION WITH IMPLANT OF ARTIFICIAL INTERN DEVICE
E878.2	11	68	79	SURGICAL OPERATION WITH ANASTOMOSIS, BYPASS OR GRAFT
V45.0	0	1	1	CARDIAC PACEMAKER IN SITU
V46.1	0	1	1	DEPENDENCE ON RESPIRATOR
Total	59	331	390	

Table A2 CCR - Complication codes for all children, with outcomes

ICD Code	ICD Text	Died	Alive	Total
008.4	INTESTINAL INFECTION DUE TO OTHER SPECIFIED BACTERIA	0	1	1
008.6	ENTERITIS DUE SPECIFIED VIRUS	0	6	6
008.8	ENTERITIS DUE OTR ORGANISM NEC	0	3	3
009.3	DIARRHOEA OF PRESUMED INFECTIOUS ORIGIN	0	1	1
034.0	STREPTOCOCCAL SORE THROAT	0	2	2
038.0	STREPTOCOCCAL SEPTICEMIA	0	1	1
038.1	STAPHYLOCOCCAL SEPTICEMIA	3	2	5
038.3	SEPTICAEMIA DUE TO ANAEROBES	0	1	1
038.4	SEPTICAEMIA DUE TO OTHER GRAM-NEGATIVE ORGANISMS	2	0	2
038.9	UNSPECIFIED SEPTICEMIA	4	3	7
041.0	STREPTOCOCCUS, BACTERIAL INFECTION	2	6	8
041.1	STAPHYLOCOCCUS, BACTERIAL INFECTION	10	22	32
041.4	ESCHERICHIA COLI, BACTERIAL INFECTION	0	1	1
041.5	HAEMOPHILUS INFLUENZAE, BACTERIAL INFECTION	1	5	6
041.7	PSEUDOMONAS, BACTERIAL INFECTION	3	12	15
041.8	BACTERIAL INFECTION, OTHER	1	6	7
055.9	MEASLES WITHOUT MENTION OF COMPLICATION	0	1	1
079.9	VIRAL INFECTION IN CONDITIONS CLASSIFIED ELSWHERE, UNSPEC.	0	1	1
112.0	CANDIDIASIS OF MOUTH	0	2	2
117.3	ASPERGILLOSIS	0	1	1
251.2	HYPOGLYCAEMIA, UNSPECIFIED	1	1	2
276.2	ACIDOSIS	5	0	5
276.3	ALKALOSIS	0	1	1
276.6	FLUID OVERLOAD	1	0	1
276.8	HYPOPOTASSAEMIA	1	1	2
276.9	ELECTROLYTE AND FLUID DISORDERS, NOT ELSEWHERE CLASSIFIED	1	0	1
280.	IRON DEFICIENCY ANAEMIAS	1	1	2
285.1	ACUTE POSTHAEMORRHAGIC ANAEMIA	1	0	1
285.9	UNSPECIFIED ANEMIA	0	1	1
286.6	DEFIBRINATION SYNDROME	3	0	3
287.5	THROMBOCYTOPENIA, UNSPECIFIED	3	2	5
315.8	OTHER SPECIFIC DELAYS IN DEVELOPMENT	0	1	1
323.9	ENCEPHALITIS, MYELITIS AND ENCEPHALOMYELITIS, UNSPEC CAUSE	0	1	1
337.9	UNSPECIFIED DISORDERS OF THE AUTONOMIC NERVOUS SYSTEM	1	1	2
342.9	HEMIPLEGIA, UNSPECIFIED	0	3	3
344.0	QUADRIPLEGIA	1	1	2
344.2	DIPLEGIA OF UPPER LIMBS	0	1	1
345.1	GENERALIZED CONVULSIVE EPILEPSY	0	2	2
345.9	EPILEPSY, UNSPECIFIED	0	1	1
348.1	ANOXIC BRAIN DAMAGE	1	0	1
348.5	CEREBRAL OEDEMA	1	0	1

ICD Code	ICD Text	Died	Alive	Total
351.0	BELL'S PALSY	0	1	1
354.8	MONONEURITIS OF UPPER LIMB AND MONONEURITIS MULTIPLEX, OTHER	0	1	1
370.0	CORNEAL ULCER	0	2	2
378.8	OTHER DISORDERS OF BINOCULAR EYE MOVEMENTS	0	1	1
397.0	DISEASES OF TRICUSPID VALVE	0	1	1
401.	ESSENTIAL HYPERTENSION	0	2	2
401.9	ESSENTIAL HYPERTENSION, UNSPECIFIED	1	9	10
405.	SECONDARY HYPERTENSION	0	1	1
410.	ACUTE MYOCARDIAL INFARCTION	5	0	5
414.1	ANEURYSM OF HEART	1	0	1
414.8	OTHER FORMS OF CHRONIC ISCHAEMIC HEART DISEASE, OTHER	2	0	2
415.1	PULMONARY EMBOLISM	3	0	3
416.0	PRIMARY PULMONARY HYPERTENSION	5	3	8
416.8	CHRONIC PULMONARY HEART DISEASE, OTHER	1	0	1
417.1	ANEURYSM OF PULMONARY ARTERY	1	0	1
417.8	DISEASES OF PULMONARY CIRCULATION, OTHER	0	1	1
420.9	OTHER AND UNSPECIFIED ACUTE PERICARDITIS	1	0	1
421.0	ACUTE AND SUBACUTE BACTERIAL ENDOCARDITIS	4	1	5
422.9	OTHER AND UNSPECIFIED ACUTE MYOCARDITIS	1	0	1
423.1	ADHESIVE PERICARDITIS	3	0	3
423.8	OTHER DISEASES OF PERICARDIUM, OTHER	1	0	1
423.9	OTHER DISEASES OF PERICARDIUM, UNSPECIFIED	3	3	6
424.0	MITRAL VALVE DISORDER	0	2	2
424.1	AORTIC VALVE DISORDERS	1	3	4
424.2	TRICUSPID VALVE DISORDERS, SPECIFIED AS NONRHEUMATIC	0	1	1
424.3	PULMONARY VALVE DISORDERS	1	0	1
424.9	ENDOCARDITIS, VALVE UNSPECIFIED	0	1	1
425.1	HYPERTROPHIC OBSTRUCTIVE CARDIOMYOPATHY	0	2	2
425.4	OTHER PRIMARY CARDIOMYOPATHIES	1	0	1
426.0	ATRIOVENTRICULAR BLOCK, COMPLETE	1	2	3
426.1	ATRIOVENTRICULAR BLOCK, OTHER AND UNSPECIFIED	0	1	1
426.5	BUNDLE BRANCH BLOCK, UNSPECIFIED	1	0	1
426.8	HEART CONDUCTION DISORDERS, OTHER	0	1	1
427.0	PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA	1	1	2
427.1	PAROXYSMAL VENTRICULAR TACHYCARDIA	0	1	1
427.3	ATRIAL FIBRILLATION AND FLUTTER	0	4	4
427.4	VENTRICULAR FIBRILLATION AND FLUTTER	3	1	4
427.5	CARDIAC ARREST	10	0	10
427.8	CARDIAC DYSRYTHMIA, OTHER	0	1	1
427.9	CARDIAC DYSRHYTHMIAS, UNSPECIFIED	2	2	4
428.0	CONGESTIVE HEART FAILURE	3	6	9
428.1	LEFT HEART FAILURE	3	1	4
428.9	HEART FAILURE, UNSPECIFIED	5	3	8
429.3	CARDIOMEGALY	0	5	5
429.4	FUNCTIONAL DISTURBANCES FOLLOWING CARDIAC SURGERY	6	22	28

ICD Code	ICD Text	Died	Alive	Total
429.8	OTHER ILL-DEFINED DESCRIP & COMPLICATIONS OF HEART DISEASE	1	0	1
430.	SUBARACHNOID HAEMORRHAGE	1	0	1
434.1	CEREBRAL EMBOLISM	0	2	2
434.9	OCCLUSION OF CEREBRAL ARTERIES, UNSPECIFIED	5	0	5
436.	ACUTE BUT ILL-DEFINED CEREBROVASCULAR DISEASE	1	0	1
441.6	AORTIC ANEURYSM OF UNSPEC SITE WITHOUT MENTION OF RUPTURE	0	1	1
442.8	OTHER ANEURYSM OF OTHER SPECIFIED ARTERY	0	1	1
444.9	ARTERIAL EMBOLISM&THROM,OTHER&UNSPEC ARTER	1	0	1
453.8	VENOUS EMBOLISM AND THROMBOSIS OF OTHER SPECIFIED VEINS	1	0	1
453.9	OTHER VENOUS EMBOLISM AND THROMBOSIS	1	0	1
457.8	OTHER NONINFECTIVE DISORDERS OF LYMPHATIC CHANNELS	1	7	8
458.9	HYPOTENSION, UNSPECIFIED	24	7	31
459.0	HAEMORRHAGE, UNSPECIFIED	1	0	1
459.9	OTR&UNSPEC CIRCULATORY DISEASE	0	1	1
465.9	ACUTE UPPER RESPIRATORY INFECTION OF UNSPECIFIED SITE	4	2	6
466.1	ACUTE BRONCHIOLITIS	2	2	4
478.7	OTHER DISEASES OF LARYNX, NOT ELSEWHERE CLASSIFIED	1	0	1
481.	PNEUMOCOCCAL PNEUMONIA	1	5	6
482.1	PNEUMONIA DUE TO PSEUDOMONAS	1	0	1
482.2	PNEUMONIA DUE HEMOPHILUS INFLUENZAE	0	1	1
482.3	PNEUMONIA DUE TO STREPTOCOCCUS	0	1	1
485.	BRONCHOPNEUMONIA,UNSPECIFIED	2	1	3
486.	PNEUMONIA, ORGANISM UNSPECIFIED	1	1	2
487.0	INFLUENZA WITH PNEUMONIA	0	1	1
490.	BRONCHITIS,UNQUALIFIED	1	0	1
493.9	ASTHMA, UNSPECIFIED	0	1	1
511.0	PLEURISY,NO EFFUSION OR TUBERCULOSIS	1	2	3
511.1	PLEURISY WITH EFFUSION, BACTERIAL CAUSE OTR THAN TUBERCULOS	0	1	1
511.8	PLEURISY,EFFUSION DUE BACT CAUSE NO TUBERCUL	0	1	1
511.9	PLEURISY WITH EFFUSION WITHOUT MENT OF CAUSE	7	39	46
512.	PNEUMOTHORAX	3	1	4
518.0	PULMONARY COLLAPSE	1	6	7
518.4	ACUTE OEDEMA OF LUNG, UNSPECIFIED	3	1	4
518.5	PULMONARY INSUFFICIENCY FOLLOWING TRAUMA AND SURGERY	5	3	8
518.8	OTHER DISEASES OF LUNG, OTHER	0	7	7
519.1	DISEASE OF TRACHEA AND BRONCHUS, NEC, OTHER	0	1	1
519.4	DISORDERS OF DIAPHRAGM	1	0	1
519.8	OTHER DISEASE OF RESPIRATORY SYSTEM, NEC	0	1	1
519.9	OTHER DISEASES OF RESPIRATORY SYSTEM, UNSPECIFIED	1	1	2
530.2	ULCER OF OESOPHAGUS	1	0	1
531.0	GASTRIC ULCER, ACUTE WITH HAEMORRHAGE	1	0	1
531.4	GASTRIC ULCER CHRONIC OR UNSPECIFIED WITH HAEMORRHAGE	1	0	1
532.9	DUODENAL ULCER, UNSPEC ACUTE OR CHRONIC, NO HAEM OR	1	0	1

ICD Code	ICD Text	Died	Alive	Total
	PERFOR			
535.0	ACUTE GASTRITIS	1	0	1
558.	NON-INFECT GASTRO-ENTERITIS&COLITIS,NO ULCER	0	6	6
560.1	PARALYTIC ILEUS	1	0	1
564.0	CONSTIPATION	0	1	1
567.2	SUPPURATIVE PERITONITIS, OTHER	1	0	1
567.9	PERITONITIS, UNSPECIFIED	0	1	1
570.	ACUTE&SUBACUTE LIVER NECROSIS	1	0	1
571.5	CIRRHOSIS OF LIVER WITHOUT MENTION OF ALCOHOL	1	0	1
572.8	OTHER SEQUELAE OF CHRONIC LIVER DISEASE	1	0	1
578.9	HAEMORRHAGE OF GASTROINTESTINAL TRACT, UNSPECIFIED	1	0	1
579.8	OTHER&UNSPEC NUTRITIONAL DEFICIENCY	0	1	1
584.5	ACURE RENAL FAILURE WITH LESION OF TUBULAR NECROSIS	2	0	2
584.7	ACUTE RENAL FAILURE WITH LESION OF RENAL MEDULLARY NECROSIS	1	0	1
584.9	ACUTE RENAL FAILURE, UNSPECIFIED	1	1	2
588.8	DISORDERS RESULTING FROM IMPAIRED RENAL FUNCTION, OTHER	1	0	1
599.0	URINARY TRACT INFECTION, SITE NOT SPECIFIED	1	3	4
684.	IMPETIGO	0	1	1
686.1	PYOGENIC GRANULOMA	0	1	1
693.0	DERMATITIS DUE TO DRUGS AND MEDICAMENTS	0	1	1
701.4	KELOID SCAR	0	2	2
704.8	OTHER DISEASES OF HAIR AND HAIR FOLLICLES	0	1	1
707.0	DECUBITUS ULCER	1	1	2
709.4	FOREIGN BODY GRANULOMA OF SKIN AND SUBCUTANEOUS TISSUE	0	2	2
730.3	PERIOSTITIS WITHOUT MENTION OF OSTEOMYELITIS	0	1	1
732.1	JUVENILE OSTEOCHONDROSIS HIP	0	2	2
737.3	KYPHOSCOLIOSIS AND SCOLIOSIS	1	1	2
746.1	TRICUSPID ATRESIA AND STENOSIS, CONGENITAL	0	1	1
746.8	OTHER SPECIFIED CONGEN ANOMALITIES OF HEART	0	1	1
748.3	OTHER CONGEN ANOMAL,LARYNX,TRACHEA&BRONCHUS	0	1	1
751.4	ANOMALIES OF INTESTINAL FIXATION	1	0	1
753.3	OTHER SPEC CONGEN ANOMALIES OF KIDNEY	1	0	1
769.	PERINAT COND DUE HYALINE MEMBRANE DISEASE	1	0	1
770.1	PERINATAL COND DUE ASPIRATION OF CONTENT OF BIRTH CANAL	0	1	1
770.3	PULMONARY HAEMORRHAGE OF FETUS AND NEWBORN	1	0	1
771.8	BACTERIAL DISEASE NEC	3	0	3
772.1	FETAL AND NEONATAL INTRAVENTRICULAR HAEMORRHAGE	1	0	1
772.4	NEWBORN HEMORRHAGIC DISEASE	0	1	1
775.7	LATE METABOLIC ACIDOSIS OF NEWBORN	3	0	3
775.8	OTHER TRANSITORY NEONATAL ENDROCRINE & METABOLIC DISTURBANCE	0	1	1
776.2	DISSEMINATED INTRAVASCULAR COAGULATION IN NEWBORN	1	0	1
777.5	NECROTIZING ENTEROCOLITIS IN FETUS OR NEWBORN	1	0	1
779.1	OTHER AND UNSPECIFIED CEREBRAL IRRITABILITY IN NEWBORN	0	1	1
779.8	OTHER ILL-DEFINED CONDITION ORIGINATING IN THE PERINATAL	1	0	1

ICD Code	ICD Text	Died	Alive	Total
	PER			
780.2	SYNCOPE OR COLLAPSE	0	1	1
780.3	CONVULSIONS	2	7	9
780.6	PYREXIA OF UNKNOWN ORIGIN	3	16	19
782.1	RASH	0	1	1
782.3	EDEMA AND DROPSY	0	2	2
782.4	JAUNDICE (NOT OF NEWBORN)	1	0	1
782.5	CYANOSIS	1	1	2
782.7	SPONTANEOUS ECCHYMOSIS	0	1	1
783.4	LACK OF EXPECTED NORMAL PHYSIOLOGICAL DEVELOPMENT	1	0	1
784.4	CHANGE IN VOICE	1	1	2
784.7	EPISTAXIS	1	2	3
786.0	DYSPNEA	1	1	2
786.1	STRIDOR	0	2	2
786.3	HEMOPTYSIS	1	2	3
787.3	FLATULENCE, ERUCTATION AND GAS PAIN	0	1	1
788.1	PAIN REFER TO URINARY SYSTEM	0	1	1
788.2	RETENTION OF URINE	0	1	1
789.1	HEPATOMEGALY	1	2	3
789.5	ASCITES	2	3	5
790.6	OTHER ABNORMAL BLOOD CHEMISTRY	1	0	1
799.0	ASPHYXIA	0	1	1
799.1	RESPIRATORY FAILURE	5	0	5
873.6	INTERNAL STRUCTURES OF MOUTH WHITOUT MENTION OF COMPLICATION	1	0	1
933.0	FOREIGN BODY IN PHARYNX	0	1	1
933.1	FOREIGN BODY IN LARYNX	1	0	1
942.3	BURN OF TRUNK, FULL-THICKNESS SKIN LOSS	0	1	1
953.8	INJURY TO MULTIPLE SITES OF NERVE ROOTS AND SPINAL PLEXUS	0	1	1
958.8	OTHER EARLY COMPLICATIONS OF TRAUMA	0	1	1
995.0	ANAPHYLACTIC SHOCK	1	0	**1**
995.8	OTHER SPECIFIED ADVERSE EFFECT NOT ELSEWHERE SPECIFIED	1	0	**1**
996.0	**MECHANICAL COMPLICATION OF CARDIAC DEVICE, IMPLANT & GRAFT**	**4**	**6**	**10**
996.1	**MECHANICAL COMPLICATION OF OTHER VASCULAR DEVICE, IMPL&GRAFT**	**4**	**3**	**7**
996.5	**MECHANICAL COMPL OF OTHR SPEC PROSTHETIC DEV, IMPLANT&GRAFT**	**1**	**1**	**2**
996.6	**INFECTION DUE TO INTERN. PROSTHETIC DEVICE, IMPLANT OR GRAFT**	**4**	**10**	**14**
996.7	**OTHER COMPL OF INTERNAL PROSTHETIC DEVICE, IMPLANT AND GRAFT**	**9**	**11**	**20**
997.	**COMPLICATION AFFECTING SPECIFIED BODY SYSTEMS, NOT ELSEWH SP**	**1**	**0**	**1**
997.0	**CENTRAL NERVOUS SYSTEM COMPLICATIONS**	**37**	**18**	**55**
997.1	**CARDIAC COMPLICATIONS**	**199**	**94**	**293**

ICD Code	ICD Text	Died	Alive	Total
997.2	**PERIPHERAL VASCULAR COMPLICATIONS**	**5**	**6**	**11**
997.3	**RESPIRATORY COMPLICATIONS**	**59**	**119**	**178**
997.4	**GASTROINTESTINAL COMPLICATIONS**	**8**	**5**	**13**
997.5	**URINARY COMPLICATIONS**	**54**	**26**	**80**
997.9	**COMPLICATIONS AFFECTING OTR SPECIFIED BODY SYSTEMS, NEC**	**0**	**1**	**1**
998.0	**POSTOPERATIVE SHOCK**	**1**	**0**	**1**
998.1	**HAEMORRHAGE OR HAEMATOMA COMPLICATING A PROCEDURE**	**39**	**21**	**60**
998.2	**ACCIDENTAL PUNCTURE OR LACERATION DURING A PROCEDURE**	**14**	**11**	**25**
998.3	**DISRUPTION OF OPERATION WOUND**	**3**	**10**	**13**
998.4	**FOREIGN BODY ACCIDENTALLY LEFT DURING A PROCEDURE**	**0**	**5**	**5**
998.5	**POSTOPERATIVE INFECTION**	**32**	**60**	**92**
998.6	**PERSISTENT POSTOPERATIVE FISTULA**	**0**	**1**	**1**
998.7	**ACUTE REACTION TO FOREIGN SUBST ACCIDENT LEFT DURING PROCED**	**1**	**0**	**1**
998.8	**OTHR SPEC COMPLICATIONS OF PROCEDURES, NOT ELSEWHERE CLASS**	**0**	**5**	**5**
999.2	**VASCULAR COMPLICATON OF MEDICAL CARE, OTHER, NOT ELSEWH SPEC**	**0**	**2**	**2**
999.3	**COMPLICATIONS OF MEDICAL CARE, OTHER INFECTIONS**	**0**	**1**	**1**
999.8	**TRANSFUSION REACTION, OTHER AS COMPLICATION OF MEDICAL CARE**	**1**	**0**	**1**
E870.	ACCIDENTAL CUT/PUNCTURE/PERFORATION/HAEMORRH DURING MED CARE	1	0	1
E870.0	ACCIDENT CUT/PUNCTURE/PERFORAT/HAEM DUR SURGICAL OPERATION	7	8	15
E870.4	ACCID CUT/PUNCT/PERF/HAEM DURING ENDOSCOPIC EXAMINATION	1	0	1
E870.8	ACCIDENTAL CUT/PUNCT/PERF/HAEM IN MEDICAL CARE, OTHER	1	0	1
E870.9	ACCIDENTAL CUT/PUNCT/PERF/HAEM DURING MEDICAL CARE, UNSP	1	0	1
E871.0	FOREIGN OBJECT LEFT IN BODY DURING SURGICAL OPERATION	0	2	2
E871.8	FOREIGN OBJECT LEFT IN BODY DURING PROCEDURE, OTHER	0	1	1
E872.6	FAILURE OF STERILE PRECAUTIONS DURING HEART CATHETERIZATION	0	1	1
E876.8	OTHER SPECIFIED MISADVENTURES DURING MEDICAL CARE	3	2	5
E878.0	SURGICAL OPERATION WITH TRANSPLANT OF WHOLE ORGAN	1	1	2
E878.1	SURGICAL OPERATION WITH IMPLANT OF ARTIFICIAL INTERN DEVICE	4	6	10
E878.2	SURGICAL OPERATION WITH ANASTOMOSIS, BYPASS OR GRAFT	99	117	216
E878.4	ABNORMAL REACTION OR LATER COMPL OF OTR RESTORATIVE SURGERY	0	3	3
E878.8	OTHER SURGIACL OP. AS CAUSE OF ABNORM.REAC. OR LATER COMPL.	9	36	45

ICD Code	ICD Text	Died	Alive	Total
E878.9	SURBICAL OPERATION, AS CAUSE OF ABNORMAL REACTION, UNSPEC	0	1	1
E879.0	ABNORMAL REACTION OR LATER COMPL OF CARDIAC CATHETERIZATION	3	13	16
E879.2	ABNORMAL REACTION ON RADIOLOGICAL PROCEDURE AND RADIOTHERAPY	1	0	1
E879.6	ABNORMAL REACTION OR LATER COMPL: URINARY CATHETERIZATION	0	1	1
E879.9	OTHER PROCEDURES, CAUSING ABNORM REACT/LATER COMPL, UNSPEC	1	1	2
E930.0	ADVERSE EFFECTS OF PENICILLINS	0	1	1
E938.4	ADVERSE EFFECTS OF OTHER AND UNSPECIFIED GENERAL ANAESTHETIC	1	0	1
V17.8	FAMILY HISTORY OF MUSCULOSKELETAL DISEASES, OTHER	0	1	1
V43.3	HEART VALVE REPLACED (NOT TRANSPLANT)	1	2	3
V44.2	ARTIFICIAL OPENING STATUS, ILEOSTOMY	0	1	1
V45.2	PRESENCE OF CEREBROSPINAL FLUID DRAINAGE DEVICE	1	0	1
V45.8	POSTSURGICAL STATES, OTHER	2	2	4
V54.8	ORTHOPAEDIC AFTERCARE, OTHER	1	0	1
V57.1	PHYSICAL THERAPY, OTHER	0	2	2
	Totals	861	980	1841

Appendix B1

ICD 9 Codes for post-operative complications

COMPLICATIONS OF SURGICAL AND MEDICAL CARE, NOT ELSEWHERE CLASSIFIED (996-999)

- Excludes: adverse effects of medicinal agents (001.0-799.9, 995.0-995.8)
    - burns from local applications and irradiation (940.0-949.5)
    - complications of:
    - conditions for which the procedure was performed
        - surgical procedures during abortion, labor, and delivery (630-676.9)
        - poisoning and toxic effects of drugs and chemicals (960.0-989.9)
        - postoperative conditions in which no complications are present, such as:
            - artificial opening status (V44.0-V44.9)
            - closure of external stoma (V55.0-V55.9)
            - fitting of prosthetic device (V52.0-V52.9)
        - specified complications classified elsewhere
            - anesthetic shock (995.4)
            - electrolyte imbalance (276.0-276.9)
            - postlaminectomy syndrome (722.80-722.83)
            - postmastectomy lymphedema syndrome (457.0)
            - postoperative psychosis (293.0-293.9)
            - any other condition classified elsewhere in
                - the Alphabetic Index when described as due to a procedure
- 996 Complications peculiar to certain specified procedures
- Includes: complications, not elsewhere classified, in the use of artificial substitutes [e.g., Dacron, metal, Silastic, Teflon] or natural sources [e.g., bone] involving:
    - anastomosis (internal)
    - graft (bypass) (patch)
    - implant
    - internal device:
        - catheter
        - electronic
        - fixation
        - prosthetic
    - reimplant
    - transplant
- Excludes: accidental puncture or laceration during procedure (998.2)
    - complications of internal anastomosis of:
        - gastrointestinal tract (997.4)
        - urinary tract (997.5)
    - other specified complications classified elsewhere, such as:
        - hemolytic anemia (283.1)
        - functional cardiac disturbances (429.4)
        - serum hepatitis (070.2-070.3)
- 996.0 Mechanical complication of cardiac device, implant, and graft
    - Breakdown (mechanical)
    - Displacement
    - Leakage
    - Obstruction, mechanical
    - Perforation
    - Protrusion
    - 996.00 Unspecified device, implant, and graft
    - 996.01 Due to cardiac pacemaker (electrode)
    - 996.02 Due to heart valve prosthesis
    - 996.03 Due to coronary bypass graft

- Excludes: atherosclerosis of graft (414.02, 414.03)
    - embolism [occlusion NOS] [thrombus] of graft (996.72)
- 996.04 Due to automatic implantable cardiac defibrillator
- 996.09 Other

- 996.1 Mechanical complication of other vascular device, implant, and graft
    - Mechanical complications involving:
        - aortic (bifurcation) graft (replacement)
        - arteriovenous:
            - fistula surgically created
            - shunt surgically created
        - balloon (counterpulsation) device, intra-aortic
        - carotid artery bypass graft
        - dialysis catheter
        - femoral-popliteal bypass graft
        - umbrella device, vena cava
    - Excludes: atherosclerosis of biological graft (440.30-440.32)
        - embolism [occlusion NOS] [thrombus] of (biological) (synthetic) graft (996.74)
- 996.2 Mechanical complication of nervous system device, implant, and graft
    - Mechanical complications involving:
        - dorsal column stimulator
        - electrodes implanted in brain [brain "pacemaker"]
        - peripheral nerve graft
        - ventricular (communicating) shunt
- 996.3 Mechanical complication of genitourinary device, implant, and graft
    - 996.30 Unspecified device, implant, and graft
    - 996.31 Due to urethral [indwelling] catheter
    - 996.32 Due to intrauterine contraceptive device
    - 996.39 Other
        - Cystostomy catheter
        - Prosthetic reconstruction of vas deferens
        - Repair (graft) of ureter without mention of resection
        - Excludes: complications due to:
            - external stoma of urinary tract (997.5)
            - internal anastomosis of urinary tract (997.5)
- 996.4 Mechanical complication of internal orthopedic device, implant, and graft
    - Mechanical complications involving:
        - external (fixation) device utilizing internal screw(s), pin(s) or other methods of fixation
        - grafts of bone, cartilage, muscle, or tendon
        - internal (fixation) device such as nail, plate, rod, etc.
    - Excludes: complications of external orthopedic device, such as:
        - pressure ulcer due to cast (707.0)
- 996.5 Mechanical complication of other specified prosthetic device, implant, and graft
    - Mechanical complications involving:
        - prosthetic implant in:
            - bile duct
            - breast
            - chin
            - orbit of eye
        - nonabsorbable surgical material NOS
        - other graft, implant, and internal device, not elsewhere classified
    - 996.51 Due to corneal graft
    - 996.52 Due to graft of other tissue, not elsewhere classified
        - Skin graft failure or rejection
        - Excludes: sloughing of temporary skin allografts or xenografts (pigskin)=omit code
    - 996.53 Due to ocular lens prosthesis
        - Excludes: contact lenses=code to condition
    - 996.54 Due to breast prosthesis
        - Breast capsule (prosthesis)
        - Mammary implant
    - 996.59 Due to other implant and internal device, not elsewhere classified

- Nonabsorbable surgical material NOS
- Prosthetic implant in:
  - bile duct
  - chin
  - orbit of eye

- 996.6 Infection and inflammatory reaction due to internal prosthetic device, implant, and graft
  - Infection (causing obstruction) due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - Inflammation due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - 996.60 Due to unspecified device, implant and graft
  - 996.61 Due to cardiac device, implant and graft
    - Cardiac pacemaker or defibrillator:
      - electrode(s), lead(s)
      - pulse generator
      - subcutaneous pocket
    - Coronary artery bypass graft
    - Heart valve prosthesis
  - 996.62 Due to vascular device, implant and graft
    - Arterial graft
    - Arteriovenous fistula or shunt
    - Infusion pump
    - Vascular catheter (arterial) (dialysis) (venous)
  - 996.63 Due to nervous system device, implant and graft
    - Electrodes implanted in brain
    - Peripheral nerve graft
    - Spinal canal catheter
    - Ventricular (communicating) shunt (catheter)
  - 996.64 Due to indwelling urinary catheter
  - 996.65 Due to other genitourinary device, implant and graft
    - Intrauterine contraceptive device
  - 996.66 Due to internal joint prosthesis
  - 996.67 Due to other internal orthopedic device, implant and graft
    - Bone growth stimulator (electrode)
    - Internal fixation device (pin) (rod) (screw)
  - 996.69 Due to other internal prosthetic device, implant, and graft
    - Breast prosthesis
    - Ocular lens prosthesis
    - Prosthetic orbital implant
- 996.7 Other complications of internal (biological) (synthetic) prosthetic device, implant, and graft
  - Complication NOS due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
    - occlusion NOS
  - Embolism due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - Fibrosis due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - Hemorrhage due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - Pain due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - Stenosis due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - Thrombus due to (presence of) any device, implant, and graft classifiable to 996.0-996.5
  - Excludes: transplant rejection (996.8)
  - 996.70 Due to unspecified device, implant, and graft
  - 996.71 Due to heart valve prosthesis
  - 996.72 Due to other cardiac device, implant, and graft
    - Cardiac pacemaker or defibrillator:
      - electrode(s), lead(s)
      - subcutaneous pocket
    - Coronary artery bypass (graft)

        - Excludes: occlusion due to atherosclerosis (414.02-414.03)
    - 996.73 Due to renal dialysis device, implant, and graft
    - 996.74 Due to vascular device, implant, and graft
        - Excludes: occlusion of biological graft due to atherosclerosis (440.30-440.32)
    - 996.75 Due to nervous system device, implant, and graft
    - 996.76 Due to genitourinary device, implant, and graft
    - 996.77 Due to internal joint prosthesis
    - 996.78 Due to other internal orthopedic device, implant, and graft
    - 996.79 Due to other internal prosthetic device, implant, and graft
- 996.8 Complications of transplanted organ
    - Transplant failure or rejection
    - Use additional code to identify nature of complication, such as:
        - Cytomegalovirus [CMV] infection (078.5)
    - 996.80 Transplanted organ, unspecified
    - 996.81 Kidney
    - 996.82 Liver
    - 996.83 Heart
    - 996.84 Lung
    - 996.85 Bone marrow
        - Graft-versus-host disease (acute) (chronic)
    - 996.86 Pancreas
    - 996.89 Other specified transplanted organ
        - Intestines
- 996.9 Complications of reattached extremity or body part
    - 996.90 Unspecified extremity
    - 996.91 Forearm
    - 996.92 Hand
    - 996.93 Finger(s)
    - 996.94 Upper extremity, other and unspecified
    - 996.95 Foot and toe(s)
    - 996.96 Lower extremity, other and unspecified
    - 996.99 Other specified body part
- 997 Complications affecting specified body systems, not elsewhere classified
- Use additional code to identify complication
- Excludes: the listed conditions when specified as:
    - causing shock (998.0)
    - complications of:
        - anesthesia:
            - adverse effect (001.0-799.9, 995.0-995.8)
            - in labor or delivery (668.0-668.9)
            - poisoning (968.0-969.9)
        - implanted device or graft (996.0-996.9)
        - obstetrical procedures (669.0-669.4)
        - reattached extremity (996.90-996.96)
        - transplanted organ (996.80-996.89)
- 997.0 Nervous system complications
    - 997.00 Nervous system complication, unspecified
    - 997.01 Central nervous system complication
        - Anoxic brain damage
        - Cerebral hypoxia
        - Excludes: Cerebrovascular hemorrhage or infarction (997.02)
    - 997.02 Iatrogenic cerebrovascular infarction or hemorrhage
        - Postoperative stroke
    - 997.09 Other nervous system complications
- 997.1 Cardiac complications
    - Cardiac:
        - arrest during or resulting from a procedure
        - insufficiency during or resulting from a procedure
    - Cardiorespiratory failure during or resulting from a procedure
    - Heart failure during or resulting from a procedure
    - Excludes: the listed conditions as long-term effects of cardiac surgery or due to the presence of cardiac prosthetic device (429.4)

- 997.2 Peripheral vascular complications
    - Phlebitis or thrombophlebitis during or resulting from a procedure
    - Excludes: the listed conditions due to:
        - implant or catheter device (996.62)
        - infusion, perfusion, or transfusion (999.2)
        - complications affecting internal blood vessels, such as:
            - mesenteric artery (997.4)
            - renal artery (997.5)
- 997.3 Respiratory complications
    - Mendelson's syndrome resulting from a procedure
    - Pneumonia (aspiration) resulting from a procedure
    - Excludes: iatrogenic [postoperative] pneumothorax (512.1)
        - iatrogenic pulmonary embolism (415.11)
            - Mendelson's syndrome in labor and delivery (668.0)
            - specified complications classified elsewhere, such as:
                - adult respiratory distress syndrome (518.5)
                - pulmonary edema, postoperative (518.4)
                - respiratory insufficiency, acute, postoperative (518.5)
                - shock lung (518.5)
                - tracheostomy complication (519.0)
- 997.4 Digestive system complications
    - Complications of:
        - Intestinal (internal) anastomosis and bypass, not elsewhere classified, except that involving urinary tract
    - Hepatic failure specified as due to a procedure
    - Hepatorenal syndrome specified as due to a procedure
    - Intestinal obstruction NOS specified as due to a procedure
    - Excludes: specified gastrointestinal complications classified elsewhere, such as:
        - blind loop syndrome (579.2)
        - colostomy or enterostomy complications (569.60-569.69)
        - gastrojejunal ulcer (534.0-534.9)
        - infection of external stoma (569.61)
        - pelvic peritoneal adhesions, female (614.6)
        - peritoneal adhesions (568.0)
        - peritoneal adhesions with obstruction (560.81)
        - postcholecystectomy syndrome (576.0)
        - postgastric surgery syndromes (564.2)
- 997.5 Urinary complications
    - Complications of:
        - external stoma of urinary tract
        - internal anastomosis and bypass of urinary tract, including that involving intestinal tract
    - Oliguria or anuria specified as due to procedure
    - Renal:
        - failure (acute) specified as due to procedure
        - insufficiency (acute) specified as due to procedure
    - Tubular necrosis (acute) specified as due to procedure
    - Excludes: specified complications classified elsewhere, such as:
        - postoperative stricture of:
            - ureter (593.3)
            - urethra (598.2)
- 997.6 Late amputation stump complication
    - Use additional code to identify site (V49.60-V49.79)
    - Excludes: phantom limb (syndrome) (353.6)
    - 997.60 Unspecified complication
    - 997.61 Neuroma of amputation stump
    - 997.62 Infection (chronic)
    - 997.69 Other
- 997.9 Complications affecting other specified body systems, not elsewhere classified
    - Excludes: specified complications classified elsewhere, such as:
        - broad ligament laceration syndrome (620.6)
        - postartificial menopause syndrome (627.4)
        - postoperative stricture of vagina (623.2)

- 997.91 Hypertension
    - Excludes: Essential hypertension (401. 0-401.9)
- 997.99 Other
    - Vitreous touch syndrome

- 998 Other complications of procedures, NEC
- 998.0 Postoperative shock
    - Collapse NOS during or resulting from a surgical procedure
    - Shock (endotoxic) (hypovolemic) (septic) during or resulting from a surgical procedure
    - Excludes: shock:
        - anaphylactic due to serum (999.4)
        - anesthetic (995.4)
        - electric (994.8)
        - following abortion (639.5)
        - obstetric (669.1)
        - traumatic (958.4)
- 998.1 Hemorrhage or hematoma complicating a procedure
    - Hemorrhage of any site resulting from a procedure
    - Excludes: hemorrhage due to implanted device or graft (996.70-996.79)
        - that complicating cesarean section or puerperal perineal wound (674.3)
- 998.2 Accidental puncture or laceration during a procedure
    - Accidental perforation by catheter or other instrument during a procedure on:
        - blood vessel
        - nerve
        - organ
    - Excludes: iatrogenic [postoperative] pneumothorax (512.1)
        - puncture or laceration caused by implanted device intentionally left in operation wound (996.0-996.5)
        - specified complications classified elsewhere, such as:
            - broad ligament laceration syndrome (620.6)
            - trauma from instruments during delivery (664.0-665.9)
- 998.3 Disruption of operation wound
    - Dehiscence of operation wound
    - Rupture of operation wound
    - Excludes: disruption of:
        - cesarean wound (674.1)
        - perineal wound, puerperal (674.2)
- 998.4 Foreign body accidentally left during a procedure
    - Adhesions due to foreign body accidentally left in operative wound or body cavity during a procedure
    - Obstruction due to foreign body accidentally left in operative wound or body cavity during a procedure
    - Perforation due to foreign body accidentally left in operative wound or body cavity during a procedure
    - Excludes: obstruction or perforation caused by implanted device intentionally left in body (996.0-996.5)
- 998.5 Postoperative infection
    - Abscess: postoperative
        - intra-abdominal postoperative
        - stitch postoperative
        - subphrenic postoperative
        - wound postoperative
    - Septicemia postoperative
    - Excludes: infection due to:
        - implanted device (996.60-996.69)
        - infusion, perfusion, or transfusion (999.3)
        - postoperative obstetrical wound infection (674.3)
        - Use additional code to identify infection
- 998.6 Persistent postoperative fistula
- 998.7 Acute reaction to foreign substance accidentally left during a procedure
    - Peritonitis:
        - aseptic
        - chemical

- 998.8 Other specified complications of procedures, not elsewhere classified
    - 998.81 Emphysema (subcutaneous) (surgical) resulting from a procedure
    - 998.82 Cataract fragments in eye following cataract surgery
    - 998.89 Other specified complications
- 998.9 Unspecified complication of procedure, not elsewhere classified
    - Postoperative complication NOS
    - Excludes: complication NOS of obstetrical surgery or procedure (669.4)
- 999 Complications of medical care, not elsewhere classified
- Includes: complications, not elsewhere classified, of:
    - dialysis (hemodialysis) (peritoneal) (renal)
    - extracorporeal circulation
    - hyperalimentation therapy
    - immunization
    - infusion
    - inhalation therapy
    - injection
    - inoculation
    - perfusion
    - transfusion
    - vaccination
    - ventilation therapy
- Excludes: specified complications classified elsewhere such as:
    - complications of implanted device (996.0-996.9)
    - contact dermatitis due to drugs (692.3)
    - dementia dialysis (294.8)
        - transient (293.9)
    - dialysis disequilibrium syndrome (276.0-276.9)
    - poisoning and toxic effects of drugs and chemicals (960.0-989.9)
    - postvaccinal encephalitis (323.5)
    - water and electrolyte imbalance (276.0-276.9)
- 999.0 Generalized vaccinia
- 999.1 Air embolism
    - Air embolism to any site following infusion, perfusion, or transfusion
    - Excludes: embolism specified as:
        - complicating:
            - abortion (634-638 with .6, 639.6)
            - ectopic or molar pregnancy (639.6)
            - pregnancy, childbirth, or the puerperium (673.0)
            - due to implanted device (996.7)
            - traumatic (958.0)
- 999.2 Other vascular complications
    - Phlebitis following infusion, perfusion, or transfusion
    - Thromboembolism following infusion, perfusion, or transfusion
    - Thrombophlebitis following infusion, perfusion, or transfusion
    - Excludes: the listed conditions when specified as:
        - due to implanted device (996.61-996.62, 996.72-996.74)
        - postoperative NOS (997.2)
- 999.3 Other infection
    - Infection following infusion, injection, transfusion, or vaccination
    - Sepsis following infusion, injection, transfusion, or vaccination
    - Septicemia following infusion, injection, transfusion, or vaccination
    - Excludes: the listed conditions when specified as:
        - due to implanted device (996.60-996.69)
        - postoperative NOS (998.5)
- 999.4 Anaphylactic shock due to serum
    - Excludes: shock:
        - allergic NOS (995.0)
        - anaphylactic:
            - NOS (995.0)
            - due to drugs and chemicals (995.0)
- 999.5 Other serum reaction
    - Intoxication by serum
    - Protein sickness

- Serum rash
- Serum sickness
- Urticaria due to serum
- Excludes: serum hepatitis (070.2-070.3)

- 999.6 ABO incompatibility reaction
  - Incompatible blood transfusion
  - Reaction to blood group incompatibility in infusion or transfusion
- 999.7 Rh incompatibility reaction
  - Reactions due to Rh factor in infusion or transfusion
- 999.8 Other transfusion reaction
  - Septic shock due to transfusion
  - Transfusion reaction NOS
  - Excludes: postoperative shock (998.0)
- 999.9 Other and unspecified complications of medical care, not elsewhere classified
  - Complications, not elsewhere classified, of:
    - electroshock therapy
    - inhalation therapy
    - ultrasound therapy
    - ventilation therapy
  - Unspecified misadventure of medical care
  - Excludes: unspecified complication of:
    - phototherapy (990)
    - radiation therapy (990)

Appendix tables for section on Perfusionists' log

Appendix C1 Description of the Excel spreadsheet for the Clinical Perfusionists' Log - CPL

Each column in the spreadsheet is described with brief comments.

1 Serial Number
(Column A)
The serial number of operations performed from when the log was started: the first entry for 1984 is 2981. The first relevant entry for the Inquiry and on the spreadsheet is 2983. This is a four digit numeric code until the end of 1992. Thereafter the format is `two digits (representing the year)/up to three digits (representing the sequence of the operation within the year). Thus there is a unique number for each visit to the operating theatre but not for each patient.

2 ***Surgeon***

(Column B)
Initials (occasionally surname or first name) of the doctor carrying out the operation(s). Different initials appear to be used for the same person: the entry in the spreadsheet is the actual entry in the record. There are 24 cases where there is no entry within the perfusionists' records and `no entry` has been included within the spreadsheet. There are 49 unique values.

3 ***First name***

(Column C)
There is only one first name available until 23 October 1991 (when the use of labels was introduced) and therefore only this has been included throughout. It appears as though the entry in the perfusionists records is the name by which the child is generally known i.e. includes a number of abbreviated terms: the entry in spreadsheet is as in record.

4 ***Surname***

(Column D)
Alpha as in the perfusionists' records. There are two missing values but these appear to have surname included in the first name column.

5 ***Age***

(Column E)
Up until 24 October 1991 the entry is in number of years and/or fractions of a year (the fraction may be in terms of days, weeks or months). After this date this field is blank except for one record for which no date of birth is recorded. Where the age is not known `no entry` has been included. (one case). 517 rows are blank.

6 ***Date of Birth***

(Column F)
Only recorded after 23 October 1991. Format in spreadsheet is (--/--/----) except for one record where only the age is given. Where the age is not known `no entry ` has been included in the spreadsheet.(2 Cases)

7 ***Sex***

(Column G)
Up until 24 October 1991 this is not stated and has been guessed on the basis of the first name. After October 1991 sex is included on the label. Entry on the spreadsheet is. M=male, F=female, if any doubt =?. No entry in 72 cases with 4 labelled "No entry", where sex is not recorded after 24 October 1991

8 ***Consultant Responsible***

(Column H)
Initials only and the same points arise, as with the surgeon i.e. initials are different for the same person). This is only recorded in the records and spreadsheet when the consultant is different from the stated surgeon. In all other cases the field has been left blank but it should be assumed to be the surgeon.

9 ***Description of operation***

(Column I)
In alpha as written in the record. Often different terminology and /or abbreviations are used for the same operation or procedure but entry in spreadsheet is as in record. The level of detail appears to differ according to the person making the entry. In a very few cases (it has been insufficient to give a code (see operation code columns). There are also four cases where there was no entry within the records: this fact has been entered on the spreadsheet for these cases.

10 ***Operation Codes***

(Column J)
Up to five operation codes using the OPCS S4. There is one case where insufficient information has been given to allocate a code. There are also some instances where the information given is limited but a code has been allocated: where this is the case an entry has been made in the comments column.

11 ***ICD Code***

(Column O)
In general only a few codes have been allocated and included in the spreadsheet in effect only those record for which an operation code was not possible. ICD 9 classification has been used (four digits including a decimal point.)

12 ***Comments***

(Column P)
As indicated above this has been included in the spreadsheet and used it indicate the possibility of a different operation code. There are 20 different comments in 90 records.

13 ***Date of Operation***

(Column R)
Format in spreadsheet --/--/-----. Available for all records.

14 BRI number.
(Column R)
Only available from 24 October 1991. This is the unique patient identification number. Format varies slightly across the record BRI plus 6-digit numeric number, BCH plus7 digit numeric number with a few exceptions namely BRI with 7 digits and STMH with 7 digits.

15 ***Emergency***

(Column S)
This has been recorded where there is a positive statement that it is an emergency case within the records. The entry in the spreadsheet is `Yes` (10 cases) or the field has been left blank.

16 ***DOT***

(Column T)
This denotes `Death on Table`. This has been recorded where there is a positive statement to this effect in the records. The entry in spreadsheet is `Yes` (33 cases) or the field has been left blank.

17 ***Repeat***

(Column U)
This denotes whether this is a repeat operation. Entry in records is `redo or repeat`. Entry in spreadsheet is `Yes` (34 cases) or the field has been left blank

Appendix C2

Descriptions of operations that were not coded as involving heart, arteries or veins in CPL

DORV inoperable,insertion of Gortex shunt

VF,support bypass

Rewarm/perfusion from Hypothermia

4 * no entry (4 operations had no entry for the operation description at all)

Re-exploration of chest tracheoplasty

3 * DORV

St Jude AVG 304 21mm conduit S/N 603649

Reopen chest onto CPB to enable bleeding points to be sutured

Repair thoracic aneurysm

Appendix C3

Table C3.1 OPCS-4 codes not included in the "Open/closed" classification and number of procedures with those codes -CPL

OPCS code	No. of procedures
K048	3
K148	5
K201	1
K228	1
K449	1
K488	1
K559	1
L013	2
L018	2
L059	3
L064	2
L104	1
Total	23

Table C3.2 OPCS-4 codes included in the "Excluded" classification and number of procedures with those codes - CPL

OPCS Code	No. of procedures
K221	2
K222	1
K231	2
K354	1
K454	1
K472	1
K478	5
K558	1
L052	1
L053	1
L058	1
L068	1
L238	3
L378	1
L798	2