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Title: Quality of data in perinatal population health databases: a systematic review

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Abstract:

Background

Administrative or population health datasets (PHDS) are increasingly being used for research related to maternal and infant health. However the accuracy and completeness of the information in the PHDS is important to ensure validity of the results of this research.

Objective

To compile and review studies that validate the reporting of conditions and procedures related to pregnancy, childbirth and newborns and provide a tool of reference for researchers.

Methods

A systematic search was conducted of Medline and EMBASE databases to find studies that validated routinely collected datasets containing diagnoses and procedures related to pregnancy, childbirth and newborns. To be included datasets had to be validated against a gold standard, such as review of medical records, maternal interview or survey, specialized register, or laboratory data. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and/or kappa statistic for each diagnosis or procedure code were calculated.

Results

Thirty nine validation studies were included. Under-enumeration was common, with the level of ascertainment increasing as time from diagnosis/procedure to birth decreased. Most conditions and procedures had high specificities indicating few false positives, and procedures were more accurately reported than diagnoses. Hospital discharge data were generally more accurate than birth data, however identifying cases from more than one dataset further increased ascertainment.

Conclusions

This comprehensive collection of validation studies summarizing the quality of perinatal population data will be an invaluable resource to all researchers working with PHDS.

Introduction

Routinely collected population health datasets (PHDS) are an important data source for epidemiological and health services research and are frequently used to estimate prevalence of conditions,[1] examine temporal trends[2-4] and evaluate health policy.[5 6] Data linkage allows enhanced utilization of PHDS for a range of research opportunities, including longitudinal studies,[7] the collection of outcome and cost data for randomized controlled trials,[8] and more recently the linkage of PHDS with laboratory data to find biomarkers of adverse outcomes.[9] Internationally population data collected for billing services, such as hospital discharge data, or for state and federal registries, such as birth and death certificate data, may be available and accessible but uncertainty remains over their accuracy and completeness.

When undertaking research using PHDS it is important that the accuracy and completeness of reporting is investigated for the variables that are used. Many studies validating routinely collected maternal and infant data have been published but to date there are only two reviews with specific and limited parameters.[10 11] The use of a large number of keywords/search terms, other than reliability and validity, means that it is often difficult to locate these articles[10] and they are of various quality,[11] so there is a strong need to collate the data from these many studies into one comprehensive document.

Our objective was to collate recent data validating routinely collected perinatal health information internationally to highlight the conditions and procedures that are consistently well reported to be used as a tool of reference for researchers. We hypothesized that; (i) perinatal data would be more accurately reported in hospital databases compared to birth certificates and birth registers, however the linkage of a number of data sources would provide the best data, (ii) broad groups of codes would provide better information than specific codes, (iii)

procedures would be better reported than conditions, and (iv) severe forms of disease would be better reported than less mild forms.

Methods

This systematic review followed the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement[12].

Search Strategy and selection criteria

We searched MEDLINE and Embase databases using the search strategy outlined in Figure 1. Studies in English published between 1990 and 2009 were considered. We hand-searched reference lists from these publications to locate other relevant publications. Inclusion criteria for studies were (1) studies must validate routinely collected datasets (population-based registry or specialized registry, birth certificates or hospital discharge datasets) from developed countries, (2) datasets validated must be from data collected from 1989 onwards, (3) datasets must be validated against a gold standard (review of medical records, maternal interview or survey, specialized register, or laboratory results), (4) data validated must contain diagnoses and procedures related to pregnancy, childbirth and newborns (excluding birth defects) and (5) one or more of the following outcome measurements must be reported, or could be calculated from the information provided in the paper: sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and/or kappa statistic.

Birth defects were excluded from this systematic review due to the large amount of studies validating the reporting of birth defects. A separate systematic review examining the reporting of birth defects in birth and hospital data is planned. We have also excluded studies validating data from developing countries as we wanted to focus on countries with established population health datasets that were being used for research purposes.

Sensitivity (sometimes referred to as true positive fraction) gives the proportion of those with the condition, as ascertained by the gold standard, who are reported in the PHDS as having it, thus measuring completeness of reporting. Specificity (equivalent to one minus false positive fraction) is the proportion of those without the condition who are correctly reported in the PHDS as not having it. PPV is the proportion of those reported to have the condition in the PHDS who have the condition, denoting accuracy. The kappa statistic is the agreement between the gold standard and the population health dataset beyond chance. A kappa value of 0.75 or greater indicates excellent agreement beyond chance, kappa between 0.4 and 0.75 indicates good agreement and kappa less than 0.4 indicates poor agreement.[13]

Studies retrieved by the search strategy (Figure 1) were assessed for inclusion in the review independently by two reviewers initially based on the study title, then on the abstract, then on the complete paper. Papers had to fulfill all inclusion criteria to be included. Data extraction was then performed by each reviewer onto a standard data abstraction form. Any differences of opinion regarding studies for inclusion were resolved through discussion.

To explore variability in study results, studies were examined by different types of datasets and by different type of gold standard used. When data are compared against a gold standard of medical records, studies can be categorized in two ways; an audit of coding or a validation of how closely the coding represents the 'truth'.[14 15] An audit involves recoding the data from medical records by experienced coders while complying with coding standards, which does not always reflect the true clinical situation. In a validation study, data are abstracted from medical records by clinicians trying to find a complete clinical picture of the presence of specific conditions. Audit studies will often report higher accuracy than validation studies. Studies with small sample sizes and/or based at one hospital have limitations[16 17] so we perform

prespecified subgroup analyses of large studies reviewing 1,000 records or more in multiple hospitals.

When a diagnosis or procedure code was validated in more than one study, the range of sensitivities, PPVs and kappa statistics are reported. A supplementary table of the validity of diagnosis and procedures that were reported in only a single study is available from the journal. Detailed tables containing the sensitivity, specificity, PPV, NPV and kappa statistic for each diagnosis or procedure from each included study are available in the Appendix.

Results

Study selection

The electronic search strategy yielded 1,189 studies published between January 1990 and December 2009 (see Figure 1). From this list of citations we found 43 papers that filled all inclusion criteria; one paper was excluded[18] due to the duplicate use of data from another included study, and another study was excluded as we were unable to determine how measures of sensitivity and specificity were calculated.[19] **Two additional papers were found when reference lists were searched[20 21].** Table 1 summarizes the details of the 43 papers included in our analysis.

Study characteristics (Table 1)

Most of the studies validated information recorded in either hospital discharge data or birth certificates/registries. Reporting of neonatal deaths in perinatal death certificates was examined in one study[22] and reporting of maternal conditions on the fetal death certificate by another study.[23]

Reporting of maternal or infant conditions and procedures in a general population of pregnant women were reported in 31 of the 43 included studies,[20 21 24-52] twenty of these studies included over 1,000 participants sampled from more than one hospital. The accuracy of reporting of some conditions were limited to pregnant women with those conditions (uterine rupture,[53] preeclampsia or eclampsia,[54 55] diabetes[56] and venous thrombosis[57]), while one study examined a range of maternal and infant conditions in a population of pregnant women with asthma.[58] One study restricted its examination of the reporting of conditions and procedures to infants admitted to neonatal intensive care.[59]

The gold standard used in most studies was from data abstracted from medical records including abstracted data on pre-existing medical conditions[25 30 41] and from prenatal records when available.[36 37 44 48] Of those studies that used medical records as the gold standard, we could ascertain that seven were audit studies[21 40 44-46 48 49] while sixteen we classified as validation studies.[25 26 29 30 33 34 36 37 41-43 45 50-53] Other gold standards used to assess reporting in hospital and birth records include specialized databases,[27 28 31 38 39 56 59] physical examination or ultrasound results[39] and two studies used guidelines from American College of Obstetrics and Gynacology (ACOG) to ascertain the diagnosis of preeclampsia and eclampsia.[32 54]

Pre-existing maternal medical conditions/ Antenatal behavior (Table 2)

Generally, medical conditions and behaviors relating to mothers prior to giving birth are underreported at the time of birth; asthma, lung disease, heart disease, and renal disease have sensitivities below 56% in birth or hospital data, while alcohol or tobacco use had sensitivities ranging from 15% to 89%. However false positives rarely occur with high specificities consistently reported, especially for hospital data where specificities were all 98.9% or higher. The reported kappa values for maternal conditions and behavior prior to delivery were mostly poor to good.

Both pre-existing hypertension and diabetes were underreported but to a lesser extent than other conditions, with the exception of Roohan *et al.* who reported a sensitivity and a PPV of 0% for pre-existing hypertension in birth data. Low sensitivities for pre-existing hypertension were also reported by Roberts *et al.*[41] and Lydon-Rochelle *et al.*[36], both of large these studies used gold standards including information abstracted from prenatal medical records. When examining the subgroup of large studies, accuracy and completeness were generally in the lower range in birth data; pre-existing hypertension had range of sensitivities from 7.3% to 62.5% and PPVs of 34.8% to 56.3%, while pre-existing diabetes had sensitivities ranging from 45.1% to 66.7% and PPVs from 32.5% to 68.8%. Hospital data had a higher level of both accuracy and completeness compared to birth data, especially in the large studies, however the combination of either hospital data or birth data further improved the ascertainment of these conditions with only a small decrease in specificity.[36 41]

Pregnancy-related conditions (Table 2)

Conditions related to pregnancy were also underreported however sensitivities were generally higher than those reported for pre-existing maternal conditions. Gestational hypertension was underreported in both hospital and birth data; sensitivities ranged from 10%, as reported by Klemmensen *et al*[32] whose gold standard included the ACOG guidelines applied at medical record review to classify hypertensive disorders of pregnancy, to 87.9% reported by Joseph *et al*[31] for the broad category 'any gestational hypertension disorder'. Preeclampsia was more accurately and completely reported than gestational hypertension. Severe preeclampsia was accurately reported with PPVs ranging from 76.9% to 100% but eclampsia was poorly reported with variable ascertainment and false positives outweighing true positives. Again, hospital data were generally more accurate and complete than birth data, and it was the large studies validating birth data[27 50] that reported the lowest sensitivities and PPVs.

Conditions and procedures related to labor and delivery (Table 3)

In general, events related to labor and delivery were accurately and completely reported across different countries and data types. Kappa statistics are mostly good to excellent with the exception of maternal bleeding, premature rupture of membranes and puerperal infection. Delivery type is well reported with cesarean section, vacuum and forceps delivery mostly having sensitivities and PPVs above 80%. Induction and augmentation of labor have a higher degree of underreporting, and have lower specificities indicating false positives. Third or fourth degree perineal tears and their repair are reliably reported in both birth and hospital data across jurisdictions with the exception of a sensitivity of 52.1% reported in Norway in 1990-1992 however this improved to 84.6% in 2000-2002.

Large studies validating birth data once again reported more under-ascertainment compared to small or one hospital studies. The range of sensitivities reported in large studies included: vaginal birth after cesarean 47% to 70%, placental abruption 28% to 68%, placenta previa 33% to 49%, premature rupture of membrane 20% to 38% and cord prolapsed 21% to 24%.

Infant outcome (Table 3)

Prematurity, birthweight and gender were accurately and completely reported across countries and data type. Although some variables are underreported, accuracy was high with the majority of PPVs over 80%. Low PPVs were reported for birth asphyxia (50%) and posterm birth (46.1%). Overall kappa ratings were good to excellent. The reporting of stillbirth in hospital data from Australia and the US were very similar with sensitivities of 75% and 74% respectively and specificities of 100%.

Table V (supplementary material) outlines the results for conditions and procedures only reported in a single included study.

Discussion

Using systematic review methodology we found, evaluated and combined data from studies validating routinely collected data about mothers and newborns. We found that under-enumeration is common, in general the level of ascertainment increased as time to birth decreased. Most conditions and procedures had high specificities indicating few false positives however false positives can still outweigh true positives if the condition is rare, such as eclampsia, leading to a low PPV. Consistency of the reporting of a number of conditions and procedures across state and countries, such as delivery procedures, placental abruption, perineal trauma, birth weight and gestation, suggest that these conditions could be used with confidence and do not have to be validated repeatedly.

Hospital discharge data were generally more accurate and reliable than birth data, as previously suggested,[11] however identifying cases from more than one dataset further increased ascertainment without significantly increasing false positives.[36 37 41 42] Not only does linking datasets improve accuracy, it can provide a more comprehensive picture of medical histories, for example longitudinally linking antenatal hospital admissions to birth and delivery data to obtain more information about pre-existing maternal and pregnancy-related conditions. Coding standards state that conditions only need to be coded if they affect the current admission,[60] so pre-existing conditions are not required to be coded if they do not play an important role in the birth admission. Klemmensen *et al* increased sensitivity of preeclampsia by almost 10% when antenatal hospital admission records were included,[32] however Yasmeen *et al* found sensitivities increased by no more than 5% when they evaluated both delivery and linked antenatal records.[48]

The results of our review suggest another possible approach to increase ascertainment without significantly increasing false positives is to, where possible, use broad categories of diagnostic codes rather than specific codes for conditions or procedures. Broader categories capture cases that have been misclassified between more specific codes such as elective and emergency cesarean delivery,[42] gestational hypertension and pre-eclampsia,[31 41] and pre-gestational and gestational diabetes.[25 56] . Reporting of induction and augmentation of labor had consistently low specificities across datasets but this was mostly due to confusion between the two procedures.[48] Using a broad category identifying 'any stimulation of labor' may be more reliable and will avoid the misclassification between procedures. Including adult diagnosis codes for neonatal conditions, as found by Joseph *et al* with neonatal sepsis,[31] or non-pregnancy codes for conditions such as gestational diabetes may also improve ascertainment. However this may only be useful for some research questions, as combining conditions that have different risk factors and care requirements, such as pre-existing and gestational diabetes, may not be appropriate.[25]

Generally, procedures were more accurately reported than diagnoses, an observation also noted in other types of PHDS.[61 62] Surgical procedures such as cesarean section or neonatal surgery tend to be reliably reported regardless of data type,[48 59] whereas minor procedures such as repair of an obstetric tear or drainage of an air leak in a neonate were less accurately reported. It has been suggested that physicians may highlight major surgery procedures in surgical notes while minor procedures may not be as well documented.[62] However both major and minor procedures regularly have high PPVs and few false positives so the inclusion of procedures used for investigation or treatment as well as diagnosis codes can also improve ascertainment.[57]

Under-reporting of conditions in PHDS may not be random. Severe forms of pregnancy hypertension[33 41] and obstetric hemorrhage[34] were more likely to be reported than less severe forms of these conditions. This is also an important factor when using PHDS to answer research questions as less severe, or perhaps well-managed, conditions are systematically underreported. However higher PPVs for severe forms of preeclampsia,[48 54] and diabetes[25] indicate that PHDS can be used reliably to identify severe adverse events.

The quality of data recorded in administrative databases relies on information documented in the medical records. Gell**e**r *et al* found diagnostic error by clinicians occurred in 82% of misclassification errors in hospital discharge records compared to coding errors which occurred in 34% of inaccurately coded records. Coders are not clinicians and are not supposed to infer diagnoses from symptoms or treatments recorded in medical records and as such false negatives are more common than false positives. False positives do occur, for example when diagnoses are coded from notes based on concern or differential diagnoses but then 'ruled out' subsequent to laboratory or pathology reports, for example for anemia or infections.[48] Errors or exclusions in databases coded from hospital discharge records can occur at various stages of the coding process, however clinician training to highlight the importance of clear documentation of diagnoses and procedures in medical records has been identified as one place to improve data quality.[54]

Although the reporting of a number of conditions and procedures are similar between validation studies, many have differing results. One thing to keep in mind when comparing studies is the gold standard used. Abstraction of data from medical records was commonly used as a gold standard, however in a number of studies the data was secondary data, originally collected for purposes other than validation. The data abstracted for the gold standard is very important for the results. In some countries not all individuals performing chart review will

have access to all information that is available to the coder.[15] This is also the case with birth certificate data, hospital staff may have access to other sources of information, such as the mother or clinician, to complete the birth certificate that is not available to the chart reviewer.[45] A maternal interview may be a better gold standard for the reporting of maternal behaviors such as smoking or alcohol use.[10]

The aim of this systematic review was to compile studies validating routinely collected perinatal health data to be used as a research tool internationally however different methods of data collection makes comparing datasets across different countries difficult. Data for birth certificates in the US are collected in the hospital within a few days of a birth by various hospital staff.[10] A study investigating the collection of birth certificate data in five hospitals in Texas found methods of data collection differed between hospital but mothers and medical charts were often the sources of data with limited input from other medical sources.[63] In Australia birth data is collected by the attending midwife or doctor at the time of birth[2] similar to data collection for birth registry data in Scandinavian countries, Norway[24] and Finland[29]. Hospital discharge data is generally collected for billing purposes and is coded from medical records by certified coding specialists according to international coding specifications however different versions of International Classifications of Diseases (ICD) are used in different countries. The United States still uses ICD9 while ICD10 is now used in Australia[3 41 42], Denmark[32] and Canada[31].

Comparing data across different countries and healthcare systems has its limitations however a number of generalizations can still be made. In general, procedures and conditions occurring near birth are reliably reported, however other data, such as the reporting of pre-existing maternal conditions, are poorly reported and should be used with caution. Using broad categories, procedure codes and linking databases can all improve reporting of conditions

however the benefit of these methods will be determined by the research question. The accuracy and completeness of data in PHDS varies between different variables so the quality of the PHDS cannot be judged on the database as a whole[20]. For researchers wishing to determine the validity of specific variables from specific datasets and countries, separate results for each diagnosis and procedure for all included studies in this review are available at (website to be provided).

Perinatal PHDS are an available and easily accessible resource in developed countries but as the data they contain were not originally collected for the purpose of research, the quality of the data should be considered before use. An increase in the quality of routinely collected data has not necessarily accompanied an increase in the use of the data for research. In the US cost savings have led to many vital statistic agencies failing to implement or maintain quality assurance programmes.[64] To monitor and improve data quality, perinatal epidemiologists who wish to use these data have been urged to become involved with the decision-making process involved in collecting the data.[65] Although this comprehensive collection of validation studies summarizing the quality of perinatal population data will be an invaluable resource to all researchers working with PHDS, as part of using routinely collected data for research purposes, all researchers should endeavor to determine the validity and reliability of the dataset they are using and respect its limitations.

1. Nassar N, Bower C, Barker A. Increasing prevalence of hypospadias in Western Australia, 1980-2000. *Arch Dis Child* 2007;92(7):580-4.
2. Lain S, Ford J, Hadfield R, Blyth F, Giles W, Roberts C. Trends in epidural analgesia use in Australia. *International Journal of Gynaecology and Obstetrics* 2008;102:253-58.
3. Roberts CL, Algert CS, Carnegie M, Peat B. Operative delivery during labour: trends and predictive factors. *Paediatr Perinat Epidemiol* 2002;16:115-23.
4. Cameron CA, Roberts CL, Olive EC, Ford JB, Fischer W. Trends in postpartum haemorrhage. *Australian & New Zealand Journal of Public Health* 2006;30(2):151-56.
5. Algert CS, Bowen JR, Hadfield RM, Olive EC, Morris JM, Roberts CL. Birth at hospitals with co-located paediatric units for infants with diagnosable and correctable congenital malformations. *Australian and New Zealand Journal of Obstetrics & Gynaecology* 2008;48:273-79.
6. Lain SJ, Ford JB, Raynes-Greenow CH, Hadfield RM, Simpson JM, Morris JM, et al. The impact of the Baby Bonus payment in New South Wales: who is having "one for the country"? *Med J Aust* 2009;190(5):238-41.
7. Ford JB, Roberts CL, Bell JC, Algert CS, Morris J. Postpartum haemorrhage occurrence and recurrence: a population-based study. *Medical Journal of Australia* 2007;187(7):391-93.
8. Morris JM, Roberts CL, Crowther CA, Buchanan SL, Henderson-Smart DJ, Salkeld G. Protocol for the immediate delivery versus expectant care of women with preterm prelabour rupture of the membranes close to term (PPROMT) Trial [ISRCTN44485060]. *BMC Pregnancy Childbirth* 2006;6:9.
9. Lain SJ, Algert CS, Tasevski V, Morris JM, Roberts CL. Record linkage to obtain birth outcomes for the evaluation of screening biomarkers in pregnancy: a feasibility study. *BMC Med Res Methodol* 2009;9:48.
10. Northam S, Knapp TR. The reliability and validity of birth certificates. *J Obstet Gynecol Neonatal Nurs* 2006;35(1):3-12.
11. Devlin HM, Desai J, Walaszek A. Reviewing performance of birth certificate and hospital discharge data to identify births complicated by maternal diabetes. *Matern Child Health J* 2009;13(5):660-6.
12. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *J Clin Epidemiol* 2009;62(10):1006-12.
13. Woodward M. *Epidemiology: study design and data analysis.*: Chapman and Hall /CRC, 1999.
14. Henderson T, Shepheard J, Sundararajan V. Quality of diagnosis and procedure coding in ICD-10 administrative data. *Med Care* 2006;44(11):1011-9.
15. Humphries KH, Rankin JM, Carere RG, Buller CE, Kiely FM, Spinelli JJ. Co-morbidity data in outcomes research: are clinical data derived from administrative databases a reliable alternative to chart review? *J Clin Epidemiol* 2000;53(4):343-9.
16. Kirby R. Invited Commentary: Using Vital Statistics Databases for Perinatal Epidemiology: Does the Quality Go In Before the Name Goes On? *American Journal of Epidemiology* 2001;154(10):889-90.
17. Ananth CV. Perinatal epidemiologic research with vital statistics data: Validity is the essential quality. *American Journal of Obstetrics & Gynecology* 2005;193(1):5-6.
18. Bradford HM, Cardenas V, Camacho-Carr K, Lydon-Rochelle MT. Accuracy of birth certificate and hospital discharge data: A certified nurse-midwife and physician comparison. *Maternal and Child Health Journal* 2007;11(6):540-48.
19. Zollinger TW, Przybylski MJ, Gamache RE. Reliability of Indiana birth certificate data compared to medical records. *Annals of Epidemiology* 2006;16(1):1-10.

20. Health Canada. An evaluation of the quality of obstetric/neonatal discharge abstract data by reabstraction of medical charts. Ottawa: Health Canada, 2003.
21. NSW Health Department. Validation Study: NSW Midwives Data Collection 1998. *New South Wales Mothers and Babies 1998*: NSW Public Health Bulletin, State Publication No. (EPI) 000029, 2000:9(S-2):97-99. http://www.health.nsw.gov.au/public-health/mdc/mdcrep98.html.
22. Hunt R, Barr P. Errors in the certification of neonatal death. *Journal of Paediatrics and Child Health* 2000;36(5):498-501.
23. Lydon-Rochelle MT, Cardenas V, Nelson JL, Tomashek KM, Mueller BA, Easterling TR. Validity of maternal and perinatal risk factors reported on fetal death certificates. *Am J Public Health* 2005;95(11):1948-51.
24. Baghestan E, Bordahl PE, Rasmussen SA, Sande AK, Lyslo I, Solvang I. A validation of the diagnosis of obstetric sphincter tears in two Norwegian databases, the Medical Birth Registry and the Patient Administration System. *Acta Obstetricia et Gynecologica Scandinavica* 2007;86(2):205-9.
25. Bell JC, Ford JB, Cameron CA, Roberts CL. The accuracy of population health data for monitoring trends and outcomes among women with diabetes in pregnancy. *Diabetes Research & Clinical Practice* 2008;81(1):105-9.
26. Costakos DT, Love LA, Kirby RS. The computerized perinatal database: are the data reliable? *American Journal of Perinatology* 1998;15(7):453-9.
27. DiGiuseppe DL, Aron DC, Ranbom L, Harper DL, Rosenthal GE. Reliability of birth certificate data: a multi-hospital comparison to medical records information. *Maternal & Child Health Journal* 2002;6(3):169-79.
28. Engeland A, Bjorge T, Daltveit AK, Vollset SE, Furu K. Validation of disease registration in pregnant women in the Medical Birth Registry of Norway. *Acta Obstet. Gynecol. Scand.* 2009;88(10):1083-89.
29. Gissler M, Teperi J, Hemminki E, Merilainen J. Data quality after restructuring a national medical registry. *Scandinavian Journal of Social Medicine* 1995;23(1):75-80.
30. Hadfield RM, Lain SJ, Cameron CA, Bell JC, Morris JM, Roberts CL. The prevalence of maternal medical conditions during pregnancy and a validation of their reporting in hospital discharge data. *Australian and New Zealand Journal of Obstetrics and Gynaecology* 2008;48(1):78-82.
31. Joseph KS, Fahey J. Validation of perinatal data in the Discharge Abstract Database of the Canadian Institute for Health Information. *Chronic Diseases in Canada* 2009;29(3):96-100.
32. Klemmensen AK, Olsen SF, Osterdal ML, Tabor A. Validity of preeclampsia-related diagnoses recorded in a national hospital registry and in a postpartum interview of the women. *American Journal of Epidemiology* 2007;166(2):117-24.
33. Korst LM, Gregory KD, Gornbein JA. Elective primary caesarean delivery: Accuracy of administrative data. *Paediatric and Perinatal Epidemiology* 2004;18(2):112-19.
34. Lain S, Roberts C, Hadfield R, Bell J, J M. How accurate is the reporting of obstetric haemorrhage in hospital discharge data? A validation study. *Australian and New Zealand Journal of Obstetrics and Gynecology* 2008;48(5):481-85.
35. Lin CM, Lee PC, Teng SW, Lu TH, Mao IF, Li CY. Validation of the Taiwan Birth Registry using obstetric records. *Journal of the Formosan Medical Association* 2004;103(4):297-301.
36. Lydon-Rochelle MT, Holt VL, Cardenas V, Nelson JC, Easterling TR, Gardella C, et al. The reporting of pre-existing maternal medical conditions and complications of pregnancy on birth certificates and in hospital discharge data. *American Journal of Obstetrics and Gynecology* 2005;193(1):125-34.

37. Lydon-Rochelle MT, Holt VL, Nelson JC, Cardenas V, Gardella C, Easterling TR, et al. Accuracy of reporting maternal in-hospital diagnoses and intrapartum procedures in Washington State linked birth records. *Paediatric and Perinatal Epidemiology* 2005;19(6):460-71.
38. Park S, Sappenfield WM, Bish C, Bensyl DM, Goodman D, Menges J. Reliability and Validity of Birth Certificate Prepregnancy Weight and Height Among Women Enrolled in Prenatal WIC Program: Florida, 2005. *Maternal and Child Health Journal* 2009:1-9.
39. Pearl M, Wier ML, Kharrazi M. Assessing the quality of last menstrual period date on California birth records. *Paediatric and Perinatal Epidemiology* 2007;21 Suppl 2:50-61.
40. Pym M, Taylor L. Validation study of the NSW Midwives Data Collection 1990. *NSW Public Health Bulletin* 1993;1993(4):1-6.
41. Roberts CL, Bell JC, Ford JB, Hadfield R, Algert CS, Morris JM. The accuracy of reporting of the hypertensive disorders of pregnancy in population health data. *Hypertension in Pregnancy* 2008.
42. Roberts CL, Bell JC, Ford JB, Morris JM. Monitoring the quality of maternity care: how well are labour and delivery events reported in population health data? *Paediatric and Perinatal Epidemiology* 2009;23(2):144-52.
43. Roberts C L, Ford J B, Lain S, Algert CS, CJ. S. Use and accuracy of reporting of general anaesthesia for childbirth: a validation study. *Anaesthetics and Intensive Care* 2008;36(3):418-24.
44. Romano PS, Yasmeen S, Schembri ME, Keyzer JM, Gilbert WM. Coding of perineal lacerations and other complications of obstetric care in hospital discharge data. *Obstetrics and Gynecology* 2005;106(4):717-25.
45. Roohan PJ, Josberger RE, Acar J, Dabir P, Feder HM, Gagliano PJ. Validation of birth certificate data in New York State. *Journal of Community Health* 2003;28(5):335-46.
46. Taylor LK, Travis S, Pym M, Olive E, Henderson-Smart DJ. How useful are hospital morbidity data for monitoring conditions occurring in the perinatal period? *Australian and New Zealand Journal of Obstetrics and Gynaecology* 2005;45(1):36-41.
47. Vagg L, Taylor O, Riley M, Palma S, Halliday J. Validation of the Victorian Perinatal Morbidity Statistics form: new items, pre-coded text and free text. *Health Information Management* 1999;29(3):118-22.
48. Yasmeen S, Romano PS, Schembri ME, Keyzer JM, Gilbert WM. Accuracy of obstetric diagnoses and procedures in hospital discharge data. *American Journal of Obstetrics and Gynecology* 2006;194(4):992-1001.
49. Piper JM, Mitchel EF, Jr., Snowden M, Hall C, Adams M, Taylor P. Validation of 1989 Tennessee birth certificates using maternal and newborn hospital records. *American Journal of Epidemiology* 1993;137(7):758-68.
50. Reichman NE, Hade EM. Validation of birth certificate data. A study of women in New Jersey's HealthStart program. *Annals of Epidemiology* 2001;11(3):186-93.
51. Dobie SA, Baldwin LM, Rosenblatt RA, Fordyce MA, Andrilla CH, Hart LG. How well do birth certificates describe the pregnancies they report? The Washington State experience with low-risk pregnancies. *Maternal & Child Health Journal* 1998;2(3):145-54.
52. Parrish KM, Holt VL, Connell FA, Williams B, LoGerfo JP. Variations in the accuracy of obstetric procedures and diagnoses on birth records in Washington State, 1989. *American Journal of Epidemiology* 1993;138(2):119-27.
53. Centers for Disease C, Prevention. Use of hospital discharge data to monitor uterine rupture--Massachusetts, 1990-1997. *MMWR - Morbidity & Mortality Weekly Report* 2000;49(12):245-8.

54. Geller SE, Ahmed S, Brown ML, Cox SM, Rosenberg D, Kilpatrick SJ. International Classification of Diseases-9th revision coding for preeclampsia: how accurate is it? *American Journal of Obstetrics & Gynecology* 2004;190(6):1629-33; discussion 33-4.
55. Riley M, Halliday J. The accuracy of eclampsia cases reported to the Victorian Inpatient Minimum Database and the Perinatal Data Collection Unit. *Health Information Management* 1998;28(1):13-5.
56. Stene LC, Eidem I, Vangen S, Joner G, Irgens LM, Moe N. The validity of the diabetes mellitus diagnosis in the Medical Birth Registry of Norway. *Norsk Epidemiologi* 2007;17(2):165-74.
57. White RH, Brickner LA, Scannell KA. ICD-9-CM codes poorly indentified venous thromboembolism during pregnancy. *Journal of Clinical Epidemiology* 2004;57(9):985-88.
58. Vilain A, Otis S, Forget A, Blais L. Agreement between administrative databases and medical charts for pregnancy-related variables among asthmatic women. *Pharmacoepidemiology and Drug Safety* 2008;17(4):345-53.
59. Ford JB, Roberts CL, Algert CS, Bowen JR, Bajuk B, Henderson-Smart DJ. Using hospital discharge data for determining neonatal morbidity and mortality: A validation study. *BMC Health Services Research* 2007;7(-).
60. University of Sydney: National Centre for Classification in Health. Australian Coding Standards for ICD-10-AM, 2006.
61. Williams JI, Young WA. A Summary of Studies on the Quality of Health Care Administrative Databases in Canada. In: Goel V WJ, Anderson G, Blackstien-Hirsch P, Fooks C, Naylor D., editor. *In: Patterns of Health in Ontario. The ICES Practice Atlas, 2nd Ed.* Ottawa: Canadian Medical Association, 1996:339-45.
62. Quan H, Parsons GA, Ghali WA. Validity of procedure codes in International Classification of Diseases, 9th revision, clinical modification administrative data. *Med Care* 2004;42(8):801-9.
63. Northam S, Polancich S, Restrepo E. Birth Certificate Methods in Five Hospitals. *Public Health Nursing* 2003;20(4):319-27.
64. Kirby R. The Quality of Data Reported on Birth Certificates (Letter). *American Journal of Public Health* 1997;87(2):301.
65. Kirby R. The quality of vital perinatal statistics data, with special reference to prenatal care. *Paediatr Perinat Epidemiol* 1997;11:122-28.

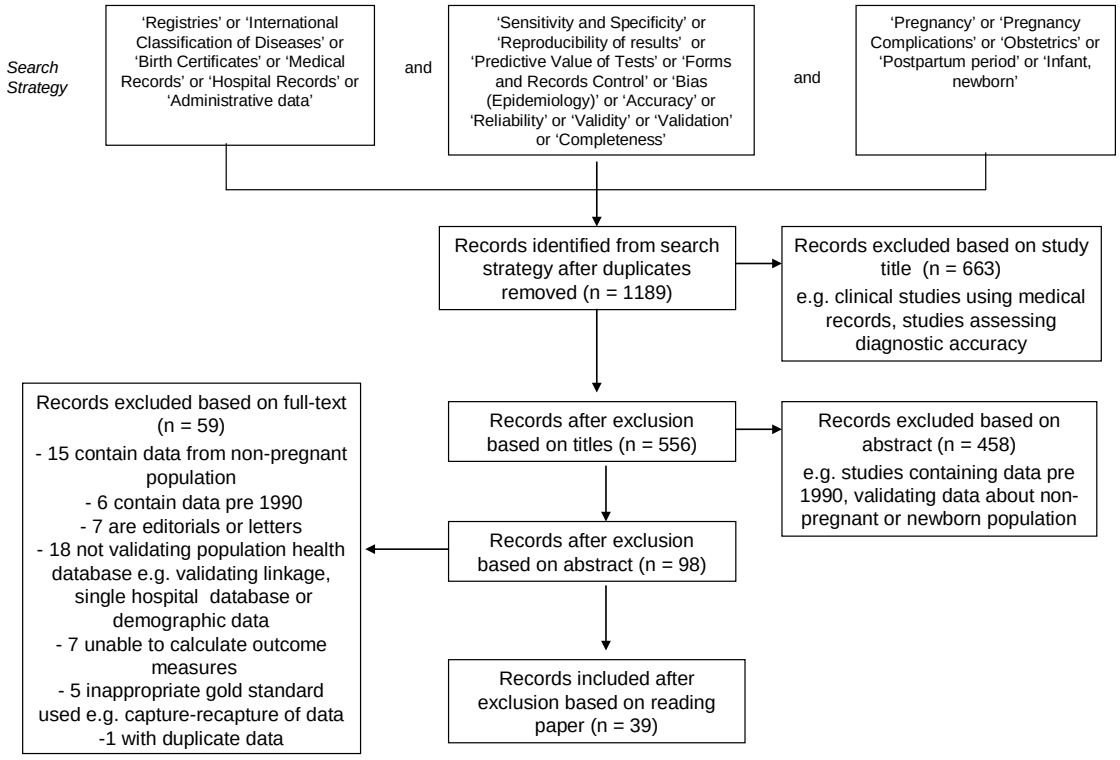

Figure 1. Flow chart of search strategy and included studies

Table 1. Characteristics of included studies

Author	Location	Study years	Population	Data source validated	Gold Standard	Outcomes validated
Baghestan *et al* 2007[24]	Norway	1990-1992 & 2000-2002	13,381 vaginal births in one hospital from 1990 to 1992 and 12,380 vaginal births from 2000 to 2002	Medical Birth Registry & Patient Administration System	Perineal tears, as recorded in the medical records, including the procedure record of surgical repair	Third or fourth degree perineal tears
Bell *et al* 2008[25]	Australia	2002	Stratified random selection of 1,200 records from births ≥ 20 weeks gestation or ≥ 400g in 2002 in a hospital with more than 50 births per annum	Birth registry & Hospital discharge database	Data abstracted from medical records by three clinicians experienced in chart review.	Pre-existing and gestational diabetes
CDC 2000[50]	Massachusetts, US	1990-1997	1244 suspected cases of uterine rupture discharged from a Massachusetts Hospital	Hospital records	Medical records of suspected cases, including registration sheets, discharge summaries and surgical reports, were reviewed by two clinicians	Uterine rupture
Costakos *et al* 1998[26]	Wisconsin, US	1995	99 randomly chosen maternal and infant charts from 893 births at Mayo health system hospital in 1995	Hospital record used for birth certificate	Hand abstraction of medical records by one reviewer	Both maternal and infant
Deneux-Tharaux *et al* 2005[19]	Massachusetts, North Carolina, Finland and France	1999-2000	404 pregnancy associated deaths from the four regions identified from the death certificates of women of reproductive age or linkage between death certificates with birth or fetal death registers	Death certificate	Panel of experts reassigning deaths as pregnancy-associated	Pregnancy-associated maternal mortality
DiGiuseppe *et al* 2002[13]	Ohio, US	1993-1995	33,616 singleton livebirths ≥ 500 grams at 20 hospitals that linked to medical record database	Birth certificates	Regional database of information abstracted in standard manner from medical records by trained medical record technicians	Both maternal and infant conditions
Engeland *et al* 2009[27]	Norway	2004-2007	108,489 first pregnancies after March 30, 2004 and before 1 January 2007	Birth registry	Prescriptions dispensed during last three months before conception and during pregnancy from a database containing all dispensed pharmaceuticals to individuals outside institutions in Norway	Pre-existing asthma, diabetes, epilepsy
Ford *et al* 2007[56]	Australia	1994-1996	2,432 infants born < 32 weeks, ≤ 1500 grams birthweight, had	Hospital discharge database	Neonatal Intensive Care Unit database containing data that are	Neonatal morbidity and

			mechanical ventilation for 4 hours or more, CPAP for 4 hours or more and/ or had major surgery		retrospectively abstracted from medical records.	mortality
Geller *et al* 2004[51]	Illinois, US	1999-2001	All 135 women with ICD9 diagnosis code of preeclampsia or eclampsia at University of Illinois Medical Centre from 1999 to 2001	Hospital discharge database	Medical chart review by a physician from Dept of O&G using guidelines of preeclampsia and eclampsia from ACOG	Eclampsia and preeclampsia
Gissler *et al* 1995[28]	Finland	1991	All 870 babies born > 500 grams or ≥ 22 weeks in a randomly selected 5 days in 1991 in one of 49 hospitals	Birth registry	Data abstraction from medical records by a trained research assistant	Both maternal and infant conditions
Hadfield *et al* 2008[29]	Australia	2002	Stratified random selection of 1,200 records from births ≥ 20 weeks gestation or ≥ 400g in 2002 in a hospital with more than 50 births per annum	Hospital discharge database	Data abstracted from medical records by three clinicians experienced in chart review.	Maternal medical conditions
Health Canada 2003[49]	Canada	1999-2000	All mothers and newborns charts were assigned a health indicator and a sample size was determined for each indicator. A total of 385 newborn and 891 mothers charts were randomly sampled from hospitals across Canada	Hospital discharge database	Classification specialists re-abstracted data from medical records, diagnoses and procedures that had not been used as indicator for sampling were also reviewed	Both maternal and infant conditions
Horon 2005[20]	Maryland, US	1993-2000	129 maternal deaths identified from linkage of death certificates of women of reproductive age with birth and fetal death records and a review of medical examiner records	Death certificate	Panel of experts to determine whether death met World Health Organisation definition of a maternal death	Maternal mortality
Hunt & Barr 2000[22]	Australia	1991-1997	All neonatal deaths (occurring less than 28 completed days) occurring at one hospital from January 1991 to December 1997	Perinatal death certificate	Clinico-pathological summary from clinical, laboratory and autopsy sources	Cause of neonatal death
Joseph *et al* 2009[30]	Canada	2002	6194 mothers and 6315 infants in Nova Scotia with perinatal data during a brief period in 2002 when data were simultaneously coded in Discharge Abstract Database and the Nova Scotia Atlee Perinatal Database	Hospital discharge database	Clinically focused perinatal database believed to have a relatively high degree of accuracy with regard to diagnoses and procedures	Both maternal and infant conditions
Klemmensen *et al* 2007[31]	Denmark	1998-2000	3,084 women who gave birth in 3 hospitals from 1998 to 2000 with electronic medical records	Hospital discharge database	Medical chart review using guidelines of preeclampsia and eclampsia from ACOG	Hypertension & preeclampsia
Korst *et al* 2004[32]	California, US	1996	440 women ≥20 weeks gestation, excluding women with previous CS,	Hospital discharge database	Data abstracted from medical records review by an obstetrician	Maternal conditions

			delivering at Cedars-Sinai Medical Center during September 1996.			
Lain *et al* 2008[33]	Australia	2002	Stratified random selection of 1,200 records from births ≥ 20 weeks gestation or ≥ 400g in 2002 in a hospital with more than 50 births per annum	Hospital discharge database	Data abstracted from medical records by three clinicians experienced in chart review.	Obstetric hemorrhage
Lin *et al* 2004[34]	Taiwan	1995-1997	2,779 singleton infants born in Taipei Municipal Hospital with a gynecologic record that could link to the Taiwan Birth Registry	Birth registry	Data abstracted from gynecological medical records of children	Infant birthweight and preterm
Lydon-Rochelle *et al* (a) 2005[36]	Washington, US	2000	Stratified random sample of 4,541 women who gave birth in a non-federal short stay hospital with > 50 births in Washington state in 2000. Women with LOS ≥3 days were oversampled	Birth certificate and hospital discharge database	Data abstracted from medical records by three trained medical record abstractors, including all physician, midwifery and nursing notes, medication lists, operative reports, laboratory reports, prenatal records where available, and consultation reports	Labor & delivery interventions and outcomes
Lydon-Rochelle *et al* (b) 2005[35]	Washington, US	2000	Stratified random sample of 4,541 women who gave birth in a non-federal short stay hospital with > 50 births in Washington state in 2000	Birth certificate and hospital discharge database	Data abstracted from medical records by three trained medical record abstractors, including all physician, midwifery and nursing notes, medication lists, operative reports, laboratory reports, prenatal records where available, and consultation reports	Maternal medical conditions
Lydon-Rochelle *et al* (c) 2005[23]	Washington, US	1996-2001	All 211 spontaneous fetal death records in a tertiary care centre between 1996 and 2991	Fetal death certificate	Data abstracted from medical records by a trained medical record abstractors, including all physician and nursing notes, autopsy and pathology reports, medical and surgical consultations and prenatal records.	Both maternal and infant conditions
NSW Health 2000[37]	Australia	1998	A random sample of 1,688 births from hospitals with more than 50 births in New South Wales in 1988	Birth registry	Recoding carried out by a health information manager and a clinical nurse consultant in midwifery, after medical record review.	Both maternal and infant conditions

Park *et al* 2009[38]	Florida, US	2005	23,314 women enrolled in the Women, Infants and Children (WIC) program that had weight and height measurements taken in the first trimester and could be linked to birth certificate data	Birth certificate	WIC program data, eligibility based on women who were pregnant or breastfeeding, or who have recently been pregnant, live in Florida, low income and nutritional risk.	Pre-pregnancy weight
Pearl *et al* 2007[39]	California, US	2002	105,936 singleton live birth records from 2002 with complete LMP data that linked with an Expanded Alphafetoprotein Screening Program (XAFP) record	Birth certificate	XAFP record estimating gestational age based on ultrasound, LMP or physical examination between 15 and 20 weeks gestation	Gestational age
Pym *et al* 1993[40]	Australia	1990	A random sample of 846 births from 30 hospitals with over 100 births per year in 1990	Birth registry	Recoding carried out by a health information manager and a clinical nurse consultant in midwifery, after medical record review.	Both maternal and infant conditions
Riley *et al* 1998[52]	Australia	1995	63 recorded cases of women with eclampsia code from all women giving birth in Victoria in 1995	Birth registry and Hospital discharge database	If record was coded as eclampsia both in birth and hospital data it was assumed eclampsia had been confirmed. Cases of eclampsia unique to each database were confirmed by examination of medical record	Eclampsia
Roberts *et al*(a) 2008[42]	Australia	2002	Stratified random selection of 1,200 records from births $\geq$ 20 weeks gestation or $\geq$ 400g in 2002 in a hospital with more than 50 births per annum	Birth registry and Hospital discharge database	Data abstracted from medical records by three clinicians experienced in chart review.	Labor & delivery interventions and outcomes
Roberts *et al* (b) 2008[41]	Australia	2002	Stratified random selection of 1,200 records from births $\geq$ 20 weeks gestation or $\geq$ 400g in 2002 in a hospital with more than 50 births per annum	Birth registry and Hospital discharge database	Data abstracted from medical records by three clinicians experienced in chart review.	Hypertension and preeclampsia
Roberts *et al* (c) 2008[43]	Australia	2002	Stratified random selection of 1,200 records from births $\geq$ 20 weeks gestation or $\geq$ 400g in 2002 in a hospital with more than 50 births per annum	Birth registry and Hospital discharge database	Data abstracted from medical records by three clinicians experienced in chart review.	General anesthesia for labor and delivery
Romano *et al* 2005[44]	California, US	1992-1993	Stratified random selection of 1,662 records from women who had given birth in a non-federal, licensed acute care hospital in California between 1	Hospital discharge database	Recoding of diagnoses and procedure codes by four reviewers experienced accredited record technicians or	Perineal lacerations

			January 1992 and 19 November 1993.		coding specialists from the medical records	
Roohan *et al* 2003[45]	New York, US	1999	440 randomly selected records from four different counties drawn from all births occurring between 1 July - 31 December 1999	Hospital discharge database	Clinical staff reviewed medical records, including hospital record of prenatal care, the infant's medical record and the birth certificate work booklet or abstract. Prenatal care records from obstetric providers were not requested so that reviewers used same documentation available to hospital staff	Both maternal and infant conditions
Salanave *et al* 1999[21]	Europe	1992-1994	359 deaths of women while pregnant or within one year of the end of the pregnancy reported from national statistical offices from enquiries into maternal deaths, and linkage between birth and death registrations in 13 European countries or regions	National enquiries into maternal deaths, linked death and birth registers and hospital registrations	Panel of experts reassigning deaths as obstetric or non-obstetric	Obstetric-related maternal mortality
Stene *et al* 2007[53]	Norway	1999-2004	419 births registered in birth registry between 1999 and 2004 by 331 mothers that could be linked to the diabetes registry	Birth registry	Childhood Diabetes Registry which prospectively registered all cases of newly diagnose type 1 diabetes	Maternal diabetes
Taylor *et al* 2005[46]	Australia	1999-2000	500 mothers and 500 infants randomly sampled from hospitals with 50 or more births from July 1999 to June 2000	Hospital discharge database	Recoding carried out by a health information manager and a clinical nurse consultant in midwifery, after medical record review.	Both maternal and infant conditions
Vagg *et al* 1999[47]	Australia	1998	Random selection of 650 records of births occurring in March 1998 from 22 hospitals	Birth registry	Data abstracted from medical record	Maternal conditions
Vilain *et al* 2008[55]	Canada	1990-2000	Random sample of 731 pregnancies that delivered between in 1999 - 2000, in women < 45 years, diagnosed with asthma or prescribed asthma medication and were covered by RAMG medication insurance plan	Hospital discharge database and Medical services database	Data abstracted from medical records	Maternal and infant characteristics in asthmatic women
White *et al* 2004[54]	California, US	1990-1998	214 records of women who delivered 1 or more infants at 1 of 12 hospitals in California with a code for venous thrombosis up to 280 days prior to delivery or up to 6 weeks after	Hospital discharge database	Medical charts of identified cases were reviewed by three physicians	Venous thrombo-embolism in pregnancy

			delivery			
Yasmeen *et al* 2006[48]	California, US	1992-1992	Stratified random selection of 1,662 records from women who had given birth in a non-federal, licensed acute care hospital in California between 1 January 1992 and 19 November 1993.	Hospital discharge database	Recoding of diagnoses and procedure codes by four reviewers experienced accredited record technicians or coding specialists from the medical records including associated prenatal records if available	Both maternal and infant conditions

Table 2. Sensitivity, specificity, positive predictive values (PPV) and Kappa ranges for pre-existing maternal conditions, antenatal behavior and pregnancy-related conditions reported in more than one included study

	Sensitivity Range		**Specificity Range**		**PPV Range**		**Kappa range***		**References**
	Birth data	*Hosp data*	*Birth data*	*Hosp data*	*Birth data*	*Hosp data*	*Birth data*	*Hosp data*	
Pre-existing conditions									
Prior pregnancy/live birth	95.3 – 98.0	-	97.5 – 98.0	-	99.0	-	Excellent	-	13, 55
Previous infant >4000g	6.0 – 12.2	-	99.0 – 99.5	-	50.0 – 64.1	-	Poor	-	13, 45
Pre-existing hypertension	0.0 – 71.4	44.4 – 85.7	97.0 – 99.8	99.8 – 100	0.0 - 83.0	85.7 - 100	Poor - Good	Good - Excel	13, 26, 30, 35, 37, 40, 41, 45, 47
Pre-existing diabetes	45.1 – 93.6	75.0 - 100.0	99.5 - 100	99.8 – 100	32.5 – 50.0	23.0 - 100.0	Poor - Good	Excellent	25, 27, 35, 37, 40, 45, 48, 53
Lung disease	0.0 - 18.0	7.2 - 16.3	99.4 – 99.0	99.1 – 99.6	0.0 - 50.9	17.3	Poor	Poor	13, 29, 35, 45
Asthma	51.0	12.3 – 42.0	98.0	98.9 – 99.4	46.0	2.0 – 91.0	-	-	27, 29, 48
Heart disease	10.9 - 29.3	12.0 - 52.7	93.0 – 99.6	95.9 – 99.0	7.0 - 25.9	95.9 – 99.0	Poor	Poor	13, 29, 35, 45, 48
Renal disease	1.9 – 55.5	11.9 - 47.0	99.0 - 100	100	8.8 – 75.0	100	Poor	Good	13, 29, 35, 45
Genital Herpes	33.2 – 67.0	9.0 - 69.0	99.6 - 100	99.5 – 99.9	57.3 – 92.0	69.0 – 80.0	Good	-	13, 32, 35, 45, 48
Anemia	10.6 – 67.0	5.7 - 12.0	95.0 – 99.0	99.9	32.7 – 36.0	14.0 – 73.1	Poor	Poor	13, 29, 35, 45, 48
Thyroid disease	80.0	10.0 – 96.6	100	99.7	100.0	50.0 – 100.0	-	Good	29, 45, 48
Incompetent cervix	38.9 – 50.0	-	99.9 - 100	-	77.3 – 100.0	-	Good	-	13, 45
Pre-pregnancy weight/ Obesity	61.1 – 86.0	11.0	82.4 – 97.5	-	48.0 – 92.7	49.0	-	-	38, 48
Antenatal behavior/service utilization									
Tobacco smoking	64.0 – 89.0	15.0 – 66.3	95.0 – 99.0	99.0	80.0 – 94.3	93.0 – 96.0	Excellent	Good	13, 23, 26, 45, 46
Alcohol use	20.0 – 86.0	15.0	95.0 – 99.0	-	50.0 – 75.0	97.0	Poor	-	13, 26, 45, 48
Amniocentesis/CVS	75.0 – 80.0	-	98.8 - 100	-	69.6 – 100.0	-	Excellent	-	23, 37, 40, 47

Pregnancy-related conditions									
Gestational hypertension	33.6 – 72.0	10.0 – 70.6	98.6 – 99.0	97.9 – 99.8	56.8 – 72.0	56.3 – 97.0	Good	Poor - Exc	13, 31, 36, 40, 41, 45, 46, 48
Pre-eclampsia	62.0 – 87.0	50.0 - 88.0	96.0 - 100	99.2 – 99.8	31.6 – 100.0	49.1 - 91.7	Good - Exc	Good	30, 31, 37, 41, 45-49, 51
Severe preeclampsia	-	43.6 – 76.0	-	99.9 – 100	-	76.9 – 100.0	-	Good	31, 41, 48, 51
Any pregnancy hypertension	63.3	48.9 – 87.9	99.5	99.6	92.4	99.6	Good	Excellent	30, 31, 41
Eclampsia	0.0 - 50.0	50.0 - 100.0	99.3 - 100	99.9	25.8	23.5 – 41.7	Poor	Poor	13, 36, 41, 45, 51, 52
Gestational diabetes	45.8 – 86.7	68.6 – 95.5	99.0 – 99.8	99.6 -100	71.9 – 85.8	95.5 – 99.	Good - Exc	Excellent	13, 25, 26, 36, 37, 40, 45, 46
Urinary tract infections	-	20.0 – 39.0	-	-	-	41.0 – 45.0	-	-	44, 48

*Kappa values: <0.4 = Poor, 0.4-0.74 = Good, ≥0.75 = Excellent

CVS = Chrionic Villius Sampling

Table 3. Sensitivity, specificity, positive predictive values and Kappa ranges for conditions and procedures relating to labor and delivery and infants reported in more than one included study

	Sensitivity Range		Specificity Range		PPV Range		Kappa range*		References
	Birth data	*Hosp data*	*Birth data*	*Hosp data*	*Birth data*	*Hosp data*	*Birth data*	*Hosp data*	
Labor and delivery conditions/procedures									
Cesarean delivery (CS)	85.1 – 98.0	73.1 - 100.0	98.2 - 100	98.1 – 98.7	89.6 – 100.0	70.4 – 99.8	Excellent	Excellent	30, 32, 42, 44, 45, 49
Repeat CS	60.9 – 100.0	74.0	99.3 - 100	-	65.1 – 100.0	91.0 – 99.3	Excellent	Excellent	13, 28, 36, 45, 48, 49
Vaginal birth after CS	60-8 – 100.0	36.4	99.6 - 100	99.5 – 100	89.3 – 100.0	98.7 – 100.0	Good	Good	13, 36, 45, 46, 49
Induction	52.4 - 92.5	45.0 - 89.2	97.2 – 98.7	96.9 – 98.7	88.0 - 96.1	88.0 - 95.4	Excellent	Excellent	30, 36, 42, 48
Augmentation	34.4 - 55.2	58.2	92.6 – 97.1	94.9	60.3 - 86.3	79.1	Good	Good	36, 42
Induction/augmentation specified by use of ARM or pharmaceutical	47.0 – 89.9	32.0 – 60.0	97.7 – 99.5	76.0	-	76.0 – 87.2	Good	Excellent	28, 37, 48, 49
Forceps delivery	55.4 - 96.1	84.6 - 92.2	99.9 - 100	99.8 – 99.9	89.1 - 100.0	95.4 – 99.0	Excellent	Excellent	36, 42, 48, 49
Vacuum delivery	99.9	86.6 – 94.0	99.5	99.5	93.7	92.6 – 96.0	Excellent	Excellent	42, 48, 49
Placental abruption	51.9 – 75.0	50.0 - 79.1	99.8 - 100	99.8 – 100	67.2 – 100.0	82.0 - 100.0	Good - Exc	Good - Exc	13, 33, 36, 40, 46, 48
Placenta previa	33.3 – 66.7	66.7 - 98.9	99.8 - 100	99.8 – 100	75.2	71.9 - 100.0	Good	Good - Exc	13, 33, 36, 40, 46, 48
Antepartum hemorrhage	41.9	20.0 – 75.8	99.1 - 100	99.0 - 100	100.0	65.7 – 100.0	Good	-	13, 32, 33, 45, 47, 48
Premature Rupture of Membranes	29.0 – 72.2	45.0 – 66.7	97.7 – 99.8	98.0	25.1 – 96.3	6.7 – 100.0	Poor - Exc	Good - Exc	13, 40, 45-49

Malpresentation / Breech	22.0 – 65.4	81.5 – 90.0	83.0 – 99.5	99.3	7.0 – 96.3	88.0 – 99.3	Good	-	13, 32, 45, 48, 49
Obstructed labor	-	35.0 – 75.0	-	97.6 – 99.3	-	69.1 – 90.9	-	Good - Exc	42, 46, 48, 49
Precipitous or Long labor	9.0 – 33.0	36.0	99.0	-	67.0 – 75.0	25.0 – 76.8	-	-	45, 48, 49
Fetal distress/ Meconium staining	0.0 – 39.4	68.0	98.0 – 99.0	-	14.0 – 75.7	69.0	Good	-	13, 26, 45, 48
Analgesia/Anesthesia	62.1 – 96.9	18.8 – 34.1	95.5 - 100	100	99.8	83.0 – 99.2	Good - Exc	Good - Exc	28, 37, 40, 42, 44
Episiotomy	82.9 - 83.7	67.3 - 84.4	98.9 – 99.8	99.4 – 99.7	98.6	95.0 - 97.4	Excellent	Excellent	33, 36, 40, 48, 49
3rd or 4th degree perineal tear	75.0 - 91.8	52.1 - 99.5	99.5 – 99.9	97.2 – 100	75.7 - 95.4	65.0 - 100.0	Excellent	Good - Exc	24, 30, 33, 40, 42, 44, 46, 49
Repair of 3rd or 4th degree tear	81.8	51.0 – 80.6	99.6	100	75.7	41.0 - 100.0	Excellent	Excellent	33, 42, 44
Postpartum hemorrhage	65.9 – 100.0	21.0 - 90.2	97.8 - 100	98.2 – 99.8	100.0	83.9 - 98.0	Good - Exc	Good	33, 40, 44, 46, 47, 49
Postpartum/puerperal infection	0.0	19.0 – 68.0	98.0	99.8 – 99.9	-	98.5 – 98.8	Poor	Good	36, 40, 44, 46
Infant outcomes									
Single/multiple birth	98.8	83.3 – 100.0	98.3	72.2 – 100	97.4	98.9 – 100.0	Excellent	Excellent	13, 32, 46, 48
Infant gender	97.0 – 99.5	-	98.0 – 99.5	-	98.0 – 99.5	-	Excellent	-	13, 55
Preterm birth (<37 weeks)	84.8 - 92.8	75.8 - 91.2	98.3 – 99.6	98.0 – 99.8	79.5 - 93.4	92.7 - 96.2	Excellent	Good - Exc	30, 32, 34, 39, 46
Low birthweight	99.4 - 100.0	97.7 - 100	96.9 - 100	99.7 – 99.8	99.7 - 100.0	92.3 - 99.8	Excellent	Excellent	13, 34, 45, 46, 56
Respiratory distress/ ventilation	46.0 – 71.4	42.1 - 94.2	-	85.3 - 100	93.0	85.3 - 100.0	-	Good - Exc	28, 30, 40, 46, 49, 56
Fetal/birth asphyxia	-	14.3 – 66.7	-	99.3 – 99.6	-	50.0	-	Good	30, 46, 49
Intraventricular hemorrhage	-	52.0 – 100.0	-	98.4 - 100	-	86.1 – 100.0	-	Good - Exc	30, 46, 56

*Kappa values: <0.4 = Poor, 0.4-0.74 = Good, ≥0.75 = Excellent

ARM = Artificial rupture of membrane

Table I. Accuracy and completeness of reporting pre-existing maternal medical conditions and antenatal behaviour

Condition	Author (Country) Year	Source of data[a]	N	Cases in gold std	Sens %	Spec %	PPV %	NPV %	Kappa
Previous pregnancy									
Prior pregnancy	DiGiuseppe (USA) 2002	B	33616	-	95.3	97.5	99.0	89.0	Excel
Previous live birth	Vilain (Canada) 2008	B	724	412	98.0	98.0	99.0	98.0	-
Previous live birth	Dobie (US) 1998	B	1937	-	99.7	-	-	-	Excel
No live births	Dobie (US) 1998	B	1937	-	96.5	-	-	-	Excel
1 live birth	Dobie (US) 1998	B	1937	-	95.8	-	-	-	Excel
2 live births	Dobie (US) 1998	B	1937	-	91.9	-	-	-	Excel
3 live births	Dobie (US) 1998	B	1937	-	-	-	-	-	Excel
≥1 prior pregnancies	Lydon-Rochelle(c) (USA) 2005	D	211	153	95.0	98.1	99.3	88.3	-
≥1 prior live births	Lydon-Rochelle(c) (USA) 2005	D	211	171	64.4	92.9	97.9	33.3	-
Previous infant with LBW	Roohan (USA) 2003	B	440	-	27.0	94.0	21.0	96.0	-
Previous infant SGA	DiGiuseppe (USA) 2002	B	33616	-	19.8	99.5	70.1	95.4	Poor
Previous preterm or SGA infant	Reichman (USA) 2001	B	46437	546	10.7	99.3	39.4	96.1	-
Previous infant SGA (cases)	Piper (USA) 1993	B	1016	22	18.2	-	30.8	98.1	-
Previous infant SGA (controls)	Piper (USA) 1993	B	634	8	12.5	-	25.0	98.9	-
Previous infant >4000g	Roohan (USA) 2003	B	440	-	6.0	99.0	50.0	92.0	-
Previous infant >4000g	DiGiuseppe (USA) 2002	B	33616	-	12.2	99.5	64.1	94.2	Poor
Previous infant >4000g	Reichman (USA) 2001	B	46437	742	5.5	99.7	23.2	98.5	-
Previous infant >4000g (cases)	Piper (USA) 1993	B	1016	19	15.8	-	50.0	98.4	-
Previous infant >4000g (controls)	Piper (USA) 1993	B	634	20	35.0	-	63.6	97.9	-
Previous preterm infant (<37 weeks)	Roohan (USA) 2003	B	440	-	3.0	97.0	8.0	93.0	-
Previous infant <37 weeks (cases)	Piper (USA) 1993	B	1016	155	34.2	-	62.3	88.6	-
Previous infant <37 weeks (controls)	Piper (USA) 1993	B	634	19	31.6	-	75.0	97.9	-
Previous spontaneous	Roohan (USA) 2003	B	440	-	38.0	99.0	86.0	90.0	-

fetal death									
Pre-existing hypertension									
Pre-existing hypertension	DiGiuseppe (USA) 2002	B	33616	-	31.9	99.6	37.3	99.4	Poor
Pre-existing hypertension	Costakos (USA) 1998	B	99	8	63.0	99.0	83.0	-	-
Pre-existing hypertension	Vagg (Aust) 1999	B	647	4	71.4	99.5	62.5	99.7	Good
Pre-existing hypertension	Roohan (USA) 2003	B	440	-	0.0	97.0	0.0	99.0	-
Pre-existing hypertension	Lydon-Rochelle(b) (USA) 2005	B	3701	-	47.1	99.7	-	-	-
Pre-existing hypertension	Pym (Aust) 1993	B	846	8	66.7	99.8	-	-	Good
Pre-existing hypertension	NSW Health (Aust) 2000	B	1688	9	62.5	99.8	-	-	Good
Pre-existing hypertension	Roberts(b) (Aust) 2008	B	1184	25	22.6	99.8	56.3	-	Poor
Pre-existing hypertension	Dobie (US) 1998	B	1937	-	7.3	-	-	-	Poor
Pre-existing hypertension	Reichman (USA) 2001	B	46437	454	18.7	99.7	34.8	99.2	-
Pre-existing hypertension (cases)	Piper (USA) 1993	B	1016	58	41.4	-	82.8	96.4	-
Pre-existing hypertension (controls)	Piper (USA) 1993	B	634	7	42.9	-	100	99.4	-
Pre-existing hypertension	Roberts(b) (Aust) 2008	H	1184	25	44.4	100	100	-	Good
Pre-existing hypertension	Lydon-Rochelle(b) (USA) 2005	H	3701	-	49.4	99.9	-	-	-
Pre-existing hypertension	Taylor (Aust) 2005	H	490	7	85.7	99.8	85.7	99.8	Excel
Pre-existing hypertension	Joseph (Canada) 2009	H	6194	-	83.3	99.9	-	-	-
Pre-existing hypertension	Roberts(b) (Aust) 2008	B or H	1184	25	46.9	99.8	72.7	-	Good
Pre-existing hypertension	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	70.3	99.6	-	-	-
Pre-existing hypertension	Lydon-Rochelle(c) (USA) 2005	D	211	22	81.0	97.5	81.0	97.5	-
Other hypertension	Korst (USA) 2004	H	440	33	69.7	100	100	97.6	-
Severe hypertension	Korst (USA) 2004	H	440	6	100	100	100	100	-
Pre-existing diabetes									
Diabetes mellitus	Roohan (USA) 2003	B	440	-	50.0	100	50.0	100	-
Pregestational diabetes	Bell (Aust) 2008	B	1184	11	45.1	99.7	32.5	99.8	Poor
Established diabetes mellitus	Lydon-Rochelle(b) (USA) 2005	B	3701	-	52.2	99.6	-	-	-
Diabetes mellitus	Pym (Aust) 1993	B	846	5	50.0	99.5	-	-	Poor
Diabetes mellitus	NSW Health (Aust) 2000	B	1688	8	66.7	99.9	-	-	Good
Diabetes mellitus (cases)	Piper (USA) 1993	B	1016	43	65.1	-	84.8	98.4	-
Diabetes mellitus (controls)	Piper (USA) 1993	B	634	23	73.9	-	85.0	99.0	-
Type I diabetes	Stene (Norway) 2007	B	419	-	88.1	-	-	-	-

Pregestational diabetes	Stene (Norway) 2007	B	419	-	93.6	-	-	-	-
Type I diabetes: with insulin use	Engeland (Norway) 2009	B	108489	322	90.0	100	56.0	-	-
Diabetes	Reichman (USA) 2001	B	46437	1599	42.1	99.3	68.8	98.0	-
Diabetes	Dobie (US) 1998	B	1937	-	52.0	-	-	-	Good
Diabetes mellitus	Yasmeen (USA) 2006	H	1614	14	75.0	-	23.0	-	-
Pregestational diabetes	Bell (Aust) 2008	H	1184	11	100	100	100	100	Exc
Established diabetes mellitus	Lydon-Rochelle(b) (USA) 2005	H	3701	-	95.3	99.8	-	-	-
Pregestational diabetes	Bell (Aust) 2008	B or H	1184	11	100	99.7	51.6	100	Good
Established diabetes mellitus	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	96.9	99.5	-	-	-
Established diabetes	Lydon-Rochelle(c) (USA) 2005	D	211	5	100	99.4	83.3	100	-
Any diabetes	Engeland (Norway) 2009	B	108489	1289	72.0	99.0	48.0	-	
Any diabetes	Bell (Aust) 2008	B	1184	-	67.4	99.7	93.0	98.3	Excel
Any diabetes	Bell (Aust) 2008	H	1184	-	70.4	100	99.7	98.4	Excel
Any diabetes	Bell (Aust) 2008	B or H	1184	-	74.6	99.7	93.4	98.7	Excel
Respiratory conditions									
Asthma	Engeland (Norway) 2009	B	108489	4141	51.0	98.0	46.0	-	-
Asthma	Yasmeen (USA) 2006	H	1614	22	42.0	-	91.0	-	-
Asthma	Hadfield (Aust) 2008	H	1184	135	12.3	98.9	2.0	99.8	Poor
Lung Disease	DiGiuseppe (USA) 2002	B	33616	-	18.0	99.4	50.9	97.4	Poor
Chronic lung disease	Roohan (USA) 2003	B	440	-	0.0	99.0	0.0	94.0	-
Chronic lung disease	Hadfield (Aust) 2008	H	1184	4	7.2	99.1	17.3	97.5	Poor
Acute or chronic lung disease	Reichman (USA) 2001	B	46437	1850	7.6	99.6	44.6	96.3	-
Acute or chronic lung disease	Lydon-Rochelle(b) (USA) 2005	B	3701	-	10.3	99.4	-	-	-
Acute/chronic lung disease (cases)	Piper (USA) 1993	B	1016	52	11.5	-	60.0	95.2	-
Acute/chronic lung disease (controls)	Piper (USA) 1993	B	634	21	9.5	-	100	96.7	-
Acute or chronic lung disease	Lydon-Rochelle(b) (USA) 2005	H	3701	-	16.3	99.6	-	-	-
Acute or chronic lung disease	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	24.6	99.1	-	-	-
Cardiac conditions									
Heart disease	DiGiuseppe (USA) 2002	B	33616	-	10.9	99.6	25.9	99.0	Poor

Heart disease	Roohan (USA) 2003	B	440	-	13.0	93.0	7.0	96.0	-
Heart disease	Lydon-Rochelle(b) (USA) 2005	B	3701	-	29.3	99.9	-	-	-
Cardiac disease	Reichman (USA) 2001	B	46437	692	9.5	99.8	41.0	98.7	-
Cardiac disease (cases)	Piper (USA) 1993	B	1016	26	7.7	-	40.0	97.5	-
Cardiac disease (controls)	Piper (USA) 1993	B	634	16	12.5	-	100	97.8	-
Cardiovascular disease	Yasmeen (USA) 2006	H	1614	37	12.0	-	99.0	-	-
Heart disease	Lydon-Rochelle(b) (USA) 2005	H	3701	-	52.7	100	-	-	-
Heart disease	Hadfield (Aust) 2008	H	1184	32	22.9	100	95.9	99.1	Poor
Heart disease	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	53.7	99.7	-	-	-
Sexually transmitted disease									
Genital herpes	DiGiuseppe (USA) 2002	B	33616	-	33.2	99.7	57.3	99.2	Good
Genital herpes	Roohan (USA) 2003	B	440	-	67.0	100	92.0	98.0	-
Active genital herpes	Lydon-Rochelle(b) (USA) 2005	B	3701	-	38.0	99.6	-	-	-
Established genital herpes	Lydon-Rochelle(b) (USA) 2005	B	3701	-	36.7	99.6	-	-	-
Genital herpes	Reichman (USA) 2001	B	46437	570	11.4	99.9	56.0	98.9	-
Active genital herpes (controls)	Piper (USA) 1993	B	634	7	57.1	-	100	99.5	-
Genital herpes	Yasmeen (USA) 2006	H	1614	38	9.0	-	69.0	-	-
Herpes	Korst (USA) 2004	H	440	25	32.0	99.5	80.0	96.0	-
Active genital herpes	Lydon-Rochelle(b) (USA) 2005	H	3701	-	69.0	99.9	-	-	-
Active genital herpes	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	77.0	99.5	-	-	-
Sexually transmitted diseases	Costakos (USA) 1998	B	99	3	0.0	100	2.0	-	-
Sexually transmitted diseases, other	Roohan (USA) 2003	B	440	-	43.0	99.0	60.0	99.0	-
Renal diseases									
Renal disease	DiGiuseppe (USA) 2002	B	33616	-	14.5	99.7	8.8	99.8	Poor
Renal disease	Roohan (USA) 2003	B	440	-	55.0	99.0	75.0	99.0	-
Renal disease	Lydon-Rochelle(b) (USA) 2005	B	3701	-	1.9	100	-	-	-
Renal disease	Reichman (USA) 2001	B	46437	241	2.9	99.9	10.9	99.5	-
Renal disease (cases)	Piper (USA) 1993	B	1016	19	21.0	-	50.0	98.5	-
Renal disease	Hadfield (Aust) 2008	H	1184	17	47.0	100	100	99.9	Good
Renal disease	Lydon-Rochelle(b) (USA) 2005	H	3701	-	11.9	100	-	-	-

Renal disease	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	12.6	100	-	-	-
Anemia									
Anemia	DiGiuseppe (USA) 2002	B	33616	-	10.6	99.0	32.7	96.4	Poor
Anemia	Roohan (USA) 2003	B	440	-	67.0	95.0	36.0	99.0	-
Anemia	Reichman (USA) 2001	B	46437	7055	12.0	97.3	44.4	86.1	-
Anemia (cases)	Piper (USA) 1993	B	1016	137	21.9	-	42.9	88.2	-
Anemia (controls)	Piper (USA) 1993	B	634	27	14.8	-	23.5	96.2	-
Anemia	Yasmeen (USA) 2006	H	1614	89	12.0	-	14.0	-	-
Anemia	Lydon-Rochelle(c) (USA) 2005	D	211	3	66.7	98.3	40.0	99.4	-
Nutritional anemias	Hadfield (Aust) 2008	H	1184	44	5.7	99.9	73.1	97.0	Poor
Hemolytic anemias	Hadfield (Aust) 2008	H	1184	13	93.6	99.4	22.5	100	Poor
Thyroid/parathyroid disease									
Thyroid diseases	Roohan (USA) 2003	B	440	-	80.0	100	100	99.0	-
Thyroid diseases	Yasmeen (USA) 2006	H	1614	24	10.0	-	100	-	-
Thyroid diseases	Hadfield (Aust) 2008	H	1184	34	96.6	99.7	50.	100	Good
Parathyroid diseases	Hadfield (Aust) 2008	H	1184	2	0.0	100	n/a	99.9	-
Tobacco, alcohol & drug use									
Tobacco smoking	DiGiuseppe (USA) 2002	B	33616	-	72.2	98.5	94.3	91.3	Excel
Tobacco smoking	Costakos (USA) 1998	B	99	25	64.0	95.0	80.0	-	-
Tobacco smoking	Roohan (USA) 2003	B	440	-	89.0	99.0	89.0	99.0	-
Tobacco use	Reichman (USA) 2001	B	46437	12385	52.7	92.3	71.3	84.3	-
Tobacco use (cases)	Piper (USA) 1993	B	1016	324	73.5	-	94.8	87.4	-
Tobacco use (controls)	Piper (USA) 1993	B	634	164	78.0	-	96.2	92.4	-
Tobacco smoking	Yasmeen (USA) 2006	H	1614	149	15.0	-	96.0	-	-
Tobacco smoking	Taylor (Aust) 2005	H	490	80	66.3	99.0	93.0	93.8	Good
Tobacco smoking	Lydon-Rochelle(c) (USA) 2005	D	211	42	78.6	98.4	91.7	95.6	-
Alcohol use	Costakos (USA) 1998	B	99	10	20.0	95.0	50.0	-	-
Alcohol use	DiGiuseppe (USA) 2002	B	33616	-	23.3	99.4	77.0	94.1	Poor
Alcohol use	Roohan (USA) 2003	B	440	-	86.0	99.0	75.0	100	-
Alcohol use (cases)	Piper (USA) 1993	B	1016	88	30.7	-	75.0	93.0	-
Alcohol use (controls)	Piper (USA) 1993	B	634	56	33.9	-	82.6	93.2	-
Alcohol use	Reichman (USA) 2001	B	46437	3864	18.4	97.7	41.8	92.9	-
Alcohol abuse and mental disorders	Yasmeen (USA) 2006	H	1614	176	15.0	-	97.0	-	-
Drug abuse	Yasmeen (USA) 2006	H	1614	51	38.0	-	98.0	-	-

Health Service Utilization

IVF	Roohan (USA) 2003	B	440	-	80.0	100	80.0	100	-
Fertilization, other treatments	Roohan (USA) 2003	B	440	-	56.0	99.0	71.0	99.0	-
Amniocentesis (<22 weeks)	Vagg (Aust) 1999	B	647	12	75.0	100	100	99.5	Excel
Amniocentesis	NSW Health (Aust) 2000	B	1680	57	78.3	99.4	-	-	Excel
Amniocentesis	Dobie (US) 1998	B	1937	-	69.1	-	-	-	Good
Amniocentesis	Reichman (USA) 2001	B	46437	1660	19.2	98.5	32.0	97.1	-
Amniocentesis (cases)	Piper (USA) 1993	B	1016	115	47.8	-	63.8	93.3	-
Amniocentesis (controls)	Piper (USA) 1993	B	634	33	60.6	-	69.0	97.8	-
Amniocentesis	Lydon-Rochelle(c) (USA) 2005	D	211	58	55.2	90.7	69.6	84.0	-
Amniocentesis/CVS	Pym (Aust) 1993	B	846	14	80.0	98.8			Good
CVS	NSW Health (Aust) 2000	B	1680	21	77.8	99.6	-	-	Good
First trimester care	Reichman (USA) 2001	B	46437	16704	82.0	63.6	55.9	86.3	-
Prenatal care received	DiGiuseppe (USA) 2002	B	33616	-	99.6	67.8	99.6	67.3	Good
Number of prenatal visits	Dobie (US) 1998	B	1937	-	-	-	-	-	Poor
Ultrasound examination < 21 weeks	Gissler (Finland) 1995	B	865	723	92.0	-	-	-	-
Ultrasound	Dobie (US) 1998	B	1937	-	63.0	-	-	-	Poor
Ultrasound (cases)	Piper (USA) 1993	B	1016	919	66.6	-	97.9	12.5	-
Ultrasound (controls)	Piper (USA) 1993	B	634	565	67.8	-	97.5	16.5	-
Sonography	Reichman (USA) 2001	B	46437	43994	44.2	67.3	96.1	6.3	-
Fetal monitoring	Dobie (US) 1998	B	1937	-	78.4	-	-	-	Poor
Electronic fetal monitoring	Gissler (Finland) 1995	B	865	745	85.0	-	-	-	-
Electronic fetal monitoring, internal (cases)	Piper (USA) 1993	B	1016	184	69.6	-	45.6	92.1	-
Electronic fetal monitoring, internal (controls)	Piper (USA) 1993	B	634	386	77.2	-	81.4	66.4	-
Electronic fetal monitoring, external (cases)	Piper (USA) 1993	B	1016	917	73.1	-	97.2	16.8	-
Electronic fetal monitoring, external (controls)	Piper (USA) 1993	B	634	612	73.7	-	98.0	4.2	-
Hospital treatment for high blood pressure	Gissler (Finland) 1995	B	865	36	83.0	-	-	-	-

Hospital treatment for threatened preterm birth	Gissler (Finland) 1995	B	865	32	44.0	-	-	-	-
Tocolysis	Reichman (USA) 2001	B	46437	3768	4.0	99.0	26.0	92.1	-
Tocolysis (cases)	Piper (USA) 1993	B	1016	416	32.2	-	89.3	66.3	-
Tocolysis (controls)	Piper (USA) 1993	B	634	35	37.1	-	59.1	96.4	-
Maternal transport prior to delivery (cases)	Piper (USA) 1993	B	1016	289	57.4	-	96.5	85.4	-
Maternal transport prior to delivery	Reichman (USA) 2001	B	46437	422	18.0	99.9	62.8	99.3	-
Other pre-existing conditions									
Mental health disorders	Hadfield (Aust) 2008	H	1184	63	4.4	100	60.3	99.6	Poor
Psychotic episodes	Hadfield (Aust) 2008	H	1184	2	28.1	100	100	100	Good
Epilepsy	Engeland (Norway) 2009	B	108489	426	74.0	98.0	37.0	-	-
Obesity	Yasmeen (USA) 2006	H	1614	65	11.0	-	49.0	-	-
Obese: pre-pregnancy weight	Park (USA) 2009	B	23314	6844	76.4	97.5	92.7	90.8	-
Underweight: pre-pregnancy weight	Park (USA) 2009	B	23314	867	77.3	96.8	48.0	99.1	-
Normal pre-pregnancy weight	Park (USA) 2009	B	23314	9318	86.0	82.4	76.5	89.8	-
Overweight: pre-pregnancy weight	Park (USA) 2009	B	23314	6285	61.1	88.4	66.0	86.0	-
Incompetent cervix	DiGiuseppe (USA) 2002	B	33616	-	38.9	99.9	77.3	99.6	Good
Incompetent cervix	Roohan (USA) 2003	B	440	-	50.0	100	100	99.0	-
Incompetent cervix	Reichman (USA) 2001	B	46437	142	20.4	99.9	56.9	99.8	-
Incompetent cervix (cases)	Piper (USA) 1993	B	1016	64	51.6	-	84.6	96.7	-
Incompetent cervix	Lydon-Rochelle(c) (USA) 2005	D	211	14	71.6	97.0	66.7	97.6	-
Congenital uterine abnormality	Yasmeen (USA) 2006	H	1614	13	91.0	-	100	-	-
Uterine fibroids	Yasmeen (USA) 2006	H	1614	65	37.0	-	100	-	-
Hemoglobinopathy	Reichman (USA) 2001	B	46437	177	1.0	99.9	5.6	99.6	-
Coagulation disorders	Hadfield (Aust) 2008	H	1184	10	88.9	99.6	8.8	100	Poor
Connective tissue diorders	Hadfield (Aust) 2008	H	1184	7	100	99.9	6.8	100	Poor
Gallbladder conditions	Hadfield (Aust) 2008	H	1184	10	49.3	100	90.8	99.8	Good
Genetic diseases	Roohan (USA) 2003	B	440	-	50.0	100	100	99.0	-
Hepatitis B	Pym (Aust) 1993	B	846	8	100	100	-	-	Poor

Hepatitis B	Lydon-Rochelle(b) (USA) 2005	B	3701	-	67.9	99.9	-	-	-
Nervous system disorders	Hadfield (Aust) 2008	H	1184	12	6.6	100	40.0	99.8	Poor
Paralytic ileus	Romano (USA) 2005	H	1611	15	9.0	-	99.0	-	-
Viral disease	Roohan (USA) 2003	B	440	-	75.0	100	75.0	100	-
Venous thromboembolism	White (USA) 2004	H	36	36	-	-	83.0	-	-
Deep-vein thrombosis	Hadfield (Aust) 2008	H	1184	4	25.2	100	0.2	100	Poor

[a]B = Birth data (birth certificate or birth registry), H = Hospital discharge data, D = Death certificate, B or D = Included in either birth or hospital data, LBW = Low birth weight, SGA = Small for gestational age, IVF = In-vitro fertilization, CVS = Chrionic villius sampling

Table II. Accuracy and completeness of reporting pregnancy-related conditions

Condition	Author	Source of data[a]	N	Cases in gold std	Sens %	Spec %	PPV %	NPV %	Kappa
Gestational hypertension									
Gestational hypertension	Lydon-Rochelle(b) (USA) 2005	B	3701	-	48.6	98.6	-	-	-
PIH	DiGiuseppe (USA) 2002	B	33616	-	33.6	98.9	56.8	97.2	Good
Pregnancy-related hypertension	Roohan (USA) 2003	B	440	-	72.0	99.0	72.0	99.0	-
PIH	Pym (Aust) 1993	B	846	51	62.9	99.1	-	-	Good
PIH	Dobie (US) 1998	B	1937	-	58.6	-	-	-	Good
PIH	Reichman (USA) 2001	B	46437	2089	20.0	98.5	38.1	96.3	-
PIH (cases)	Piper (USA) 1993	B	1016	163	42.9	-	90.9	89.7	-
PIH (controls)	Piper (USA) 1993	B	634	51	49.0	-	78.1	95.6	-
Gestational hypertension	Yasmeen (USA) 2006	H	1614	80	58.0	-	86.0	-	-
Pregnancy hypertension	Hadfield (Aust) 2008	H	1184	165	68.2	99.6	94.4	97.2	Excel
Gestational hypertension	Roberts(b) (Aust) 2008	H	1184	72	47.8	99.2	78.9	-	Good
Gestational hypertension	Taylor (Aust) 2005	H	490	29	58.6	99.1	81.0	97.4	Good
Pregnancy-related hypertension	Klemmensen (Denmark) 2007	H	3039	90	10.0	99.8	56.3	97.3	Poor
PIH	Lydon-Rochelle(b) (USA) 2005	H	3701	-	70.6	97.9	-	-	-
PIH	Taylor (Aust) 2005	H	490	51	62.7	99.8	97.0	95.8	Good
PIH	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	73.5	97.3	-	-	-

Preeclampsia									
Preeclampsia	Roberts(b) (Aust) 2008	B	1184	93	84.7	96.0	31.6	-	Good
Preeclampsia	Roohan (USA) 2003	B	440	-	62.0	100	100	99.0	-
Preeclampsia	Vagg (Aust) 1999	B	647	21	87.0	99.7	90.9	99.5	Excel
Preeclampsia	NSW Health (Aust) 2000	B	1688	111	66.7	99.3	-	-	Excel
Preeclampsia	Yasmeen (USA) 2006	H	1614	71	88.0	-	91.0	-	-
Gestational hypertension with proteinuria	Joseph (Canada) 2009	H	6194	-	75.2	99.5	-	-	-
Preeclampsia	Roberts(b) (Aust) 2008	H	1184	93	71.0	99.2	66.7	-	Good
Preeclampsia	Taylor (Aust) 2005	H	490	22	50.0	99.8	91.7	97.7	Good
Preeclampsia	Health Canada 2003	H	891	-	-	-	49.1	-	-
Preeclampsia	Roberts(b) (Aust) 2008	B or H	1184	93	99.1	95.8	33.8	-	Good
Preeclampsia	Lydon-Rochelle(c) (USA) 2005	D	211	23	63.6	98.1	82.4	95.2	-
All types of preeclampsia	Klemmensen (Denmark) 2007	H	3039	88	69.3	99.3	74.4	99.1	Good
Mild or unspecified preeclampsia	Geller (USA) 2004	H	64	29	-	-	45.3	-	-
Mild, severe or unspecified preeclampsia or eclampsia	Geller (USA) 2004	H	135	84	-	-	54.0	-	-
Severe preeclampsia									
Severe preeclampsia	Yasmeen (USA) 2006	H	1614	31	76.0	-	94.0	-	-
Severe preeclampsia	Geller (USA) 2004	H	59	50	-	-	84.8	-	-
Severe preeclampsia	Klemmensen (Denmark) 2007	H	3039	55	43.6	100	100	99.0	Good
Severe preeclampsia	Roberts(b) (Aust) 2008	H	1184	59	44.3	99.9	76.9	99.5	-
Any pregnancy hypertension									
Any pregnancy hypertension	Roberts(b) (Aust) 2008	B	1184	165	63.3	99.5	92.4	-	Good
Any pregnancy hypertension	Roberts(b) (Aust) 2008	H	1184	165	68.2	99.6	94.4	-	Excel
Any gestational hypertension disorder	Joseph (Canada) 2009	H	6194	-	87.9	99.6	-	-	-
Hypertensive disorders of pregnancy	Klemmensen (Denmark) 2007	H	3039	178	48.9	99.6	88.8	96.9	Good
Any pregnancy hypertension	Roberts(b) (Aust) 2008	B or H	1184	165	82.3	99.3	91.9	-	Excel
Eclampsia									
Eclampsia	DiGiuseppe (USA) 2002	B	33616	-	9.7	99.9	25.8	99.5	Poor
Eclampsia	Riley (Aust) 1998	B	41	16	39.0	-	-	-	-
Eclampsia	Roohan (USA) 2003	B	440	-	0.0	100	-	100	-

Eclampsia	Lydon-Rochelle(b) (USA) 2005	B	3701	-	50.0	99.3	-	-	-
Eclampsia	Reichman (USA) 2001	B	46437	242	5.4	99.9	20.0	99.5	-
Eclampsia (cases)	Piper (USA) 1993	B	1016	11	54.5	-	27.3	99.5	-
Eclampsia	Riley (Aust) 1998	H	34	23	67.6	-	-	-	-
Eclampsia	Geller (USA) 2004	H	12	5	-	-	41.7	-	-
Eclampsia	Roberts(b) (Aust) 2008	H	1184	2	100	99.9	23.5	100	Poor
Eclampsia	Lydon-Rochelle(b) (USA) 2005	H	3701	-	50.0	99.9	-	-	-
Eclampsia	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	50.0	99.2	-	-	-
Gestational diabetes									
Gestational diabetes	DiGiuseppe (USA) 2002	B	33616	-	45.8	99.2	71.9	97.7	Good
Gestational diabetes	Costakos (USA) 1998	B	99	3	67.0	99.0	67.0	-	-
Gestational diabetes	Roohan (USA) 2003	B	440	-	83.0	99.0	83.0	99.0	-
Gestational diabetes	Lydon-Rochelle(b) (USA) 2005	B	3701	-	64.3	99.2	-	-	-
Gestational diabetes	Bell (Aust) 2008	B	1184	69	63.3	99.5	85.8	98.2	Good
Gestational diabetes	Pym (Aust) 1993	B	846	17	66.7	99.6	-	-	Good
Gestational diabetes	NSW Health (Aust) 2000	B	1688	59	86.7	99.8	-	-	Excel
Gestational diabetes	Bell (Aust) 2008	H	1184	69	68.6	100	99.7	98.5	Excel
Gestational diabetes	Lydon-Rochelle(b) (USA) 2005	H	3701	-	81.3	99.6	-	-	-
Gestational diabetes	Taylor (Aust) 2005	H	490	22	95.5	99.8	95.5	99.8	Excel
Gestational diabetes	Bell (Aust) 2008	B or H	1184	69	72.9	99.5	87.2	98.7	Excel
Gestational diabetes	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	93.3	99.1	-	-	-
Gestational diabetes	Lydon-Rochelle(c)2005	D	211	3	50.0	100	100	99.4	-
Urinary tract infection									
Urinary tract infection	Romano (USA) 2005	H	1611	13	20.0	-	41.0	-	-
Genitourinary infections	Yasmeen (USA) 2006	H	1614	30	39.0	-	45.0	-	-
Other Pregnancy related complications									
Rhesus sensitized	Roohan (USA) 2003	B	440	-	100	99.0	17.0	100	-
Rhesus isoimmunisation	Pym (Aust) 1993	B	846	6	40.0	99.8	-	-	Excel
RH sensitization	Reichman (USA) 2001	B	46437	773	3.2	99.9	29.1	98.4	-
RH sensitization (cases)	Piper (USA) 1993	B	1016	12	16.7	-	22.2	99.0	-
RH sensitization (controls)	Piper (USA) 1993	B	634	11	18.2	-	25.0	98.6	-
Hydramnios/Oligohydramnios	Roohan (USA) 2003	B	440	-	78.0	100	93.0	99.0	-
Hydramnios/oligohydramnios	Reichman (USA) 2001	B	46437	326	16.7	99.4	15.5	99.4	-

Polyhydramnios/ Oligohydramnios	DiGiuseppe (USA) 2002	B	33616	-	21.1	99.8	67.8	98.2	Poor
Hydramnios (cases)	Piper (USA) 1993	B	1016	35	34.3	-	75.0	97.6	-
Oligohydramnios (cases)	Piper (USA) 1993	B	1016	98	29.6	-	72.5	92.6	-
Oligohydramnios (controls)	Piper (USA) 1993	B	634	6	16.7	-	100	99.2	-
Abnormal amniotic fluid volume	Dobie (US) 1998	B	1937	-	29.7	-	-	-	Good
Acute lung disease, pregnancy related	Roohan (USA) 2003	B	440	-	33.0	100	83.0	97.0	-
Pulmonary complications	Romano (USA) 2005	H	1611	21	1.0	-	13.0	-	-
Pregnancy specific DVT	White (USA) 2004	H	178	178	-	-	30.0	-	-
Thromboembolic complications	Romano (USA) 2005	H	1611	4	0.0	-	-	-	-
Excessive weight gain	Yasmeen (USA) 2006	H	1614	43	3.0	-	19.0	-	-
Chorioamnionitis	Yasmeen (USA) 2006	H	1614	75	79.0	-	87.0	-	-

[a]B = Birth data (birth certificate or birth registry), H = Hospital discharge data, D = Death certificate, B or D = Included in either birth or hospital data, PIH = Pregnancy-induced hypertension, DVT = deep-vein thrombosis

Table III. Accuracy and completeness of reporting conditions and procedures relating to labour and delivery

Condition	Author	Source of data[a]	N	Cases in gold std	Sens %	Spec %	PPV %	NPV %	Kappa
Vaginal delivery									
Delivery type (vaginal, CS)	DiGiuseppe (USA) 2002	B	33616	-	95.6	99.6	98.6	98.8	Exc
Vaginal delivery	Roohan (USA) 2003	B	440	-	100	99.0	100	100	-
Vaginal delivery	Reichman (USA) 2001	B	46437	35260	91.2	82.1	94.1	74.8	-
Vaginal delivery (cases)	Piper (USA) 1993	B	1016	471	98.1	-	92.2	98.2	-
Vaginal delivery (controls)	Piper (USA) 1993	B	634	468	96.4	-	97.0	89.9	-
Cesarean Section (CS)									
Elective CS	Roberts(a) (Aust) 2008	B	1184	171	93.0	98.2	89.6	98.8	Exc
Elective CS	Roberts(a) (Aust) 2008	H	1184	171	88.3	98.7	91.7	98.0	Exc
Elective CS	Korst (USA) 2004	H	440	26	73.1	98.1	70.4	98.3	-
Elective CS	Roberts(a) (Aust) 2008	B or H	1184	-	93.7	97.5	86.2	98.9	Exc
Emergency CS	Roberts(a) (Aust) 2008	B	1184	125	85.1	98.9	89.9	98.3	Exc
Emergency CS	Roberts(a) (Aust) 2008	H	1184	125	87.2	98.1	84.5	98.5	Exc
Emergency CS	Roberts(a) (Aust) 2008	B or H	1184	125	95.0	98.0	84.8	99.4	Exc
CS	Health Canada 2003	H	891	-	-	-	99.8	-	-

CS	Romano (USA) 2005	H	1611	789	100	-	99.7	-	-
CS	Joseph (Canada) 2009	H	6194	-	99.8	98.7	-	-	-
Primary CS	Parrish (USA) 1993	B	7539	-	79.8	-	99.2	-	-
Primary CS	Roohan (USA) 2003	B	440	-	98.0	100	100	100	-
Primary CS	Reichman (USA) 2001	B	46437	5740	81.3	98.5	88.2	97.4	-
Primary CS (cases)	Piper (USA) 1993	B	1016	436	93.3	-	96.2	94.9	-
Primary CS (controls)	Piper (USA) 1993	B	634	89	91.0	-	96.4	98.5	-
Primary CS	Parrish (USA) 1993	H	7539	-	93.0	-	97.1	-	-
Primary CS	Parrish (USA) 1993	B or H	7539	-	93.7	-	98.8	-	-
Repeat CS									
Previous CS	DiGiuseppe (USA) 2002	B	33616	-	80.7	99.3	95.3	96.7	Exc
Previous CS	Gissler (Finland) 1995	B	865	74	68.0	-	-	-	-
Repeat CS without labour	Lydon-Rochelle(a) (USA) 2005	B	4541	-	81.2	99.5	93.0	98.6	-
Repeat CS with labour	Lydon-Rochelle(a) (USA) 2005	B	4541	-	60.9	99.4	65.1	99.3	-
Repeat CS	Roohan (USA) 2003	B	440	-	100	100	100	100	-
Repeat CS	Parrish (USA) 1993	B	7539	-	92.6	-	91.1	-	-
Repeat CS	Reichman (USA) 2001	B	46437	3606	80.0	99.1	87.7	98.3	-
Repeat CS (cases)	Piper (USA) 1993	B	1016	68	79.4	-	93.1	98.5	-
Repeat CS (controls)	Piper (USA) 1993	B	634	62	96.8	-	96.8	99.6	-
Repeat CS	Parrish (USA) 1993	H	7539	-	95.3	-	92.8	-	-
Previous CS	Health Canada 2003	H	891	-	-	-	99.3	-	-
Previous CS	Yasmeen (USA) 2006	H	1614	366	74.0	-	91.0	-	-
Repeat CS	Parrish (USA) 1993	B or H	7539	-	98.9	-	90.5	-	-
Vaginal Birth After Cesarean (VBAC)									
VBAC	DiGiuseppe (USA) 2002	B	33616	-	60.8	99.6	89.3	97.7	Good
VBAC	Lydon-Rochelle(a) (USA) 2005	B	4541	-	61.5	99.8	92.0	98.5	
VBAC	Roohan (USA) 2003	B	440	-	100	100	100	100	
VBAC	Parrish (USA) 1993	B	7539	-	70.0	-	91.0	-	-
VBAC	Reichman (USA) 2001	B	46437	1169	47.3	99.0	55.1	98.6	-
VBAC (cases)	Piper (USA) 1993	B	1016	23	39.1	-	81.8	98.6	-
VBAC (controls)	Piper (USA) 1993	B	634	15	53.3	-	100	98.9	-
VBAC	Parrish (USA) 1993	H	7539	-	67.7	-	84.6	-	-
VBAC	Health Canada 2003	H	891	233	97.5	99.5	98.7	99.1	Excel
VBAC	Taylor (Aust) 2005	H	490	11	36.4	100	100	98.6	Good

VBAC	Parrish (USA) 1993	B or H	7539	-	84.6	-	88.0	-	-
Induction/ Augmentation									
Induction	Lydon-Rochelle(a) (USA) 2005	B	4541	-	52.4	97.2	88.0	84.0	-
Induction	Roberts(a) (Aust) 2008	B	1184	301	92.5	98.7	96.1	97.5	Excel
Induction (cases)	Piper (USA) 1993	B	1016	80	42.5	-	63.0	95.1	-
Induction (controls)	Piper (USA) 1993	B	634	114	61.0	-	74.5	91.8	-
Induction	Lydon-Rochelle(a) (USA) 2005	H	4541	-	72.9	97.5	91.9	90.3	
Induction	Roberts(a) (Aust) 2008	H	1184	301	78.3	98.7	95.4	93.0	Excel
Induction	Joseph (Canada) 2009	H	6194	-	89.2	96.9	-	-	-
Induction	Yasmeen (USA) 2006	H	1614	244	45.0	-	88.0	-	-
Induction or augmentation	Dobie (US) 1998	B	1937	-	71.7	-	-	-	Good
Induction	Lydon-Rochelle(a) (USA) 2005	B or H	4541	-	86.4	95.9	89.0	94.8	-
Induction	Roberts(a) (Aust) 2008	B or H	1184	301	95.0	98.0	94.3	98.3	Excel
Augmentation	Lydon-Rochelle(a) (USA) 2005	B	4541	-	34.4	92.6	60.3	81.2	-
Augmentation	Roberts(a) (Aust) 2008	B	1184	297	55.2	97.1	86.3	86.6	Good
Stimulation of labour (cases)	Piper (USA) 1993	B	1016	145	20.0	-	63.0	87.7	-
Stimulation of labour (controls)	Piper (USA) 1993	B	634	249	25.7	-	75.3	65.9	-
Augmentation	Roberts(a) (Aust) 2008	H	1184	297	58.2	94.9	79.1	87.1	Good
Augmentation	Roberts(a) (Aust) 2008	B or H	1184	297	75.9	92.9	78.2	92.0	Good
Medical induction of labour	Health Canada 2003	H	891	-	-	-	87.2	-	-
Medical induction of labour	Yasmeen (USA) 2006	H	1614	-	42.0	-	84.0	-	-
Artificial rupture of membranes (ARM)	Gissler (Finland) 1995	B	865	471	81.0	-	-	-	-
Induction/augmentation with ARM	NSW Health (Aust) 2000	B	1688	477	71.9	97.7	-	-	Good
Surgical induction of labour	Yasmeen (USA) 2006	H	1614	-	32.0	-	76.0	-	-
Oxytocin	Gissler (Finland) 1995	B	865	368	80.0	-	-	-	-
Induction/augmentation with oxytocics	NSW Health (Aust) 2000	B	1688	434	82.1	98.5	-	-	Excel
Prostaglandin	Gissler (Finland) 1995	B	865	72	47.0	-	-	-	-
Induction/augmentation with prostaglandins	NSW Health (Aust) 2000	B	1688	212	89.9	99.5	-	-	Excel
Failed induction	Yasmeen (USA) 2006	H	1614	26	60.0	-	68.0	-	-

Forceps Delivery

Forceps delivery	Lydon-Rochelle(a) (USA) 2005	B	4541	-	55.4	99.9	89.1	99.1	-
Forceps delivery	Roberts(a) (Aust) 2008	B	1184	49	96.1	100	100	99.8	Excel
Forceps/vacuum delivery	Parrish (USA) 1993	B	7539	-	69.7	-	95.3	-	-
Forceps delivery	Reichman (USA) 2001	B	46437	688	60.0	98.7	41.3	99.4	-
Forceps delivery (cases)	Piper (USA) 1993	B	1016	51	74.5	-	92.7	98.6	-
Forceps delivery (controls)	Piper (USA) 1993	B	634	123	82.9	-	94.4	96.0	-
Forceps delivery	Health Canada 2003	H	891	-	-	-	99.6	-	-
Forceps delivery	Lydon-Rochelle(a) (USA) 2005	H	4541	-	84.6	99.9	95.4	99.7	
Forceps delivery	Roberts(a) (Aust) 2008	H	1184	49	92.2	99.8	96.1	99.7	Excel
Forceps delivery	Yasmeen (USA) 2006	H	1614	38	89.0	-	99.0	-	-
Forceps/vacuum delivery	Parrish (USA) 1993	H	7539	-	77.9	-	93.7	-	-
Forceps delivery	Lydon-Rochelle(a) (USA) 2005	B or H	4541	-	88.9	99.8	90.0	99.8	-
Forceps delivery	Roberts(a) (Aust) 2008	B or H	1184	49	96.1	99.8	96.2	99.8	Excel
Forceps/vacuum delivery	Parrish (USA) 1993	B or H	7539	-	91.8	-	92.1	-	-

Vacuum Delivery

Vacuum delivery	Roberts(a) (Aust) 2008	B	1184	79	99.9	99.5	93.7	100	Excel
Vacuum delivery	Reichman (USA) 2001	B	46437	1028	60.3	98.6	50.2	99.1	-
Vacuum delivery (cases)	Piper (USA) 1993	B	1016	11	54.5	-	66.7	99.5	-
Vacuum delivery (controls)	Piper (USA) 1993	B	634	61	70.5	-	82.7	96.9	-
Vacuum delivery	Health Canada 2003	H	891	-	-	-	100	-	-
Vacuum delivery	Roberts(a) (Aust) 2008	H	1184	79	86.6	99.5	92.6	99.0	Excel
Vacuum delivery	Yasmeen (USA) 2006	H	1614	-	94.0	-	96.0	-	-
Vacuum delivery	Roberts(a) (Aust) 2008	B or H	1184	79	99.9	99.3	91.6	100	Excel

Placental Abruption

Placental abruption	DiGiuseppe (USA) 2002	B	33616	-	51.9	99.8	67.2	99.6	Good
Placental abruption	Lydon-Rochelle(a) (USA) 2005	B	4541	-	68.3	99.8	83.8	99.6	-
Placental abruption	Roohan (USA) 2003	B	440	-	67.0	100	100	100	-
APH (placental abruption)	Pym (Aust) 1993	B	846	4	75.0	99.9	-	-	Excel
Placental abruption	Dobie (US) 1998	B	1937	-	45.9	-	-	-	Good
Placental abruption	Reichman (USA) 2001	B	46437	256	28.5	99.8	50.3	99.6	-
Placental abruption (cases)	Piper (USA) 1993	B	1016	154	46.7	-	92.3	90.9	-
Placental abruption (controls)	Piper (USA) 1993	B	634	9	77.8	-	100	99.7	-

Placental abruption	Lydon-Rochelle(a) (USA) 2005	H	4541	-	79.1	99.8	87.2	99.7	-
Placental abruption	Lain (Aust) 2008	H	1184	12	60.2	100	100	99.8	Excel
Placental abruption	Taylor (Aust) 2005	H	490	4	50.0	100	100	99.6	Good
Placental abruption	Yasmeen (USA) 2006	H	1614	27	63.0	-	82.0	-	-
Placental abruption	Lydon-Rochelle(a) (USA) 2005	B or H	4541	-	85.0	99.7	83.6	99.8	-
Placental abruption	Lydon-Rochelle(c) (USA) 2005	D	211	17	68.8	96.3	64.7	96.9	-
Placenta Previa									
Placenta previa	DiGiuseppe (USA) 2002	B	33616		39.7	99.9	75.2	99.6	Good
Placenta previa	Lydon-Rochelle(b) (USA) 2005	B	3701	-	33.3	100	-	-	
APH (placenta previa)	Pym (Aust) 1993	B	846	6	66.7	99.8	-	-	Good
Placenta previa	Dobie (US) 1998	B	1937	-	49.0	-	-	-	Good
Placenta previa	Reichman (USA) 2001	B	46437	164	39.6	99.9	62.5	99.8	-
Placenta previa (cases)	Piper (USA) 1993	B	1016	55	54.6	-	88.2	97.4	-
Placenta previa	Lydon-Rochelle(b) (USA) 2005	H	3701	-	66.7	100	-	-	--
Placenta previa with hemorrhage	Lain (Aust) 2008	H	1184	11	98.9	99.8	71.9	99.9	
Placenta previa	Taylor (Aust) 2005	H	490	8	87.5	100	100	99.8	Excel
Placenta previa	Yasmeen (USA) 2006	H	1614	24	88.0	-	100	-	-
Placenta previa	Lydon-Rochelle(b) (USA) 2005	B or H	3701	-	69.5	100	-	-	-
Placenta previa	Lydon-Rochelle(c) (USA) 2005	D	211	3	0.0	99.4	0.0	98.3	-
<u>Antepartum Hemorrhage</u> ***(APH)***									
APH or placental conditions	Korst (USA) 2004	H	440	20	20.0	100	100	96.3	-
Hemorrhage prior to birth	Lain (Aust) 2008	H	1184	42	75.8	99.1	65.7	99.5	-
APH	Yasmeen (USA) 2006	H	1614	24	46.0	-	70.0	-	-
APH	Vagg (Aust) 1999	B	647	43	41.9	100	100	96.2	Good
Maternal bleeding	DiGiuseppe (USA) 2002	B	33616	-	8.6	99.0	10.9	98.7	Poor
Other excessive bleeding	Reichman (USA) 2001	B	46437	291	5.5	99.8	17.6	99.4	-
Other excessive bleeding (cases)	Piper (USA) 1993	B	1016	173	4.6	-	50.0	83.0	-
Other excessive bleeding (controls)	Piper (USA) 1993	B	634	14	7.1	-	33.3	97.9	-
Uterine bleeding	Roohan (USA) 2003	B	440	-	33.0	100	75.0	98.0	-

Uterine bleeding	Reichman (USA) 2001	B	46437	1137	0.4	99.9	12.5	97.6	-
Uterine bleeding (cases)	Piper (USA) 1993	B	1016	183	20.2	-	61.7	84.1	-
Uterine bleeding (controls)	Piper (USA) 1993	B	634	43	11.6	-	45.4	93.8	-
Uterine bleeding	Lydon-Rochelle(c) (USA) 2005	D	211	16	33.3	95.2	38.5	94.1	-
Premature Rupture of Membranes (PROM)									
PROM	DiGiuseppe (USA) 2002	B	33616		37.8	97.7	25.1	98.7	Poor
PROM	Roohan (USA) 2003	B	440	-	29.0	99.0	64.0	96.0	
PROM	Vagg (Aust) 1999	B	647	35	72.2	99.8	96.3	98.4	Excel
PROM	Reichman (USA) 2001	B	46437	1763	20.5	98.5	35.4	96.9	-
PROM (cases)	Piper (USA) 1993	B	1016	62	51.6	-	12.6	95.9	-
PROM (controls)	Piper (USA) 1993	B	634	41	19.5	-	57.1	94.6	-
PROM	Health Canada 2003	H	891	-	-	-	6.7	-	-
PROM	Taylor (Aust) 2005	H	490	44	61.4	98.0	75.0	96.3	Good
PROM	Yasmeen (USA) 2006	H	1614	85	45.0	-	57.0	-	
Preterm PROM	Taylor (Aust) 2005	H	490	9	66.7	100	100	99.4	Excel
Prolonged rupture of membranes	Pym (Aust) 1993	B	846	5	13.5	99.8	-	-	Poor
Prolonged rupture of membranes (cases)	Piper (USA) 1993	B	1016	201	25.9	-	86.7	83.7	-
Prolonged rupture of membranes (controls)	Piper (USA) 1993	B	634	18	38.9	-	100	98.2	-
Cord Prolapse									
Cord prolapse	DiGiuseppe (USA) 2002	B	33616	-	24.4	99.9	38.5	99.8	Poor
Cord prolapse	Reichman (USA) 2001	B	46437	113	21.2	99.8	18.6	99.8	-
Cord prolapse (cases)	Piper (USA) 1993	B	1016	21	52.4	-	84.6	99.0	-
Cord prolapse	Lydon-Rochelle(c) (USA) 2005	D	211	8	57.1	97.1	44.4	98.2	-
Malpresentation/ Breech									
Infant malpresentation	DiGiuseppe (USA) 2002	B	33616	-	65.4	99.5	86.3	98.4	Good
Nonvertex presentation	Roohan (USA) 2003	B	440	-	22.0	83.0	7.0	95.0	-
Breech/malpresentation	Reichman (USA) 2001	B	46437	1182	52.5	99.2	63.3	98.8	-
Breech presentation (cases)	Piper (USA) 1993	B	1016	276	65.92	-	90.6	88.0	-
Breech presentation (controls)	Piper (USA) 1993	B	634	17	70.6	-	100	99.2	-
Malpresentation (cases)	Piper (USA) 1993	B	1016	54	25.9	-	43.7	95.86	-

Malpresentation (controls)	Piper (USA) 1993	B	634	7	14.3	-	33.3	99.0	-
Breech presentation	Health Canada 2003	H	891	-	-	-	99.3	-	-
Malpresentation	Korst (USA) 2004	H	440	27	81.5	99.3	88.0	98.8	-
Malpresentation	Yasmeen (USA) 2006	H	1614	192	90.0	-	97.0	-	-
Obstructed Labour									
Obstructed labour	Health Canada 2003	H	891	-	-	-	69.1	-	-
Obstructed labour	Roberts(a) (Aust) 2008	H	1184	-	35.0	97.6	74.9	88.1	Good
Obstructed labour	Yasmeen (USA) 2006	H	1614	183	40.0	-	80.0	-	-
Obstructed labour	Taylor (Aust) 2005	H	490	40	75.0	99.3	90.9	97.8	Excel
Occiput posterior	Yasmeen (USA) 2006	H	1614	48	60.0	-	81.0	-	-
Shoulder dystocia	Yasmeen (USA) 2006	H	1614	16	99.0	-	98.0	-	-
Fetal-pelvic disproportion	Health Canada 2003	H	891	-	-	-	93.4	-	-
Cephalopelvic disproportion	Lydon-Rochelle(a) (USA) 2005	B	4541	-	35.3	99.3	62.1	98.0	-
Cephalopelvic dispropprtion	Dobie (US) 1998	B	1937	-	76.6	-	-	-	Excel
Cephalopelvic disproportion	Reichman (USA) 2001	B	46437	1132	41.6	98.6	43.4	98.5	-
Cephalopelvic disproportion (cases)	Piper (USA) 1993	B	1016	6	33.3	-	28.6	99.6	-
Cephalopelvic disproportion (controls)	Piper (USA) 1993	B	634	39	71.8	-	82.3	98.1	-
Cephalopelvic disproportion	Lydon-Rochelle(a) (USA) 2005	H	4541	-	79.6	99.0	72.1	99.4	-
Cephalopelvic disproportion	Lydon-Rochelle(a) (USA) 2005	B or H	4541	-	83.1	98.6	65.1	99.5	-
Length of Labour									
Precipitous labour	Roohan (USA) 2003	B	440	-	33.0	99.0	75.0	97.0	-
Precipitous labor	Reichman (USA) 2001	B	46437	651	23.5	99.1	26.1	98.9	-
Precipitous labour (cases)	Piper (USA) 1993	B	1016	32	31.3	-	28.6	97.7	-
Precipitous labour (controls)	Piper (USA) 1993	B	634	14	35.7	-	71.4	98.6	-
Long labour	Health Canada 2003	H	891	-	-	-	76.8	-	-
Long labour	Yasmeen (USA) 2006	H	1614	24	36.0	-	25.0	-	-
Prolonged labour	Reichman (USA) 2001	B	46437	677	4.6	99.4	10.3	98.6	-
Prolonged labour	Roohan (USA) 2003	B	440	-	9.0	100	67.0	95.0	-
Prolonged labour (cases)	Piper (USA) 1993	B	1016	13	0	-	0	98.7	-
Prolonged labour (controls)	Piper (USA) 1993	B	634	12	16.7	-	28.6	99.0	-
Dysfunctional labour (cases)	Piper (USA) 1993	B	1016	35	17.1	-	54.5	95.3	-
Dysfunctional labour (controls)	Piper (USA) 1993	B	634	19	31.6	-	75.0	97.9	-

Dysfunctional labor	Reichman (USA) 2001	B	46437	1022	17.4	99.1	29.8	98.2	-
Uterine inertia	Yasmeen (USA) 2006	H	1614	256	56.0	-	84.0	-	-
Analgesia/ Anaesthesia									
Nitrogen oxide	Gissler (Finland) 1995	B	865	411	88.0	-	-	-	-
Pain relief: Nitrous oxide	NSW Heath (Aust) 2000	B	1688	845	89.2	95.5	-	-	Excel
Other local anaesthetic/ pain medication	Gissler (Finland) 1995	B	865	222	63.0	-	-	-	
Pain relief: local to perineum	NSW Heath (Aust) 2000	B	1688	341	62.1	98.3	-	-	Good
Pain relief: IM narcotics	NSW Heath (Aust) 2000	B	1688	457	84.5	98.1	-	-	Excel
Pain relief: pudendal	NSW Heath (Aust) 2000	B	1688	23	87.0	99.8	-	-	Excel
Epidural	Pym (Aust) 1993	B	846	191	82.1	98.7	-	-	Excel
Pain relief: epidural/caudal	NSW Heath (Aust) 2000	B	1688	477	96.6	98.3	-	-	Excel
Pain relief: spinal	NSW Heath (Aust) 2000	B	1688	64	74.0	99.6	-	-	Excel
Pain relief: general anaesthetic	NSW Heath (Aust) 2000	B	1688	82	77.7	99.9	-	-	Excel
Any general anaesthetic	Roberts(c) 2008	B	1184	-	81.7	100	99.8	98.5	Excel
Any general anaesthetic	Roberts(c) 2008	H	1184	-	34.1	100	99.2	94.8	Good
Any general anaesthetic	Roberts(c) 2008	B or H	1184	-	92.5	100	99.7	99.4	Excel
Anesthetic complications	Reichman (USA) 2001	B	46437	20	0	99.9	0	99.9	-
Spinal anaesthesia complications	Romano (USA) 2005	H	1611	16	24.0	-	97.0	-	-
Other anaesthetic complications	Romano (USA) 2005	H	1611	21	18.0	-	83.0	-	-
Fetal Distress/ Meconium Staining									
Fetal distress	Costakos (USA) 1998	B	99	6	0.0	99.0	14.0	-	-
Fetal distress	Dobie (US) 1998	B	1937	-	21.5	-	-	-	Poor
Fetal distress	Reichman (USA) 2001	B	46437	1900	33.2	98.4	46.5	97.2	-
Fetal distress (cases)	Piper (USA) 1993	B	1016	280	37.9	-	76.3	79.4	-
Fetal distress (controls)	Piper (USA) 1993	B	634	49	38.8	-	67.9	95.0	-
Fetal distress	Yasmeen (USA) 2006	H	1614	230	68.0	-	69.0	-	-
Meconium Staining	DiGiuseppe (USA) 2002	B	33616	-	39.4	98.0	75.7	91.1	Good
Meconium, moderate/heavy	Reichman (USA) 2001	B	46437	2503	31.8	99.4	33.3	96.1	-
Meconium Heavy/moderate	Roohan (USA) 2003	B	440	-	6.0	99.0	33.0	96.0	-
Meconium moderate-heavy (cases)	Piper (USA) 1993	B	1016	70	44.3	-	83.8	95.9	-
Meconium moderate-heavy (controls)	Piper (USA) 1993	B	634	81	45.7	-	80.4	92.4	-

Other									
Mother febrile	Reichman (USA) 2001	B	46437	498	10.4	99.6	20.6	99.0	-
Mother febrile (cases)	Piper (USA) 1993	B	1016	220	21.4	-	82.5	81.4	-
Mother febrile (controls)	Piper (USA) 1993	B	634	53	9.4	-	41.7	92.2	-
Seizure during labour	Reichman (USA) 2001	B	46437	31	22.6	99.9	31.8	99.9	-
Uterine scar other than CS	Korst (USA) 2004	H	440	4	0.0	100	-	99.1	-
Macrosomia	Korst (USA) 2004	H	440	16	50.0	96.5	34.8	98.1	-
Unengaged foetus	Korst (USA) 2004	H	440	69	0.0	99.5	0.0	84.3	-
Soft tissue condition	Korst (USA) 2004	H	440	16	43.8	99.1	63.6	97.9	-
Cervical suture	Pym (Aust) 1993	B	846	5	100	99.8	-	-	Excel
Threatened premature labour	Pym (Aust) 1993	B	846	21	50.0	98.9	-	-	Good
Preterm labour	Health Canada 2003	H	891	-	-	-	99.3	-	-
Premature labour	Yasmeen (USA) 2006	H	1614	165	77.0	-	96.0	-	-
Fetal growth, excessive	Yasmeen (USA) 2006	H	1614	73	41.0	-	88.0	-	-
Fetal growth, poor	Yasmeen (USA) 2006	H	1614	28	27.0	-	93.0	-	-

[a]B = Birth data (birth certificate or birth registry), H = Hospital discharge data, D = Death certificate, B or D = Included in either birth or hospital data

Table IV. Accuracy and completeness of reporting of pregnancy outcomes

Condition	Author	Source of data[a]	N	Cases in gold std	Sens %	Spec %	PPV %	NPV %	Kappa
Third (3rd) or fourth(4th) degree perineal tear									
3rd / 4th degree tear: 1990-92	Baghestan (Norway) 2007	B	13381	774	85.3	99.5	91.4	99.1	Excel
3rd / 4th degree tear: 2000-02	Baghestan (Norway) 2007	B	12380	813	91.8	99.7	95.4	99.4	Excel
3rd / 4th degree tear	Roberts(a) (Aust) 2008	B	1184	19	81.8	99.6	75.7	99.7	Excel
3rd degree tear	Pym (Aust) 1993	B	846	4	75.0	99.9	-	-	Excel
3rd / 4th degree tear: 1990-92	Baghestan (Norway) 2007	H	13381	774	52.1	99.0	75.8	97.1	Good
3rd / 4th degree tear: 2000-02	Baghestan (Norway) 2007	H	12380	813	84.6	98.5	92.7	98.9	Excel
3rd / 4th degree tear	Romano (USA) 2005	H	1611	62	93.0	-	73.0	-	-
3rd / 4th degree tear	Lain (Aust) 2008	H	1184	24	94.2	100	100	99.9	-
3rd / 4th degree tear	Lydon-Rochelle(a) (USA) 2005	H	4541	-	90.5	99.0	80.6	99.6	-
3rd degree tear	Romano (USA) 2005	H	1611	44	90.0	-	65.0	-	-
3rd degree tear	Joseph (Canada) 2009	H	6194	-	97.1	99.9	-	-	-
3rd degree tear	Taylor (Aust) 2005	H	490	11	90.9	100	100	99.8	Excel

3rd degree tear	Health Canada 2003	H	891	-	-	-	59.8	-	-
4th degree tear	Joseph (Canada) 2009	H	6194	-	94.7	99.9	-	-	-
4th degree tear	Romano (USA) 2005	H	1611	18	97.0	-	99.6	-	-
Any perineal laceration	Taylor (Aust) 2005	H	490	170	95.3	97.2	94.7	97.5	Excel
3rd / 4th degree tear	Roberts(a) (Aust) 2008	B or H	1184	19	83.3	99.6	78.2	100	Excel
Episiotomy									
Episiotomy	Roberts(a) (Aust) 2008	B	1184	172	83.7	99.8	98.6	97.3	Excel
Episiotomy	Pym (Aust) 1993	B	846	196	82.9	98.9	-	-	Excel
Episiotomy	Health Canada 2003	H	891	-	-	-	99.9	-	-
Episiotomy	Lain (Aust) 2008	H	1184	157	67.3	99.7	97.4	94.7	-
Episiotomy	Lydon-Rochelle(a) (USA) 2005	H	4541	-	84.4	99.4	96.6	96.9	-
Episiotomy	Yasmeen (USA) 2006	H	1614	410	70.0	-	95.0	-	-
Episiotomy	Roberts(a) (Aust) 2008	B or H	1184	172	90.6	99.7	98.0	98.4	Excel
Repair of third or fourth degree perineal tear									
Repair of 3rd/4th degree tear	Roberts(a) (Aust) 2008	B	1184	-	81.8	99.6	75.7	99.7	Excel
Repair of 3rd/4th degree tear	Lain (Aust) 2008	H	1184	24	80.6	100	100	99.7	-
Repair of 4th degree tear	Romano (USA) 2005	H	1611	54	51.0	-	41.0	-	-
Repair of 3rd/4th degree tear	Roberts(a) (Aust) 2008	B or H	1184	-	93.0	99.6	77.8	99.9	Excel
Postpartum hemorrhage/ retained placenta									
Postpartum hemorrhage	Vagg (Aust) 1999	B	647	4	100	100	100	100	Excel
Postpartum hemorrhage	Pym (Aust) 1993	B	846	47	65.9	97.8			Good
Postpartum hemorrhage	Health Canada 2003	H	891	-	-	-	93.2	-	-
Postpartum hemorrhage	Lain (Aust) 2008	H	1184	203	73.8	98.9	83.9	98.0	-
Postpartum hemorrhage	Taylor (Aust) 2005	H	490	29	58.6	99.8	94.4	97.5	Good
Postpartum hemorrhage	Joseph (Canada) 2009	H	6194		90.2	98.2	-	-	-
Postpartum hemorrhage	Romano (USA) 2005	H	1611	70	21.0	-	98.0	-	-
Retained products, delayed postpartum hemorrhage	Romano (USA) 2005	H	1611	49	62.0	-	84.0	-	-
Retained placenta / adherent placenta	Lain (Aust) 2008	H	1184	73	88.4	99.3	63.6	99.8	-
Manual removal of placenta	Lain (Aust) 2008	H	1184	64	52.3	99.8	85.8	99.0	-
Pelvic hematoma and reoperation for obstetric injury	Romano (USA) 2005	H	1611	8	45.0	-	69.0	-	-
Hysterectomy	Lain (Aust) 2008	H	1184	8	28.3	100	100	99.9	-

Transfusion									
Blood transfusion	Joseph (Canada) 2009	H	6194	-	85.7	99.8	-		-
Transfusion of packed cells	Lain (Aust) 2008	H	1184	143	83.1	99.9	98.8	99.8	-
Transfusion of platelets or coagulation factors	Lain (Aust) 2008	H	1184	17	73.1	100	100	99.9	-
Uterine Rupture									
Uterine Rupture - ICD9 665.0 & 665.1	CDC (USA) 2000	H	615	-	-	-	50.7	-	-
Uterine Rupture - ICD9 674.1	CDC (USA) 2000	H	636	-	-	-	28.6	-	-
Uterine rupture	Lain (Aust) 2008	H	1184	4	100	100	100	100	-
Infection									
Post partum infection	Taylor (Aust) 2005	H	490	12	50.0	99.8	85.7	98.8	Good
Endometritis or postpartum fever	Romano (USA) 2005	H	1611	125	46.0	-	98.0	-	-
Major puerperal infection	Pym (Aust) 1993	B	846	17	0.0	98.0	-	-	Poor
Major puerperal infection	Lydon-Rochelle(a) (USA) 2005	H	4541	-	19.0	99.9	81.6	98.5	-
Wound infection, disruption, or dehiscence	Romano (USA) 2005	H	1611	40	68.0	-	98.0	-	-
Febrile	Lydon-Rochelle(c) (USA) 2005	D	211	8	83.3	89.5	21.7	99.4	-
Plurality									
Nulliparity	DiGiuseppe (USA) 2002	B	33616	-	98.8	98.3	97.4	99.2	Excel
Single live birth	Taylor (Aust) 2005	H	490	472	99.4	72.2	98.9	81.3	Excel
Twins	Taylor (Aust) 2005	H	490	6	83.3	100	100	99.8	Excel
Multiple gestation	Korst (USA) 2004	H	440	9	100	100	100	100	-
Multiple gestation	Yasmeen (USA) 2006	H	1614	44	92.0	-	100	-	-
Stillbirth									
Single stillbirth	Taylor (Aust) 2005	H	490	8	75.0	100	100	99.6	Excel
Intrauterine death	Yasmeen (USA) 2006	H	1614	14	74.0	-	100	-	-

[a]B = Birth data (birth certificate or birth registry), H = Hospital discharge data, D = Death certificate, B or D = Included in either birth or hospital data

Table V. Accuracy and completeness of reporting conditions and procedures related to infant

Condition	Author	Source of data[a]	N	Cases in gold std	Sens %	Spec %	PPV %	NPV %	Kappa
Preterm/Postterm birth									
Preterm birth (< 37 weeks)	Lin (Taiwan) 2004	B	2758	153	92.8	99.6	93.4	99.6	Excel
Preterm birth (< 37 weeks)	Pearl (USA) 2007	B	105936	7614	84.8	98.3	79.5	-	-
Preterm birth (< 37 weeks)	Joseph (Can) 2009	H	6194	-	91.2	98.8	-	-	-
Preterm birth (< 37 weeks)	Taylor (Aust) 2005	H	491	33	75.8	99.8	96.2	98.3	Excel
Prematurity	Korst (USA) 2004	H	440	45	84.4	99.2	92.7	98.2	-
Postterm birth (>41 weeks)	Pearl (USA) 2007	B	105936	2445	-	98.0	46.1	-	-
Gender									
Infant gender	DiGius. (USA) 2002	B	33616	-	99.5	99.5	99.5	99.5	Excel
Infant gender	Vilain (Can) 2008	B	726	346	97.0	98.0	98.0	97.0	-
Birthweight									
Very low birthweight (<1500g)	Roohan (USA) 2003	B	440	-	100	100	100	100	-
Very low birthweight (<1500g)	Reichman (USA) 2001	B	46437	468	85.5	99.9	86.4	99.9	-
Very low birthweight (<1500g)	Ford (Aust) 2007	H	2432	1242	97.7	99.7	99.8	97.6	Excel
Low birth weight (<2500g)	Lin (Taiwan) 2004	B	2768	127	99.7	96.9	99.8	94.6	Excel
Low birthweight (<2500g)	Roohan (USA) 2003	B	440	-	100	100	100	100	-
Low birthweight (<2500g)	Reichman (USA) 2001	B	46437	3501	91.0	99.1	89.3	99.3	-
Low birth weight (< 2500 gms)	Taylor (Aust) 2005	H	491	12	100	99.8	92.3	100	Excel
Birthweight (<3000g)	DiGius. (USA) 2002	B	33616		99.4	98.8	99.7	97.9	Excel
Infant death									
Death during birth admission	Ford (Aust) 2007	H	2432	289	90.0	100	99.6	98.7	Excel
Infant cause of death	Hunt 2000	D	179	103	58%	-	-	-	-
Asphyxia									
Birth asphyxia	Taylor (Aust) 2005	H	491	3	66.7	99.6	50.0	99.8	Good
Fetal/birth asphyxia	Joseph (Can) 2009	H	6135	-	14.3	99.3	-	-	-
Fetal asphyxia/ fetal distress	Health Canada 2003	H	385	-	-	-	90.1	-	-
Apgar score									
5-min Apgar score <7	DiGius. (USA) 2002	B	33616	-	100	75.4	99.7	95.1	Excel

5-min Apgar score ≤9	DiGius. (USA) 2002	B	33616	-	99.6	85.4	98.6	95.7	Excel
Respiratory problems /ventilation									
Hyaline membrane disease (cases)	Piper (USA) 1993	B	1016	650	32.8	-	90.2	41.2	-
Hyaline membrane disease (controls)	Piper (USA) 1993	B	634	13	53.8	-	87.5	99.0	-
Respiratory distress syndrome	Ford (Aust) 2007	H	2432	1205	82.2	92.4	97.0	63.9	Excel
Respiratory distress (vs any)	Joseph (Can) 2009	H	6315	-	94.2	96.6	-	-	-
Respiratory distress of newborn (hyaline membrane disease)	Taylor (Aust) 2005	H	491	14	50.0	100	100	98.6	Good
Respiratory distress syndrome	Health Canada 2003	H	385	-	-	-	89.3	-	-
Transient tachypnea	Ford (Aust) 2007	H	2432	347	42.1	85.3	70.9	63.5	Good
Transient tachypnea of newborn	Taylor (Aust) 2005	H	491	11	63.6	99.6	77.8	99.2	Good
Any mechanical ventilation	Ford (Aust) 2007	H	2432	2023	76.1	97.1	99.2	45.1	Good
Intubation of newborn	Gissler (Fin) 1995	B	865	24	46.0	-	-	-	-
Infant resuscitation	Pym (Aust) 1993	B	846	86	71.4	-	93.0	-	-
CPAP	Ford (Aust) 2007	H	2432	1055	65.5	93.2	88.0	77.9	Good
Assisted ventilation <30 mins (cases)	Piper (USA) 1993	B	1016	59	10.2	-	11.5	94.3	-
Assisted ventilation <30 mins (controls)	Piper (USA) 1993	B	634	20	15.0	-	30.0	97.2	-
Assisted ventilation >30 mins (cases)	Piper (USA) 1993	B	1016	732	37.0	-	95.1	33.9	-
Assisted ventilation >30 mins (controls)	Piper (USA) 1993	B	634	11	18.2	-	50.0	98.6	-
Hemorrhage									
IVH	Ford (Aust) 2007	H	2432	394	52.0	98.4	86.1	91.4	Good
IVH, grade 3, 4	Joseph (Can) 2009	H	6315		88.9	100	-	-	-
Intracranial hemorrhage	Taylor (Aust) 2005	H	491	4	100	100	100	100	Excel
Any brain hemorrhage	Ford (Aust) 2007	H	2432	400	62.8	98.4	89.3	92.4	Good
Surgery/ procedures									
Drainage of air leak	Ford (Aust) 2007	H	2432	135	37.0	99.6	83.3	96.4	Good
PDA surgery	Ford (Aust) 2007	H	2432	19	94.7	100	100	100	Excel
NEC surgery	Ford (Aust) 2007	H	2432	17	82.4	100	100	99.9	Excel
Major surgery	Ford (Aust) 2007	H	2432	77	90.9	99.8	94.6	99.7	Excel
Other									

Retinopathy of prematurity	Ford (Aust) 2007	H	2432	273	57.5	99.4	92.9	94.9	Good
Neonatal aspiration of meconium	Taylor (Aust) 2005	H	491	4	25.0	100	100	99.4	-
Meconium aspiration	Ford (Aust) 2007	H	2432	56	67.9	99.5	95.0	95.8	-
Meconium aspiration syndrome (cases)	Piper (USA) 1993	B	1016	11	36.4	-	50.0	99.3	-
Pneumonia	Ford (Aust) 2007	H	2432	29	48.3	99.8	93.3	96.5	Good
Pulmonary hypertension	Ford (Aust) 2007	H	2432	53	64.2	100	95.6	99.2	Excel
NEC	Ford (Aust) 2007	H	2432	76	61.8	99.7	85.5	98.8	Good
Antibiotics to newborn	Gissler (Fin) 1995	B	865	26	73.0	-	-	-	-
Anemia, newborn (cases)	Piper (USA) 1993	B	1016	167	9.0	-	50.0	83.9	-
Anemia, newborn (controls)	Piper (USA) 1993	B	634	5	20.0	-	33.3	99.4	-
pH measurement of fetal blood	Gissler (Fin) 1995	B	865	41	59.0	-	-	-	-
Haemolytic disease of fetus and newborn	Taylor (Aust) 2005	H	491	5	60.0	100	100	99.6	Good
Neonatal jaundice	Taylor (Aust) 2005	H	491	25	80.0	99.6	90.9	98.9	Excel
Neonatal hypoglycemia	Taylor (Aust) 2005	H	491	20	85.0	99.8	94.4	99.4	Excel
Newborn seizuers (cases)	Piper (USA) 1993	B	1016	65	4.6	-	37.5	93.6	-
Convulsions of newborn	Taylor (Aust) 2005	H	491	1	0.0	99.8	0.0	99.8	
Neonatal withdrawal symptoms from maternal use of drug of addiction	Taylor (Aust) 2005	H	491	2	100	100	100	100	Excel
Bacterial sepsis (neonatal codes)	Joseph (Can) 2009	H	6135	-	38.4	99.7	-	-	-
Bacterial sepsis (adult/neonatal code)	Joseph (Can) 2009	H	6135	-	67.4	99.6	-	-	-
Fracture of clavicle	Joseph (Can) 2009	H	6135	-	91.7	100	-	-	-
Birth injury (cases)	Piper (USA) 1993	B	1016	284	1.8	-	83.3	71.3	-
Birth injury (controls)	Piper (USA) 1993	B	634	141	1.4	-	100	77.8	-
Infant transferred	Reichman (USA) 2001	B	46437	980	22.8	99.9	79.9	98.4	-
Infant transferred	DiGiuseppe (USA) 2002	B	33616	-	48.1	99.8	87.0	98.8	Good
Infant transferred (cases)	Piper (USA) 1993	B	1016	136	72.8	-	97.1	95.9	-

[a]B = Birth data (birth certificate or birth registry), H = Hospital discharge data, D = Death certificate, B or D = Included in either birth or hospital data, CPAP = Continuous positive airway pressure, IVH = Intraventricular Hemorrhage, NEC = Necrotizing enterocolitis, PDA = Patent ductus arteriosus