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Validation study for a record linkage of births and infant deaths in Canada

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of the Canadian Perinatal Surveillance System

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How to obtain information:

This report can soon be downloaded free of charge at
<http://www.statcan.ca/english/research/other.htm>

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SUMMARY

Objectives

This study was initiated to test the validity of probabilistic linkage methods used at Statistics Canada. It compared the results of data linkages on infant deaths in Canada with infant death data from Nova Scotia and Alberta. It also compared the availability of fetal deaths on the national and provincial files. Finally it examined the values of two important analytical variables – gestational age and birth weight – which are used for descriptive and analytical purposes in the Canadian Perinatal Surveillance System.

Data Sources

Records of infants born during the period January 1990 to December 1991 were extracted from a Canadian birth-death probabilistic linkage of vital statistics data at Statistics Canada, and were compared with records from the provincial data bases of Alberta and Nova Scotia. In these two provinces, the source of data is primarily hospital records, with the particulars of the mother and child collected at the time of the birth. Birth weight and gestational age are also found on the birth registrations. The parent generally fills out these forms. Canadian birth data are available at Statistics Canada. Infant deaths in Canada for the period 1985 – 1995 have been linked to births for 1985 – 1994 (excluding Newfoundland prior to 1991) using probabilistic record linkage matching techniques.

Analytical Techniques

Records relating to events occurring in Alberta and Nova Scotia for births in 1990-1991 were selected from the STC linked file. These records were then matched to the provincial files for Nova Scotia and Alberta. An estimate was made of the accuracy of the individuals found in the three data bases. The values of birth weight and gestational age variables for the same individual were examined.

Main Results

Overall the Statistics Canada linkage methods were effective in this validation study, and agreement between the provincial and the Statistics Canada data bases is strong. For the Nova Scotia file, 99% of the infant deaths were successfully located on the linked STC file; for the Alberta neonatal deaths the comparable linkage rate was over 99%. Agreement on fetal deaths between the Nova Scotia and the Statistics Canada files was 92%, whereas for the Alberta file it was nearly 99%. The study's findings point to the importance of complete and correct identifiers, as well as to the uniform application of event definitions (e.g., for live birth and stillbirth). Examination of gestational age and birth weight indicates good overall agreement.

1. BACKGROUND

Health Canada is leading the development of the Canadian Perinatal Surveillance System (CPSS) (1), under the guidance of a national steering committee. Dr. Alexander Allen chairs the CPSS's Fetal-Infant Mortality Study Group, which is made up of members of the steering committee and staff from Health Canada and Statistics Canada (STC). One project for this group is a study that required the linkage of the Canadian birth files for 1985-1994 with Canadian death files for 1985-1995 (located at STC).

Existing databases such as the Canadian Birth Data Base (CBDB) (2) and the Canadian Mortality Data Base (CMDDB) (3) are attractive to health and health care analysts because they permit detailed studies of large populations. However, a single database may lack information that is crucial to the analysis. For example, information on birth weight and gestational age are usually recorded on birth registrations, while information on infant mortality is recorded on death registrations. The result is that the data eventually reside on two distinct files. In recent years, developments in computerized record linkage methodology have made it possible to bring these files together. In the present study, probabilistic linkage is used to link death records to corresponding birth records, based on a calculated probability using relevant identifying variables (e.g., name, sex, date of birth).

The CBDB records of births occurring in Canada in 1990-1991 were linked to the 1990-1992 infant death records selected from the Canadian Mortality Data Base using probabilistic linkage. Fetal deaths - where both birth and death information are available - were then added. This created a file of Canadian fetal and infant deaths that could be compared with the two selected provincial data bases, specifically those of Alberta and Nova Scotia. This report outlines the steps and results of this validation study.

2. THE STUDY'S OBJECTIVES

The *primary objective* of this study was to test the validity of the birth and infant death linkage methods used at STC. A *secondary objective* was to evaluate the quality of key analytical variables, namely birth weight and gestational age, on the STC database. These two variables are crucial indicators for infant health and survival. "Infants born too small and too soon have a much greater risk of death and disability" (4).

The validation study ascertains the strengths and weaknesses of the fetal and infant mortality data utilized by the CPSS, especially regarding the reliability of data collection and linkage strategies, and what improvements can be made. Once purely data, coding or linkage issues are identified, the surveillance system can then focus with greater precision on the analysis of fetal and infant deaths.

The study's objectives were achieved in two major stages: (i) by verifying that records on the Alberta and Nova Scotia files were also found on the linked STC birth-death file; and then

(ii) by comparing the analytical variables (for birth weight and gestational age) on the Alberta and Nova Scotia files with those on the linked STC birth-death file.

Other items of importance emerged in the course of completing the study, including:

- event definitions, particularly that of fetal death (stillbirth)
- rules for inclusion of event registrations (based on province of occurrence and/or residence)
- the possibility of missing and late registrations
- the data coding methods being used, e.g., for cause of death coding, and,
- question and respondent variations -- these depend on whether the data were supplied by parent (e.g., birth registration), physician (e.g., notice of live birth) or hospital (e.g., provincial sources).

3. DATA SOURCES AND PROCESSING

3.1 The Linked STC Birth-Death File

The Registrars of the ten provinces and two territories collect data on live births, fetal deaths and other deaths. Paper and electronic copies (if available) of the registration documents are submitted to Statistics Canada under federal and provincial agreements. Data are reformatted, edited, verified and stored in STC's Integrated Vital Statistics files. National vital statistics are generated and published from these files.

The STC files are preprocessed into a format suitable for record linkage. The phonetic New York State Individual Intelligence System (NYSIIS) codes (5) are generated, data items from other sources such as postal codes are added and alternate records are created using other surname fields (e.g., parental surnames). Live birth and fetal death data are stored on the Canadian Birth Data Base and the death records are stored on the Canadian Mortality Data Base.

The 1990-1991 CBDB birth events occurring in Canada were linked to the 1990-1992 CMDB for deaths occurring in Canada. A probabilistic record linkage was done using the Generalized Record Linkage System (6,7). This system compares fields common to the two files, assigns weights to the resulting links and calculates a total weight. Manual resolution was carried out to confirm all linked records with a total weight varying from -90 to 300, and to confirm all links to multiple births. Updates were made to the computer decisions where necessary, thus creating the linked STC birth-death file.

Two subsets of the linked STC birth-death file were extracted for the validation comparison. The subsets were:

1. All 1990-1991 live birth-death linkages *or* fetal death events where:
 - the province of occurrence of the birth is **Nova Scotia and**
 - the age at death is 0-364 days.
2. All 1990-1991 live birth - death linkages *or* fetal death events where:

- the province of occurrence of the birth and province of occurrence of the death is **Alberta and**
- the age at death is 0 - <28 days.

The total number of records selected in these subsets is shown in Table 1.

3.2 The Nova Scotia and Alberta Provincial Data Files

In order to match the records of deaths available in Alberta and Nova Scotia, a request was made of each province to have a special file prepared and sent to Statistics Canada.

3.2.1 Nova Scotia

The Reproductive Care Program of Nova Scotia supports the Nova Scotia Atlee Perinatal Database, which collects data for obstetrical and neonatal events from hospitals in the province (8). These data include information on birth weight and gestational age derived from hospital records. To ensure that all cases have been received, these records are matched with Nova Scotia vital statistics to ensure all infants are recorded. Birth and death registration numbers are entered on the data base. The fact of infant death occurring after discharge from hospital is captured from Nova Scotia vital statistics.

Nova Scotia supplied data for this validation study for events that took place only in Nova Scotia. For example, babies born out of province and moved or transferred to Nova Scotia are not included in the data. As well, babies who were born (or died) out of province to Nova Scotia residents are not included. The Nova Scotia file contains data for fetal deaths and for infant deaths from 0 to 364 days of age and includes birth weight and gestational age.

3.2.2 Alberta

The Alberta Medical Association Committee on Reproductive Care obtains mortality data for case review of fetal, neonatal and maternal deaths. The departments of medical records of Alberta hospitals provide the committee with components of the patient records. Patient records are verified with Alberta vital statistics (no information is extracted) to ensure that all cases have been received (9).

The cases reviewed are those that took place in Alberta. For example, babies born out-of-province and moved or transferred to Alberta are not included in the review. As well, babies who were born (or died) out of province to Alberta residents are not included. Alberta data are collected from Alberta hospital records of birth including delivery, prenatal and newborn records as well as autopsy reports. The Alberta file contains data for fetal deaths and for neonatal deaths of less than 28 days and includes birth weight and gestational age.

3.3 Data Editing and Processing

The Alberta and Nova Scotia files were processed at Statistics Canada to facilitate the match to the STC files. Name fields were standardized, geography fields were recoded and infant and fetal death records were grouped.

The standard definition of fetal death, supported by the Vital Statistics Council of Canada in 1993, requires that the fetus complete 20 weeks gestation or more, or that the weight of the fetus be 500 grams or greater. The wording for the relevant questions on the Nova Scotia Registration of Stillbirth form is "Duration of pregnancy (in completed weeks)" and "Weight of child at birth" in pounds and ounces or grams. The wording for the relevant questions on the Alberta Registration of Stillbirth form is "Duration of pregnancy (in completed weeks)" and "Weight of child at birth" in grams.

A total of 13 fetal death records on the Nova Scotia provincial file were excluded at the outset from this validation study. Two of these records were excluded because, according to the STC file, the mothers had delivered in New Brunswick, i.e., the province of occurrence was New Brunswick. The other 11 excluded records did not comply with the standard definition of fetal death.

Data anomalies were noted in the age of death and type of death¹ fields in 22 of the Alberta records. The Alberta data base administrator was contacted and 19 of 22 records were resolved and updated. Three cases could not be reconciled: two cases were coded as fetal deaths on the Alberta file but as infant deaths on the STC file; one case was coded as a neonatal death on the Alberta file and as a fetal death on the STC file. Two infant deaths and three fetal deaths were excluded due to missing identifiers and anomalies in the data, such as implausible birth weight and gestational age combinations (e.g., birth weight=97 grams and gestational age=25 weeks).

After data editing and processing, the number of eligible provincial records for comparison to the STC file is shown in Table 2.

3.4 Statistics Canada Data Availability

For livebirths in 1991 on the STC file, the variable "gestational age" was available on 99.8% of Nova Scotia records; it was 99.99% available for Alberta. (Between 1985 and 1991, neither province's availability for "gestational age" went below 99.75%.) Availability of "birthweight" in 1991 was 99.9% for Nova Scotia and Alberta. (For the period 1985 to 1991, STC availability of "birthweight" for Nova Scotia did not go below 99.7%, while for Alberta the low was 99.98%.)

For fetal deaths in 1991, the variable "gestational age" was available on 100% of the STC records for both Nova Scotia and Alberta. (Between 1985 and 1991, availability of "gestational age" went below 100% for Nova Scotia only in 1985 (98.9%) and 1988 (97.2%). In that period,

¹ On the Alberta database, the "type of death" field specifies whether the death was antepartum, intrapartum, early neonatal or late neonatal.

availability of that variable for Alberta did not go below 99.6%.) For "stillbirth weight", STC data availability in 1991 was 98.7% for Alberta and 100% for Nova Scotia. (Between 1985 and 1991, "stillbirth weight" availability did not go below 94.4% for Nova Scotia; for Alberta, it did not go below 96.4%.)

4. METHODS

4.1 Matching Techniques - Nova Scotia

The fetal and infant death records on the Nova Scotia file were processed separately. The infant deaths on the Nova Scotia file were matched to the linked STC file by the death registration and birth registration numbers supplied by the province. An exact match technique was employed using the SAS software package.

The province did not supply fetal death registration numbers. Therefore, the fetal death records on the Nova Scotia file were matched to the STC file using name and date of birth fields. Two data passes were done to maximize the number of matches. Selected fields for matching in the first pass were sex, the first four bytes of the surname and the date of birth (year, month and day). For matching in the second pass the sex field, the first four bytes of the maiden surname, and date of birth were selected.

Ninety of 144 (over 62%) of the fetal death matches were picked up in the first pass while nine of 144 (6%) were identified in the second pass; the remaining 45 (31%) were matched manually. Computer reports on the matches were generated to list the following common variables: surname, mother's given names or initials, date of birth, date of death, sex, mother's age, birth weight, gestational age, and province of residence. All matches were manually verified. The Statistics Canada fetal death registration numbers were attached to the Nova Scotia fetal death matches. Finally, eight STC records were pulled in an unsuccessful attempt to resolve the 12 remaining unmatched cases from the Nova Scotia file.

4.2 Matching Techniques - Alberta

Registration numbers were not available on the Alberta fetal and neonatal death records. Therefore, they were matched using common personal identifiers and processed together to maximize the number of individual matches. Because there was no "type of event" field (i.e., livebirth or stillbirth) on the Alberta file, this variable was imputed using "age at death" and "time of death" variables. When we compared "type of event" on the STC and Alberta files, there were some discrepancies. The Alberta database administrator was contacted. In two of these cases, the records were coded to fetal death on the Alberta file and to infant death on the linked STC file. In the remaining case, the event was coded to neonatal death on the Alberta file and to fetal death on the STC file. Nineteen of 22 cases agreed with the STC file while three of 22 were not reconciled. The anomalies in the "type of event" field were corrected for the 19

cases. In the remaining three cases, the STC type of event code was used in the preparation of the tables.

Three passes were executed to maximize the number of potential matches. The selected fields for matching in the first pass were sex, the first four bytes of the surname, and the date of birth (year, month, day). The second pass used sex, the first four bytes of the surname field and birth weight. The third pass used sex, and date of birth. As a result, 857 of 982 (87%) of the matches were picked up on the first pass. The second pass matched 6 of 982 (less than 1%) but the third pass picked up a further 119 (12%). Computer reports were generated to list all matches and the following common variables: surname, date of birth, date of death, sex, mother's age, birth weight, gestational age, and province of residence. All matches were manually verified. The STC fetal and infant death registration numbers were attached to the Alberta file to enable comparison of the analytical variables. To gather additional information for the unmatched records, prints of the original live birth and stillbirth registration forms were examined. The Alberta data base administrator was contacted to query the unmatched Alberta records, netting one extra match, therefore bringing the total matches to 983.

4.3 Comparison of Analytical Variables

Birth weight and gestational age on the two provincial files were compared with the STC file if the records referred to the same individual and the events complied to the standard definition (e.g., a fetal death record would have to meet the eligibility criteria for gestational age and birth weight).

5. **RESULTS FOR NOVA SCOTIA**

5.1 Nova Scotia - Infant Deaths

The presence of the birth and death registration numbers provided by Nova Scotia Vital Statistics facilitated the comparison between the linked STC birth-death file and the Nova Scotia infant death file.

As shown in Table 3, 153 of 155 (99%) of infant deaths on the Nova Scotia file were found on the linked STC birth-death file. Two were not found. One case was identified by the record linkage system but manually rejected after reviewing computer reports and determining that incorrect identifiers had been entered on the CBDB birth record. In the other case, a birth registration could not be located and it was also noted on the death registration form that a birth registration was not available.

Of the five infant deaths appearing on the linked STC file which were not present on the Nova Scotia file, two did occur in Nova Scotia and three occurred outside the province – one in Ontario and two in Prince Edward Island.

5.2 Nova Scotia - Fetal Deaths

As seen in Table 3, 144 of 156 (92%) of the fetal deaths on the Nova Scotia file matched to the STC file. Twelve Nova Scotia fetal death records did not match to the STC file. The Nova Scotia data base administrator provided extra information regarding these cases. Variance in the data definition of fetal death used by Nova Scotia and Statistics Canada may explain these 12 missing Nova Scotia records.

Also pertinent, and in contrast to infant deaths, Nova Scotia Vital Statistics did not provide registration numbers for fetal deaths. Statistics Canada captures fetal death events if gestational age is 20 or more complete weeks or the birth weight is 500 grams or more. As noted in Table 3, nine of the 12 Nova Scotia fetal deaths had a gestational age equal to 20 weeks. Birth weight was less than 500 grams in five of these cases, and it was missing in the other four. These nine cases had therefore been classified as stillbirths on the Nova Scotia file based on gestational age only.

As well, the STC file had eight fetal death records that did not match to the Nova Scotia file. Two of the eight women resided in another province but six resided in Nova Scotia. Some of these cases may be matches to the 12 missing Nova Scotia records noted above but, due to limited identifiers, they could not be reconciled.

5.3 Nova Scotia Matches – Analysis of Gestational Age

Mean gestational age by event type is shown in Table 4. As shown in Tables 5 to 7, gestational age was grouped by the analytical categories specified by the Fetal-Infant Mortality Study Group, and compared. As seen in Table 5, 105 of 153 (almost 70%) of the infant deaths and 109 of 144 (76%) of the fetal deaths were in agreement. These rather low agreements may be due to differences in the calculation of gestational age. Nova Scotia's Atlee Perinatal Database electronically computes gestational age from the date of the first day of the last menstrual period (found on the hospital chart) to the date of live birth or stillbirth. In contrast, gestational age on the STC file comes from Nova Scotia stillbirth registrations, whose information is provided by the mother (or father). However, Tables 6 and 7 indicate that most disagreements were by just plus or minus one narrow category. Gestational age was missing on 9 of 144 (nearly 6%) of the infant deaths and on 4 of 144 (nearly 3%) of the fetal deaths in Nova Scotia.

5.4 Nova Scotia Matches – Analysis of Birth Weight

Mean birth weight by event type is shown in Table 8. According to the CPSS broad birth weight groupings in Table 9, 4 of 144 (about 3%) of fetal death records did not agree within the same category. Using the narrow groupings shown in Table 10, also netted just 4 fetal death records that did not agree within the same category. Altogether, 5 of 144 (over 3%) of Nova Scotia fetal death records were missing birth weight information.

Table 11 shows the CPSS broad birth weight groupings for Nova Scotia infant deaths; agreement is almost complete. Only one of 153 did not agree. In Table 12, applying the CPSS

narrow groupings for Nova Scotia infant deaths reveals relatively more non-agreement at 5 of 153 (about 3%), however, four of the five disagreements were within one narrow category. As well, one infant death record was missing birth weight information.

6. RESULTS FOR ALBERTA

6.1 Alberta - Neonatal Deaths

As shown in Table 13, 365 of 367 (over 99%) of the neonatal deaths on the Alberta file matched to the linked STC birth-death file. Two neonatal deaths on the Alberta file could not be located on the linked STC file. The data base administrator for Alberta was contacted to obtain additional information. Both infants were born and died in Alberta.

6.2 Alberta - Fetal deaths

Table 13 also shows that 618 of 625 (99%) of the fetal deaths on the Alberta file matched to the STC file. The data base administrator was contacted to obtain additional information regarding the seven outstanding cases. The mothers resided in and the event occurred in Alberta, but these cases were not found on the STC file.

Three fetal deaths on the STC file did not match to the Alberta file (Table 13), even though the mothers lived in Alberta and the event occurred there.

6.3 Alberta Matches – Analysis of Gestational Age

Mean gestational age by event type is shown in Table 14. As shown in Tables 15 to 17, there was a high level of concordance in gestational age. Gestational age was grouped by analytical category, as specified by the CPSS Fetal-Infant Mortality Study Group, and compared. As seen in Table 15, 317 of 365 (almost 87%) of the neonatal deaths and 549 of 618 fetal deaths (89%) were in agreement. Furthermore, Tables 16 and 17 indicate that most disagreements were within one category. Notably, no gestational age data were missing.

6.4 Alberta Matches – Analysis of Birth Weight

Mean birth weight by event type is shown in Table 18. We grouped birth weight by the grouping specifications established by the CPSS Fetal-Infant Mortality Study Group. Tables 19 to 22 show the differences between birth weight fields in the matched records. Table 19 reveals that 5 of 618 (less than 1%) fetal death matches disagreed according to the CPSS broad groupings. The CPSS narrow groupings (Table 20) resulted in 9 of 618 disagreements (less than 2%). A total of 10 Alberta fetal death records were missing birth weight information.

Table 21 shows that there were just 3 of 365 birth weight disagreements for neonatal deaths (less than 1%) using the CPSS broad groupings. Using the CPSS narrow groupings, disagreement climbs to 9 of 365 (over 2%) (Table 22). Just one Alberta neonatal death record was missing birth weight data.

7. WEAKNESSES AND LIMITATIONS OF THE PRESENT STUDY

Although the CBDB and CMDDB are considered to be very complete for events occurring in Canada, under-reporting does exist, mostly due to missing late registrations (i.e., records received after the processing cut-off date of a given year). For example, approximately two to three per cent of all infant deaths during the period 1985 to 1995 could not be linked to a birth record on the CBDB for the birth years 1985 to 1994 (excluding Newfoundland and Ontario). Missing also are deaths, live births and fetal deaths of Canadians occurring outside Canada.

This validation study examines the linkage results and analytical variables in only two provinces over a two-year period. There may be differences in the coding and recording practices over time in other provinces and territories. For example, the recording of birthweight - whether pounds and ounces and/or grams - has varied by province.

Application of the definition of a fetal death appears to vary in the two study provinces. For example, Nova Scotia captured some fetal deaths where the gestational age was less than 20 weeks *and* weight was less than 500 grams. Standard definitions and coding schemes are required in all jurisdictions in order to carry out a comprehensive comparison.

In preprocessing the Alberta file, it was found that for the year 1990, mother's province of residence and transfer status of the patient was unknown. This widens the search for unmatched cases. Some miscoding on the type of event (neonatal death versus fetal death) also occurred. Also noted within the Alberta file were inconsistencies between the type of death and the age of death.

8. CONCLUSIONS

Overall, the Statistics Canada linkage methods were effective in this validation study, and agreement between the provincial and the STC databases is strong. For the Nova Scotia file, 99% of the infant deaths were successfully located on the linked STC file; for Alberta neonatal deaths, the comparable linkage rate was over 99%.

Record linkage also provides an opportunity to improve data quality of participating databases, in this case, those of Nova Scotia and Alberta. The linkage study located three infants born in Nova Scotia who had died in another province and who had not been identified on the Nova Scotia file. The linkage also located 22 Alberta events (i.e., fetal or neonatal deaths) that had been incorrectly identified as to type of event on the Alberta file. As well, the provincial files contained records that were not on the STC linked file. Some of these may have been late registrations that were not yet on the STC file for 1990 and 1991.

Agreement between the STC file and the Nova Scotia file for fetal deaths was 92%. For the Alberta file, it was 99%. The study located two fetal deaths that occurred in Nova Scotia to mothers who resided in another province; they were not included in the provincial file. As well,

the Nova Scotia file contained 12 fetal death records that were missing from the STC file. These findings illustrate the importance of complete and correct identifiers, as well as the uniform application of event definitions.

Agreement was good on gestational age data for both infant and fetal deaths. On the Nova Scotia file, data on gestational age were missing on nine infant death records and on four fetal death records. Alberta file data on gestational age had few disagreements and no missing data.

For birth weight by CPSS category, the linkage yielded a small number of disagreements for both Nova Scotia and Alberta for infant deaths, but almost all of these were within one category. For each province, one infant death record was missing birth weight information.

For fetal death records, the CPSS birth weight categories again yielded few disagreements in Nova Scotia and Alberta. What few discrepancies there were may be due to the different data sources or reporting methods. A few Nova Scotia and Alberta fetal death records were missing birth weight information.

To improve results from record linkage:

- definitions should be followed precisely, particularly pertaining to fetal deaths
- no analytical values should be missing
- complete personal identifiers necessary for record linkage need to be collected
- correct records should be captured
- the data should be edited for unlikely combinations of birth weight and gestational age.

9. ACKNOWLEDGEMENTS

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APPENDIX A

GLOSSARY OF TERMS

Early neonatal death - death of a live born infant occurring before 168 hours or the 7th full day of age.

Infant death - death of a child less than one year of age.

Late neonatal death - death of a live born infant occurring from and including the 7th to and including the 27th full day of age.

Live birth - complete expulsion or extraction from the mother, irrespective of the duration of the pregnancy, of a fetus in which, after expulsion or extraction there is breathing, beating of the heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle, whether or not the umbilical cord has been cut or the placenta attached.

Neonatal death - death of a live born infant occurring less than 28 full days after birth, including early and late neonatal deaths.

Stillbirth (fetal death) - complete expulsion or the extraction from the mother after at least 20 weeks' pregnancy, or after attaining a weight of 500 grams or more, of a fetus in which, after the expulsion or extraction there is no breathing, beating of the heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle.

APPENDIX B

DESCRIPTIVE STATISTICS FOR UNMATCHED RECORDS – NOVA SCOTIA AND ALBERTA

Table B.1
Descriptive statistics for gestational age (in weeks) for unmatched Statistics Canada records and unmatched Nova Scotia records, fetal and infant death, for birth years 1990-1991

	Infant Death (0 – 364 days)		Fetal Death		
	Nova Scotia	STC	Nova Scotia		STC
			Eligible	Ineligible	
Mean	35.00	34.60	20.18	21.00	23.50
SD	7.07	6.46	0.40	7.36	4.70
Minimum	30.00	24.00	20.00	17.00	21.00
Maximum	40.00	40.00	21.00	40.00	35.00
N	2	5	11	9	8
Number of Missing	0	0	1	4	0

Table B.2
Descriptive statistics for birth weight (in grams) for unmatched Statistics Canada records and unmatched Nova Scotia records, fetal and infant death, for birth years 1990-1991

	Infant Death (0 – 364 days)		Fetal Death		
	Nova Scotia	STC	Nova Scotia		STC
			Eligible	Ineligible	
Mean	2157.50	2865.40	546.87	697.22	1357.86
SD	1382.39	1401.34	931.71	1285.46	1536.30
Minimum	1180.00	500.00	90.00	95.00	290.00
Maximum	3135.00	4195.00	2840.00	4110.00	4430.00
N	2	5	8	9	7
Number of Missing	0	0	4	4	1

Table B.3
Descriptive statistics for gestational age (in weeks) for unmatched Statistics Canada records and unmatched Alberta records, fetal and neonatal deaths, for birth years 1990-1991

	Neonatal Death (0 - <28 days)			Fetal Death		
	Alberta		STC	Alberta		STC
	Ineligible	Eligible		Ineligible	Eligible	
Mean	32.50	23.50	31.33	22.3	28.57	25.33
SD	13.43	0.70	10.46	2.51	6.77	4.16
Minimum	23.00	23.00	18.00	20.00	20.00	22.00
Maximum	42.00	24.00	40.00	25.00	36.00	30.00
N	2	2	6	3	7	3
Number of Missing	0	0	0	0	0	0

Table B.4
Descriptive statistics for birth weight (in grams) for unmatched Statistics Canada records and unmatched Alberta records, fetal and neonatal deaths, for birth years 1990-1991

	Neonatal Death (0 - <28 days)			Fetal Death		
	Alberta		STC	Alberta		STC
	Ineligible	Eligible		Ineligible	Eligible	
Mean	1680.00	602.50	1640.83	75.00	957.42	511.66
SD	1781.91	53.03	1202.49	31.11	1254.38	705.80
Minimum	420.00	565.00	225.00	53.00	240.00	60.00
Maximum	2940.00	640.00	3070.00	97.00	3710.00	1325.00
N	2	2	6	2	7	3
Number of Missing	0	0	0	1	0	0

TABLES

Table 1
Records selected from the Statistics Canada file for the validation study by birth outcome, for birth years 1990-1991

Birth Outcome	Alberta (0 - <28 days)	Nova Scotia (0 - 364 days)
Death	371	158
Fetal death	621	152
TOTAL	992	310

Table 2
Number of eligible records on provincial Nova Scotia and Alberta data files for the validation study by birth outcome, for birth years 1990-1991

Birth Outcome	Alberta (0 - <28 days)	Nova Scotia (0 - 364 days)
Death	367	155
Fetal death	625	156 ¹
TOTAL	992²	311

1 The initial file for Nova Scotia fetal deaths contained 169 records. However, 13 fetal death records on the Nova Scotia file could not be included in this validity study. Please see subsection 3.3.

2 The initial file for Alberta contained a total of 997 records. However, three fetal death records and two infant death records could not be included in this validity study. Please see subsection 3.3.

Table 3
Results of the comparison of the Nova Scotia with the Statistics Canada records, fetal and infant deaths, for birth years 1990 - 1991

Results	Infant death (0 - 364 days)	Fetal death
Infant/fetal death present on both files	153	144
NS infant/fetal death present on NS file only	2	12 ¹
STC infant/fetal death present on STC file only	5 ²	8 ³
TOTAL RECORDS	160	164

¹ In nine cases, gestational age = 20 weeks. In five of these cases the birthweight < 500 grams, and birthweight was missing in the remaining four.

² In three cases, death occurred in another province, and in two cases in Nova Scotia.

³ In two cases, the mother resided in another province. The remaining six cases could not be reconciled due to limited identifiers, but the province of occurrence of birth was Nova Scotia.

Table 4
Descriptive statistics for gestational age (in weeks) for the matched Statistics Canada and Nova Scotia records, fetal and infant deaths, for birth years 1990-1991

	Infant Death (0-364 days)		Fetal Death	
	Nova Scotia	STC	Nova Scotia	STC
Mean	32.68	32.63	30.93	31.11
SD	6.68	6.84	6.49	6.54
Minimum	21.00	20.00	15.00	20.00
Maximum	43.00	44.00	41.00	42.00
Number of non-missing values	144	153	140	144
Number of missing values	9	0	4	0
Total	153	153	144	144

Table 5
Comparison of gestational age¹ on Statistics Canada records with gestational age on the Nova Scotia records, fetal and infant deaths, for birth years 1990-1991

Results	Infant Death (0 – 364 days)	Fetal Death
Agree with STC File	105 (68.6%)	109 (75.7%)
Disagree with STC File	39 (25.5%)	31 (21.5%)
Missing	9 (5.9%)	4 (2.8%)
TOTAL	153 (100%)	144 (100%)

¹Gestational age groupings in weeks: < 20, 20-21, 22, 23-24, 25-26, 27-28, 29-31, 32-33, 34-36, 37-41, ≥42

Table 6
Comparison of gestational age on Statistics Canada records with gestational age on the Nova Scotia records - fetal deaths, for birth years 1990-1991

STATISTICS CANADA											
Gestational Age (weeks)	20-21	22	23-24	25-26	27-28	29-31	32-33	34-36	37-41	≥42	Row Total Percent
<20				1				1			2 1.39
20-21	11	1									12 8.33
22	1	4									5 3.47
23-24	1	1	7	1							10 6.94
25-26			1	6							7 4.86
27-28	1				11	1		1			14 9.72
29-31			3	1	1	13	4				22 15.28
32-33			1			3	8	1			13 9.03
34-36						1	1	16	2		20 13.89
37-41								1	33	1	35 24.31
NA					2				2		4 2.78
Column Total Percent	14 9.72	6 4.17	12 8.33	9 6.25	14 9.72	18 12.50	13 9.03	20 13.89	37 25.69	1 0.69	144 100.00

Table 7
Comparison of gestational age on Statistics Canada records versus gestational age on the Nova Scotia records – infant deaths, for birth years 1990-1991

Gestational Age (weeks)	STATISTICS CANADA										Row Total Percent
	20-21	22	23-24	25-26	27-28	29-31	32-33	34-36	37-41	≥42	
20-21	1	3									4 2.61
22		3		1							4 2.61
23-24		4	12	1							17 11.11
25-26			3	7	2						12 7.84
27-28				2	8						10 6.54
29-31			1	1	1	10		1			14 9.15
32-33						1	3	2			6 3.92
34-36				1			1	13	4		19 12.42
37-41						1		3	43	4	51 33.33
≥42									2	5	7 4.58
NA	1		1	1				1	5		9 5.88
Column Total Percent	2 1.31	10 6.54	17 11.11	14 9.15	11 7.19	12 7.84	4 2.61	20 13.07	54 35.29	9 5.88	153 100.00

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Table 8
Descriptive statistics for birth weight (in grams) for the matched Statistics Canada and Nova Scotia records, fetal and infant deaths, for birth years 1990-1991

	Infant Death (0 – 364 days)		Fetal Death	
	Nova Scotia	STC	Nova Scotia	STC
Mean	2039.58	2026.43	1640.18	1642.35
SD	1245.64	1251.32	1199.55	1192.96
Minimum	350.00	350.00	195.00	141.00
Maximum	5400.00	5414.00	4990.00	4990.00
Number of non-missing values	153	152	139	144
Number of missing values	0	1	5	0
Total	153	153	144	144

Table 9

Comparison of birth weight (CPSS broad groupings) on Statistics Canada records with birth weight on the Nova Scotia records – fetal deaths, for birth years 1990-1991

		STATISTICS CANADA					
Birth Weight (grams)		≤999	1000-1499	1500-2499	≥2500	NA	Row Total Percent
NOVA SCOTIA	≤999	55	1				56 38.89
	1000 - 1499	1	19				20 13.89
	1500 - 2499			23	1		24 16.67
	≥2500			1	38		39 27.08
	NA	2	1	1	1		5 3.47
	Column Total	58	21	25	40		144
	Percent	40.28	14.58	17.36	27.78		100.00

Table 10

Comparison of birth weight (CPSS narrow groupings) on Statistics Canada records with birth weight on the Nova Scotia records – fetal deaths, for birth years 1990-1991

		STATISTICS CANADA									
Birth Weight (grams)		≤399	400-499	500-749	750-999	1000-1499	1500-2499	2500-4499	≥4500	NA	Row Total Percent
NOVA SCOTIA	≤399	16				1					17 11.81
	400 - 499		15								15 10.42
	500 - 749			12	2						14 9.72
	750 - 999				10						10 6.94
	1000 - 1499				1	19					20 13.89
	1500 - 2499						23	1			24 16.67
	2500 - 4499						1	36			37 25.69
	≥4500								2		2 1.39
	NA	2				1	1	1			5 3.47
	Column Total	18	15	12	13	21	25	38	2		144
Percent	12.50	10.42	8.33	9.03	14.58	17.36	26.39	1.39		100.00	

Table 11
Comparison of birth weight (CPSS broad groupings) on Statistics Canada records with birth weight on the Nova Scotia records – infant deaths, for birth years 1990-1991

		STATISTICS CANADA						
N O V A S C O T I A	Birth Weight (grams)	≤999	1000-1499	1500-2499	≥2500	NA	Row Total Percent	
		≤999	51			1		52 33.99
		1000 – 1499		11				11 7.19
		1500 – 2499			26			26 16.99
		≥2500				63	1	64 41.83
		Column Total	51	11	26	64	1	153
		Percent	33.33	7.19	16.99	41.83	0.65	100.00

Table 12
Comparison of birth weight (CPSS narrow groupings) on Statistics Canada records with birth weight on the Nova Scotia Records – infant deaths, for birth years 1990-1991

		STATISTICS CANADA										
N O V A S C O T I A	Birth Weight (grams)	≤399	400-499	500-749	750-999	1000-1499	1500-2499	2500-4499	≥4500	NA	Row Total Percent	
		≤399	4									4 2.61
		400 -499		9					1			10 6.54
		500 - 749		2	20	1						23 15.03
		750 - 999			1	14						15 9.80
		1000 - 1499					11					11 7.19
		1500 - 2499						26				26 16.99
		2500 - 4499							60	1		61 39.87
		≥4500								3		3 1.96
		Column Total	4	11	21	15	11	26	61	3	1	153
	Percent	2.61	7.19	13.73	9.80	7.19	16.99	39.87	1.96	0.65	100.00	

Table 13

Results of the comparison of the Alberta records with the Statistics Canada records, fetal and neonatal deaths, for birth years 1990 - 1991

Results	Neonatal Death (0 – <28 days)	Fetal Death
Infant/Fetal Death Present on Both Files (Matches)	365	618
Neonatal/Fetal Death Present on ALTA File Only	2	7
Infant/Death Present on STC File Only	6 ¹	3 ²
TOTAL RECORDS	374	628

¹ One of the six mothers resided in British Columbia; the other five were Alberta residents.

² In these three cases, the mothers lived in Alberta and the event occurred there.

Table 14

Descriptive statistics for gestational age (in weeks) for the matched Statistics Canada and Alberta records, fetal and neonatal deaths, for birth years 1990-1991

	Neonatal Death (0 - <28 days)		Fetal Death	
	Alberta	STC	Alberta	STC
Mean	29.26	29.29	29.80	29.75
SD	6.83	6.97	6.94	6.98
Minimum	18.00	17.00	20.00	20.00
Maximum	43.00	43.00	42.00	43.00
Number of non-missing values	365	365	618	618
Number of missing values	0	0	0	0
Total	365	365	618	618

Table 15
Comparison of gestational age¹ on Statistics Canada fetal death records with gestational age on the Alberta records, fetal and neonatal deaths, for birth years 1990-1991

Results	Neonatal Death (0 – <28 days)	Fetal Death
Agree with STC File	317 (86.8%)	549 (88.8%)
Disagree with STC File	48 (13.2%)	69 (11.2%)
TOTAL	365 (100%)	618 (100%)

¹Gestation age groupings in weeks: < 20, 20-21, 22, 23-24, 25-26, 27-28, 29-31, 32-33, 34-36, 37-41, 42 +.

Table 16
Comparison of gestational age on Statistics Canada records with gestational age on the Alberta records – fetal deaths, for birth years 1990-1991

STATISTICS CANADA											
Gestational Age (weeks)	20-21	22	23-24	25-26	27-28	29-31	32-33	34-36	37-41	≥42	Row Total Percent
20-21	75	5	1	1							82 13.27
22	2	46	5								53 8.58
23-24	3	3	69	2	1						78 12.62
25-26			3	28	2			1			34 5.50
27-28			5	3	38	1					47 7.61
29-31	1	2			2	47	1	1			54 8.74
32-33						2	39	2			43 6.96
34-36			1				3	66	7		77 12.46
37-41								4	135	5	144 23.30
≥42										6	6 0.97
Column Total Percent	81 13.11	56 9.06	84 13.59	34 5.50	43 6.96	50 8.09	43 6.96	74 11.97	142 22.98	11 1.78	618 100.00

Table 17
Comparison of gestational age on Statistics Canada records with gestational age on the Alberta records – neonatal deaths, for birth years 1990-1991

STATISTICS CANADA												
Gestational Age (weeks)	<20	20-21	22	23-24	25-26	27-28	29-31	32-33	34-36	37-41	≥42	Row Total Percent
<20		1										1 0.27
20-21	3	27	3									33 9.04
22		3	26	2								31 8.49
23-24	1	2	4	55	4	1						67 18.36
25-26			1	3	32	4				1		41 11.23
27-28				1	2	27	2					32 8.77
29-31						2	22					24 6.58
32-33								12	2			14 3.84
34-36									38	3		41 11.23
37-41									2	72	1	75 20.55
≥42											6	6 1.64
Column Total Percent	4 1.10	33 9.04	34 9.32	61 16.71	38 10.41	34 9.32	24 6.58	12 3.29	42 11.51	76 20.82	7 1.92	365 100.00

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Table 18
Descriptive statistics for birth weight (in grams) for the matched Statistics Canada and Alberta records, fetal and neonatal deaths, for birth years 1990-1991

	Neonatal Death (0 - <28 days)		Fetal Death	
	Alberta	STC	Alberta	STC
Mean	1498.33	1485.71	1439.10	1434.88
SD	1189.83	1159.64	1143.79	1140.27
Minimum	215.00	200.00	60.00	50.00
Maximum	6010.00	6024.00	4460.00	4460.00
Number of non-missing values	364	364	613	608
Number of Missing values	1	1	5	10
Total	365	365	618	618

Table 19

Comparison of birth weight (CPSS broad groupings) on Statistics Canada records with birth weight on the Alberta records – fetal deaths, for birth years 1990-1991

		STATISTICS CANADA					
Birth Weight (grams)	≤999	1000-1499	1500-2499	≥2500	NA	Row Total	Percent
≤999	295	1			4	300	48.54
1000 - 1499	2	61	1			64	10.36
1500 - 2499		1	105			106	17.15
≥2500				140	3	143	23.14
NA	2				3	5	0.81
Column Total	299	63	106	140	10	618	
Percent	48.38	10.19	17.15	22.65	1.62	100.00	

Table 20

Comparison of birth weight (CPSS narrow groupings) on Statistics Canada records with birth weight on the Alberta records – fetal deaths, for birth years 1990-1991

		STATISTICS CANADA								
Birth Weight (grams)	≤399	400-499	500-749	750-999	1000-1499	1500-2499	2500-4499	NA	Row Total	Percent
≤399	123							3	126	20.39
400 -499		47	2		1			1	51	8.25
500 - 749	1		90	1					92	14.89
750 - 999				31					31	5.02
1000 - 1499				2	61	1			64	10.36
1500 - 2499					1	105			106	17.15
2500 - 4499							140	3	143	23.14
NA	2							3	5	0.81
Column Total	126	47	92	34	63	106	140	10	618	
Percent	20.39	7.61	14.89	5.50	10.19	17.15	22.65	1.62	100.00	

Table 21

Comparison of birth weight (CPSS broad groupings) on Statistics Canada records with birth weight on the Alberta records – neonatal deaths, for birth years 1990-1991

		STATISTICS CANADA					
A L B E R T A	Birth Weight (grams)	≤999	1000-1499	1500-2499	≥2500	NA	Row Total Percent
	≤999	182				1	183 50.14
	1000 - 1499	2	45				47 12.88
	1500 - 2499			44			44 12.05
	≥2500			1	89		90 24.66
	NA	1					1 0.27
	Column Total Percent	185 50.68	45 12.33	45 12.33	89 24.38	1 0.27	365 100.00

Table 22

Comparison of birth weight (CPSS narrow groupings) on Statistics Canada records with birth weight on the Alberta records – neonatal deaths, for birth years 1990-1991

		STATISTICS CANADA									
A L B E R T A	Birth Weight (grams)	≤399	400-499	500-749	750-999	1000-1499	1500-2499	2500-4499	≥4500	NA	Row Total Percent
	≤399	29									29 7.95
	400 - 499	1	40								41 11.23
	500 - 749			81	1					1	83 22.74
	750 - 999				30						30 8.22
	1000 - 1499			1	1	45					47 12.88
	1500 - 2499						44				44 12.05
	2500 - 4499						1	84			85 23.29
	≥4500							4	1		5 1.37
	NA				1						1 0.27
Column Total Percent	30 8.22	40 10.96	82 22.47	33 9.04	45 12.33	45 12.33	88 24.11	1 0.27	1 0.27	365 100.00	