Alberta's Infant Mortality Rate: The Effect of the Registration of Live Newborns Weighing Less Than 500 Grams

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Infant mortality is a frequently used measure of population health status. Because of concern that Canada's infant mortality rate (IMR) was rising, Joseph and Kramer^{1,2} examined trends in Canada's IMR and the effect of registering extremely low birthweight (under 500 grams) infants as live births. A live birth is defined as any infant who, after delivery, "...breathes or shows any other evidence of life, as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles...".³ This definition does not, however, refer to the *viability* of the newborn and as a result there may be differences in how live births are recorded in different jurisdictions. The World Health Organization has recommended the removal of newborns weighing less than 500 grams from the calculation of IMR when they are to be compared across regions.³

Joseph and Kramer,¹ noting an increase in the number of under 500 gram newborns registered as live births and assuming a 90% mortality rate for these newborns, recalculated the Canadian IMR. For 1993,

this decreased the IMR for Canada from 6.3 to 5.5 per 1,000 live births. In a second report,² they excluded all live births weighing less than 500 grams and again demonstrated an impact on the IMR. Joseph and Kramer¹ concluded that infant mortality rates should be modified for the proportion of registered live births which are under 500 grams.

One of the limitations acknowledged by Joseph and Kramer¹ was that they did not directly link births with deaths to determine the actual mortality rate. We undertook the present analysis to determine the effects of the registration of live births weighing less than 500 grams on Alberta's IMR by linking data on birth and death

registrations and comparing the results with a chart review strategy described elsewhere.⁴

METHOD

Using birth and death registration data supplied by Alberta Registries - Vital Statistics, we extracted all live birth registrations where the birthweight was less than 500g for the period 1985 to 1994. To determine survival among this group, a deterministic record linkage strategy was used to link the birth and death registration files using the newborn's name, date of birth, and sex as the main linking criteria. For those records that we were unable

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Figure 1. Crude and adjusted for under 500 gram survivors infant mortality rates per 1,000 live births in Alberta, 1985 through 1994.

TABLE I
Number of Newborns Registered
Weighing 500 grams or Less in
Alberta, 1985-1994

Year	<500 grams	500 grams	Total
1985	0	23	23
1986	0	39	39
1987	0	28	28
1988	0	29	29
1989	0	28	28
1990	45	3	48
1991	29	2	31
1992	30	2	32
1993	34	2	36
1994	44	4	48

to link with the death registration data, a second deterministic linkage was performed with the Alberta Health Care Insurance Plan (AHCIP) Stakeholder Registry which maintains demographic information on residents of Alberta eligible for insured services and would, for this group, represent survivors. The number of under 500 gram survivors was then compared with a labour-intensive province-wide chart review conducted for the same time period by Sauve and colleagues.⁴

RESULTS

For the birthweight group of less than 500 grams born 1985 through 1989, there were no registered live births determined by the record linkage strategy. From 1990 through 1994, 182 live births in this weight group were recorded; 172 (95%) were successfully linked to a death record. Of the remaining 10 infants, 6 were located within the AHCIP Stakeholder Registry and had survived past their first birthday, while 4 could not be located and were presumed to be either dead or stillbirths incorrectly coded as live births. For each of the 4 unlinked records, it was possible to find a record for the mother within the AHCIP Stakeholder Registry. Between the Vital Statistics and Alberta Health databases, we were able to successfully link 98% of the birth records. Overall, 97% (176) had died.

Among those infants who died, all but two died in hospital and 88% (156) died within 24 hours of birth. Twenty survived past the first day with a mean survival age of 4.7 days (range 1-90 days).

Figure 1 displays the crude and adjusted IMR for Alberta for the years 1985 through 1996. During this period, the crude IMR for Alberta decreased from 7.9 to 7.4 per 1,000 live births, a decrease of 7%. When adjusted for under 500 gram survivors, the IMR decreased from 7.9 to 6.3 per 1,000 live births; a 21% decrease. The early neonatal mortality rate decreased 16% during the study period from 2.8 per 1,000 live births in 1985 to 2.4 in 1994. Adjustment for under 500 gram survivors resulted in a 49% decrease over the same period from 2.8 per 1,000 live births to 1.4. In 1994 the difference between the unadjusted and adjusted early neonatal mortality rate was 39% (2.4 versus 1.4 per 1,000 live births).

Sauve et al.⁴ reviewed hospital records and found five newborns born prior to 1990 with a recorded birthweight under 500 grams. The five newborns who were discharged alive were linked to their birth registration record maintained by Alberta Registries - Vital Statistics. All five had a birthweight of 500 grams recorded on the Vital Statistics database. For the survivors born between 1990 and 1994, there were no differences between the weight recorded on the hospital record and that recorded with Vital Statistics. Table I shows the changes over time in the number of newborns registered weighing less than 500 grams and those weighing 500 grams.

DISCUSSION

The apparent leveling, and modest increase found in 1994 in the Alberta IMR is related to the increased registration of newborns weighing less than 500 grams, of whom only 3% survived past their first birthday. Removing these infants has an impact on Alberta's IMR and neonatal

mortality rate. Nearly a three-fold difference exists in the early neonatal mortality rate between the crude and adjusted rates, implying greater improvements in this measure over the study period.

The registration of live births weighing less than 500 grams appears to be a relatively recent phenomenon in Alberta, beginning in 1990. A systematic bias existed prior to 1990 in that newborns weighing less than 500 grams had their birthweight recorded as 500 grams. The computer system in place prior to 1990 would not accept the entry of a birthweight under 500 grams and as a result, data entry clerks entered a weight of 500 grams for those records to allow the electronic record to be created (C. Schultz, Alberta Vital Statistics, personal communication). There was no corresponding shift in policy which would account for this change in registration practice, simply a limitation of the computing system in use at that time. In 1990, the system was updated and birthweights under 500 grams could be entered. Other provinces should investigate whether the recording bias noted for Alberta exists elsewhere. Though Joseph and Kramer¹ recommended the removal of under 500 gram newborns, it would seem reasonable to remove all newborns under 501 grams for the calculation of IMR. This should be done using consistent record linkage strategies across provinces.

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