A Closer Examination of Neonatal Mortality Rates among The Texas Spanish Surname Population

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Abstract: Considering the poor socioeconomic status of the Spanish surnamed population in Texas, the Spanish surname neonatal mortality rate seems surprisingly low. During five of the last 10 years, the neonatal mortality rate for Texas Spanish surnamed population was actually lower than for Anglos. It is often suggested that the low Spanish surname neonatal mortality rate is due in part to reporting problems peculiar to the Spanish surname population in Texas. Linked birth and neonatal death records of Texas residents are examined for evidence of underreporting or misreporting of Spanish surnamed neonatal deaths. It is found that discrepancies in coding race on the birth and death records cause a minor deflation of Spanish surname neonatal and infant mortality rates. Indirect evidence indicates that there may be a substantial amount of underreporting of Spanish surname neonatal deaths. This underreporting appears to be associated with the presence of a large number of Mexican nationals misidentified as Texas residents, and the greater reliance upon lay midwives by the Spanish surname population in Texas. Reasons proposed to explain a reluctance to report neonatal deaths include fear of contact with authorities, and fear that a reported death would diminish the value of the birth certificate. (*Am J Public Health* 1982; 72:993–999.)

This paper examines neonatal mortality* for the Spanish surname population of Texas during 1979. Neonatal mortality rates in Texas have declined in the past decade.[1] Although non-White neonatal rates are substantially higher than those for Whites, differences in White Spanish surname and White non-Spanish surname** neonatal mortality rates are surprisingly small (Table 1). In fact, several studies report lower neonatal mortality rates for Spanish surname infants than for Anglo infants.[3,4] This is surprising since the Spanish surname population is characterized by several disadvantages, including lower socioeconomic status, higher parity,*** less adequate medical care, a larger proportion of teenage births, a larger proportion of out-of-wedlock births, and a somewhat higher proportion of low birthweight infants, all of which are associated with higher rates of infant death.[3,4] The unexpectedly low neonatal mortality rates for Spanish surname babies have generally been viewed with suspicion, and have frequently been attributed to unreliable data. It has been suggested that problems may arise from several sources, including discrepancies in the coding of race on birth and death records, reporting of some neonatal deaths as fetal deaths, inflation of births and underrepresentation of deaths due to Mexican nationals crossing the border to give birth in Texas, and to underrepresentation of deaths due to unreported "shoebox" burials.[3,4]

Our research question is: to what extent do the reported neonatal mortality rates truly depict the health status of the Spanish surname newborn population, and to what extent are they the result of miscoding the race of the child, or reporting problems peculiar to the Spanish surname population? We will focus our inquiry on three potential sources of coding or reporting problems that may be particularly serious for the Spanish surname population in Texas. These problems would deflate the numerator in the computation of the Spanish surname neonatal mortality rate.

In Texas, the race designation of an individual is arrived at in a different manner on the birth certificate than on the death certifcate. Therefore, it is important to ascertain whether there is systematic miscoding of race among Spanish surname infants. A second problem arises because of inmigration of Mexican nationals into Texas to give birth. Since Mexican mothers can easily be misclassified as Texas residents and because, for various reasons, they may be less likely to report a neonatal death, their presence might result in artificial deflation of neonatal mortality rates for the Spanish surname population. We investigate this possibility by means of several indirect measures. Finally, Spanish surname women are more likely than Anglos or Blacks to use non-professional birth attendants. To test the supposition that deaths to neonates delivered by lay or empirical midwives are more likely to be unreported or misreported as fetal deaths, we examine the distribution of neonatal deaths by age at death and fetal-to-neonatal death ratios.

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*Neonatal mortality refers to deaths occurring within 28 days following birth.

**The terms "Anglo" and "White, non-Spanish surname" are used interchangeably herein for convenience; "Spanish surname" refers to White infants of Spanish surname.

***Holck: Fertility trends among Mexican-Americans in Texas. Paper presented at the 37th Annual Meeting of the United States-Mexico Border Health Association, San Diego, CA, April 10, 1979.

TABLE 1—Annual Neonatal Mortality Rates 1970–1979 by Race/Ethnicity, Texas Residents

Year	White, Non-Spanish Surname	White, Spanish Surname	Black
70	15.3	14.0	22.9
71	13.9	13.3	20.9
72	13.8	13.6	21.3
73	13.3	13.0	19.2
74	12.0	12.5	18.7
75	11.0	10.4	18.8
76	10.0	10.7	18.7
77	9.2	9.3	16.2
78	8.6	9.3	13.4
79	7.3	8.5	13.6

Neonatal Mortality Rate:[2]
Number of deaths under 28 days of age reported during a given time inferred for a given group/Number of live births reported during the same time interval for the same group = per 1,000 at risk

Materials and Methods

The data used in this study are from Texas vital records. The Texas vital record system includes information drawn from certificates of birth, death, and fetal death occurring in Texas and information from certificates of birth, death, and fetal death of Texas residents occurring elsewhere in the United States. In order to provide the most complete information possible, the Texas Department of Health's Bureau of Vital Statistics began linking infant's (less than one year of age) death records with their birth records in January 1979. The linked records provide information regarding the place of birth, the mother's usual place of residence, the race/ethnicity of the child, the child's birthweight, the type of attendant at birth, the mother's age, report of previous fetal loss, and the first year's outcome for the child, among other information. The fetal death record provides essentially the same descriptive information.

Throughout this study the 1979 birth cohort is examined. The data include information from 254,263 certificates of birth to Texas residents occuring during calendar year 1979. Death records of 2,063 Texas resident neonates were linked to 1979 birth records. For this birth cohort, there was a 100 per cent match of neonatal deaths to birth records for Texas residents. Also examined are 2,214 records of fetal deaths to Texas residents occurring during 1979. Except for Table 1, which reports time-period neonatal rates for Texas residents, all rates reported in this paper utilize only linked neonatal deaths of Texas residents in the numerator and all 1979 Texas resident births in the denominator. In addition, records of 7,314 births to non-Texas residents occurring in Texas in 1979 were available. However, because vital data are normally reported by place of residence in Texas, only the Texas resident data are used unless otherwise noted.

Three possible sources of underreporting or misreporting of neonatal deaths peculiar to the Spanish surname population in Texas have been suggested. An analysis of the three hypotheses follows.

Hypothesis I: Coding discrepancies in race result in deflated neonatal death rates among the Spanish surname population.

In Texas, different methods are used for determining race on birth records and on death records. The race of an infant on a birth certificate is determined by information regarding both father's and mother's race according to procedures outlined by the National Center for Health Statistics.[5] If the infant's race is coded as "White", the surname of the newborn is checked against a computer program which phonetically distinguishes Spanish surnames from other surnames.‡ The newborn is then classified as either "White, non-Spanish Surname" or "White, Spanish Surname." The race of a deceased infant is determined according to the entry on the report of death, or death certificate. This information is supplied either by the attending physician, by a "person having knowledge of the facts," or by the person disposing of the body.[6] The race item pertains only to the deceased infant and hence does not consider the race of the parents. No routine check of accuracy is made. If the infant is coded as "White", the surname is checked against the computer program which distinguishes Spanish surnames from other surnames. However, if the infant's race is coded as "non-White" no distinction is made between Spanish surname and non-Spanish surname. Therefore neonates designated as "White" at birth, but designated as "non-White" at death would not be included in the count of Spanish surname neonatal deaths. Such miscoding would result in deflated Spanish surname neonatal mortality rates. Similar miscoding has been reported for minority populations in other states.[7–9]

Since Texas began linking birth and infant death records in 1979, it is possible to examine the race designations for discrepancies and to correct those discrepancies by using the race designation on the birth certificate. Of the 2,063 linked birth/neonatal death records examined, discrepancies in race designation were discovered in 1.1 per cent of the cases. The impact upon ethnic-specific neonatal mortality rates are presented in Table 2.

‡Buechley RW: A Computer Program that Distinguishes Spanish Surnames. Unpublished report, New Mexico Cancer Center, University of New Mexico, Albuquerque, 1973.

TABLE 2—Neonatal Mortality Rates, 1979 Texas Live Birth Cohort

	Ethnicity Based Upon		
	Death Record	Birth Record	Difference
Spanish Surname	8.1 (N = 601)	8.2 (N = 609)	+0.1
Black	12.7 (N = 465)	12.7 (N = 465)	0.0
White, Non-Spanish Surname	7.0 (N = 997)	6.9 (N = 989)	−0.1

Cohort Neonatal Mortality Rate:[2]
Number of deaths under 28 days of age reported for the 1979 birth cohort for a given group/Number of live births for the 1979 birth cohort for the same group = per 1,000 at risk

On the basis of this Table, we conclude that there are very minor differences in most rates when the ethnicity of the newborn is based upon the birth record rather than the death record. The effect of the coding discrepancies certainly does not account for the low neonatal death rates among the Spanish surname population in Texas.

Hypothesis II: Mexican nationals who give birth in Texas may deflate the neonatal mortality rates by increasing the denominator (births) without increasing the numerator (deaths).

In 1979, 4,092 births occurred in Texas to mothers who acknowledged Mexican residence. Because it is quite easy for a Mexican resident to be misclassified as a Texas resident (a Texas address listed on the birth certificate), it is often assumed that the actual number of births to Mexican nationals occurring in Texas is substantially higher than reported. For various reasons—including a general fear of authorities, a return to Mexico, or the value of the birth certificate—it has been suggested that this population is less likely to report the death of a newborn. This would have the effect of inflating the denominator without similarly inflating the numerator in the calculation of Texas resident, Spanish surname neonatal mortality rates, resulting in low rates.

Vital data are inadequate for determining whether such an effect is occurring in Texas. However, it is possible to develop indirect techniques that shed some light on the question. Of the 4,092 live births to Mexican residents occurring in Texas in 1979, 3,813 or 93.2 per cent occurred in four moderately populated border counties (Cameron, El Paso, Hidalgo, and Webb). We reasoned that the births to Mexican mothers misidentified as Texas residents would likely be distributed geographically in a similar fashion. Therefore, Spanish surname Texas resident live births were divided into two groups: a Study group comprised of Spanish surname births to residents of Cameron, El Paso, Hidalgo, and Webb Counties, and a Comparison group comprising the remainder of the births to Spanish surname Texas residents. Since we argue that the major relevant difference between the two groups is the presence of an unknown number of Mexican nationals in the Study group, the two groups were compared on selected demographic measures (Table 3). The measures of association (Phi and Goodman and Kruskals tau) indicate that the two groups are similar insofar as these variables are concerned except that births in the Study group were more likely to have been attended by midwives (see Hypothesis III). Three indirect techniques were employed in an attempt to uncover evidence suggesting that neonatal deaths are less likely to be reported in the Study than in the Comparison group.

TABLE 3—Demographic Comparison of Study and Comparison Groups, Texas Resident Spanish Surname Live Births, 1979

	Study Group[a]	Comparison Group[b]	ϕ[c]	τ_b[d]
Per cent with Birthweights* <2500 Grams	6.1	6.7	.01	.0002
Per cent Maternal Age <18	5.8	9.9	.02	.0004
Per cent Illegitimate	10.2	12.2	.02	.0007
Per cent Mothers Initiating Prenatal Care during First Trimester	53.1	58.7	.08	.0076
Per cent Mothers Reporting Previous Fetal Loss	6.6	5.0	.03	.0009
Per cent Mothers Using Non-Professionally Trained Birth Attendant	15.1	4.1	.19	.0358
Per cent of Texas Resident Spanish Surname Births, 1979	25.2 (N = 18,812)	74.8 (N = 55,832)		
Per cent of Texas Resident Spanish Surname Neonatal Deaths to the 1979 Live Birth Cohort	17.9 (N = 108)	82.1 (N = 494)		

*Birthweight adjusted to exclude midwife-delivered births.
[a]Study Group—Includes 1979 live births to Spanish surname residents of Cameron, El Paso, Hidalgo, and Webb Counties.
[b]Comparison Group—Includes 1979 live births to all other Spanish surname Texas residents.
[c]ϕ is a measure of association whose values range from 0.0 to 1.0, with 1.0 indicating perfect correlation between the dependent and independent variables.[10]
[d]τ_b is a measure of strength of association which indicates the proportion reduction of error in predicting the dependent variable when the value of the independent variable is known. Its values range from 0 to 1.0[10]

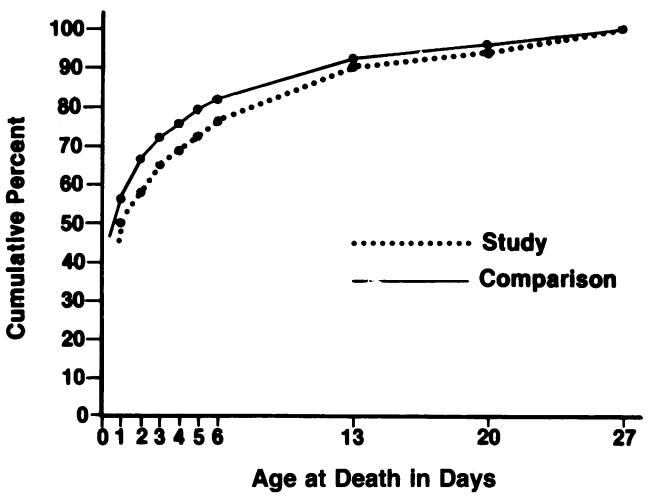
TABLE 4—"Observed" versus "Predicted" Neonatal Deaths in Study Group, Spanish Surname Texas Residents, 1979

Category	Predicted Deaths in Study Group*	Observed Deaths in Study Group**	Difference, Predicted-Observed
<500 grams	6.2	5	1.2
500–999 grams	32.6	24	8.6
1000–1499 grams	18.5	10	8.5
1500–1999 grams	11.8	17	−5.2
2000–2499 grams	13.7	13	0.7
2500–2999 grams	9.2	10	−0.8
3000–3499 grams	12.1	9	3.1
3500–3999 grams	10.7	5	5.7
4000–4499 grams	2.2	3	−0.8
4500–4999 grams	0.7	1	−0.3
>4999 grams	0.3	1	−0.7
Midwife attended	21.2	10	11.2
TOTAL	139.2	108	31.2

*Midwife-attended births excluded from birthweight categories. "Predicted Deaths" computed by applying category-specific, cohort neonatal mortality rates of the Comparison group (1979 live births to all other Spanish surname Texas residents) to the distribution of births among categories of the Study group.

**Study Group—Includes 1979 live births to Spanish surname residents of Cameron, El Paso, Hidalgo, and Webb Counties.

First, the availability of linked birth-death record data allows computation of birth weight-specific mortality rates for the Comparison group. These mortality rates can be applied to the birthweight distribution of the Study group to yield the number of expected neonatal deaths for the Study group. Since birthweight information from midwife-attended births is suspect, these births were treated as a separate category: in effect, as if they constituted a birthweight category in themselves. The application of these birthweight specific mortality rates to the observed birthweight distribution of the Study group's linked records results in 139 predicted neonatal deaths among that group (Table 4). However, only 108 neonatal deaths were reported for the Study group, a difference of 29 per cent. Further, neonatal mortality rates for babies weighing 500–999 grams in the Study group are surprisingly low (558.1) when compared to rates for non-Texas populations (780.4),[11] or the Comparison population (758.8). Alley states that neonatal mortality rates of less than 750 per 1,000 live births for infants weighing 500–999 grams at birth is indicative of underreporting.[12] In the study area, underreporting of very low birthweight deaths appears likely.



Study-Neonatal Deaths to Spanish Surname Residents Of Cameron, El Paso, Hidalgo and Webb Counties, Texas

Comparison-Neonatal Deaths to All Other Spanish Surnamed Texas Residents

FIGURE 1—Cumulative Per Cent of Spanish Surname Neonatal Mortality, Texas Residents, 1979 Live Birth Cohort by Age at Death and Place of Residence.

Second, it is reasonable to believe that the neonates whose deaths are most likely to be unreported are very young neonates. Since 60 to 65 per cent of neonatal deaths occur in the first two days, substantial underreporting is expected to result in the deflation of percentages of neonatal deaths occurring early in the neonatal period. If substantial underreporting of neonatal deaths occurs in the Study group, a plotted cumulative per cent of neonatal deaths by age at death is expected to take on a flatter, more gradual curve as a larger proportion of reported neonatal deaths occur later in the neonatal period. This pattern is revealed in Figure 1. While about 56 per cent of all neonatal deaths in the Comparison group occur on the first day, only 51 per cent occur in the first day in the Study group. By the second day, 66 per cent of the Comparison group's neonatal deaths have occurred, yet only 58 per cent of the Study group's neonatal deaths have occurred. This finding also suggests that there is more underreporting of neonatal deaths in the Study group.

Finally, since the Study and Comparison groups are similar demographically, we would expect the ratio of fetal to neonatal deaths to be similar for the two groups. However, while the ratio of fetal to neonatal deaths for the

TABLE 5—Number of Spanish Surname Texas Residents, Births and Deaths for Two Areas, 1979

	Study Group*	Comparison Group**
Number of Fetal Deaths	155	558
Number of Neonatal Deaths	108	505
Number of Live Births	18,812	55,832
Ratio Fetal: Neonatal Deaths	1.42:1.0	1.10:1.0
Fetal Mortality Rate II	8.2	9.9
Per cent Mothers Reporting Previous Fetal Loss	6.6	5.0

Fetal Mortality Rate II:[2]
Number of fetal deaths of 20 weeks or more gestation reported during a given time interval for a given group/ Number of fetal deaths of 20 weeks or more gestation reported during the same time interval for the same group plus the number of live births occurring during the same time interval for the same group = per 1,000 at risk
*Study Group—Includes 1979 births to Spanish surname residents of Cameron, El Paso, Hidalgo, and Webb Counties.
**Comparison Group—Includes 1979 births to all other Spanish surname Texas residents.

Comparison group is 1.10:1, the ratio for the Study group is higher, 1.42:1 (the ratio for the entire state, all races, is 1.02:1). Since the distribution of previous fetal losses and the fetal mortality rates for the two groups are similar (Table 5), the difference in observed fetal to neonatal death ratios may be due principally to fewer reported neonatal deaths in the Study group, again suggesting that there is less complete reporting of neonatal deaths in the Study than in the Comparison group.

Each of the three indirect techniques employed above suggests that there is more underreporting of neonatal deaths in the Study group than in the Comparison group. This conclusion tends to support the hypothesis that the presumed larger proportion of misidentified Mexican nationals in the Study group is associated with underreporting of neonatal deaths.

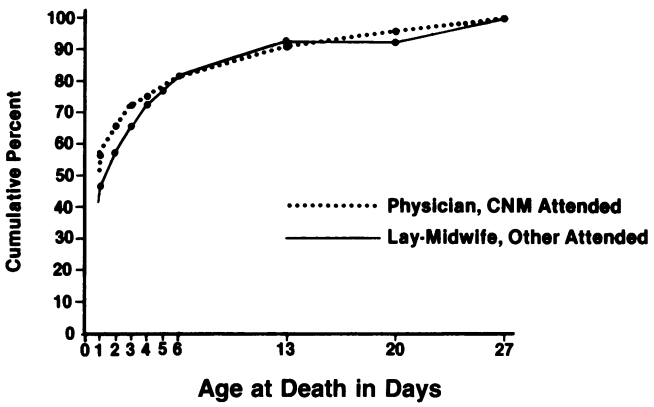
Hypothesis III: Large numbers of midwife-attended births may result in artificially low neonatal mortality rates among the Spanish surname population.‡‡

The Spanish surname population in Texas is much more likely to rely upon non-professionally trained birth attendants than are Anglos or Blacks. In 1979, 7 per cent of Spanish surname births were attended by lay or empirical midwives, compared with 2 per cent and 0.5 per cent of Anglos and Blacks, respectively.

It has been suggested that midwives are less likely to report or encourage the mother to report the death of a newborn than is the professional birth attendant. Reasons often proposed include the value of the birth certificate and fear or mistrust of authorities. In order to indirectly test Hypothesis III, the distribution of neonatal deaths by age at death and fetal-to-neonatal death ratios are examined.

The effect of the underreporting of neonatal deaths among midwife-delivered infants is expected to occur disproportionately in the first few days following birth. The younger the neonate at death, the less likely the death is to be reported. Concealment of the death could be more easily accomplished for those expiring soon after delivery than for other infants. Therefore, the plotted cumulative per cent of midwife-delivered neonatal deaths by age at death is expected to have the flatter, more gradual curve indicative of underreporting. This pattern appears in Figure 2, although the small number of neonatal deaths among midwife-delivered infants (N=25) results in an unstable curve.

It is also expected that substantial underreporting of neonatal deaths among midwife-delivered infants would be reflected in the ratio of fetal-to-neonatal deaths. As Table 6 shows, the ratios for the two types of delivery are virtually identical. Given the different fetal mortality rates of the two groups, it appears that this finding may be indicative of underreporting of both fetal and neonatal deaths of midwife-delivered infants. The data reveal no evidence that midwives are reporting neonatal deaths as stillbirths to any significant extent.



Study-Neonatal Deaths to Spanish Surname Residents Of Cameron, El Paso, Hidalgo and Webb Counties, Texas

Comparison-Neonatal Deaths to All Other Spanish Surnamed Texas Residents

FIGURE 2—Cumulative Per Cent of Spanish Surname Neonatal Mortality, Texas Residents, 1979 Live Birth Cohort by Age at Death and Attendant at Birth.

‡‡Hereafter, "Midwives" include Lay-Midwives and Others. "Professional birth attendants" include physicians and Certified Nurse-Midwives.

TABLE 6—Number of Spanish Surname Births and Deaths by Attendant at Birth, Texas 1979

	Professionally Trained Birth Attendant*	Non-Professionally Trained Birth Attendant**
Number of Fetal Deaths	684	29
Number of Neonatal Deaths	583	26
Number of Live Births	69,524	5,120
Ratio Fetal:Neonatal Deaths	1.17:1.0	1.12:1.0
Fetal Mortality Rate II	9.7	5.6

Fetal Mortality, Rate II:[2]
Number of fetal deaths of 20 weeks or more gestation reported during a given time interval for a given group/Number of fetal deaths of 20 weeks or more of gestation reported during the same time interval for the same group plus the number of live births occurring during the same time interval for the same group = per 1,000 at risk
*Includes physicians and certified nurse-midwives.
**Includes lay midwives and "other".

Discussion

At the outset of the paper, it was asked whether underreporting or misreporting of deaths is partially responsible for the surprisingly low Spanish surname neonatal mortality rate. As we discuss our findings, we must emphasize the tentative and speculative nature of the task.

The first and simplest step was to see whether there exists in Texas some sort of systematic coding bias in reporting Spanish surname neonatal deaths. While discrepancies do exist in racial designation between birth and death records, they are fairly minor. On the whole, it can be concluded that the system of coding race works well in Texas. Reporting problems of the magnitude reported elsewhere do not seem to have occurred in Texas in 1979.

It was then asked whether the presumed presence of a large number of unidentified Mexican nationals, or the more widespread use of midwives, might be associated with the underreporting of neonatal deaths among the Spanish surname population. By comparing the pattern of neonatal deaths in a "Study" area—which is assumed to contain most of the misidentified Mexican nationals—with the remainder of the Spanish surname births in 1979, strong, though indirect, evidence of a greater magnitude of underreporting in the Study area was found. By comparing the pattern of neonatal deaths to babies delivered by lay midwives with those delivered by physicians and certified nurse-midwives, similar indications of underreporting were noted.

Several other factors mlust be considered, however. First, Hypotheses II and III are not independent. More than 50 per cent of the mothers identified as Mexican residents who deliver in Texas rely upon non-professionally trained midwives. Since we do not know how many deliveries there are annually to Mexican mothers misidentified as Texas residents, we cannot even estimate what proportion of Spanish surname, midwife-attended births are actually to Mexican mothers.

In a recent study of midwife deliveries in Webb County, for example, 42 per cent of 101 births listing a Texas address as usual place of residence on the birth certificate actually had false addresses, indicating that the mothers of these infants may not have been Texas residents.‡‡‡ It is conceivable that some of the apparent relationship between the use of midwives and the underreporting of neonatal deaths is spurious, the result of a tendency of misidentified Mexican mothers to use lay midwives. Since the Spanish surname neonatal mortality rate for babies delivered by midwives is 28 per cent lower than that of Black and Anglo midwife-delivered babies, factors other than "attendant at birth" are probably involved as well.

Second, we assumed during the testing of Hypothesis II that the demographic similarity between our Study and Comparison groups meant that we had controlled for most of the relevant factors other than our hypothesized effects. While there seems to be little reason to believe that there are major differences in the health care delivery system between the two areas, this was not examined.

Having outlined the major reasons for caution, we believe that two conclusions are apparent. First, we have found no evidence that there is *not* a significant amount of underreporting of neonatal deaths among Texas Spanish surname population. Second, although our indicators are indirect, they all point in the direction that would be expected if there was a significant amount of underreporting.

But what factors might be operating in Texas that inhibit the reporting of neonatal deaths by its Spanish surname population? One frequently suggested reason is that the birth certificate may have some value, even a commercial value. It is commonly believed that Texas birth certificates facilitate obtaining residence and derivative United States citizenship. While, in fact, a Texas birth certificate offers no such advantage to an infant's family, this may not be widely known. In any event, in Texas, reporting the death of a newborn would do little to diminish the value of its birth certificate. No routine linking of birth and newborn or children's death certificates is conducted (except in the case of infants, and then only for statistical purposes), so that it is unlikely that the fraudulent use of a birth certificate would be detected. Since this may not be widely understood, the reporting of neonatal deaths may be inhibited.

The desire to obtain a Texas birth certificate may also result in the fraudulent registration of births, especially by midwives. Indeed, there is concern that a widespread market exists for selling the documents. The fraudulent registration of births on a wide scale would contribute to the deflation of the Spanish surname neonatal mortality rate since the denominator would be inflated without affecting the numerator. Nonetheless, it is unlikely that the fraudulent registration of births has a great impact on the Spanish surname neonatal mortality rate. Because neonatal death is a relatively rare event, the denominator—in this instance, reported live births—would have to change substantially to noticeably affect the rate. On the other hand, the numerator—reported neonatal deaths—would have to change only slightly to have a noticeable impact on the rate.

‡‡‡Ruiz J, *et al*: Study of Lay Midwife Deliveries. Unpublished paper, Webb County Health Department (Texas), 1981.

A more persuasive explanation is that the mother, and the midwife in the case of a midwife-attended delivery, may fear any contact with civil authorities. It seems likely that this is especially pertinent if the mother resides in the country illegally. While there may, in fact, be little chance of deportation as a result of reporting a neonate's death, the mother may not be willing to risk contact with the authorities. In the case of the midwife-delivered neonatal death, the midwife may resist reporting the death. Midwifery in Texas is not defined as the practice of medicine in the case of a normal, uncomplicated childbirth. If the newborn dies as a result of a complicated labor or delivery, however, the midwife may be liable for prosecution for practicing medicine without a license. While such prosecution is very unlikely, the midwife may perceive it as a serious threat. The midwife may also desire to protect her "professional" reputation by concealing any mishaps from other potential clients in the community.

It is also possible that many Mexican mothers may cross the border during the final stages of pregnancy specifically to deliver in the United States. Since, in many Texas counties, medical services available to indigents are restricted to residents of that county, indigent Mexican nationals who cross the border to deliver may be encouraged to offer false Texas addresses as the "Usual Place of Residence." Doing so would result in their misclassification as Texas residents. Most of these mothers probably return to Mexico shortly after delivery, and any neonatal death after that time would go unreported in Texas. The net result would be the deflation of the Spanish surname neonatal mortality rate for Texas residents as the denominator is artificially inflated without affecting the numerator.

Conclusion

In lieu of more direct measures, mortality rates are frequently used as indicators of the health status of a given population, and often are a determining factor in the allocation of public health resources. It is important, therefore, that sources of error in mortality rates be identified. There are many potential sources for error in mortality rates, especially those for newborns. Others have documented some sources of error, particularly underreporting of neonatal death and misreporting ethnicity, that can influence mortality rates. We have focused our attention on the Texas Spanish surname population because the Spanish surname neonatal mortality rates appear suspiciously low and because relatively little research has been conducted on that group in Texas or elsewhere.

We tentatively conclude from our study that the low neonatal mortality rates observed in Texas among the Spanish surname population are due in part to underreporting of neonatal deaths. This underreporting, which affects the numerator of the rate, is related to the reliance upon nonprofessional birth attendants and the tendency for Mexican nationals to be misidentified as Texas residents. Belief that the Texas birth certificate may have some value may also contribute to the underreporting of neonatal deaths. Further, the denominator used in the calculation of the Spanish surname neonatal mortality rate may be inflated by the misreporting of some births to Mexican national women as births to Texas residents.

We hope that this study will serve as a reference point and beginning for further investigation of the issues which we have examined. We believe our findings are clear enough to advise caution in utilizing neonatal mortality rates as a planning tool, especially in areas containing large Spanish surname subpopulations. Many fruitful areas of research remain. For example, it would be very useful if future work included follow-up and review of births occurring in border counties in order to determine whether the birth is to a Texas resident, whether the birth is registered, whether the mother remains in Texas after the birth of her child, and, if the infant dies, whether the death is registered in Texas. Studies of this sort would be helpful in determining the accuracy of neonatal mortality rates among the Spanish surname population in Texas.

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