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# Hyaline Membrane Disease Is Underreported in a Linked Birth–Infant Death Certificate Database

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ABSTRACT

*Objective.* This study compared the Missouri State Department of Health linked birth–infant death certificate database and medical records with respect to recording hyaline membrane disease in very low-birthweight infants.

*Methods.* We reviewed the records for all 976 infants weighing 500 to 1500 g who were born to St. Louis, Mo, residents in 1989, 1991, and 1992.

*Results.* Eighteen percent of the birth certificates and 54% of the medical records documented hyaline membrane disease, resulting in 34% sensitivity and 99% specificity.

*Conclusions.* The Missouri State Department of Health birth–infant death certificate database underestimates the incidence of hyaline membrane disease, which suggests that national statistics for the disease are also underestimated. (*Am J Public Health.* 1998;88:1387–1389)

The National Center for Health Statistics revised the Standard Certificate of Live Birth in 1989 to include expanded sociodemographic information, information on maternal use of medical services, and infant health characteristics.[1] These certificates provide extensive databases for perinatal epidemiologic research and public health planning.[2–5] However, several studies have suggested that many clinical features are underreported on birth certificates, thereby introducing uncertainty about the certificates' utility for population-based studies.[5–8]

While performing an earlier study in which we linked medical record information with the Missouri birth–infant death certificate database, we noted that the 2 sources were frequently discrepant with respect to the diagnosis of hyaline membrane disease.[9] To evaluate the extent of this discordance, we compared data derived from the Missouri State Department of Health linked birth–infant death certificate database with information abstracted from medical records.

## Methods

The database derived from medical records was the reference data source. All infants with birthweights of 500 to 1500 g who were born to St. Louis City and St. Louis County residents in 1989, 1991, or 1992 were identified in the databases of the 4 neonatal intensive care nursery systems that serve the St. Louis metropolitan area. From these sources, we obtained the infant's name, date of birth, birthweight, the presence or absence of hyaline membrane disease, and survival data. Hyaline membrane disease was considered present if the diagnosis, applied by neonatologists, appeared in the neonatal intensive care unit database or the clinical discharge summary. On the rare occasions when the clinical course was suggestive but the diagnosis was absent from the summary, we considered hyaline membrane disease to be present if the infant required supplemental oxygen and had chest radiographs with diffuse granular densities and air bronchograms at birth.[10,11]

The Missouri State Department of Health linked birth–infant death certificate database was the comparison data source and was screened for infants who met the aforementioned criteria. In addition, we obtained mothers' first, last, and maiden names and information about death within the first 28 days, about hyaline membrane disease, and about transfer to a tertiary care center after birth.

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**TABLE 1—Presence or Absence of Hyaline Membrane Disease (HMD), by Data Source: St. Louis, Mo, 1989, 1991, and 1992**

| | Medical Record | |
|---|---|---|
| Birth certificate | + HMD | – HMD |
| + HMD | 179 | 5 |
| – HMD | 345 | 447 |
| Total | 524 | 452 |

Sensitivity: 34%
Specificity: 99%
Positive predictive value: 97%
Negative predictive value: 66%

Statistical Analysis System software (SAS Institute, Cary, NC) was used to perform statistical calculations. Comparisons between data sources were made with the Cochran-Mantel-Haenszel method of $\chi^2_{1,2}$ analysis to calculate 2-tailed $P$ values.[12] Review boards at each institution approved the review.

## Results

A total of 67 482 infants were born during the study period. The medical records identified 1000 infants with birthweights of 500 to 1500 g, and the Missouri State Department of Health linked birth–infant death certificate database identified 1005 infants. Incomplete information in the neonatal intensive care unit databases necessitated additional review of 560 medical records. The identifiers we obtained permitted direct comparison of the 2 data sources. Date of birth, race, and sex were concordant in all but 1 instance each. Birthweight discrepancies of more than 100 g were present in 45 (5%) of the records. After adjustment for birthweight discrepancies and missing data, the corrected database contained data for 976 infants.

A diagnosis of hyaline membrane disease was present in 524 (54%) of the medical records (Table 1). However, the vital statistics database identified only 179 of these 524 cases, a false-negative rate of 66%. This underestimate of the frequency of hyaline membrane disease was biased toward neonates who survived: survivors had a false-negative recording rate of 38%, while infants who died had a 23% false-negative rate ($P = .001$). According to the linked database, 39 of 179 infants (21.8%) with hyaline membrane disease died, while medical record review indicated that 78 of 524 (14.9%) infants with hyaline membrane disease died. Consequently, the contribution of hyaline membrane disease to the overall neonatal death rate doubled, from 17.3% to 34.5%, in this very low-birthweight population.

We evaluated whether specific infant characteristics might systematically explain underreporting of hyaline membrane disease. Neither birthweight nor transfer to a tertiary care center influenced reporting of hyaline membrane disease ($P = .67$ and .66, respectively). On the other hand, infants who were White or who were born in 1992 were more likely to be underreported for hyaline membrane disease ($P = .003$ and $P < .001$, respectively). Although no intrainstitutional discordance in reporting for Black and White infants occurred, one institution with a 50% discordance rate served 40% of the White neonates and one with a 20% discordance rate served 40% of the Black neonates.

## Discussion

The Missouri State Department of Health linked birth–infant death certificate database reliably records name, race, birthweight, and outcome with accuracy comparable to that of other states.[5,6] However, this database identified only one third of the cases of hyaline membrane disease, which is comparable to the experience in Tennessee.[5] The incidence of hyaline membrane disease for all infants in this vital statistics database was comparable to that reported nationally (7 vs 6 cases per 1000 live births[3]). Therefore, we suspect that the true incidence of hyaline membrane disease and its contribution to the neonatal death rate are greater than the national figures indicate.

Several sources may contribute to discrepancies in reporting. The birth certificate is generally completed within 24 to 48 hours of birth, often before the diagnosis of hyaline membrane disease can be applied, and by personnel who may not have access to the necessary clinical information. Although the definition of hyaline membrane disease has not changed, uniform application of the diagnosis has become more difficult with therapies, such as surfactant replacement, that change the natural history and improve outcomes.

Although many cross-checks to enhance accuracy are used by vital statistics bureaus, these checks are not designed to verify a diagnosis of hyaline membrane disease or other more detailed clinical information. The availability of medical record–based databases in neonatal intensive care units provides an opportunity to improve state birth certificate reporting. Although these medical record–based databases are the most reliable sources available, like the birth certificate database, they are expensive to develop and maintain and are limited by the expertise and uniformity of clinicians' application of definitions and their ability to enter and retrieve the information easily and reliably. A medical record–based database that uses the birth certificate as a template for the minimum information and that is directly linked to vital statistics databases will provide reliable outcome data with which to shape clinical practice and maternal and child health planning. □

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# Reactions of Adult and Teenaged Smokers to the Massachusetts Tobacco Tax

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ABSTRACT

*Objectives.* This study assessed smokers' reactions to a 25¢ cigarette tax imposed in Massachusetts.

*Methods.* A statewide telephone survey of 1783 adult smokers and 216 teenaged smokers was conducted.

*Results.* Among adult smokers, 3.5% reported that they had stopped smoking, owing in part to the price increase; 35% had considered quitting and 19% had attempted to cut the cost of smoking by switching to cheaper brands or cutting down. Among teenagers, 21% had considered quitting and 26% had cut costs. Low-income smokers were more responsive to the price increase than more affluent smokers.

*Conclusions.* A modest and temporary price increase promoted quitting among adult smokers and reduced cigarette consumption among low-income teenagers. (*Am J Public Health.* 1998;88:1389–1391)

The Commonwealth of Massachusetts imposed an excise tax of 25 cents per pack on cigarettes on January 1, 1993, resulting in a 15% increase in the average price per pack. Four months later, cigarette manufacturers reduced the price of premium brands. Despite the fact that most smokers experienced an increase in the cost of smoking for less than 6 months, data on cigarette consumption in Massachusetts show a 12.5% drop in sales from 1992 to 1993, compared with a 3% drop in the nation as a whole.[1]

Studies of the relationship between cigarette taxes and consumption of cigarettes have shown that the higher the tax increase, the greater the reduction in sales.[2–7] To date, no published analysis has examined smokers' perceptions of the impact of new tobacco taxes. This study does so by examining adults' and teenagers' reports about whether the price increase affected them and, if so, whether it led them to quit, to consider quitting, or only to reduce the cost of continuing to smoke. We hypothesized that lower-income smokers would be more responsive to the price increase than more affluent smokers and that in comparison with lighter smokers, heavier smokers would be more likely to try to reduce the cost of continuing to smoke rather than attempting to quit.

## Methods

On the basis of household enumeration, a representative sample of Massachusetts adults and teenagers (12 to 17 years of age) was drawn by random-digit-dialing techniques.[8] Telephone interviews were conducted between October 1993 and March 1994, prior to the full implementation of a statewide tobacco control program.

Current adult smokers were defined as adults who reported having smoked at least 100 cigarettes in their lifetime and who said they now smoked "every day" or "some days." Posttax quitters were defined as adults who had smoked at least 100 cigarettes in their lifetime, who now smoked "not at all," and who reported stopping smoking regularly after January 1, 1993. Teenaged smokers were defined as teenagers who reported smoking more than 1 whole cigarette in their lifetime and at least 1 cigarette in the previous 30 days.

Smokers were asked whether or not they did each of the following when the price of cigarettes went up: bought fewer cigarettes; switched to a cheaper brand; and thought seriously about quitting. To clarify the motives underlying these actions, respondents were assigned to 1 of 3 mutually exclusive categories based on the pattern of their responses to these questions: (1) did not respond to tax (those who denied engaging in any of the 3 reactions); (2) cut costs (those who reported changing to a cheaper brand and/or reducing the number smoked but who did not consider quitting); and (3) considered quitting (those who reported considering quitting, with or without the other 2 reactions). Posttax quitters were asked whether the price increase had affected their decision to quit "a lot, some, a little, or not at all."

Data were weighted to account for oversampling. The SUDAAN program[9] was used to compute standard errors. Hypotheses were tested with multinomial logistic regressions. This program calculates coefficients for all possible pairs of outcomes in a multinomial set. In this case, the outcomes examined were

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