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IN 1992, THE U.S. PUBLIC HEALTH SERVICE recommended that all women of childbearing age consume 400 μg of folic acid daily to help prevent pregnancies affected by neural tube defects (NTDs) such as spina bifida.1 Subsequently, the Food and Drug Administration mandated adding folic acid to all enriched cereal grain products by January 1998.2 During October 1998–December 1999, the birth prevalence of spina bifida in the United States decreased 22.9% compared with 1995-1996; however, by 2003-2004, no further decrease had been observed.4 Notably, the prevalence of NTD-affected pregnancies remained higher among Hispanic women than among women in other racial/ethnic populations.5,6 To update previously reported data and assess racial/ethnic differences, CDC analyzed birth certificate data for four periods during 1995-2005. This report summarizes the results of that analysis, which indicated that from the early postfortification period, 1999-2000, to the most recent period of analysis, 2003-2005, the prevalence of spina bifida declined 6.9%, from 2.04 to 1.90 per 10,000 live births (prevalence ratio [PR]=0.93; 95% confidence interval [CI]=0.87-1.00). Among infants with non-Hispanic black mothers, prevalence fell 19.8%, from 2.17 to 1.74 per 10,000 live births (PR=0.80; CI=0.67-0.96), while prevalence among infants with non-Hispanic white and Hispanic mothers remained nearly constant. Additional public health efforts targeting women with known risk factors (e.g., obesity and certain genetic factors) likely are needed to further reduce the prevalence of spina bifida in the United States.

Birth certificate data in the United States are collected routinely by state vital statistics programs, and data on selected birth defects have been available since 1989 from the National Vital Statistics System. The U.S. Census Bureau has estimated that more than 99% of all births in the United States are registered on birth certificates.* Race and Hispanic ethnicity of the mother are reported independently on birth certificates. Although 1997 revised standards require federal data collection programs to allow respondents to select more than one race category, these revisions have not been implemented for birth registration in all states. Therefore, to facilitate comparison of birth data in this analysis, mothers who reported multiple race categories were assigned to one of the following four classifications: non-Hispanic white, non-Hispanic black, Hispanic, or all other.6 Small sample sizes precluded calculation of prevalence estimates for mothers in the “other” group. Data were included from 46 states and the District of Columbia, representing approximately 90% of all births in the United States during the periods examined. Births in Maryland, New Mexico, New York, and Oklahoma were excluded because information on spina bifida from those states was not reported on birth certificates for at least 1 year or was recorded as “not stated” for >25% of all births for multiple years; however, exclusion of the four states was found to have a negligible impact on prevalence estimates.


Births during 1997-1998 were excluded because most conceptions corresponding to births during that period occurred before folic acid fortification was mandated in the United States. To evaluate postfortification trends in the prevalence of spina bifida and update previous analyses,3,4 the early postfortification period (1999-2000) was selected as the referent period for PR calculations. PRs were calculated by dividing birth prevalence during the prefortification, mid-postfortification, and recent postfortification periods by birth prevalence during the early postfortification period (1999-2000); CIs were calculated by Poisson regression.

During the four comparison periods combined, infants with non-Hispanic white, Hispanic, and non-Hispanic black mothers accounted for 58.7%, 21.0%, and 14.1% of all births, respectively. An average of 767 cases of spina bifida were reported each year among all racial/ethnic populations. The prevalence of spina bifida reported on birth certificates during 2003-2005 was 2.00 per 10,000 live births among infants with non-Hispanic white mothers, 1.96 among infants with Hispanic mothers, and 1.74 among infants with non-Hispanic black mothers.

From the early postfortification period of 1999-2000 to the recent postfortification period of 2003-2005, the birth prevalence of spina bifida among infants born to mothers of all racial/ethnic populations decreased 6.9%, from 2.04 to 1.90 cases per 10,000 live births (PR=0.93). Among non-Hispanic black mothers, the prevalence decreased 19.8%, from 2.17 to 1.74 cases per 10,000 live births (PR=0.80). No significant decrease was noted for infants with non-Hispanic white and Hispanic mothers when the same two periods were compared. In contrast to previous reports,7 spina bifida prevalence was similar for infants born to Hispanic and non-Hispanic white mothers.

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CDC Editorial Note: This report updates and expands upon a previously published study3 and provides additional information on racial/ethnic differences in the birth prevalence of spina bifida in the United States. The previous study revealed that from October 1995–December 1996 (before the folic acid fortification mandate) to October 1998–December 1999 (after the January 2008 mandate deadline), the prevalence of spina bifida decreased from 2.62 to 2.02 per 10,000 live births, a decrease of 22.9%. The analysis in this report indicates that from the early postfortification period, 1999–2000, to the most recent surveillance period, 2003–2005, the prevalence of spina bifida in the United States decreased 6.9%. The analysis also showed significant decreases in prevalence among infants with non-Hispanic black mothers, but not among infants with non-Hispanic white mothers or Hispanic mothers.

These findings generally are consistent with those from a previous study that used population-based data from 21 birth defects surveillance systems and reported a 3% decline in spina bifida from 1995–2000 to 2003–2004 for the total population and a 14% decline for infants with non-Hispanic black mothers. However, the decreases in that study were not statistically significant.4 In this report, the decrease in prevalence of spina bifida among infants with non-Hispanic black mothers is similar in magnitude to those observed earlier in the postfortification period for infants with non-Hispanic white and Hispanic mothers. This might have resulted from a delay in the effect of folic acid fortification of cereal grain products among non-Hispanic black mothers. If so, the reasons for the delay might be racial/ethnic differences in folic acid consumption, eating habits, or genetic factors.4,5 Another possibility is that, during this period, changes might have occurred in spina bifida ascertainment on birth certificates that differed by race/ethnicity. Although no specific evidence exists to suggest differential ascertainment by race/ethnicity, the possibility cannot be ruled out.

The findings in this report are subject to at least two limitations. First, birth defects are underreported on birth certificates, including defects such as spina bifida that are readily apparent at birth.4 Previous findings comparing birth certificate data to birth defects registry data have reported a sensitivity of 40%.8 The low sensitivity of birth certificate data likely is attributable to false negatives and might lead to an underestimate of the total number of cases of spina bifida. Because the overall trends in spina bifida prevalence based on birth certificate data are consistent with those derived from population-based birth defects surveillance data, substantial changes in the proportion of false negatives among study periods are unlikely. Although the sensitivity of birth certificates is low for spina bifida, a positive predictive value of 100% for spina bifida suggests that the trends described in this report reflect true cases of spina bifida.4 Second, because birth certificates are completed for live births only, pregnancies affected by spina bifida that ended in induced or spontaneous abortion were not ascertained. Although little information is available regarding recent trends in pregnancy termination after a prenatal diagnosis of spina bifida, data from the Metropolitan Atlanta Congenital Defects Program indicate that the yearly proportion of all defects that were diagnosed prenatally remained constant from 1995 to 2004.9 Furthermore, the trends presented in this report are consistent with those based on birth defects surveillance data that included prenatally ascertained cases,4 which suggests that the observed changes are likely to be representative of actual changes in spina bifida prevalence.

An estimated 50%-70% of NTDs can be prevented through daily consumption of 400 µg of folic acid.1 Recent reports have described decreasing concentrations of serum and red blood cell folate among women of childbearing age.10 The results presented in this report show no corresponding rise in spina bifida prevalence. However, continued monitoring of spina bifida prevalence is essential to monitor the impact of folic acid fortification and other interventions to reduce the incidence of NTDs. Future decreases in the prevalence of spina bifida might be attenuated as the percentage of NTDs preventable by consuming folic acid continues to diminish.

Future public health efforts to reduce the prevalence of spina bifida should focus on subgroups of women with known risk factors for an NTD-affected pregnancy, such as obesity, Hispanic ethnicity, and certain genetic factors. Additional study of genetic and environmental risk and protective factors is warranted. All women of childbearing age who are capable of becoming pregnant should consume 400 µg of folic acid daily through dietary supplements and/or fortified foods, in addition to a diet containing folate-rich foods, to reduce their risk for a pregnancy affected by an NTD.

REFERENCES

1. CDC. Recommendations for the use of folic acid to reduce the number of cases of spina bifida and other neural tube defects. MMWR. 1992;41(RR-14).