

- <sup>3</sup> Moore, D. H., Charney, J., Kramarsky, B., Lasfargues, E. Y., Sarkar, N. H., Brennan, M. J., Burrows, J. H., Sirsat, S. M., Paymaster, J. C., and Vaidya, A. B., *Nature*, **229**, 611 (1971).  
<sup>4</sup> Sarkar, N. H., and Moore, D. H., *Nature*, **236**, 103 (1972).  
<sup>5</sup> Calafat, J., and Hageman, Ph. C., *J. Gen. Virol.*, **14**, 103 (1972).  
<sup>6</sup> Moore, D. H., Sarkar, N. H., Kelly, C. E., Pillsbury, N., and Charney, J., *Texas Rep. Biol. Med.*, **27**, 1027 (1969).  
<sup>7</sup> Chenaillé, P., Levy, J. P., Tavitian, A., and Boiron, M., *Nature*, **213**, 107 (1967).  
<sup>8</sup> Anderson, R., *The Wistar Institute Symposium Monograph No. 4* (edit. by Defendi, V.), 113 (The Wistar Institute Press, Philadelphia, 1965).  
<sup>9</sup> de Harven, E., *The Wistar Institute Symposium Monograph No. 4* (edit. by Defendi, V.), 147 (The Wistar Institute Press, Philadelphia, 1965).  
<sup>10</sup> Jensen, E. M., and Schidlow, G., *J. Nat. Cancer Inst.*, **33**, 1029 (1964).  
<sup>11</sup> Sarkar, N. H., and Moore, D. H., *J. Nat. Cancer Inst.*, **48**, 1051 (1972).  
<sup>12</sup> Schlom, J., Spiegelman, S., and Moore, D., *Nature*, **231**, 97 (1971).

## Congenital Heart Disease and Maternal Smoking Habits

FEDRICK *et al.*<sup>1</sup> have produced data to show that the incidence of congenital heart disease in infants of mothers who are cigarette smokers is significantly higher than among infants

X-rays. Furthermore, at the end of the study all suspected children were examined and all records were reviewed by one paediatric cardiologist (Dr Julien I. E. Hoffman, University of California Medical Center, San Francisco). We were therefore confident that the final diagnoses were valid, and that the mothers' accounts of their smoking history were not biased by the outcome of their pregnancies.

The incidence of congenital heart disease among the infants of smokers was almost identical in our study and in that of Fedrick *et al.* (7.3% in their study, which is identical to the incidence among all races in our study, and very close to the 8.2% we obtained for whites). But we found a much greater incidence of congenital heart disease among the children of non-smokers (8.1 and 7.7 for all races and for whites, respectively, compared with 4.7).

After a thorough search of the literature, consisting of eighteen studies, four based on relatively large samples<sup>7,8</sup>, I conclude that the findings of Fedrick *et al.* are at variance with most previous investigations, especially those based on relatively large samples (Table 2). Thus, contrary to the statement<sup>1</sup> that, "It is generally accepted that maternal smoking during pregnancy is associated with an increased risk of spontaneous abortion, low birth weight and stillbirth or neonatal death", the mortality rate is not greater for infants of smokers, and the perinatal mortality rate of low birth weight infants of smoking mothers is significantly lower than that of low birth weight infants of non-smoking mothers.

**Table 1** Proportion of Smoking and Non-smoking Mothers of Children with and without Congenital Heart Disease (CHD)

Maternal smoking habits	Congenital heart disease				Live births without CHD			
	All races		Whites		All races		Whites	
	No.	%	No.	%	No.	%	No.	%
Smokers	38	33.0	31	39.7	5,158	35.3	3,735	38.1
Non-smokers	77	67.0	47	60.3	9,458	64.7	6,077	61.9
Total	115	100.0	78	100.0	14,616	100.0	9,812	100.0

**Table 2** Perinatal Mortality\* Among all Infants and Among Low-Birth-Weight Infants by Maternal Smoking Status in Four Studies of Large Sample

Study	Number of births	% low-birth-weight ( $\leq 2,500$ g)		Total Non-smoker	Perinatal mortality per 1,000			
		Non-smoker	Smoker		Smoker	Non-smoker	$\leq 2,500$ g Smoker	
Yerushalmy <sup>2</sup>	White	5,381	3.5	6.4	12.4	13.9	232.1	137.7
	Black	1,419	4.9	13.4	23.4	22.9	260.9	109.4
Underwood <i>et al.</i> <sup>3</sup>	48,505	5.7	8.9	19.7	20.8	269.0	187.0	
Rantakallio <sup>4</sup>	11,931	3.5	6.1	23.2	23.4	343.6	287.6	
Butler <i>et al.</i> <sup>5</sup>	16,994	5.4	9.3	32.4	44.8	284.5	268.5	
Yerushalmy <sup>6</sup>	White	9,793	3.2	6.4	11.0	11.3	218.3	113.9
	Black	3,290	5.8	12.3	17.1	21.5	201.6	113.6

\*Study of Yerushalmy refers to neonatal mortality only. A more complete review of all the evidence is given in the correspondence published in refs. 7 and 8.

of non-smoking mothers. In our child health development studies my colleagues and I have attempted to duplicate those findings which relate to their "control week" data. We used the same criteria, thus omitting all multiple births and all cases in which the defect was associated with anencephalus, spina bifida or Down's syndrome. We found no difference in the proportion of smokers and non-smokers between mothers of affected and unaffected children. Thus we found no difference between the children of smoking and non-smoking mothers with regard to the incidence of congenital heart disease (Table 1).

Our study was entirely prospective. The information on smoking was derived early in pregnancy, whereas in the study by Fedrick *et al.* the questionnaire was completed after delivery. Also, the children in our study were observed continuously and any suspected of congenital heart disease were given all appropriate tests, including electrocardiogram and

This study was supported by the National Institute of Child Health and Human Development.

J. YERUSHALMY

*School of Public Health,  
University of California,  
Berkeley, California 94720*

Received November 12, 1972.

<sup>1</sup> Fedrick, J., Alberman, E. D., and Goldstein, H., *Nature*, **231**, 529 (1971).

<sup>2</sup> Yerushalmy, J., *Amer. J. Obstet. Gynec.*, **88**, 505 (1964).

<sup>3</sup> Underwood, P. B., Kessler, K. F., O'Lane, J. M., *et al.*, *Obstet. Gynec.*, **29**, 1 (1967).

<sup>4</sup> Rantakallio, P. A., *Acta Paed. Scand.*, 193 (1969).

<sup>5</sup> Butler, N. R., and Alberman, E. D. (eds.), *Perinatal Mortality* (Livingstone, Edinburgh, 1969).

<sup>6</sup> Yerushalmy, J., *Amer. J. Epidemiol.*, **93**, 443 (1971).

<sup>7</sup> Yerushalmy, J., *Amer. J. Obstet. Gynec.*, **112**, No. 2, 227 (1972).

<sup>8</sup> Yerushalmy, J., *Amer. J. Obstet. Gynec.*, **114**, No. 4, 571 (1972).