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Mortality from congenital malformations in England and Wales: variations by mother's country of birth

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SUMMARY Stillbirth and infant mortality from congenital malformations in England and Wales during 1981–5 was investigated according to the mother's country of birth. Significant differences remained after standardising for maternal age and social class. The highest overall mortality was in infants of mothers born in Pakistan (standardised mortality ratio 237), followed by infants of mothers born in India (standardised mortality ratio 134), East Africa (standardised mortality ratio 126), and Bangladesh (standardised mortality ratio 118). Caribbean and West African mothers showed an overall deficit. Mortality was inversely related to social class in all groups except the Afro-Caribbean. Infants of mothers born in Pakistan had the highest mortality in every social class except I, and for most anomalies investigated. Their ratios were particularly high for limb and musculoskeletal anomalies (standardised mortality ratio 362), genitourinary anomalies (standardised mortality ratio 268), and central nervous system anomalies (standardised mortality ratio 239). Our findings highlight the need for further research to identify the causes underlying these differences.

Ethnic differences in the incidence of congenital malformations have been recorded in many countries, including Britain.[1–13] Regional studies in this country have reported comparatively low rates of malformations among Afro-Caribbean subjects and comparatively high rates among Asians.[1–3] Differences in types of malformations and incidence patterns within the Asian community have been less well documented. A study of mortality from malformations in England and Wales for the years 1976–80 showed significant differences between immigrant groups, and within the different Asian groups.[4]

In this study we have investigated ethnic differences in mortality from malformations in England and Wales in greater detail for 1981–5, the latest years for which national data were available. Infants of mothers born in India, Pakistan, and Bangladesh were analysed separately, in addition to those born to mothers from East and West Africa, Republic of Ireland, and the Caribbean. Because mortality from congenital anomalies in England and Wales is associated with social class,[14] we have also investigated the contribution of social class to mortality within the different ethnic groups.

Methods

Mortality from congenital malformations in England and Wales during 1981–5 was analysed according to the mother's country of birth, using data from the Office of Population Censuses and Surveys (OPCS). Stillbirths and infant deaths with congenital anomalies as the underlying cause of death were examined for mothers born in the United Kingdom, Republic of Ireland, India, Bangladesh, East and West Africa, Pakistan, and the Caribbean. For convenience, mothers born in the Indian subcontinent are sometimes referred to as Asians.

Although information on ethnic origin is not directly available, the mother's country of birth is a reasonable substitute for ethnicity for most women of childbearing ages.[15] The only notable exceptions are East African immigrants, most of whom are of Indian origin.[16 17] The groups studied do not, however, include second generation immigrant mothers, who have been classified as born in the United Kingdom. Their numbers are too small to have a significant effect on the results for mothers born in the United Kingdom.[18]

OPCS codes a 10% sample of live births for social

Table 1 *Mortality from congenital malformations as a proportion of births and infant deaths, by mother's country of birth, England and Wales: 1981–5*

Mother's country of birth	*Total No of live births and stillbirths*	*Total No of infant deaths and stillbirths from all causes*	*Infant deaths and stillbirths from congenital malformations*		
			Total No	*% Of all births*	*% Of infant deaths and stillbirths*
United Kingdom	2796404	43459	8895	0·32	20·5
Republic of Ireland	33941	603	127	0·37	21·1
India	58851	1071	268	0·46	25·0
Bangladesh	18837	359	92	0·49	25·6
East Africa	35156	606	140	0·40	23·1
West Africa	14112	254	37	0·26	14·6
Caribbean	27612	546	91	0·33	16·7
Pakistan	67065	1846	601	0·90	32·6
Total births: England and Wales	3202958	50869	10647	0·33	20·9

class. Social class (derived from father's occupation) is given for legitimate births and illegitimate births registered by both parents. Deaths among illegitimate births registered by the mother alone are coded separately. The social class groups studied were: I professional and managerial, II intermediate, IIIn skilled non-manual, IIIm skilled manual, IV partly skilled, and V unskilled. For ease of presentation, the social classes were aggregated into non-manual (I–IIIn) and manual (IIIm–V).

Ethnic differences in mortality from all malformations and selected anomalies were investigated using standardised mortality ratios. The ratios were standardised for maternal age and social class with rates for England and Wales as standard. Age standardised mortality ratios were also examined for ethnic differences in mortality within social class groups. The significance of differences between groups was assessed by χ^2 test and a p value of $<0{\cdot}05$ was accepted as significant; 95% confidence intervals (CI) are given for the principal comparisons.

Results

During 1981–5 there were 10 647 stillbirths and infant deaths from congenital abnormalities in England and Wales, constituting 0·33% of all births during the same period (table 1). This proportion was generally high in groups of Asian origin, being highest in Pakistanis (0·90%). Malformation deaths as a proportion of all infant deaths and stillbirths were comparatively low in West Africans and Caribbeans, and highest in Pakistanis. Types and patterns of mortality from congenital malformations differed significantly among immigrant communities, irrespective of maternal age and social class. Overall mortality from malformations was low in

Table 2 *Standardised mortality ratios and numbers of infant deaths and stillbirths for all congenital anomalies, by mother's country of birth, England and Wales: 1981–5*

Mother's country of birth	*All congenital anomalies*		
	Mortality ratio standardised for mother's age and social class (England and Wales=100)	*Observed deaths*	*95% Confidence interval*
United Kingdom	96	8895	94 to 98
Republic of Ireland	107	127	89 to 126
India	134	268	118 to 150
Bangladesh	118	92	96 to 145
East Africa	126	140	105 to 147
West Africa	74	37	53 to 102
Caribbean	93	91	76 to 114
Pakistan	237	601	218 to 256
All mothers: England and Wales	100	10647	

West Africans and Caribbeans (table 2). Infants of mothers born in India, East Africa, and Bangladesh showed moderate excesses. The highest mortality (standardised mortality ratio 237) was found in Pakistani infants.

In all groups except West Africans and Caribbeans mortality was higher in the manual than in the non-manual classes, with the groups of Asian origin showing a significant and consistent excess in the manual category (table 3). In the non-manual category only Pakistanis showed a significant excess (standardised mortality ratio 191). A detailed examination by social class showed that Pakistanis had the highest standardised mortality ratios in every social class except I (one death), with mortality in social classes II–V being 2·5–3·1 times the corresponding rates for mothers born in the United Kingdom. Although the other Asian groups also showed consistently raised mortality in social classes II–V, their rates were considerably lower than those for Pakistani infants.

Mortality from central nervous system anomalies (table 4) was highest in infants of mothers born in Pakistan (standardised mortality ratio 239), with Indians showing a smaller but nonetheless significant excess (standardised mortality ratio 142).

Table 3 *Standardised mortality ratios and numbers of infant deaths and stillbirths for all congenital anomalies, by mother's country of birth and social class, England and Wales: 1981–5*

Mother's country of birth	*Non-manual*		*Manual*		*Other*		*Sole registered illegitimate*		*Total*	
	Mortality ratio standardised for mother's age†	*Observed deaths*	*Mortality ratio standardised for mother's age†*	*Observed deaths*	*Mortality ratio standardised for mother's age†*	*Observed deaths*	*Mortality ratio standardised for mother's age†*	*Observed deaths*	*Mortality ratio standardised for mother's age†*	*Observed deaths*
United Kingdom	83*	2703	100	5077	134*	414	112*	701	96*	8895
Republic of Ireland	93	39	123	76	34	1	128	11	110	127
India	107	70	148*	183	233*	14	100	1	137*	268
Bangladesh	105	12	138*	77	242	3	0	0	134*	92
East Africa	117	70	131*	65	86	3	167	2	123*	140
West Africa	75	16	36	3	91	12	153	6	79	37
Caribbean	118	27	86	41	94	3	104	20	98	91
Pakistan	191*	79	272*	490	353*	29	455*	3	261*	601
All mothers: England and Wales	85*	3192	106*	6161	131*	534	113*	760	100	10647

*p<0·05; †England and Wales=100.

Table 4 *Standardised mortality ratios and numbers of infant deaths and stillbirths by mother's country of birth for anomalies of the central nervous system, England and Wales: 1981–5*

Mother's country of birth	*Anencephalus*		*Spina bifida*		*Other central nervous system anomalies*		*All central nervous system anomalies*	
	Mortality ratio standardised for mother's age and social class†	*Observed deaths*	*Mortality ratio standardised for mother's age and social class†*	*Observed deaths*	*Mortality ratio standardised for mother's age and social class†*	*Observed deaths*	*Mortality ratio standardised for mother's age and social class†*	*Observed deaths*
United Kingdom	95	663	104	1118	90*	770	97	2551
Republic of Ireland	160	14	113	14	113	12	126	40
India	149	22	97	23	196*	36	142*	81
Bangladesh	118	8	57	5	128	10	98	23
East Africa	113	9	103	13	185*	18	132	40
West Africa	90	3	20	1	113	5	71	9
Caribbean	54	4	10*	1	44	4	33*	9
Pakistan	268*	54	101	30	379*	94	239*	178
All mothers: England and Wales	100	803	100	1231	100	984	100	3018

*p<0·05; †England and Wales=100.

Table 5 *Standardised mortality ratios and numbers of infant deaths and stillbirths, by mother's country of birth, for selected anomalies, England and Wales: 1981–5*

Mother's country of birth	Anomalies of circulatory system		Anomalies of respiratory system		Cleft lip/palate, anomalies of upper alimentary tract and digestive system		Anomalies of genitourinary system		Limb and musculoskeletal anomalies		Chromosomal anomalies	
	Mortality ratio standardised for mother's age and social class†	Observed deaths	Mortality ratio standardised for mother's age and social class†	Observed deaths	Mortality ratio standardised for mother's age and social class†	Observed deaths	Mortality ratio standardised for mother's age and social class†	Observed deaths	Mortality ratio standardised for mother's age and social class†	Observed deaths	Mortality ratio standardised for mother's age and social class†	Observed deaths
United Kingdom	98	2837	98	651	97	363	98	462	94	703	97	426
Republic of Ireland	95	36	132	11	120	6	91	5	85	8	151	11
India	138*	86	76	11	156	12	112	12	88	14	84	8
Bangladesh	114	26	94	5	181	5	160	6	99	6	87	4
East Africa	132	47	75	6	94	4	116	7	103	9	140	8
West Africa	78	13	57	2	49	1	80	2	75	3	122	3
Caribbean	114	35	213*	15	76	3	86	4	128	10	114	6
Pakistan	169*	130	182*	33	234*	22	268*	35	362*	73	109	14
All mothers:												
England and Wales	100	3346	100	766	100	431	100	545	100	857	100	515

*p<0·05; †England and Wales=100.

Caribbeans showed a significant deficit (standardised mortality ratio 33). These patterns were also apparent for anencephaly. Differences between groups were much smaller for spina bifida, with the lowest ratios in the Caribbean and West African groups. Mortality from other central nervous system anomalies was high in all groups of Asian origin, being highest in Pakistanis (standardised mortality ratio 379).

Infants of mothers born in Pakistan showed the highest mortality for most other anomalies examined (table 5), particularly for genitourinary (standardised mortality ratio 268) and limb and musculoskeletal anomalies (standardised mortality ratio 362). Other groups of Asian origin also showed high mortality from anomalies of the circulatory, digestive, and genitourinary systems. Chromosomal anomalies showed relatively smaller intergroup variations.

Discussion

This study is based on the underlying cause of death and does not include other abnormalities mentioned on death certificates. As a study of mortality, it also does not include defects compatible with life beyond the first year. The reliability of mortality as a measure of birth prevalence will therefore depend on the type of anomaly under consideration. Furthermore, rates of survival for similarly affected infants may vary among the different ethnic groups, thereby affecting the proportions dying within the first year.

Our findings showed significantly higher mortality from malformations in infants of Asian origin compared with infants of mothers born in this country. The overall rate in Indians and Pakistanis was 25% and 121% higher respectively than the rate among mothers in social class V born in the United Kingdom. Compared with mothers born in the United Kingdom in social class I, the rates among Indians and Pakistanis were higher by 68% and 196% respectively. Of particular concern is the incidence of malformation among Pakistani infants. Differences in mortality between Pakistanis and other groups of Asian origin were considerably larger than those between the latter and the indigenous population.

Most East Africans are of Indian origin, which may explain why their standardised mortality ratios correspond to those for Indians. The low standardised mortality ratios for West Africans, on the other hand, showed greater agreement with those for Caribbeans. West Africans and Caribbeans were different from the other groups studied in that they did not show rising mortality from social class I to V, a finding noted also in a study of perinatal mortality among mothers delivered at St Thomas's Hospital, London, during 1969–76.[19]

These results are broadly consistent with the patterns reported for 1976–80,[4] even though the earlier analysis did not adjust for social class. In both periods Pakistanis had high standardised mortality ratios for most types of defects, specially for central nervous system and musculoskeletal anomalies. In both periods Caribbeans had low standardised mortality ratios, particularly for central nervous system defects and most notably for spina

bifida. As in 1976–80, spina bifida showed less variation among groups than other malformations. In this study chromosomal anomalies, not included in the earlier analysis, showed the least variation.

Our findings are generally consistent with the results of other studies. A low incidence of serious malformations has been reported for populations of Afro-Caribbean origin in America, Africa, Britain, and elsewhere, even after migration.[1 2 5–10] In particular, the significantly low mortality from central nervous system anomalies among Caribbeans in this study is consistent with other reports of a low rate of neural tube defects in negroid subjects. On the other hand they are consistently found to have higher rates for some less severe abnormalities, in particular for polydactyly and supernumerary nipples,[6–9 11] conditions which could not be examined in a study of mortality such as this.

For the Asian groups, data from the countries of origin is sparse except in the case of India. Most of the Indian data comes from local hospital based studies, and the indices of measurement are not uniform. Comparisons with our results therefore were not readily possible. Previous studies in England have reported a high incidence of malformations in Asian infants generally[1 2 10 12] and among Pakistanis in particular.[3]

Discussion about the causes underlying ethnic differences in malformations has on the whole been inconclusive, because the aetiology of most congenital anomalies is both complex and unknown. Many factors in addition to genetic susceptibility are associated with incidence: season of birth, social class, maternal age, parity, sex of child, and nutrition. Antenatal screening and social and cultural practices (for instance, smoking, alcohol consumption, diet, and consanguinity) also influence incidence. The relative impact of environmental factors and genetic susceptibility on incidence is said to vary both with the type of anomaly and with the populations under consideration.[5]

The low overall incidence of defects (neural tube defects in particular) in negroid subjects is generally attributed to genetic factors and mixed descent.[5 6 8 13] It has also been suggested that different rates of fetal maturation and skeletal growth during critical periods of fetal development could explain some of the differences observed between white and negroid subjects.[8]

Reasons for variations within the Asian community have scarcely been investigated. Of particular interest are the differences observed here between Pakistanis and Indians. Consanguinity, high fertility, and childbearing late into the reproductive period, are more common in Pakistanis than Indians,[2 3 10 20] and could be contributory factors. Neural tube defects are thought to be more common in women of high fertility.[5]

It was not possible to estimate the impact of antenatal screening on these ethnic differences as abortion statistics are not available by country of birth. Induced abortions for fetal abnormalities contributed to the decline in central nervous system anomalies (anencephaly in particular) that has been evident in England and Wales since the early 1970s.[21–23] The number of terminations of pregnancy was, however, insufficient to account for more than a small part of the national decline.[23] The notification rate for Down's syndrome has shown little change since 1970, except among older mothers.[22] The notification rate for all malformations, though concealing variations between individual conditions, has remained steady during the years 1976–85.[24] The contribution of antenatal screening to ethnic differences in malformations is likely to be small, therefore, except in the case of central nervous system anomalies.

These differentials between similar ethnic groups offer an opportunity to gain new insights into the aetiology of congenital malformations. The costs, both human and economic, of such high malformation rates will increase as the population at risk grows. The Pakistani population in Great Britain, estimated by the Labour Force Survey to be 380 000 during 1983–5, is young and has high fertility, with about 14 000 births a year. The number of infants at risk is therefore large, and likely to increase. There are an additional 23 000 births a year to other mothers of Asian origin (including East Africans). Our results highlight the need for further research among these high risk groups to investigate and identify some of the underlying causes which contribute to these differences.

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