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Socio-Economic Status and Pregnancy Outcome: An Australian Study

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Abstract

A prospective cohort of 8556 pregnant women attending the Mater Misericordiae Mothers' Hospital in Brisbane was examined to consider the impact of socio-economic status on pregnancy outcome. The indicators of socio-economic status selected were family income, maternal education and paternal occupational status. Pregnancy out-comes considered were preterm delivery, low birthweight, low birth-weight for gestational age, and perinatal death. Subsidiary analyses were also undertaken for Apgar scores, time to establish respiration, need for mechanical respiration and admission to intensive care. Before adjustment, the main consistent association was between the occupational status of the father and three measures of perinatal morbidity. Initial adjustment for the mother's socio-demographic background and weight/height ratio reduced the strength and statistical significance of the above associations, while further adjustment for lifestyle variations between the three status groups further reduced the above associations to marginal statistical significance. The findings suggest that observed class differences in pregnancy outcome are attributable to the mother's personal characteristics (height/weight^2, parity) and her lifestyle.

The relation between socioeconomic status and perinatal mortality was brought into focus by Baird & Wyper (1941) when they stated 'there is a large wastage of child life associated with childbirth in Scotland, intimately connected with unfavourable economic conditions, and malnutrition and fatigue of the mother'.

Baird (1945, 1973) analysed perinatal mortality against social class (using the Registrar General's classification) and confirmed the existence of an inverse association between stillbirth and neonatal death rates and social class. Since then, a number of European, British and American studies have replicated these observations, which are well summarized by Antonovsky & Bernstein (1977) and Gray (1982).

Illsley (1983) noted that, while perinatal mortality had decreased dramatically between 1951 and 1977 in Scotland, the mortality ratio between the various social classes had remained virtually unchanged, a point confirmed more recently by Whitehead (1987) for Britain in general.

The evidence available to date demonstrates that class differences are predictors of pregnancy outcome for a number of countries, but leaves three key questions unanswered. Firstly, there is some uncertainty concerning the extent of class variations in pregnancy outcome in Australian obstetric practice. This is, in part, derived from the general belief that there has been a unique pattern of Australian migration (early convict origins, then a large number of displaced per-sons following World War II) coupled with a widely held egalitarian ethic and the lack of an 'inherited' class structure. Secondly, as class itself cannot logically 'cause' particular out-comes of pregnancy (since class is a concept, an abstraction for research purposes), there is a need to determine the relevant causal sequence. Thirdly, and more specifically, while class may be correlated with pregnancy outcome, it is not clear whether such an association is a con-sequence of specific behavioural differences or the result of a general process associated with chronic economic disadvantage.

The studies of Dasvarma (1980), who found an association between neonatal mortality rates and Aboriginal and ex-nuptial births, and Johnston (1980), who showed an inverse relation between perinatal mortality and maternal education in two Hobart suburbs, provide indirect evidence that some associations between class and pregnancy outcome may be present in Australia. However, while Lumley *et al.* (1985) found an inverse association between low birthweight and social class in Tasmania, this association did not extend to the group at greatest risk, those children born with a birthweight below 1500 g. Siskind *et al.* (1987) have shown that lower class areas of Brisbane have higher infant mortality rates, but Australian data for a cohort observed longitudinally have not been available.

The purpose of this paper is to consider social class/socio-economic status differences in pregnancy outcome in a large hospital-based Brisbane sample.

Subjects and methods

Sampling and research design

A prospective cohort of 8556 patients attending the Mater Misericordiae Mothers' Hospital in Brisbane was enrolled in the study between 1981 and 1983. Full profiles of their demographic, social, cultural and past obstetric characteristics have been detailed by Keeping *et al.* (1989). Data for this paper were obtained from phase I (a questionnaire administered at the first clinic visit) and phase IV (the medical record of the pregnancy and its outcome).

Full details of data collection have been reported previously (Keeping *et al.* 1989). The data were analysed using SAS *(SAS User's Guide: Statistics* 1985) on an IBM mainframe computer at the University of Queensland. The analysis involved the use of the program CATMOD which provides odds ratios of particular outcomes adjusted for a range of potential confounders.

The analysis aimed to establish the relation between social class/socio-economic status and the outcome of pregnancy, and the influence of associated variables.

Social class/socio-economic status

Social class, despite its abstract status, is, according to Illsley (1983), an effective epidemiological concept based on the recognition that paternal occupation is a sensitive indicator, not only of working conditions, but also of income, education, housing, diet and a variety of social, economic and cultural characteristics which are often loosely described as 'lifestyle'. While Illsley has correctly noted that the variable 'class' provides indirect evidence of the association between the social circumstances of groups in the community and their health, it remains unclear why such an association exists. Two types of possibility may be considered in the above context. Firstly, class differences may influence a limited number of specific lifestyle variables which, in turn, modify the mothers' health and the outcome of pregnancy. Secondly, class differences may be associated with such a wide variety of lifestyle factors and socio-environmental differences that it may be more appropriate to conceptualize these under a more general schema (see Syme & Berkman 1976; Syme 1986; Najman 1980; Marmot *et al.* 1984). According to this latter view, class differences in health are attributable to a constellation of inter-acting variables which are unique to particular class groups. The impact of this constellation of factors, it is argued, renders lower class groups more 'susceptible' to a wide range of diseases and causes of death. Until these variables and their mode of expression are better known, the concept 'class' might best be treated, according to this latter view, as an identifying label which directs attention to an area of concern.

While mortality differences have been repeatedly demonstrated in the relatively stratified British (and the more general European) class structure, there are many difficulties in transposing this observation to the Australian situation. Differences in racial, social and cultural back-ground, population mobility (both in housing and employment), changes in wage, employment and educational structure, a low population density, and often a marked disparity between income and occupational status, as well as an inappropriately conceptualized Australian Bureau of Statistics' classification (Najman 1988) have created difficulties in determining a clearly defined class structure in Australia.

For these reasons, sociologists and epidemiologists in Australia, such as Najman *et al.* (1979) and McMichael (1985), have tended to use more specific indices such as occupational status, income and education as indicators of social class, rather than occupation as defined by the British Registrars General.

Following this practice we have chosen to use three somewhat distinct indicators of socio-economic status, namely:

Family income. This was used because it is likely to reflect the mother's and father's combined economic position relative to other families. Income inequalities are likely to distinguish most directly between families' capacities to purchase goods (food, clothing, etc.) and services (transport, communication, support facilities when unwell). Such a variable elevates the position of dual-income families relative to indicators based upon the circumstances of one or other of the partners. Respondents were provided with seven categories of income in the questionnaire and asked to indicate which category was closest to their family gross income. These have been reduced to five, with the lowest income group receiving well below the minimum wage.

Mothers' education. This was used to provide a more direct measure of the woman's relative socio-economic status. Numerous studies in developing countries have shown that more educated women have lower perinatal mortality rates. Higher education not only presumes higher economic standing but suggests a more informed approach to both self care and the use of the health care system. Better knowledge of health-related behaviours is also likely to be reflected by the woman's education level. For analysis the seven alternatives provided to respondents were amalgamated into four categories. Included in the college group are women with varied non-university tertiary qualifications (e.g. secretarial). The recoded version of the variable is perhaps best interpreted as a nominal scale.

Table 1. The correlation of selected socio-demographic variables in a sample of pregnant women in Brisbane (Kendall's Tau-B)

	Family income	Mothers' education	Fathers' status
Mothers' education	0.16**	–	–
Fathers' status	0.22**	0.16**	–
Mothers' age	0.13**	–0.03*	0.10**
Parity	0.10**	–0.09**	0.02*

***P<0.01;* *0.01>*P*>0*.05.*

Fathers' occupational status. This was used because conventional families are generally ranked according to the relative standing of the main income earner, usually the male head-of-house. Occupations were allocated to status scores according to the scale originally developed by Congalton (1969) and updated by Daniel (1983). According to this scale occupations are ranked on the criterion of 'status' using predetermined community norms for each occupation. Typically, medical practitioners, other professionals and directors of major companies are perceived to have high prestige, while cleaners, refuse collectors and labourers receive a low ranking. For the purpose of categorical comparison these rankings were recoded into three ordered groups.

Table 1 provides a correlation matrix of the three SES indicators as well as the mother's age and parity. All the variables are significantly correlated, though the correlations are not strong. The relatively weak intercorrelation between the SES indicators reflects, in part, the choice of the three somewhat distinct measures used. Previous studies in Australia (Broom *et al.* 1968) and Israel (Abramson *et al.* 1982) point to correlations between indicators of perhaps twice those observed in Table 1, if the male partners' characteristics are correlated, rather than the characteristics of either (maternal education, paternal occupation) or both (family income) partners, as is the case in this study.

Pregnancy outcome

Traditionally, perinatal mortality has been used to judge the effect of social class/socio-economic status on pregnancy outcome. However, the decline in perinatal mortality over the past decades has made this outcome a relatively rare event. Much of the residual mortality is due to lethal malformations and very preterm delivery, and may not be of use with a sample of modest size. We have therefore also selected a range of pregnancy outcomes which reflect perinatal morbidity and which are likely to identify those who are at higher risk of perinatal death.

The selected outcomes used are: (i) preterm delivery (≤ 36 completed weeks gestation); (ii) low birthweight (<2500 g); (iii) birthweight <5th centile for gestation (based on hospital birthweight data); (iv) perinatal mortality (includes all stillbirths >20 weeks gestation or ≥ 400 g and neonatal deaths within 28 days of birth).

Results

The three indicators of socio-economic status (SES) are correlated with a number of lifestyle variables including diet, levels of passive recreation (TV watching), cigarette use and missed antenatal visits (Table 2). In each instance the women who score higher on the SES indicator report an apparently healthier lifestyle, smoking fewer cigarettes, being more consistent attenders for antenatal care, eating breakfast more regularly, and watching less television. The above lifestyle differences, it should be stressed, are a partial list of what are more general SES behavioural variations within our sample.

Table 2. The association between lifestyle and socio-economic status in a sample of pregnant women in Brisbane (Kendall's Tau-B)

	Family income	Mothers' education	Fathers' status
Cigarettes			
First visit	0.08**	0.09**	0.07**
Before birth	0.08**	0.09**	0.07**
Missed antenatal visits	0.07`*	0.06**	0.07**
Breakfast regularly	0.05**	0.06**	0.05**
Hours television per day	0.03*	0.09**	0.05**

***P<0.01;* *0.01>P>0.05.

Each of the above associations has been reported because it is apparently related to the outcome of the pregnancy (Table *3).* This is also the case for some socio-demographic and physical characteristics of the mother as indicated in Table *3.* This Table provides a clear indication that associations between pregnancy outcome and SES may be a function of the socio-demographic, physical and lifestyle variables listed in Table 2. These include the findings that the youngest women and nulliparous women have lower birthweight and more low-weight-for-gestation babies; that more obese women have heavier babies; that women who rarely eat breakfast have lower birthweight babies; and that women watching more television or smoking have more low birthweight and low-birthweight-for-gestation babies.

Table 3. Mothers' social background, lifestyle and the outcome of pregnancy (Pearson correlation)

	Birthweight	Gestation at delivery	Birthweight/gestation
Social background			
Mothers' age	0.08*	-0.05*	0.10*
Number of live children	0.11*	0.00	0.13*
Mothers' height/weight ratio	0.10*	0-02	0.10*
Lifestyle			
Cigarettes			
First visit	-0.19*	-0.07*	-0.18*
Before birth	-0.19*	-0.05*	-0.19*
Missed antenatal visits	0.00	0.03*	0.02
Breakfast regularly	0.09*	0-02	0.10*
Hours television per day	-0.04*	-0.02	-0.04*

*P<0.01.

Table 4 shows that there is a consistent association between preterm delivery and the mothers' SES ratings as indexed by the fathers' occupational status. This association reduces to marginal statistical significance when differences are adjusted for lifestyle and relevant sociodemographic and physical variables. There is no association between the preterm delivery rate and the other two indicators of socioeconomic status.

Table 4. Socio-economic status by preterm delivery (≤ 36 completed weeks)

	Rate/100 births	Odds ratio unadjusted	Odds ratio adjustment 1*	Odds ratio adjustment 2†
Family income ($)				
0- 5199	6.4 (547)	1.38	1.03	0.98
5200-10 399	4.6 (1964)	0.97	0.87	0.83
10 400-15 599	4.5 (2683)	0.95	0.94	0.93
15 600-20 799	5.1 (1188)	1.09	1.09	1.09
20 800+	4.7 (764)	1.00	1.00	1.00
		χ^2_4=4.2	χ^2_4=2.0	χ^2_4=2 8
		P=0.38	P=0.74	P=0.60
Fathers' occupational status				
Very low	6.3 (1200)	1.72 (1.2-2.4) ¦	1.59 (1.1-2.3)	1.50 (1.1-2.1)
Low-middle	4.8 (4038)	1.30 (1.0-1.7)	1.23	1.17
Middle-upper	3.7 (1684)	1.00	1.00	1.00
		χ^2_2=9.5	χ^2_2=6.8	χ^2_2=5.3
		P=0.009	P=0.03	P=0.07
Mothers' education				
Incomplete grade 10	6.1 (1433)	1.33	1.15	1.05
Complete grade 10	4.8 (4127)	1.02	0.94	0.91
Grade 12 and/or university	4.3 (921)	0.92	0.90	0.93
College	4.7 (1130)	1.00	1.00	1.00
		χ^2_3=5.4	χ^2_3=2.4	χ^2_3=1.19
		P=0.14	P=0.50	P=0.76

*Adjustment 1 for age, parity, marital status and mothers' weight/height^2.
†Adjustment 2 for the above plus smoking and eating breakfast regularly.
¦ 95% confidence intervals (CI) for odds ratios.

A similar finding appears in Table 5 when we examine the association between low birthweight and SES. Women who fall into the lowest status group appear to manifest consistently the highest rate of low birthweight. These differences remain statistically significant after adjusting for the mothers' age, parity, marital status and weight/height, but diminish to marginal statistical significance (for occupational status) or non-significance (for mothers' education) once there is further adjustment for the mothers' lifestyle.

Table 5. Socio-economic status by low birthweight (≤ 2499g)

	Rate/100 births	Odds ratio unadjusted	Odds ratio adjustment 1*	Odds ratio adjustment 2t
Family income ($)				
0- 5199	6.8(546)	1.51 (0.9-2.5)¦	1.30	1 25
5200-10 399	5.4(1964)	1.18	1.13	1.05
10 400-15 599	5.1 (2683)	1-13	1.16	1.14
15 600-20 799	4.6 (1188)	0.99	0.98	0.99
20 800+	4.6 (764)	1.00	1.00	1.00
		χ^2_4=4.5	χ^2_4=1. 98	χ^2_4=1.53
		P =0.35	*P* =0.74	*P*=0.82
Fathers' occupational status				
Very low	6-5 (1200)	1.70 (1.2-2.4)	1-69 (1.2-2.4)	1-53 (1.1-2.2)
Low-middle	5.5 (4038)	1.43 (1.1-1.9)	1.40 (1.1-1.9)	1.29 (0-9-1.7)
Middle-upper	3.9 (1684)	1.00	1.00	1.00
		χ^2_2=10.0	χ^2_2=9.0	χ^2_2=5.8
		P =0.007	*P* =0.01	P=0.06
Mothers' education				
Incomplete grade 10	7.0 (1433)	1.56 (1.1-2.2)	1-48 (1-0-2.1)	1.25
Complete grade 10	5.1 (4126)	1.12	1.10	1.02
Grade 12 and/or university	4.5 (921)	0.97	0.97	1.02
College	4.6 (1130)	1.00	1.00	1.00
		χ^2_3= 10.6	χ^2_3=7.6	χ^2_3=2.8
		P =0.01	*P* =0.05	*P*=0.43

*Adjustment 1 for age, parity, marital status and mothers' weight/height[2].
† Adjustment 2 for the above plus smoking and eating breakfast regularly.
¦ 95°/ CI for odds ratios.

This latter pattern is evident again in Table 6 where family income and fathers' occupational status are associated with low-weight-for-gestation, but adjustment in successive stages for the mothers' socio-demographic and physical characteristics reduces the significance of these associations, and for lifestyle the associations become of marginal significance (for family income) or non-significant (for occupational status).

Table 7 indicates that, despite some trends in the expected direction, there is no association between perinatal mortality and SES in our sample. While not statistically significant, the lowest SES group, in every instance, manifests the highest (unadjusted) mortality rates. This, of course, reflects the low number of deaths in this sample, and, in view of the earlier findings, should not be interpreted as evidence inconsistent with that derived from Tables 4-6. In a second set of analyses, data were processed using the analysis of variance program in the general linear model (GLM) producing similar results to those in Tables 4-6. Regardless of whether the analysis involved a comparison of adjusted mean differences or adjusted odds of particular outcomes (equivalent to relative risks), the findings point to some modest associations which diminish to marginal statistical significance once lifestyle adjustments are added to those relating to the physical characteristics of the mother.

The categorical analysis was also repeated for a range of additional indicators of pregnancy outcome. These included low Apgar scores at 5 min (≤ 6), time to establish respiration ≥ 3 min, baby requiring mechanical respiration and admission to the intensive care nursery for ≥15 days. These failed to produce statistically significant (unadjusted) associations with the three SES indicators used in this study.

Discussion

The results suggest that, in this community, low socio-economic status as measured by the fathers' occupational status, is associated with a number of indicators of perinatal morbidity. Adjustment for the mothers' age, parity, marital status and weight/height reduces the magnitude and significance of the above differences as does further adjustment for indicators of the mothers' lifestyle.

Two reservations may be raised in the context of these findings. The first is that the database may not be sufficiently large to reveal statistically significant associations. This would appear unlikely as our sample is half the size of that of the 1970 British Birth Cohort (Chamberlain *et al.* 1975) but, by contrast, our data have the advantages of including detailed social and obstetric data.

The second reservation is that our sample is under-represented in the upper socio-economic group. A comparison of perinatal mortality rates for public and private patients at the Mater Hospital showed no differences once transfers from other hospitals were excluded from the calculations (Keeping *et al.* 1989). Whitehead (1987), in her review of the British and other literature, notes that studies which have been limited to a cohort which is relatively homogeneous (e.g. the Whitehall study-Marmot *et al.* 1984) have observed differences between socio-economic strata which are even greater than those observed in a broader population, perhaps in part because more reliable and valid occupational data are obtained. Further, we would argue that we have sufficient spread, from middle to lower class, to identify substantial differences if they existed. Moreover, from a practical point of view, any effective intervention programmes would be directed to reducing the socio-economic gap between the low to middle levels, and these groups are well represented in our sample.

Three issues, identified in the introduction, are of relevance in this discussion. Firstly, the data from this study point to socioeconomic differences in perinatal morbidity with mothers in the lowest status category manifesting significantly higher rates of preterm delivery, low birthweight and low birthweight for gestational age. This finding is consistent (arid interestingly of a similar magnitude) with the results reported by Lumley *et al.* (1985) for Tasmanian infants born between 1975 and 1983, though their classification of SES differs markedly from ours. While we have not found an association between perinatal mortality and SES, Siskind *et al.* (1987) do report such an association for a Brisbane area-based study. The small numbers of deaths in our sample suggest that the failure to observe an association between SES and perinatal mortality should not be considered evidence denying the existence of such an association. When we compare the adjusted point estimates of the magnitude of elevated risk manifested by the lowest SES group, we observe about a 50% increased rate of adverse outcomes in the lowest group in this study and those by Lumley *et al.* (1985) and Siskind *et al.* (1987).

The second issue of concern relates to the causal sequence associating SES and perinatal morbidity. The data from this sample suggest that a component of the SES effect is attributable to the mother's age, parity, marital status and weight/height ratio. Yet a further component of this association is attributable to some specific lifestyle differences. Thus it seems that women in the lowest status group have more adverse pregnancy outcomes because they are younger, less often married, and of lower parity, as well as more often being smokers and eating breakfast less frequently.

This leads to the third and related point, that adjustment for all the above variables reduces the observed association between SES and perinatal morbidity to one of marginal statistical significance, suggesting that SES differences in perinatal morbidity are attributable to a relatively small number of characteristics of the mother, only some of which represent modifiable behaviours. While bearing in mind the limitations of the sample enrolled in this study, our findings appear to differ from those reported elsewhere.

Marmot *et al.* (1984) have, in the context of the Whitehall Study, argued that class differences in adult mortality remain even after the data are adjusted for lifestyle variations between the classes. A similar finding was reported in data from the Alameda County Study, California, when it was observed that SES differences remained even after adjustment for 13 known risk factors (Berkman & Breslow 1983). Slater *et al.* (1985) have also found, for a large American sample, that self-rated health varies with various indices of SES even after adjustment for the respondent's age and health habits. They suggest that SES makes an 'independent' contribution to health status. Whitehead (1987), in a comprehensive review of the UK and inter-national literature regarding SES differences in mortality, points out that class differences may be observed in nutrition, housing, exercise patterns, cigarette smoking, alcohol use and presumably a wide range of other potentially health pertinent behaviours. Illsley (1986) has further argued that a component of the class difference in mortality is attributable to a process of social mobility, with women who are more likely to have adverse pregnancy outcomes (they are shorter, score lower on IQ tests) being downwardly mobile. The contribution of this biological component to the socio-economic difference in pregnancy outcomes is likely to be modest (Wilkinson *1986).*

Thus the data we have reported disagree with the existing literature in a number of respects. Our study points to some socio-economic differences in pregnancy outcomes, though these are of a comparatively modest magnitude. A component of this difference appears to be attributable to the socio-demographic and physical characteristics of the mother and a second component to a small number of lifestyle factors.

Our data may be interpreted in various ways. Epidemiologists and sociologists might argue that there remains a residual effect of marginal significance after allowing for the effects of such variables as age, parity, marital status, smoking and eating breakfast regularly. Indeed, it could be argued that the very existence of an association between indicators of socio-economic status and the outcome of pregnancy (regardless of whether the association is mediated by the mother's lifestyle) demands that methods of reducing the level of socio-economic inequality should be identified, and that lifestyle intervention programmes (e.g. to reduce cigarette smoking by pregnant women) be mounted.

A second, more pragmatic, interpretation could be advanced by the practising obstetrician who might argue that low socio-economic status is not an independent cause of perinatal mortality or any of the more serious indicators of perinatal morbidity. Obstetricians might wish to question whether the birthweight difference was of sufficient magnitude to be of obstetric importance.

We have previously partitioned birthweight in our population (Keeping *et al.* 1979) and considered the effect of many factors-maternal age, patient status, height and height-adjusted weight, country of origin, individual family and sex of infant-and conclude that the differences in mean birthweight due to socio-economic influences in our area are of no real independent obstetric significance. However, socio-economic status is clearly associated with 'lifestyle' differences which are both obstetrically significant and an appropriate focus of obstetric intervention.

Conclusions

Low socio-economic status appears to have a modest impact on pregnancy outcome in a public hospital sample of Australian obstetric patients. In this sample, provided allowance is made for age, parity, smoking and alcohol consumption, then low socio-economic status should not be regarded as an independent risk indicator in pregnancy but rather as primarily associated with the physical characteristics of the mother and her lifestyle. Women of lower socio-economic status engage in higher rates of unhealthy behaviours. These behaviours and the circumstances which lead to their continuation should continue to be the focus of obstetric attention.

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