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Full Length Research Paper

Association of socioeconomic status with health and birth outcomes: Maternal variables (Part 1)

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Social class is one of the strongest known predictors of health or illness, but paradoxically very little is known about this variable. Adequate data on socioeconomic status (SES) and birth outcomes must be available to monitor socioeconomic inequality in birth outcomes. Our research was designed to respond to this gap. This is the first large-scale survey of this kind in Ontario. Results from large scale surveys are instrumental for policy making and planning programs to improve population health and wellbeing. In this survey, the association of SES with maternal variables such as maternal age, height, previous stillbirths, previous neonatal deaths, duration of gestation, and forms of delivery was studied. In this study, the records from about 47,000 babies which have been collected over a period of 5 years by the hospitals in rural and urban areas of Ontario were accessed and analyzed. The results demonstrate that mothers from lower social classes were significantly younger, shorter, more previous stillbirths, more previous neonatal deaths with longer duration of gestation, and more spontaneous deliveries but less chance of having forceps or a Cesarean section. Lower income respondents may be exposed to more stressful life events beyond their control and there may be fewer social and psychological resources to cope with stressful life events. To improve health outcomes of infants born to teenage mothers, policies should aim at providing additional social support as well as additional financial resources to adolescent mothers.

Key words: Socioeconomic status, maternal health variables, age, height, stillbirths, neonatal deaths, duration of gestation, forms of delivery.

INTRODUCTION

Degree of access to resources such as money, goods, services or gratification like status or respect are the main factors defining social class. Socioeconomic status (SES) is an individual's or family's economic and social position relative to others, based on family income, education (usually of mother's), and occupation (usually of father's).

Income and wealth provide access to food, and education provides knowledge, skills, and beliefs that determine food choices, acquisition, preparation and intake. Socioeconomic class is a complex issue that may involve wealth, culture, education, occupation and income of a single person or a couple. There are several different factors influencing health of every individual, some of which also come under the umbrella of socioeconomic class, thus while association between socioeconomic class and health is well established, it is not simple (Warren and Hernandez, 2007). Although, there has been improvement in health parameters during the last half a century, there remain significant differences in all

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Abbreviation: SES, Socioeconomic status.

parameters of health across the socioeconomic classes (White and Edgar, 2010).

SES is typically broken into three categories, high, middle and low SES to describe the three areas a family or an individual may fall into. Any or all of the three variables (income, education and occupation) can be assessed in each of these categories.

Individuals or families in the upper class tend to have high education, highest occupational positions and income compared to those in lower or middle level classes. Middle-class or white collar workers are generally high school or college graduates, hold technical or mid-level managerial positions, and earn average to above average incomes. People with low levels of education, unskilled or semiskilled occupations, and low income are generally referred to as working class or blue collar workers. Other classifications represent social class in five levels from the most privileged to the least privileged.

Few population-based studies have examined the relation between infant health and family poverty. Adverse reproductive outcomes such as low birth weight (LBW), pre-term delivery, intra-uterine growth retardation are recognized as important determinants not only of infant mortality but also of health outcomes occurring over the entire life course (Barker, 1995). This is because health in early life affects health later in life. Investigations into etiology of chronic diseases highlighted intrauterine and early life influences in the occurrence of several diseases of public health significance (Harding, 2001; Ben-Shlomo and Kuh, 2002). This life-course perspective is not new: In 1945 Baird attributed the high prevalence of stillbirth and premature labor in groups with a low SES to poor maternal nutrition and found a strong influence of a mother's environment from birth to maturity on her capacity to bear healthy children. To monitor socio-economic inequality in birth outcomes, adequate data on birth outcomes and SES must be available. The aim of this research was to respond to this gap. This is the first large-scale survey of this kind in Ontario. Results from large scale surveys are instrumental for policy making and planning programs to improve population health and wellbeing.

MATERIALS AND METHODS

During 2001 and 2002, the first author had Fellowship at the Division of Clinical and Metabolic Genetics, Hospital for Sick Children, Toronto, Canada, in the late Prof. Ahmad Teebi's Department. A questionnaire was developed and completed with the hospitals' recorded data which have been collected over a period of 5 years from about 47,000 babies born in several hospitals in Ontario. The designed questionnaire covered a comprehensive range of information on both mothers and their babies' health, which will be the source for a series of other future articles. The babies whose records had missing data on any of the maternal or infant maternal or infant variables under study, were excluded from the analyses. Consequently, the number of samples in different tables is not equal. The population surveyed was of mixed ethnicity from both rural and urban areas.

In this study, we report the results of our studies on the impact of SES on some maternal variables like maternal age, height, previous stillbirths, previous neonatal deaths, duration of gestation, and forms of delivery.

According to our scrutiny in National Occupational Classification-Statistics (NOC-S) 2001-Canada, The National Statistics Socioeconomic Classification (NS-SEC) 2001- UK, and UK Registrar General's Classification of Occupations, a number of classifications exist, but the broadest one, groups occupations into five socioeconomic classes with the implication that occupation is a meaningful indicator of social welfare. For a more precise classification of social class, we divided our data into 5 rather than customary 3 classes, with class 1 covering high socioeconomic and class 5 covering low socioeconomic group of subjects:

1. Professional occupations
2. Intermediate occupations (managerial and lower professional occupations)
3. Skilled occupations (manual and non-manual)
4. Partly skilled occupations
5. Unskilled occupations

Our results were tabulated based on the various pregnancy outcomes indicators in relation to above five social groups. Associations of SES with some maternal variables and health were explored.

Statistical analysis

Statistical analysis was performed using the SPSS statistical package, version 15.0 for Windows (SPSS, Chicago, USA) and the Chi-square test was used to estimate the probable association between the variables, and a p value less than 0.05 was considered statistically significant for all the tables.

RESULTS

Each variable was divided into a number of categories. Maternal age consisted of six subgroups of <18, 18 to 19, 20 to 24, 25 to 29, 30 to 34, and =>35 years old. Table 1 shows that mothers from lower social classes are significantly younger than mothers from higher social classes. This means that there are factors increasing the possibility of becoming pregnant in a younger age for girls coming from the less well to do families.

Maternal height was divided into eleven subgroups of two extremes of <147.5 and >170 cm, and nine subgroups with 2.5 cm intervals. Table 2 shows that maternal height gradually decreases from social class 1 to 5. The differences were highly significant.

Table 3 shows the incidence of previous stillbirths in respect of social class. It was found that lower social classes have significantly more stillbirths than upper social classes. In our investigation, 2.13% of women had one, and 0.15% had two or more previous stillbirths.

Table 1. Distribution of social class (S.C.) with regards to maternal age.

Parameter	S.C. 1 (%)	S.C. 2 (%)	S.C. 3 (%)	S.C. 4 (%)	S.C. 5 (%)	Total (%)
< 18	11(0.32)	47 (0.81)	821(3.44)	380(6.09)	312(7.76)	1571(3.62)
(18-19)	34(0.99)	159 (2.74)	1990 (8.35)	806 (12.91)	670 (16.66)	3659(8.44)
(20-24)	503(14.59)	1233 (21.26)	8537(35.81)	2401 (38.47)	1631 (40.55)	14305(33.00)
(25-29)	1768 (51.29)	2567 (44.26)	7832(32.85)	1582 (25.34)	851 (21.16)	14600(33.68)
(30-34)	871(25.27)	1323 (22.81)	3238(13.58)	685 (10.97)	340(8.45)	6457 (14.89)
> 35	260 (7.54)	471 (8.12)	1424 (5.97)	388(6.22)	218(5.42)	2761(6.37)
Total	3447 (100.0)	5800 (100.0)	23842 (100.0)	6242 (100.0)	4022 (100.0)	43353(100.0)

(X^2 = 3801.70, p < 0.0001). S.C. 1: Highest socioeconomic class; S.C. 5: lowest socioeconomic class.

Table 2. Distribution of social class (S.C.) in regard to maternal height (cm).

Parameter (%)	S.C. 1 (%)	S.C. 2 (%)	S.C. 3 (%)	S.C. 4 (%)	S.C. 5 (%)	Total (%)
Height <147.5	14(0.42)	28(0.50)	272 (1.17)	106(1.74)	73 (1.87)	493(1.17)
Height 147.5-	33(0.99)	67(1.18)	501 (2.15)	154(2.53)	129 (3.30)	884(2.09)
Height 150-	88(2.64)	195 (3.45)	1204 (5.17)	350(5.74)	241 (6.17)	2078 (4.91)
Height 152.5	205 (6.14)	362 (6.40)	1994 (8.56)	635 (10.42)	437 (11.19)	3633 (8.59)
Height 155	292 (8.75)	632(11.17)	3075 (13.19)	890 (14.60)	587 (15.03)	5476(12.95)
Height 157.5	460(13.79)	884(15.63)	3864 (16.58)	1036(16.99)	640 (16.39)	6884(16.27)
Height 160	569(17.06)	929(16.43)	3947 (16.94)	1003(16.45)	657 (16.82)	7105(16.80)
Height 162.5	526(15.77)	885(15.65)	3316 (14.23)	788 (12.93)	504 (12.90)	6019(14.23)
Height 165	448(13.43)	693(12.25)	2316 (9.94)	552(9.05)	297 (7.60)	4306(10.18)
Height 167.5	327 (9.80)	496 (8.77)	1433 (6.15)	331(5.43)	199 (5.09)	2786 (6.59)
Height 170+	374(11.21)	485 (8.57)	1381 (5.92)	251(4.12)	142 (3.64)	2633 (6.22)
Total	3336 (100.0)	5656 (100.0)	23303 (100.0)	6096(100.0)	3906 (100.0)	42297 (100.0)

(X^2 = 960.91, p < 0.0001). S.C. 1: Highest socioeconomic class; S.C. 5: lowest socioeconomic class.

Table 3. Distribution of social class (S.C.) in regard to previous stillbirths**.**

Previous stillbirth	S.C. 1 (%)	S.C. 2 (%)	S.C. 3 (%)	S.C. 4 (%)	S.C. 5 (%)	Total (%)
None	3407 (98.84)	5689(98.03)	23280 (97.65)	6075(97.31)	3920 (97.42)	42371 (97.72)
One	35 (1.02)	110(1.90)	524 (2.20)	160(2.56)	93 (2.31)	922 (2.13)
Two or more	5 (0.14)	4 (0.07)	37 (0.15)	8 (0.13)	11 (0.27)	65 (0.15)
Total	3447 (100.0)	5803(100.0)	23841 (100.0)	6243(100.0)	4024 (100.0)	43358 (100.0)

(X^2 = 35.81, p < 0.0001). S.C. 1: Highest socioeconomic class; S.C. 5: lowest socioeconomic class.

The frequency of previous neonatal deaths in relation to social class is given in Table 4. Neonatal deaths consisted of early and late neonatal deaths. Early neonatal mortality refers to a death of a live-born baby within the first 7 days of life. Late neonatal mortality refers to a death of a live-born baby after 7 days until before 28 days of life. Our data show that lower social classes have significantly more neonatal deaths than higher social classes. In this investigation 1.95% of women had one, and 0.20% had two or more previous neonatal deaths.

Duration of gestation was separated into five categories of 38, 39, 40, 41, and 42 weeks. Our data (Table 5) indicate that mothers from lower social classes have significantly longer duration of gestation than those from higher social classes.

Table 6 shows the distribution of social class among the two (spontaneous cephalic and non-spontaneous) and three (spontaneous cephalic, by forceps, and by Cesarean section) categories of delivery. It was discovered that the frequency of spontaneous cephalic

Table 4. Distribution of social class (S.C.) in regard to previous neonatal deaths

Previous neonatal deaths	S.C. 1 (%)	S.C. 2 (%)	S.C. 3 (%)	S.C. 4 (%)	S.C. 5 (%)	Total (%)
None	3402 (98.69)	5710 (98.40)	23325 (97.84)	6074 (97.29)	3916 (97.32)	42427 (97.85)
One	42 (1.22)	85 (1.46)	471 (1.97)	151 (2.42)	96 (2.38)	845 (1.95)
Two or more	3 (0.09)	8 (0.14)	45 (0.19)	18 (0.29)	12 (0.30)	86 (0.20)
Total	3447 (100.0)	5803 (100.0)	23841 (100.0)	6243 (100.0)	4024 (100.0)	43358 (100.0)

(X^2 = 36.16, $p < 0.0001$). S.C. 1: Highest socioeconomic class; S.C. 5: lowest socioeconomic class.

Table 5. Distribution of social class (S.C.) with regards to duration of gestation

Parameter (Weeks)	S.C. 1 (%)	S.C. 2 (%)	S.C. 3 (%)	S.C. 4 (%)	S.C. 5 (%)	Total (%)
≤38	649 (18.81)	1070 (18.41)	`4655 (19.51)	1291 (20.67)	826 (20.52)	8491 (19.57)
39	750 (21.73)	1257 (21.63)	4290 (17.98)	1064 (17.03)	579 (14.38)	7940 (18.30)
40	1331 (38.57)	2169 (37.32)	9314 (39.04)	2486 (39.79)	1678 (41.68)	16978 (39.12)
41	531 (15.39)	968 (16.65)	3945 (16.53)	970 (15.53)	637 (15.82)	7051 (16.25)
≥42	190 (5.50)	348 (5.99)	1655 (6.94)	436 (6.98)	306 (7.60)	2935 (6.76)
Total	3451 (100.0)	5812 (100.0)	23859 (100.0)	6247 (100.0)	4026 (100.0)	43395 (100.0)

(X^2 = 146.07, $p < 0.0001$). S.C. 1: Highest socioeconomic class; S.C. 5: lowest socioeconomic class.

Table 6. Distribution of social class (S.C.) in regard to categories of delivery.

Two categories	S.C. 1 (%)	S.C. 2 (%)	S.C. 3 (%)	S.C. 4 (%)	S.C. 5 (%)	Total (%)
Spontaneous	2377 (68.88)	4037 (69.48)	17656 (74.01)	4718 (75.52)	3125 (77.62)	31913 (73.55)
Non-spontaneous	1074 (31.12)	1773 (30.52)	6201(25.99)	1529 (24.48)	901 (22.38)	11478 (26.45)
Total	3451(100.0)	5810 (100.0)	23857(100.0)	6247(100.0)	4026 (100.0)	43391(100.0)
(X^2) = 137.46, $p < 0.0001$)						
Three categories						
Spontaneous	2377 (69.48)	4037 (70.09)	17656 (74.58)	4718 (76.13)	3125 (78.28)	31913 (74.14)
Forceps	727 (21.25)	1188 (20.62)	4110 (17.36)	974 (15.72)	594 (14.88)	7593 (17.64)
Cesarean	317 (9.27)	535 (9.29)	1908 (8.06)	505 (8.15)	273 (6.84)	3538 (8.22)
Total	3412 (100.0)	5760 (100.0)	23674 (100.0)	6197 (100.0)	3992 (100.0)	43044 (100.0)
(X^2 = 144.20, $p < 0.0001$)						

S.C. 1: Highest socioeconomic class; S.C. 5: lowest socioeconomic class.

deliveries gradually increases from social class 1 to 5. In contrast, the chances of having forceps and Cesarean section both decrease from social class 1 to 5. The differences were highly significant.

DISCUSSION

It has been widely reported that teenage mothers experience more complications of labor and delivery as well as higher rates of prematurity and low birth weight infants than women 20 to 30 years old. The birth of small for date (S.F.D.) babies is encountered more frequently in very young as well as in women above the age of 30 years (Institute of Medicine, 1985). However, a few studies have suggested that birth complications are related to social class, not maternal age (Roosa 1984). It was concluded that youth itself is not an accurate predictor of obstetric risk, nor does it protect mothers from the hazards of childbirth. Studies have shown that the average adolescent mother has lower income than the average older mother, which has less education and less awareness of her infant's medical needs (Bagge et al., 1989; McCarthy and Hardy, 1993).

Parama and Resmiati (2010) have reported a relationship between occupation, age and SES, and mother's knowledge of LBW infants in Jakarta. Pittard et al. (2008) found that infants of adolescent mothers are more likely than infants of older mothers to use a variety of health care services that suggest poorer health and that a considerable proportion of this greater use seems to be attributable to specific characteristics of mothers, such as SES, rather than to some inability of adolescents to promote infant health or to use health care appropriately. Reichman and Pagnini (1997) in their studies of the effects of maternal age on LBW and infant mortality in New Jersey concluded that the seemingly poorer birth outcomes of teenage mothers appear to result largely from their adverse SES and not from young maternal age per se. They noted that on the other end of the age spectrum, while women who give birth relatively late in their reproductive lives have fewer socioeconomic disadvantages than teenagers; they nonetheless share increased risks for poor birth outcomes. Delayed childbearing poses its own biological risks, such as an increased likelihood of medical conditions such as hypertension and diabetes (La Grew Jr., 1996). Also, Verkerk et al. (1994) concluded that in the Netherlands, older mothers are at increased risk of preterm delivery. Mothers aged 40 years and older had an increased risk of preterm delivery compared with mothers of 20 to 29 years. These observations are in line with the results obtained by us.

Our results show that mothers from lower social classes are shorter than mothers from higher social classes. Obviously, better nutrition during childhood is responsible for better growth and possibly girls from the lower social classes have had an inferior nutritional status compared to those from the higher economic classes. This may in turn affect the pregnancy outcomes. In the studies of the association of maternal height with child mortality, anthropometric failure, and anemia in India, Subramanian et al. (2009) have concluded that in a nationally representative sample of households, maternal height was inversely associated with child mortality and anthropometric failure.

According to Gigante et al. (2006), the main determinants of height in 19 year old adolescent girls were family income, maternal pre-gestational weight, maternal height, birth weight, height gain, age at menarche and smoking during pregnancy. These analyses showed that birth weight was a stronger predictor of height than weight gain during infancy. Results from developed countries suggest that social inequalities in height are substantially reduced in subsequent generations, in parallel with economic development. These findings, as well as this present result, highlight the continued of SES and early life factors in promoting growth.

Our results on SES and stillbirth are similar to those reported earlier. Guildea et al. (2001) showed relative risk of combined stillbirth and infant death to be 1.53 in the most deprived compared with the least deprived enumeration districts. The early neonatal mortality rate was not significantly associated with deprivation. Sudden infant death syndrome showed a 307% increase in mortality across the range of deprivation. Deaths caused by specific conditions and infection were also associated with deprivation.

Stephansson et al. (2001) studied the association between SES and risk of stillbirth to assess whether any differences in risk are mediated by other maternal socio-demographic or anthropometrical characteristics, differences in lifestyle, or attendance at antenatal care. They concluded that low SES increases the risk of stillbirth. The association could not be explained by any of the factors they studied, and the underlying reasons remained unclear.

Joyce et al. (1999) investigated whether social class or a census-based deprivation score is a better predictor of stillbirth rates using data for 1993-5 for residents of South Thames Region. They concluded that social class, which is based on data on each individual, is a better predictor of stillbirth than Townsend score, which is based on data from the area of residence.

Some causes of stillbirth may also lead to fetuses that are small for gestational age or are delivered preterm (before 37 weeks of gestation). Surkan et al. (2004) assessed the associations between previous adverse outcomes of pregnancy and the risk of stillbirth in Sweden in a nationwide study between 1983 and 1997. Compared with women whose first infant was born at term (37 weeks of gestation or more) and was not small for gestational age, women whose first infant was born at term or preterm and was small for gestational age had an increased risk of stillbirth during their second pregnancy. The rates of stillbirth in second pregnancies ranged from 2.4 per 1000 births among women whose first infant was born at term and was not small for gestational age to 19.0 per 1000 births among women whose first child was very preterm and was small for gestational age. Investigators concluded that delivery of a previous small-for-gestational-age infant is an important predictor of the subsequent risk of stillbirth, particularly if the infant was delivered preterm.

Joseph et al. (2007) investigated whether prenatal and infant outcomes varied by family income and other socioeconomic factors in Canada where essential health services to all women irrespective of SES. They found that lower family income is associated with increased rates of gestational diabetes, small-for-gestational age, live birth and post-neonatal death despite health care services being widely available at no expense.

Duration of gestation is a point of controversy in scientific literature. Kramer (1987) extensively reviewed the literature and concluded that available information indicates no effect of social class on mean gestational age or on intrauterine growth in developed and developing countries, except for what could be attributable to nutritional or behavioral factors. Polednak et al. (1982) found no independent effect of social class on gestational age. In contrast, Berkowitz (1981) reported an odds ratio of 5.50 for prematurity for Class V compared to Class I mothers.

Social class and ethnicity are important risk factors for small-for-gestational-age and preterm delivery in many countries. Verkerk et al. (1994) studied this issue in the Netherlands where all inhabitants have a high level of social security, relatively small income differences and easy access to medical care. After adjustment for possible confounding factors, very low social class was significantly associated with reduced birth weight, but not with preterm delivery.

As evident from our results**,** the frequency of spontaneous deliveries gradually increases from Social Class 1 to 5. In contrast, the chances of having forceps and Cesarean section both decrease from Social Class 1 to 5. These differences are highly significant. While factors associated with high risk Cesarean delivery have been examined, only a few studies have explored the role of social class. Cesaroni et al. (2008) studied the effect of educational level on risk of Cesarean section. They concluded that mothers with little education were consistently more likely to deliver by Cesarean section than highly educated women, even when their partner's level of education was taken into account. Studies of United Stateswomen have indicated that married white women giving birth in private hospitals are more likely to have a Cesarean section than poorer women even though they are less likely to have complications that may lead to a Cesarean section being required. In contrast to this, a recent retrospective study in the British Medical Journal analyzed a large number of Cesarean sections in England and stratified them by social class. Their finding was that Cesarean sections are not more likely in women of higher social class than in women in other classes (Barley et al, 2004). Hurst and Summey (1984) found that more Cesareans are being performed in the socio-economic group of women with the lowest medical risk and much of the variation in Cesarean rates explained by factors other than medical need.

Conclusion

One of the strongest known predictors of health or illness is social class yet paradoxically very little is known about this variable. Increased income may promote health by enabling the poor to purchase better health services.

Women with lower education levels and those living in poorer neighborhoods are more vulnerable to adverse birth outcomes and may benefit from targeted interventions. Our results similarly indicate an association between pregnancy outcomes, maternal age and height with maternal socioeconomic conditions.

Association between SES and health may stem in part from experiencing greater stress either perceiving that demands exceed abilities to cope, or by exposure to life events that require adaptation. In a community survey, lower income respondents were exposed to more stressful life events beyond their control than were higher income respondents.

It should be noted that low SES may be a social cause of other nutritional, toxic, anthropometric, or infectious factors that may themselves be causal determinants. Indirect causal effects may be important for intervention. One aspect of SES is maternal education. Since higher education may be the best predictor of good health outcomes, ensuring maternal education can help improve health outcomes for mothers and their infants although, in the long term, family income could also be influenced. It is therefore important to consider the potential of SES when planning for the public health intervention programs. If economics or time dictates that a single parameter of SES be chosen, then higher education may be the best predictor of good health outcomes.

It can be concluded that to improve health outcomes of infants born to teenage mothers, policies should aim at providing additional social support as well as additional financial resources to adolescent mothers. Additional research is needed, however, to identify specific interventions that may improve health outcomes for infants of adolescents. Moreover, effective interventions aimed at reducing Cesarean delivery rates in women of lower social class should be a priority for national health services, particularly in countries where the Cesarean rate has been increasing.

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