Effect of socioeconomic status and parents' education at birth on risk of schizophrenia in offspring

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Abstract

Although it is known that schizophrenia is associated with social class, controversy exists as to the nature of this association. The authors studied the incidence of schizophrenia in relation to social class at birth in a population-based cohort of 88,829 offspring born in Jerusalem in 1964–1976. They constructed a six-point scale to index social class, based on paternal occupation at the time of birth, with each of 108 occupations being ranked by mean education. Cox proportional hazards methods were used in adjusting for sex, parents' ages, duration of marriage and birth order. Linkage with Israel's Psychiatric Registry identified 637 people admitted to psychiatric care facilities with schizophrenia-related diagnoses, before 1998. There was no gradient of risk for schizophrenia associated with social class at birth; however, offspring of fathers in the lowest social class showed a modest increase in risk (adjusted Relative Risk = 1.4; 95% Confidence interval = 1.1–1.8, *P* =

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0.002). These data suggest that in contrast to many other health outcomes, there is not a continuous gradient for increasing schizophrenia with decreasing social class of origin. Instead, a modest increase in risk for schizophrenia was observed only for those born at the bottom of the social ladder.

Keywords

Introduction

A socioeconomic gradient is observed worldwide for a number of health outcomes, such as cancer and coronary heart disease, whereby small decrements in social class confer increases in morbidity and mortality [1,2,22,25,26,30–32]. Social class at birth and in childhood, determined by rank of paternal occupation, is associated with all-cause mortality, as well as deaths from cardiovascular and coronary heart disease, and respiratory diseases, such that each step down the social ladder confers an additional 10–25% increase in hazard for death [1,11]. It has sometimes been assumed that a similar gradient must exist for psychiatric disorders such as schizophrenia. However, there is as yet no clear evidence for a socioeconomic gradient of risk for schizophrenia.

It has long been considered that social class may be causally related to schizophrenia. In the mid-nineteenth century, it was noted in Massachusetts that "the pauper class furnishes, in ratio of its numbers, sixty-four times as many cases of insanity as the independent class" [18]. Throughout the twentieth century, studies have found that having schizophrenia is associated with lower social class [10,17,34]. A debate ensued as to whether this association between social class and schizophrenia was a consequence of social causation (lower social class → schizophrenia) or social drift (schizophrenia → lower social class) [9,34].

The social causation hypothesis was tested in a landmark study which examined the association of social class at birth (paternal occupation on birth certificates) with adult schizophrenia [12]. In refutation of this hypothesis, the study found that the social class at birth of schizophrenia patients was comparable to that of the general population [12]. A series of subsequent studies also found that social class at birth was comparable [13] or even higher [27,40] in schizophrenia patients. A few found a modest increase in relative risk for schizophrenia (RR = 1.6–1.8) for the very lowest social class [6,16], which would suggest some effects of social class but not a gradient. However, definitive conclusions cannot be drawn from these studies, as they frequently had small sample sizes, limited catchment areas (from which individuals could move in and out), limited measures of social class and often extensive missing data.

A socioeconomic gradient for schizophrenia is also not supported by more recent population cohort studies, which have been conducted in Scandinavia and the United Kingdom, and which typically include paternal occupation as an indicator of social class [19,23,36,39]. In fact, some of these studies suggest that risk for later schizophrenia might be greater for children in the higher social classes, as compared to middle and working classes [19,23,36]. An effect of lower social class on risk for schizophrenia is evident only for children from the very lowest social classes, or those whose families have other indices of adversity (i.e. unemployment, disability, social welfare, single-parent status) [5,39].

In the current study, we examined the risk for schizophrenia associated with parents' education and social class at birth, defined by rank of paternal occupation, in a large cohort in Jerusalem.

Materials and methods

This study relies on a population-based research cohort known as the Jerusalem Perinatal Study. In 1964–76 all 92,408 births were recorded for mothers resident in a defined geographic area of Jerusalem. Demographic data, including the parents' occupations, were copied from the birth notification. Other data were added from surveillance of obstetric and pediatric inpatient departments, well baby clinics and interviews with mothers. Descriptions of the study have been published over the past four decades [8,14,15,24].

To study schizophrenia and its related diagnoses in offspring in this cohort, the data base was linked to that of Israel's National Psychiatric Registry. This registry, established in 1950, receives all psychiatric diagnoses, including reports from patients admitted to specialized psychiatric hospitals, psychiatric wards within general hospitals and psychiatric day care facilities [24]. The diagnoses for individuals with psychosis have been validated [38]. For this study, the Registry defined schizophrenia broadly using the International Classification of Diseases, 10th Revision, as diagnoses of F20–29 (schizophrenia, schizotypal disorder, delusional disorders, nonaffective psychoses and schizoaffective disorders). The date of incidence was defined as the date of the first admission to a psychiatric facility. The Registry removed the names, identity numbers and other identifying information from the linked file which was then analyzed collaboratively in New York and Israel. The study was approved by the Institutional Review Boards in both countries.

Construction of a scale to assess social class

In 1964–76, when the cohort was ascertained, there was no national classification of social class available in Israel. A scale developed in 1981 that assessed the "prestige" of paternal occupations, as determined by population survey [21], could not be used for the Jerusalem cohort because it relied on a later system of coding occupations. For the current study, social class ranks were determined by levels of education observed for paternal occupations. Using the information on occupation and educational attainment provided on the birth records, we computed the mean paternal education for each of the 108 fathers' occupations. The occupations were then grouped into one of six ordinal categories, ranked from one, associated with the highest mean education, to six, with the lowest. No information was available on income. Table 1 lists the six groups and shows the main occupations (and their proportions) in each group.

Statistical analysis

Of the 92,408 births in 1964–76, 91,479 were born alive and of these, 88,829 (97.1%) were available for study, having been traced and followed to December 31, 1997; 637 were admitted to psychiatric facilities with a schizophrenia-related diagnosis before that date. Life table estimates of the cumulative incidence were 0.35% at age 20 and 0.91% at age 30 (See Ref. [24] for further detail). Offspring were followed from birth until the date of diagnosis, death or end of the follow-up period; at this point they were ages 21–33. Cox proportional hazards methods were used to estimate the relative risk (hazard ratio) of schizophrenia diagnosis in offspring and to take into account potential confounding variables, using the PHREG procedure available in SAS 9.0 [29]. We chose variables for inclusion in the model based on the following criteria: confounding by the variable, as defined as altering with adjustment the crude hazard ratio for paternal social class at birth and schizophrenia by more than 10%; known independent contribution to risk of schizophrenia (in this cohort or in others); and/or covariates that independently improved the otherwise full regression model's fit (by comparison of the full model with and without the specific variable of interest). Any identified covariates were than entered into a regression model to examine the association of social class with risk for schizophrenia.

All variables relate to their values at the time of the offspring's birth. Paternal age was modeled as a continuous variable for adjustment in other models and was expressed in decades from the mean (age 30) with unknowns (0.8%) assigned to this age. Categories of paternal age were also described (<25, 25–34, 35–44, 45+), and used for modeling the association between paternal age and schizophrenia. For adjustment in models, maternal age was categorized as 30–34, 35+ vs. <30; unknowns for maternal age (0.1%) were assigned the mean age of 27.7. Maternal age was also categorized as <25, 25–29, 30–34, 35+ for descriptive purposes and for modeling the association between maternal age and schizophrenia. Ethnic origin was a series of categories, depending on place of birth of paternal grandfather (Israel, other Western Asia, North Africa, or Europe etc, the latter group including the Americas and other industrially developed countries). No information was available on grandmothers' origins. Birth order was modeled in categories ("four to six" and "seven or more" versus "one to three"). Duration of marriage in years was described as "two to four", "five to nine", and 10+ versus "two or fewer"; unknown duration of marriage (1.7%) was set to the median of 5 years. All other variables were described and used as dichotomies (sex, immigrant status, urban/rural, maternal employment, and birthweight (<2,500 g vs. ≥2,500 g). No information was available on family history of psychiatric disorders.

Results

Table 2 shows the characteristics of the cohort, comparing the distributions of various categories of demographic variables in each category of social class. Offspring whose fathers had lower class jobs also had parents who were older and more likely to have ancestries in Islamic countries of West Asia or North Africa. Not shown in the table, they were more likely to be immigrants and live in rural areas. Parents in the lowest rank were married longer and had more children, and these mothers were less likely to work outside the home. As expected, low birthweight was somewhat more common in the groups with lower social class.

Table 3 shows the association of key variables with schizophrenia in this cohort, without adjustment for social class. Male sex and parental ages were related to the future risk of schizophrenia, while rural residence of the parents at the time of the birth, and birthweight, were not. Longer durations of marriage and maternal work inside the home showed a modest protective relation to the risk of schizophrenia before adjustment for social class. Not shown in the table, there were no associations of schizophrenia with place of birth or immigrant status of the parents [7].

Social class and risk for schizophrenia

Table 4 shows the crude relative risk of schizophrenia in the six social classes, using the highest category as the reference group. Among the offspring whose fathers were in the first five ranks, there was no discernable trend with decreasing or increasing social class and no statistically significant difference between the groups. Offspring with fathers in the very lowest group, however, had an increased risk of schizophrenia, which held true regardless of which of the first four groups were used as the reference category (data not shown).

Table 5 shows estimates that combine the first four categories of social class to form the reference category and compares the results with and without adjustment for additional variables. There was a small increase in risk of schizophrenia in the fifth category that was not statistically significant, while the crude hazard ratio estimated for schizophrenia indicated a 40% increase in risk for schizophrenia in the sixth, i.e. lowest, group. The middle column in Table 5 shows that the increased risk in this lowest group persisted even when controlling for advanced paternal age, a major risk factor for schizophrenia [24], which was more prevalent in the lower social classes. The final set of estimates in Table 5 shows furthermore that additional adjustment for sex, maternal age, duration of marriage and birth order did not explain

the increased risk of schizophrenia associated with the lowest social class. (Further, we considered whether low birthweight might mediate or confound this relationship: it modified the hazard ratios for the fifth and sixth social classes only by 0.2%). This finding of an association of lowest social class with risk of schizophrenia was ro-bust, existing across strata of sex, paternal age, and paternal country of origin (data not shown).

Table 6 demonstrates that risk for schizophrenia was not related to parents' education. Adjustment for parental education also had no evident effect on the risk of schizophrenia estimated for the lowest group of socioeconomic status (RR = 1.4 adjusted for maternal or paternal education).

Discussion

This study did not find a socioeconomic gradient of risk for schizophrenia, when using either parental education or parental occupation to index social class. Instead, it demonstrated a small increase in the incidence of schizophrenia only in offspring from the lowest social class, defined by fathers' occupation at the time of birth. This increase in risk for schizophrenia, although statistically significant, was modest. It was independent of effects of other variables, such as paternal age and low birthweight. The increased risk for schizophrenia for the lowest social class was seen across sex, paternal age, and paternal country of origin.

Advantages of this study include (1) a large, population-based cohort of approximately 89,000 subjects; (2) a sufficiently-long follow up period (33 years after birth), with large numbers of cases (3); a validated method for the diagnosis of schizophrenia through a national registry of admissions to psychiatric facilities; (4) a well-characterized and well-defined method of identifying parental social class at birth; and (5) follow-up data required for the use of appropriate statistical methods (proportional hazards regression models), taking into account varying length of follow-up and control for covariates.

Our results accord with those of other cohort studies, which also do not find a socioeconomic gradient of risk for schizophrenia [19,23,36,39], as measured by parental education, occupation, income or wealth. Our data are consistent with adversity or disadvantage instead conveying increased risk for schizophrenia. In a Swedish birth cohort study, hazard for schizophrenia increased with an accumulation of adverse social factors, such as unemployment, "unclassified" employment, receipt of social welfare and single-parent households [39]. In this same study, paternal unemployment itself yielded an adjusted hazard ratio for schizophrenia of 1.40, similar to our finding for the lowest social class [39]. In a Danish national registry study, parents of young people with schizophrenia were more likely to be unemployed or in the lowest quartile for income in the year prior to admission of their child [5].

There are a number of potential mechanisms, not mutually exclusive, which could account for this effect of the lowest social class on risk for schizophrenia. A threshold effect of social class (vs. a gradient) on risk of schizophrenia in Israel (as in Scandinavia) may reflect a different social structure in Israel [7] than in the United Kingdom [31]. Alternatively, as studies of socioeconomic gradients implicate the current stress of hierarchies on medical health [31], such graded hierarchies may not be relevant to schizophrenia. One potential mechanism for increased risk of schizophrenia among the lowest social classes, as described above, is adversity, which can increase maternal stress with potential effects on the fetus [20] and/or increase liability for later behaviors in offspring such as drug use, which may increase risk for schizophrenia [35]. A second possibility is that members of the lowest social class had less access to medical resources. However, in Jerusalem during this time, there was universal access to prenatal care, which was free of charge. Although the poorest group had a slight excess in low birthweight babies, this did not account for the increased risk of schizophrenia in offspring

from this disadvantaged group. A third alternative is that members of the lowest social class had increased early exposures to toxins, infections, or nutritional difficulties, which have been implicated in increasing schizophrenia risk [3,4,28,33,37]. Exposures to these environmental risk factors in this cohort are not known. Finally, it is possible that parental psychopathology could account for both low social class and increased risk for schizophrenia in offspring; genetic transmission of social selection cannot be ruled out. A limitation of the current study is that parental psychopathology is not known; however, in other cohort studies already described, the effect of adversity on schizophrenia risk in offspring persisted even when adjusting for parental psychopathology [5,39].

In this study, social class was ascertained only at birth, and hence social class over the life course is not known. Another limitation is the lack of data on parental wealth and income, which were unrelated to risk for schizophrenia in other studies [5]. However, it is unlikely that the pattern of association would be different with multiple measures of social class over time through childhood. An additional limitation is that occupations were ascertained from birth certificates only, which increases the risk for intracategory variability. Further, among immigrants, who comprise a segment of the parents of the cohort, the nature of education and its relation to employment may vary with the country of origin. Other limitations, as described, include a lack of data on environmental exposures and parental psychopathology.

Conclusion

The role of social class in schizophrenia has been considered for more than a century, with debate as to the causal direction and the nature of their relationship. Accumulating evidence from several large population cohort studies, including the one presented here, now suggests that the association of social class with schizophrenia is distinct from that of other diseases and health outcomes. These studies provide no evidence of a socioeconomic gradient of risk. However, a modest increase in risk for schizophrenia is apparent for those at the bottom of the social ladder.

Acknowledgments

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Table 1

Paternal occupations of each social class

Social class	Group mean years of education	Main occupations (%) included in the group
1	15+	Teachers 39%; Accountants/social workers/statisticians 33%; Chemists/physicists/geologists/scientists 11%; Physicians/dentists 9%; Judges/lawyers 8%.
2	13–14	Rabbis/students in Talmud academies; 57% architects/engineers/surveyors 18%; students 15%; managers (i.e. in public and municipal institutions) 5%; artists/writers 3%; pharmacists 1%.
3	12	Clerks/stock-keepers 74%; military 11%; accountant/cashiers 4%; secretaries/typists 4%; various types of managers 3%.
4	9–11	Taxi drivers/chauffeurs 24%; building & other contractors 9%; electricians 8%; metal workers (tinsmiths, auto body repairmen, welders, blacksmiths, electric platers, assemblers of metal constructions) 8%; manufacturers and repairmen of work tools and assembly/installation/repair of machines 8%; diamond workers 6%; typesetters and printers 5%; skilled construction workers 4%; male nurses 1%; photographers 1%
5	7–8	Skilled agricultural workers in mixed agriculture 22%; policemen/guards/firemen 15%; truck and bus drivers 12%; carpenters/woodworkers/furniture makers 10%; plumbers and pipe layers 6%; salesmen (traveling) 5%; agents (real estate, insurance, travel, tax, auctioneer) 5%; painters 5%; tile-layers/plasterers 5%; unskilled agricultural workers 5%; cooks/waiters 4%; food & drink production workers 3%; messengers 2%; barbers/hairdressers 1%
6	<7	Unskilled laborers 71%; unskilled construction workers 14%; unskilled industrial laborers 4%; gatekeepers/beadles/street-cleaners 4%; unemployed 3%; porters 2%

Table 2

Numbers of offspring by paternal social class and percent distribution of selected variables

Characteristic	Paternal social class							P-value
	1 (high)	2	3	4	5	6 (low)	Total	
Offspring, N Percent	9,538 100.0	18,548 100.0	13,393 100.0	16,165 100.0	19,396 100.0	11,789 100.0	88,829 100.0	
Sex								
Male	52.2	52.7	50.8	51.2	51.5	51.4	45,872	0.007
Female	47.8	47.3	49.2	48.9	48.5	48.6	42,957	
Paternal age								
<25	3.6	22.0	11.9	13.5	11.9	10.2	11,700	<0.0001
25–34	66.8	60.9	56.1	60.5	56.1	44.6	51,112	
35–44	26.6	15.2	28.0	23.0	26.5	35.3	22,120	
45+	2.9	1.9	4.1	3.0	5.5	9.8	3,897	
Maternal age								
<25	18.2	41.6	30.5	39.5	36.1	26.6	30,062	<0.0001
25–29	42.0	35.2	34.4	31.9	28.6	24.8	28,768	
30–34	26.3	15.1	21.6	17.9	20.4	24.3	17,914	
35+	13.4	8.1	13.5	10.7	15.0	24.3	12,085	
Birth place of paternal grandfather								
Israel	12.0	27.5	16.9	15.6	13.1	12.0	14,995	<0.0001
Other west Asia	12.1	9.9	29.9	41.0	43.7	43.6	27,241	
North Africa	8.1	6.8	18.0	23.5	30.3	38.5	18,639	
Europe etc.	67.8	55.8	35.2	20.0	12.9	5.9	27,954	
Duration of parents' marriage (years)								
<2	14.8	21.8	21.3	23.2	17.4	12.2	16,860	<0.0001
2–4	32.5	35.7	29.4	29.6	24.5	19.1	25,434	
5–9	34.0	27.3	28.3	27.7	28.5	25.4	25,105	
10+	18.8	15.2	21.0	19.5	29.6	43.4	21,430	
Birth order								
1–3	83.6	74.7	80.2	77.4	62.3	44.4	62,407	<0.0001
4–6	13.5	18.2	16.0	17.7	24.1	30.6	17,955	

Characteristic						Paternal social class		P-value
	1 (high)	2	3	4	5	6 (low)	Total	
Offspring, N	**9,538**	**18,548**	**13,393**	**16,165**	**19,396**	**11,789**	**88,829**	
Percent	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	
7+	2.8	7.1	3.8	4.8	13.6	25.0	8,467	
Maternal employment outside the home								
Yes	65.6	46.3	55.5	40.6	28.8	20.7	36,853	<0.0001
No	34.4	53.8	44.5	59.4	71.2	79.3	51,976	
Birthweight								
<2,500 g	5.6	5.7	5.8	6.4	7.0	7.0	5,587	<0.0001
≥2500 g	94.4	94.3	94.2	93.6	93.0	93.0	83,242	

Table 3

Numbers of offspring with and without schizophrenia, crude and adjusted relative risks (RR) and 95% confidence intervals (CI), by selected variables

Variable for each model		Schizophrenia −	Schizophrenia +	Crude RR	95% CI	Adjusted RR*	95% CI
Sex	Female	42,694	263	1		1	
	Male	45,498	374	1.3	1.1–1.6	1.3	1.1–1.6
Paternal age	<25	11,638	62	1		1	
	25–34	50,775	337	1.2	0.9–1.6	1.3	1.0–1.7
	35–44	21,931	189	1.5	1.2–2.1	1.6	1.1–2.3
	45+	3,848	49	2.2	1.5–3.2	2.3	1.4–3.6
Maternal age	<25	29,882	180	1		1	
	25–29	28,576	192	1.1	0.9–1.4	1.1	0.9–1.4
	30–34	17,772	142	1.3	1.0–1.6	1.3	1.0–1.7
	35+	11,962	123	1.7	1.3–2.1	1.6	1.1–2.3
Rural	No	84,888	623	1		1	
	Yes	3,304	14	0.8	0.5–1.3	0.8	0.5–1.4
Birth order	1–3	61,969	438	1		1	
	4–6	17,821	134	1.0	0.9–1.3	0.9	0.7–1.1
	7+	8,402	65	1.0	0.8–1.3	0.7	0.5–1.0
Birthweight	≥2,500 g	82,645	597	1		1	
	<2,500 g	5,547	40	1.2	0.9–1.7	1.2	0.9–1.7
Maternal work outside home	Yes	36,618	235	1		1	
	No	51,574	402	1.2	1.0–1.4	1.2	1.0–1.4
Duration of marriage	<2	16,741	119	1		1	
	2–4	25,262	172	1.0	0.8–1.2	0.9	0.7–1.2
	5–9	24,934	171	0.9	0.7–1.2	0.8	0.6–1.0
	10+	21,255	175	1.1	0.9–1.4	0.7	0.5–1.0

Sex: adjusted for paternal age (continuous), maternal age, duration of marriage and birth order. Paternal age: adjusted for sex, maternal age, duration of marriage and birth order. Maternal age: adjusted for sex, paternal age (continuous), duration of marriage and birth order. Birth order: adjusted for sex, paternal age (continuous), maternal age and duration of marriage. Duration of marriage: adjusted for sex, paternal age (continuous), maternal age and birth order. Rural, birthweight, maternal work outside home: adjusted for sex, paternal age (continuous), maternal age, duration of marriage and birth order

Table 4

Numbers of offspring with and without schizophrenia, crude relative risks (RR) and 95% confidence intervals (CI), by social class

Social class	Schizophrenia		RR	95% CI
	−	+		
1 (high)	9,471	67	1	ref
2	18,429	119	0.9	0.7–1.3
3	13,298	95	1.0	0.7–1.4
4	16,073	92	0.8	0.6–1.2
5	19,249	147	1.0	0.8–1.3
6 (low)	11,672	117	1.3	1.0–1.8

Table 5

Numbers of offspring with and without schizophrenia, crude and adjusted relative risks (RR) and 95% confidence intervals (CI) associated with low social class

Social class	Schizophrenia		Crude RR	95% CI	Adj RR[a]	95% CI	Adj RR[b]	95% CI	P-value
	−	+							
1–4	57,271	373	1	1	1		1		
5	19,249	147	1.1	0.9–1.3	1.0	0.9–1.3	1.1	0.9–1.3	0.3
6 (low)	11,672	117	1.4	1.1–1.7	1.3	1.0–1.6	1.4	1.1–1.7	0.003

[a] Adjusted for paternal age (as a continuous variable)

[b] Additionally adjusted for sex, maternal age, duration of marriage and birth order

Table 6

Numbers of offspring with and without schizophrenia, relative risks (RR) and 95% confidence intervals (CI) and effects of additional adjustment for SES, by paternal and maternal education

	Schizophrenia		Crude RR	95% CI	RR[a]	95% CI	RR[b]	95% CI	P-value
	−	+							
Paternal education (years)*									
13+	26,905	168	1		1	1			
9–12	30,367	206	1.0	0.8–1.2	1.0	0.8–1.3	1.0	0.8–1.2	0.9
5–8	19,373	166	1.2	1.0–1.5	1.2	1.0–1.6	1.1	0.9–1.4	0.4
0–4	5,153	45	1.2	0.8–1.6	1.1	0.8–1.6	0.9	0.6–1.4	0.7
Unknown	6,394	52	1.1	0.8–1.4	1.1	0.8–1.5	1.0	0.7–1.3	0.8
Maternal education (years)**									
13+	22,750	150	1		1	1			
9–12	29,854	181	0.9	0.7–1.1	0.9	0.7–1.2	0.9	0.7–1.1	0.4
5–8	21,416	180	1.2	0.9–1.4	1.2	1.0–1.5	1.1	0.9–1.4	0.3
0–4	8,245	74	1.1	0.9–1.5	1.2	0.8–1.6	1.0	0.7–1.4	0.9
Unknown	5,927	52	1.1	0.8–1.5	1.1	0.8–1.5	1.0	0.7–1.4	1

[a] Adjusted for sex, paternal and maternal age, duration of marriage, and birth order

[b] Additionally adjusted for paternal social class