



## Real-world premorbid functioning in schizophrenia and affective disorders during the early teenage years: A population-based study of school grades and teacher ratings

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### ABSTRACT

**Background:** Population-based studies of cognitive and behavioral premorbid functioning in psychotic disorders generally focus on late adolescence in schizophrenia and most are based on IQ test scores.

**Aims:** To examine differences in school grades at the ages of 13–14 between persons hospitalized during adulthood for schizophrenia or affective disorders and their peers.

**Methods:** Ten years of school report data were ascertained on 8th grade children ( $n = 21,448$ ) in the city of Jerusalem (1978–1988). During adulthood cases with schizophrenia ( $n = 194$ , 0.9%) or an affective disorder ( $n = 41$ , 0.19%) were identified based on psychiatric hospitalizations in the National Psychiatric Hospitalization Case Registry of the State of Israel. School assessments of academic performance, nonacademic topics, and teacher ratings of classroom behavior were compared between peers without illness and cases, and their association with illness was examined.

**Results:** Children subsequently hospitalized with schizophrenia had significantly lower nonacademic performance ( $ES = .20$ ,  $p = .007$ ) and teacher ratings on behavior ( $ES = .18$ ,  $p = .02$ ) than controls and numerically lower teacher behavior ratings than people subsequently hospitalized for an affective disorder ( $ES = .25$ ,  $p = .19$ ). Cox regression modeling showed that poorer nonacademic and lower behavioral ratings were significantly associated with earlier age of onset of schizophrenia.

**Conclusions:** Premorbid behavior and nonacademic deficits are evident in early adolescence among persons subsequently hospitalized with schizophrenia and different from those hospitalized with affective disorders. This suggests that these ratings may have diagnostic specificity between schizophrenia and affective disorders.

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### 1. Introduction

Historically, premorbid deficits have been observed in many persons prior to a formal diagnosis of psychosis (e.g., Kraepelin, 1919; Bleuler, 1950). These early clinical observations have received empirical support over the last decade (Maccabe, 2008). Meta-analysis has shown that prior to the onset of schizophrenia, IQ scores are approximately half a standard deviation below that of healthy controls (Woodberry et al., 2008). Research with epidemiological population-based cohorts has used a historical prospective design to link standardized IQ tests administered nationally as part of draft board screening in Israel (e.g., Davidson et al., 1999; Rabinowitz et al., 2005) and Sweden (David et al., 1997) to psychiatric hospitalization registries. These studies have shown that premorbid IQ (a) is lower in people later hospitalized with schizophrenia compared with controls; and (b) is

moderately related to increased risk for schizophrenia and (c) is associated with subsequent poorer hospitalization outcomes. For instance, in an Israeli study, risk for schizophrenia spectrum disorders increased with lower IQ scores (Reichenberg et al., 2006). Prior research, however, acknowledges the limitation that it is unascertainable as to whether or not cases were premorbid or in the prodromal stage of illness. This highlights that more population-based research, like previous reports of pre-schizophrenia IQ deficits during childhood (Cannon et al., 2000), is required to extend the period from assessment to the onset of illness, by using data from an earlier age. This helps ensure that the assessment was done premorbidly and examines the extent of premorbid deficits at a younger age (for a review of studies of earlier ages see: Maccabe, 2008; Woodberry et al., 2008; Khandaker et al., 2011).

Unlike research with the large population-based cohorts using a historical prospective design, that was mostly undertaken in Israel and Sweden with standardized tests during late adolescence, research with school grades in early adolescence has produced less clear-cut findings (MacCabe et al., 2008). Premorbid academic deficits in native language and math have, however, been observed during the early

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teenage years, including, a registry study of 15 year olds in Sweden (MacCabe et al., 2008) and general grade deficits in a birth cohort in Northern Finland (Isohanni et al., 1998). Other research has shown deficits in premorbid non-academic, but not in academic performance, in a population-based matched control–case study of 400 11 year olds in Finland (Cannon et al., 1999). Unlike those studies, one study has reported that excellent performance on academic and nonacademic subjects was associated with an increased risk of schizophrenia among 54 cases from a birth cohort of 11,017 (Isohanni et al., 1999).

Relatively few studies have aimed to differentiate between premorbid functioning of persons with affective disorders and schizophrenia. Research has shown that persons with affective disorders, relative to controls, exhibit impaired premorbid intellectual and behavioral functioning at ages 16–17, although the deficit is more pronounced in schizophrenia (Reichenberg et al., 2002). Population-based research of Swedish conscripts has shown no association between premorbid IQ scores and risk of bipolar disorder, although lower premorbid IQ was associated with increased risk of schizophrenia, severe depression, and other nonaffective psychoses (Zammit et al., 2004), indicating differential neurodevelopmental etiology. Research into Finnish conscripts based on premorbid assessments aged 19 indicates that visuospatial reasoning is impaired in bipolar disorder and schizophrenia and less so in other psychoses. Also, high arithmetic test performance may be associated with greater risk for bipolar disorder (Tiihonen et al., 2005). Others have shown a nearly fourfold preponderance of excellent premorbid school performance in bipolar disorder (MacCabe et al., 2010). These studies indicate that the deficit is more pronounced in schizophrenia than in affective disorders and so highlight diagnostic specificity. Despite this studies are yet to examine diagnostic specificity between schizophrenia and affective disorders during early adolescence. Evidence of such a deficit would reinforce the specificity of illness, highlight neurodevelopmental specificity and evidence as to whether premorbid functioning is a marker or risk factor for illness.

In the British 1946 Medical Research Council National Survey of Health and Development Birth Cohort test scores at the ages of 8, 11 and 15 were impaired in schizophrenia (Jones et al., 1994). Nonetheless whether this is a characteristic of and/or specific to schizophrenia is unclear during early adolescence. Also, in the British 1958 National Child Development Study poorer educational attainment from the age of 7 to 16 was found in those who subsequently developed schizophrenia, with no relative change in the degree of impairment over time compared to controls (Done et al., 1994). Recent meta-analysis of population-based research reports strong associations between premorbid IQ and risk and onset of schizophrenia (Khandaker et al., 2011).

The role of behavioral, cognitive and non-behavioral academic functioning as a differential risk factor for schizophrenia and affective disorders in early adolescence is unclear. Accordingly, using population-based data the current study uniquely examines differences in school functioning between persons later in life hospitalized for schizophrenia and affective disorders and their peers. Persons hospitalized for schizophrenia, affective disorders and controls within 17 to 27 years after completing 8th grade were compared on teacher ratings of behavior, academic performance and non-academic performance as recorded in their report cards at the end of 8th grade (ages 13 to 14). Based on prior research it was hypothesized that more severe premorbid deficits would be characteristic and specific to schizophrenia.

## 2. Method

### 2.1. Registries

#### 2.1.1. Israel National Psychiatric Hospitalization Case Registry

The Israel National Psychiatric Hospitalization Case Registry contains a complete listing of all psychiatric hospitalizations in Israel

and includes the ICD-10 diagnoses assigned at discharge by a board-certified psychiatrist. Diagnoses recorded in earlier ICD codes are routinely upgraded by the registry. All inpatient facilities in the country, including day hospitals, are required by law to report psychiatric admissions and discharges to the registry. Reporting is monitored by a special department at the Ministry of Health that verifies compliance with reporting and consistency of the information, ensuring the completeness and correctness of the data in the registry. Psychiatric care in Israel is freely available by law to all de jure residents (Levav and Grinshpoon, 2004). Therefore, through the Registry we were able to identify all currently and previously hospitalized cases in the cohort. We used the most recent registry diagnosis either the last discharge diagnosis or current admission diagnosis for those persons in the hospital at the time of the registry merger, as per prior research (Levine et al., 2011). Research into schizophrenia registry diagnoses assessed in this manner has shown good sensitivity and specificity when measured against research diagnosis (Weiser et al., 2005) and reliability over time (Rabinowitz et al., 1994). The schizophrenia group included all forms of schizophrenia, schizotypal and delusional disorders (ICD codes F20–F29). The affective group included all affective disorders (ICD codes F30–F39). There were not a sufficient number of affective cases to examine subgroups of psychotic and non-psychotic disorders.

#### 2.2. Jerusalem school grade archive: 8th grade school marks (ages 13–14)

Jerusalem Municipality routinely collected all 8th grade school records from all public school students in the city from 1978 to 1988 ( $n=21,449$ ). The operational definition of Jerusalem Municipality for this study was the city proper, and not schools in outlying areas (i.e., urban or metro areas). In Israel students attend the school nearest to their home. From the age of six, education is compulsory and free of charge. The Ministry of Education centrally determines core subject curriculum and examination content, and all children study the same core subjects for the same time-period. The local school boards select non-core subjects from a predetermined list that is monitored by the ministry.

We present data collected on 8th grade students attending Hebrew language public elementary schools (1–8) serving a majority of the population in municipal Jerusalem. This included both secular and religious schools with the exception of the ultra-orthodox schools and special education schools who did not participate in the annual survey of grades. During the study years there were on average 5687 8th grade students per year. Of these 1795 were in the ultraorthodox schools and 121 in special education (Choshen and Greenbaum, 1990). Thus after removing the ultra-orthodox and special education students there were approximately 3771 eligible 8th graders per year. During the study years, the city began opening junior high schools and moving 8th grade students to those schools. Junior high schools did not participate in the data collection. The average number of 8th grade junior high school students was 1833 per year. Of the estimated 3771 8th graders we had data on about 2000 annually who were 8th grade students situated in elementary public and religious public schools. The remainder was students in 8th grade classes attending junior high schools (approximately 1833).

Marks given for each subject ranged from 0 to 100 (excellent). Teachers also rated students on school behavior. These include conduct, orderliness and motivation on a scale ranging from 1 (low) to 6 (high). For each student the data on file included: 1) report card grades for academic core subjects (i.e., Hebrew, science, math and English); 2) nonacademic subjects (i.e., physical education, music, arts and drawing and handicraft); 3) teacher behavior ratings (i.e., conduct, orderliness and motivation); and 4) the personal identification number of the student. It also indicated which track they were in for math and English. In the analysis, track was adjusted for by

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