Review of the NIMH Israeli Kibbutz-City Study and the Jerusalem Infant Development Study

by Joseph Marcus, Sydney L. Hans, Shmuel Nagler, Judith G. Auerbach, Allan F. Mirsky, and Annie Aubrey

Shmuel Nagler passed away in March 1987, and all of us are still numb from our feelings of loss. Shmuel's central role in the National Institute of Mental Health Israeli Kibbutz-City Study was both intellectual and emotional, and all of us gained much from him in our personal and academic lives. We were enriched by our association with him, just as the knowledge base regarding the etiology of schizophrenia was enriched by the research that he spearheaded. This article is one of Shmuel's last gifts to us and to those suffering from the particularly painful disorder he researched.—J.M.

Abstract

The National Institute of Mental Health (NIMH) Israeli Kibbutz-City Study has followed the development of offspring of schizophrenic parents from middle childhood through early adulthood. During childhood, a subgroup of offspring of schizophrenic patients showed clear neurobehavioral deficits often accompanied by poor social competence. Early followup data suggest that this subgroup of high-risk children is at greatest risk for adult schizophrenia spectrum illness. The Jerusalem Infant Development Study has followed a similar population of children at risk for schizophrenia from before birth through middle childhood. A subgroup of high-risk children showed sensorimotor dysfunctioning in the first year of life, which was followed by perceptual, motor, and attentional dysfunctioning in childhood—identical to that found in the NIMH cohort. Results from both studies support the hypothesis that schizophrenic illness involves constitutional factors whose expression can be observed as early as infancy. Results also illustrate the importance of using data-analytic approaches that (1) look for subgroups within high-risk groups rather than only group differences between high- and low-risk groups, and (2) examine profiles of behavior rather than only single variables.

This article discusses two studies of the offspring of schizophrenics: the National Institute of Mental Health (NIMH) Israeli Kibbutz-City Study, begun in Israel in 1965, and the Jerusalem Infant Development Study (JIDS), begun in Israel in 1973. The JIDS, an outgrowth of the earlier study, which lacked data on the early development and experience of high-risk children, recruited a high-risk sample before the birth of the children. Since data are now being collected on the JIDS subjects at school age, the two studies will soon converge, providing a more complete picture of schizophrenic development from birth to breakdown.

NIMH Kibbutz-City High-Risk Study

The sample consisted of 100 subjects, 46 boys and 54 girls, who ranged in age from 8.1 to 14.8 years when they were first studied in 1967. The mean age of the boys was 11.3; of the girls, 11.4.

Characteristics of the Sample

Definition of Risk Status. The high-risk group were offspring of a schizophrenic parent, either mother or father; the control group were offspring of parents who had no mental illness. The sample was divided.

Diagnostic Criteria for Parents. Because DSM-III (American Psychiatric Association 1980) and Research Diagnostic Criteria (RDC) (Spitzer et al. 1975) were not available, patients were selected whose records showed: (1) diagnosis of schizophrenia or any subgroup of schizophrenia; (2) several hospitalizations for this disease; and (3) at least three symptoms from a checklist of classical signs (see Schizophrenia Bulletin, Vol. 11, No. 1, 1985). We believe that virtually all of the parents’ illnesses would have been classified as some subtype of schizophrenia or as schizoaffective psychosis by DSM-III criteria. A review, with DSM-III criteria in mind, of the original clinical records and subsequent medical histories is now underway.

Comparison Groups. The kibbutz index cases were chosen first because of the small pool available. The sample contains almost all school-age kibbutz children with schizophrenic parents who resided in Israel at the time of the study. Matched control subjects were selected from classmates of each index child. Identical educational setting was the most important matching criterion, followed by age, ethnic origin, family size, parental educational level, and parental cultural level. On the basis of the same criteria, city pairs were chosen to match each kibbutz pair, so that the 100 subjects were divided into 25 “quadrons.” It was assumed that middle-class city children provided the best match in socioeconomic status (SES) for kibbutz-reared children.

Because some kibbutz school classes were small and non-homogeneous with respect to age, a few compromises were made in matching. Age differences of up to 1.5 years were unavoidable for a few pairs, although for the majority they were not more than 5 months. More emphasis was given to original educational level than to present occupation because parents’ education was often superior to occupation in the kibbutz (Schizophrenia Bulletin, Vol. 11, No. 1, 1985; see table 1).

Sample Biases. Several biases were introduced by the method of sample selection. “Soft” cases of schizophrenia such as those receiving diagnoses popular at the time (e.g., pseudoneurotic and borderline) were excluded, creating a bias toward a chronic type of schizophrenia.

The average IQ and SES of the sample children are high. The range of Wechsler Intelligence Scale for Children IQs was 72–144 (Sohlberg 1985). The mean IQs for each group were as follows: index kibbutz, 112.96; index town, 111.40; control kibbutz, 110.58; and control town, 112.75. The sample is predominantly middle class. There is a bias toward intact family structures with two parents (for details see Schizophrenia Bulletin, Vol. 11, No. 1, 1985).

Attrition. Attrition was low and almost exclusively due to families emigrating. At the 5-year followup, only one child refused examination; six others were out of the country and could not be tested. At the 13-year followup, one child had died; nine who were out of the country could not be tested because of limited financial resources (Mirsy et al. 1985). The low attrition resulted from an effort to establish strong personal relationships, to keep in touch, and from Israel’s practice of requiring registration on moving.

| Table 1. Index offspring by sex and ill parent \( n = 50 \) |
|----------------------------------|-----------------|
|                                   | Mother schizophrenic | Father schizophrenic |
| Boys                              | 17               | 6               |
| Girls                             | 21               | 6               |
| Total                             | 38               | 12              |

Procedures for Index Offspring Assessment

Initial Assessment. On entry into the study, index and control offspring were given two series of examinations on different days a week apart. The first series consisted of a two-part clinical interview; a set of psychomotor tasks measuring individual rhythm, mirror drawing, distractibility, learning, digit span, and decision making; a psychometric test battery including figure drawing, the Bender-Gestalt Test (Koppitz 1964), the Wechsler Intelligence Scale for Children (WISC) (Wechsler 1949), four verbal subtests, and the Taylor Closure Test (Snyder et al. 1961). The second part included a specially designed sentence completion test; the Sarason General Anxiety Scale for Children (Sarason 1960); and the Rorschach and Thematic Apperception Tests coded for communication deviance (Singer and Wynne 1966). Electro-physiological (galvanic skin response; GSR) and developmental neurological examinations were con-
ducted on the second test day.

All examiners assessed behavior using a uniform observation score sheet. Children were observed during school using a time-sample method, with special attention given to automatic movements. The entire class was given a sociometric test to assess the social standing of subjects. Parents and teachers were interviewed about children's behavior for further information on assessments, see Schizophrenia Bulletin, Vol. 11, No. 1, 1985.

At this writing, analyses have been done on the neuropsychological testing, some behavioral observations, and attentional, perceptual, psychophysiological, and sensorimotor measures. The information analyzed has proved valuable with the exception of parents' retrospective reports. Parents' reports on present behavior, however, were validated by other sources (interviews with child and teacher, and examiner ratings).

Subsequent Assessments. Two subsequent assessments have been carried out: The first was done after 5 years on 93 of the subjects, most of them in their late teens. The second was done in 1981, 13 years after the initial examination, on 90 of the subjects, then in their mid-twenties—well into the age of greatest risk for onset of schizophrenia. A third assessment is now underway.

Developmental Problems in Assessment. We encountered few problems of assessment at any age. Examiners observed few signs of anxiety during the examinations. To attain an appropriate sample size, it was necessary to enroll a wide age range. Some instruments were not appropriate for such a broad range. The developmental neurological tests, for example, were designed for children under 11 and generally revealed fewer problems in older children. The adolescent assessment instruments were similar to those used 5 years earlier. The parent interview was omitted, and the neurological test was modified to make it more age appropriate.

Psychiatric Assessments. At the third examination (1981), a test battery was administered to subjects consisting of the Schedule for Affective Disorders and Schizophrenia-Lifetime Version (SADS-L) (Endicott and Spitzer 1978), the Social Adjustment Scale (SAS) (Weissman and Bothwell 1976), and six subtests of the Wechsler Adult Intelligence Scale (WAIS) (Wechsler 1955; Mirsky et al. 1985). A DSM-III diagnosis was established from the SADS-L interview by consensus of two team members in the United States.

Use of the SADS-L and DSM-III systems creates some problems. To get a schizoid personality diagnosis, it was necessary to supplement the SADS-L with the SAS. Because the SADS-L has skip rules limiting the use of questions on schizotypal features to cases in which there is another diagnosis, strict adherence to these rules might miss cases in the schizophrenia spectrum. Moreover, the SADS-L does not have questions that would permit a borderline personality diagnosis. We are also concerned that compared to other classification systems, DSM-III may be overdiagnosing affective disorders relative to schizophrenia spectrum disorders (20 percent of our index cases did receive affective disorder diagnoses at this third assessment, and 18 percent received schizophrenia spectrum diagnoses). Finally, the DSM-III is an evolving classification system. Thus, longitudinal studies must define their risk populations not by diagnosis alone but by a profile of parameters such as pedigree, symptoms, biological indicators, and assessment of neurobehavioral, cognitive, or social functioning that will remain standard no matter how classificatory systems change.

Other Outcome Criteria. At both childhood and adolescent ages, assessment was not limited to achieving a diagnosis but included a large battery of measures of many types and from many sources. Analyses of parts of the data by members of the research team appear in the Schizophrenia Bulletin (Vol. 11, No. 1, 1985).

Multidimensional Scalogram Analysis found a subgroup of offspring of schizophrenics with a neurointegrative defect (Marcus et al. 1985a). A replication analysis on data from Mednick's obstetric study in Copenhagen (Marcus et al. 1985b) found that a similar-sized subgroup of offspring had profiles of "neurological" dysfunctioning. These analyses demonstrate the efficacy of multidimensional analyses of individual profiles and provide a model that could be used in other replication analyses on existing data of other consortium members.

Current Psychiatric Status of Index Offspring

Age Groups. The sample was between the ages of 26 and 32 as of April 1985. Seventy-four percent were between the ages of 26 and 29, and 26 percent were over 30.

Breakdowns and Dysfunction to Date. At the 13-year (young adult) followup, 26 subjects received DSM-III diagnoses—22 in the index group and 4 in the control group (table 2; Mirsky et al. 1985). Sixteen subjects...
Table 2. DSM-III diagnoses of offspring

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Schizophrenia</th>
<th>Major affective</th>
<th>Minor affective</th>
<th>Other diagnosis</th>
<th>No diagnosis</th>
<th>Total DSM-III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibbutz-index</td>
<td>23</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>Town-index</td>
<td>23</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Kibbutz-control</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Town-control</td>
<td>21</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Totals</td>
<td>90</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>7</td>
<td>63</td>
</tr>
</tbody>
</table>

Note — DSM-III diagnoses were based on information gained in the Schedule for Affective Disorders and Schizophrenia-Lifetime Version (SADS-L) interview. A $\chi^2$ test performed on the cell frequencies in the 6 columns of diagnostic categories yielded a value of 47.6. For 15 df, $p < .0001$. Further comparisons yielded the following, all with 5 df: kibbutz-index vs. town-index, $\chi^2 = 18.4, p < .005$; kibbutz-index vs. kibbutz-control, $\chi^2 = 21.9, p < .0005$; kibbutz-index vs. town-control, $\chi^2 = 23.2, p < .0003$; town-index vs. kibbutz-control, NS; town-index vs. town-control, NS; kibbutz-control vs. town-control, NS. Another parallel series of $\chi^2$ tests was performed on the frequencies yielded by pooling all (or total) DSM-III diagnoses and comparing this with no diagnosis (i.e., comparing the last 2 columns in table 1). In every case, the parallel $\chi^2$ on the pooled data yielded statistically significant values where they had been found in the unpooled data.

with diagnoses (three schizophrenia, three other schizophrenia spectrum disorders, five major affective disorders, and five minor affective disorders) were in the kibbutz index group. DSM-III diagnoses in the town index cases were two schizophrenia, one schizophrenia spectrum, and three “other” (mostly phobias). Of the four diagnoses in the control group, three (one minor affective and two “other”) were from the kibbutz group, and one “other” was from the town group. None of the control cases developed schizophrenia. Thus, there was a disproportionately greater number of affective and “other” diagnoses, but not schizophrenia-spectrum diagnoses, in the kibbutz high-risk group. Mirsky et al. (1985) speculated that the small, closed nature of the kibbutz community would make it difficult, if not impossible, to escape one’s family history and proved stressful to the high-risk children. However, they left open the question of which environmental influences on kibbutz-reared youths interact with a schizophrenic family history to produce so many cases of psychopathology. Because the risk period for schizophrenia may extend to age 50, they view the reported result as interim and are now carrying out further assessments of these subjects and their families to clarify the finding. Several yet unexplored factors may have influenced the greater psychopathology in the kibbutz-reared high-risk group. For example, we have no knowledge of the psychopathology or the pedigree of the index parents’ spouses. Some of these may have had affective disorders, and it is possible that more such spouses were present in the kibbutzim. Moreover, we lack extensive information about recent life stressors that could be related to affective disorders. One major stressor affecting Israeli youth, military service, is not a likely contributor to this finding since 11 of the individuals with affective disorders were females (Mirsky et al. 1985), and the military experience of women in Israel is less dangerous and presumably less stressful than that of males. Some of the reasons for the excess of psychopathology in the kibbutz index group will be clarified by further study of the probands, their health records, and their parents. Another possible explanation for the excess of psychopathology in the kibbutz-reared individuals has to do with administration of the interview used for arriving at diagnoses. The version of the SADS-L used in the Israeli study included a lengthy list of questions related to affective disorders. However, a skip rule prescribed that these questions not be asked if the subject reported never having sought treatment for depression or never having been told by others that he had a problem with depression. It is arguable that city-reared individuals have poorer ac-
cess to mental health services and have a smaller pool of individuals from whom they might receive feedback than do kibbutz-reared individuals. These factors would make it more likely that city-reared subjects would not be asked the full series of affective questions, and would thus have their incidence of affective disorders underestimated.

**Social Adequacy.** Mirsky et al. (1985) found that control subjects were significantly more involved in social and leisure activity, had more relations with their extended family, and had a better overall score on the SAS ($p < .05$).

**Predictors of Vulnerability**

Modern theories of the etiology of schizophrenia are multifactorial. They assume that some combination of constitutional diathesis (specific or nonspecific, genetic or induced), when coupled with environmental stress (either general or in some specific aspect of the family interaction), will produce schizophrenic illness. To identify the true predictors of subsequent schizophrenic illness from research data, we believe it is necessary to analyze multifactorial profiles of individuals over the process of development. Thus far, we have carried out three principal multifactorial studies: (1) an analysis of profiles of neurological and neuro-psychological signs and behaviors; (2) a multidimensional analysis of social behavior; and (3) an analysis of a decision-tree model, which includes the previous sets of behavior as well as intervening parental behaviors. Our approach enables us to combine multidimensional statistical analyses with clinical case studies to increase our understanding of the multiple causes of adult disorder.

If schizophrenia requires a genetically transmitted central nervous system (CNS) diathesis, there should be at least three types of individuals in a sample with schizophrenic parents: (1) vulnerable individuals who have a constitutional CNS deficiency and later become schizophrenic; (2) vulnerable individuals who have a constitutional CNS deficiency but avoid eventual schizophrenic breakdown because of compensatory personal abilities or a protective environment; and (3) invulnerable individuals who have no inherited CNS deficiency and cope adequately with life's stress.

**Neurobehavioral Markers.** Several studies have now shown that a subgroup of offspring of schizophrenics have childhood signs of nonfocal neurobehavioral dysfunctioning (Fish and Hagin 1973; Marcus 1974; Erlenmeyer-Kimling 1975; Ragnins et al. 1975; Hanson et al. 1976; Orvaschel et al. 1979; Rieder and Nichols 1979; Marcus et al. 1981, 1985a, 1985b; Erlenmeyer-Kimling et al. 1982; Marcuse and Cornblatt, in press), including attentional problems (Rutschmann et al. 1977; Asarnow et al. 1978; Erlenmeyer-Kimling and Cornblatt 1978; Nuechterlein et al. 1981; Erlenmeyer-Kimling et al. 1982; Cornblatt and Erlenmeyer-Kimling 1984; Weintraub and Neale 1984). Some investigators have also noted the similarity between the type of functioning seen in this subgroup and the pattern seen in children with attentional deficit disorder (ADD) (Bellak 1979). As of this writing, however, there are few reports of whether attentional and neurological signs co-occur as a constellation of symptoms in some subgroup of offspring of schizophrenics, and whether such signs, individually or in combination, mark those children who eventually become schizophrenic.

Because we were interested in studying “ADD-like” neurointegrative deficits in children at risk for schizophrenia, two psychologists not involved in the original assessment examined the available items from the assessment battery to select those that were relevant to the diagnosis of ADD and ADD-like behavior (Marcus and Hans 1984; Marcus et al., in preparation). Since ADD and similar diagnostic categories such as minimal brain dysfunction (MBD) are rather vaguely defined in the literature, we formalized our own concept of ADD-like behavior to provide a clear rationale for selection of the items. We chose to define the syndrome by a brief mapping sentence taken from our facet design of child development (Marcus and Aubrey 1982; Marcus and Hans 1982; Hans et al. 1984; Marcus et al. 1984).

![Mapping sentence]

<table>
<thead>
<tr>
<th>Function facet</th>
<th>Lack of coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modality facet</td>
<td></td>
</tr>
<tr>
<td>motor</td>
<td></td>
</tr>
<tr>
<td>cognitive</td>
<td></td>
</tr>
<tr>
<td>perceptual</td>
<td></td>
</tr>
<tr>
<td>verbal</td>
<td></td>
</tr>
</tbody>
</table>

is mapped as

- more characteristic of ADD-like disorders.
- less characteristic of ADD-like disorders.

There are two facets especially relevant to the diagnosis of ADD and ADD-like conditions: behavior modality (cognitive or motor), and behavior function (control or coordination). The Cartesian cross-product
of these two facets yields five categories of behavior, here identified also by familiar terminology: lack of motor control (hyperkinesis), lack of cognitive control (poor concentration), lack of motor coordination (motor dyscoordination), lack of cognitive coordination (perceptual signs), and poor verbal abilities. Items measuring these five concepts were found in several parts of the assessment battery, including interviews with child, teacher ratings, neurological examination, cognitive and psychomotor testing, and observations made by the examiners.

For analysis, each score from the various scoring schemes used was converted into one of three categories: worrisome sign, mild sign, and no sign. Then each child received a score for each of the five ADD variables that was equal to the most extreme score seen by any examiner. Final scoring was: 2 = at least one of the five sources reported a worrisome sign; 1 = at least one of the five sources reported a mild sign; and 0 = none of the five sources reported signs. This method of scoring was used instead of averages because of the possibility of certain ADD-like behaviors (especially those related to the function of control) appearing only sporadically or only in specific contexts.

To examine the patterns of the five variables simultaneously, a Partial Order Scalogram Analysis by Coordinates (POSAC) (Shye 1980; Marcus et al. 1984) was computed. The results of this POSAC analysis yielded a variable structure with motor control as one axis, cognitive control as an orthogonal axis, and the three coordination variables as intermediate (joint) axes (figure 1). POSAC is a multidimensional data-analytic technique that both reveals the structure of the set of variables and produces plots of individual subjects within this structure.

A line is drawn on the POSAC plot separating the children with ADD-like poor neurobehavioral scores (a sum $\geq 8$ of the five variables). Twenty-four of the index cases (48 percent) were in the region of poor neurobehavioral scores; only 13 of the control cases (26 percent) were in this region. Eight of the nine individuals who later received diagnoses of schizophrenia spectrum disorders were in the region of poor neurobehavioral scores. The one exception (case i) was atypical in that she was an older female (and thus at low risk for such signs) and, as an adult, had only a schizoid personality disorder diagnosis combined with an affective diagnosis. Even so, she exhibited mild neurobehavioral signs. Without exception, all the psychotic schizophrenic breakdowns were in cases exhibiting poor neurobehavioral signs. We do not consider these children identical to children diagnosed as ADD; some aspects of their behavior are, however, similar (Marcus 1986).

Interpersonal Markers. A second set of analyses (Hans and Marcus 1985) examined data on interpersonal behavior from parent, child, and teacher interviews. As a group, index children showed more pathology: their behavior was less desirable, less active, less sociable

Figure 1. POSAC of childhood neurobehavioral profiles

(more withdrawn), and less compliant (more antisocial). There was a mix of types of poor social adjustment, but the strongest discriminant (more antisocial). There was a (more withdrawn), and less compliant (more antisocial). There was a mix of types of poor social adjustment, but the strongest discriminant (more antisocial). There was a mix of types of poor social adjustment, but the strongest discriminant (more withdrawal), and less compliance cues dictated by a logical and not belonging.

Eight of the nine adults receiving schizophrenia spectrum diagnoses had shown undesirable interpersonal behavior at school age. None had shown excellent interpersonal adjustment in childhood. Males had shown extremely undesirable behavior (antisocial behavior, social withdrawal, or both) that was clearly observable by the child, teachers, and parents. Females had shown less overt dysfunctioning. Although parents and teachers observed adequate interpersonal adjustment, the girls themselves had reported acute feelings of rejection and not belonging.

Multiple Etiological Factors. Finally, to broaden the view of the multiple developmental factors that might relate to later psychopathology, Hans and Marcus (in press) made a third report, which included neurobehavioral and interpersonal factors as well as parental factors. Using a decision-tree data analytic model and a diathesis-stressor theoretical model, they identified several variables that seem to predict schizophrenic breakdown.

Differential diagnosis can be understood as a problem of deriving a categorical decision (in this case, schizophrenia) from a set of multiple cues. Some models for differential diagnosis, such as those using linear discriminant analysis, have relied on statistics for selecting cues that are the most powerful discriminators in a particular sample. A process model, in contrast, uses a set of sequential cues dictated by a logical model derived before the beginning of analysis, here from theory about the etiology of schizophrenia. A decision tree is an especially simple and flexible structure for representing this process. The developmentally ordered decision cues and their operationalization in the NIMH sample were:

1. Is there a family history of schizophrenia? Was the child in the index or control group?
2. Does the child show early neurobehavioral signs that might reflect a constitutional deficit? Did the child's neurobehavioral profile place him in the region of poor functioning in figure 1?
3. Is the childhood environment, particularly the family environment, stressful? Does the child have at least one parent whose parenting style shows at least two of the following: overinvolvement, inconsistency, hostility?
4. Are there premorbid childhood signs of poor social adjustment? Did the child show moderate to severe signs of social withdrawal or antisocial behavior in the analyses?
5. Does schizophrenia spectrum illness emerge in adulthood? Does the young adult receive a DSM-III diagnosis in the schizophrenia spectrum?

Figure 2 shows the application of this decision model to the data of the NIMH study. Of the nine cases who received DSM-III diagnoses within the schizophrenia spectrum, seven followed the "worst" developmental course: they had a schizophrenic parent, showed signs of neurobehavioral dysfunctioning, had stressful family environments, and showed premorbid signs of social maladjustment. Only four cases following the worst pathway have not received a DSM-III diagnosis, but because the group is relatively young, these "false negatives" might no longer be "false" at a later followup. Also, we have not yet systematically examined protective factors that might be operating in the lives of these four individuals.

The decision cues selected do seem to be specific to the etiology of schizophrenia. Individuals with other diagnoses appeared scattered across the branches of the tree. We believe that such a decision tree model is an exceptionally straightforward and flexible way of looking at the process of development. The decision cues can be whatever univariate or multivariate cues the scientist believes, for theoretical reasons, should be important to the discrimination. A decision cue allows for changes in the significance of cues over time as well as the interaction of cues within time periods. When parsimoniously constructed, such a model, because it does not force an essentially dynamic system into a static model, can offer insight into underlying developmental processes.

Possible Protective Factors
We have not looked systematically at protective factors. For the whole group, a well-integrated CNS seems to protect against the development of schizophrenia, but this may just be a way of identifying those who are not at "real risk." In E. James Anthony's model (Anthony 1974), these are the children made from metal rather than wood or clay. To identify protective factors, one must first identify those children who seem to be at risk biologically.

A structured, nondemanding environment may be a protective factor for those who would appear to be at real risk as in the case of one of our subjects, who showed numerous signs of early neurobiological and physiological dysfunctioning, but as an adult functions adaptively within the structured and nondemanding lifestyle of the religious setting. This
Figure 2. Decision-tree model for development of schizophrenia: Application to Israeli high-risk study data

Environment may, therefore, be assumed to be a "protective factor."

Recommendations

Even though the NIMH study collected a wide range of data, some useful information on this sample remains to be analyzed or collected. There was no organized or complete information on perinatal history or early development other than mothers' retrospective reports. Also, information about the parents should be more complete. In particular, a more complete assessment of CNS functioning in the parents and direct observations of family interaction would be valuable. Since young adult diagnoses change, a second round of diagnoses of both parents and offspring is needed. Because of assortative mating, we see absence of a diagnosis of the second parent as one of the serious holes in the NIMH study. Brain imagery, biochemical measures, and pedigrees should be included in future studies. Some of these are now being carried out. New, more comprehensive studies could be designed, but we recommend making fuller use of existing studies before
initiating expensive new ones.

Jerusalem Infant Development Study

An important issue that could not be addressed by the NIMH study was the role of perinatal history in the causation of CNS defects. To determine this, it was necessary to start with a cohort of schizophrenic women who were pregnant and obtain detailed data on the perinatal period and the development of the infant offspring. Other methodological control groups, use of the Current and Past Psychopathology Scale (CAPPS) (Endicott and Spitzer 1972) to obtain diagnostic information on the parents, and use of DSM-II (American Psychiatric Association 1968) and RDC to establish diagnoses. These offspring were studied during the first year of life (Marcus et al. 1981), and we have been following the families since then with visits and questionnaires. We recently completed a round of followup examinations of these children, as well as some of their siblings.

Characteristics of the Sample

Fifty-four couples and their infants participated. Data from 58 of 67 infants born into the study were used. Nine infants were excluded because of lack of consensus on parental diagnosis, parental diagnosis of primarily organic disorder, twin birth, loss of contact with the mother, and death of the infant.

Definition of Risk Status. Based on parental diagnosis, four diagnostic categories were formed: schizophrenic (19 cases), affective disorders (six cases), personality disorders and neuroses (14 cases), and no mental illness (19 cases).

Diagnostic Criteria for Parents. DSM-II was used to make the initial diagnoses from a clinical interview based on the CAPPS, psychiatric case histories, and the CAPPS computer diagnosis. Diagnoses were later refined using updated information and RDC. All reported analyses are based on the RDC diagnoses. When there were differences of opinion, a consensus diagnosis was made by two psychiatrists, two psychiatric social workers, and a psychologist.

Families were recently reinterviewed to obtain a current parent diagnosis. The SADS–L (based on DSM-III) and RDC are being used. Final diagnosis will be according to RDC. On initial perusal of the data, there seems to be an increase in pathology among the no-mental-illness group (e.g., major depression, usually situational, and Briquet’s disorder) and an increase in severity of pathology among groups with pathology. When DSM-III guidelines for diagnosis are used, some cross-cultural difficulties arise. For instance, antisocial personality in Israel is of a different order than the DSM-III antisocial personality. In Israel, most antisocial types have close emotional attachments to their families. Therefore, the criterion of shallow affective relationships should not be included for the Israeli sample.

Dimensionalized Assessments. All parents were categorized according to severity and chronicity of disorder. There was a relationship between chronicity of maternal mental illness and motor development during the infant’s first year. High chronicity was associated with maternal perception of low infant activity level at 4 and 8 months, and with delayed acquisition of motor milestones.

Comparison Groups. The control groups were also defined by RDC based on CAPPS interviews and other available materials. Normality was defined as “no mental illness.”

Sample Biases. The sample was citywide, recruited from maternal and child care centers of Jerusalem between 1973 and 1978. About 90 percent of the population, mostly middle and lower classes, use these centers. Because the well-to-do and ultra-Orthodox do not, they were excluded. The schizophrenia group contains mixed subtypes. Some schizophrenic-group children have ill mothers; others, ill fathers. Middle and lower classes, Ashkenazi and Sephardic Jews, Israeli-born, and immigrant Jews are represented. Only family structure is homogeneous; all families were intact.

Attrition. From the original 54 families, five have dropped out. We included as many age-appropriate siblings of the project child in the followup study as we could find.

Procedures for Index Offspring Assessment

Infants were assessed at 3 and 14 days of age with the Neonatal Behavioral Assessment Scale (NBAS) (Brazelton 1973), and at 4, 8, and 12 months of age with the Bayley (1969) Scales of Infant Development. Information about prenatal, perinatal, and postnatal difficulties was obtained from obstetrical records and rated on the Rochester Obstetrical Scale (Zax et al. 1977). When the offspring were 4 and 8 months of age, mothers were interviewed about the temperament of their babies with the Carey Temperament Interview.
Few problems were encountered in carrying out the study and administering the instruments. If performance of the infant seemed to be affected by illness, the test was redone within a week. A just completed school-age followup study has assessed social competence, school performance, cognitive behavior, neurological status, attentional behavior, and motor behavior. Most instruments are identical to those used in the NIMH study, so we can eventually pool the data from these studies to create a convergence-like model.

Current Psychiatric Status of Index Offspring

All the children are now between the ages of 7 and 12. Followup data have just been collected and have not been analyzed. In addition to repeating many of the analyses done in the NIMH study (and in the process constructing the multidimensional, multifactorial profiles described earlier), we intend to pool individual profiles from the two cohorts and identify "pairs" or small subgroups of children with identical or similar profiles. Using this variation of a convergence model, we will be able to make inferences about the perinatal history and early development of the children from the NIMH study who eventually had breakdowns or who proved to be "invulnerable."

Predictors of Vulnerability

Among the measures used to test infants, the motor and sensorimotor items were valuable (Marcus et al. 1981). Analyses of temperament were not helpful, partly because of the questionable validity of the Carey Temperament Interview and partly because our data were incomplete. It was hypothesized that infants' motor and sensorimotor functioning would be related to parental diagnosis. For each of the five points at which testing was done (3 days, 14 days, 4 months, 8 months, and 12 months), a Multidimensional Scalogram Analysis was done of the motor and sensorimotor items on either the NBAS or Bayley scales. Two main subgroups emerged. A subgroup of 13 infants born to schizophrenics showed repeatedly poor motor and sensorimotor performance during the first year of life, although their overall developmental functioning was often in the normal range. The low birth weights of most of these children may be a result of genetically determined intrauterine growth retardation and not, as some have suggested, a cause of their poor sensorimotor functioning. Their performance could not be accounted for by the existence of prenatal, perinatal, and postnatal complications. Thus, it seems most likely that the etiology of this subgroup's poor performance is a genetic-neurointegrative deficit (Marcus et al. 1981). Other infants who performed poorly were scattered among the other three diagnostic groups. We were also able to identify a subgroup of possibly "invulnerable" infants who had a schizophrenic parent, good motor and sensorimotor functioning, and no signs of a neurointegrative deficit. The followup study will attempt to determine whether the subgroups identified as vulnerable and invulnerable in infancy remain so at school age. Although not all children have been reexamined, we do have many interesting cases that illustrate a continuity of functioning from the first year of life to school age, and whose functioning is identical to that of the children in the NIMH cohort.

Recommendations

The major findings of the two studies described here provide evidence for the roles of both constitutional and environmental factors. Our data on the offspring of schizophrenics point to the existence of a subgroup of children who clearly have constitutional (possibly genetic) CNS deficits combined with social deficits—principally withdrawn behavior—or a combination of withdrawn and antisocial behavior. The CNS deficits express themselves in early signs of motor, perceptual, and attentional difficulties. This combination of deficits seen in individuals who eventually had psychotic schizophrenic breakdowns resembles the syndrome of behavioral patterns that is currently defined in DSM-III as ADD. We feel, however, that there are probably subtle differences in the patterns of attentional deficits between ADD children and children with schizophrenic parents, and in their underlying biological dysfunctions as well (Marcus 1986). More research directly comparing these two groups, such as that of Nuechterlein (1984), could yield interesting results.

Our data also clearly point to the existence of a second, nonvulnerable subgroup who exhibit behavior indicative of an intact, normally maturing CNS. We consider them to be physiologically protected from schizophrenia, but not other psychopathology and, most likely, they do not carry any genetic vulnerability. They are not at "real risk" for schizophrenia.

In contrast, the finding of different rates of mental disorder in high-risk children reared in different environments (kibbutz vs. city) suggests that environmental factors—their specific nature as yet undetermined—influence the development.
of psychopathology, although not necessarily of schizophrenia. It is especially notable that a number of cases were diagnosed with affective disorders. We are trying to reinvestigate these cases to learn more about the existence of affective disease in the family (especially in the non-schizophrenic parent) that could be related to the major affective disorder break downs, and of later life stressors that could account for minor affective disorders.

We have learned a number of methodological lessons. It is necessary to study a wide range of background variables, including socioeconomic factors, biological and psychopathological status of both parents and other family members, cognitive functioning of both parents, and various environmental issues. Using type of parent illness as the only "independent" variable in a risk study can lead to fallacious conclusions. Group differences between at-risk and control groups may often be confounded by other factors.

We have also found the study of individual profiles more revealing than group trends and more consonant with clinical approaches. Indispensable to this approach have been Facet Theory (Shye 1978; Marcus and Aubrey 1982; Marcus and Hans 1982; Marcus et al. 1984) and programs for the multidimensional analysis and geometrical presentation of item structure and individual profiles (Guttman 1968; Shye 1980). Facet design provides an a priori scheme for conceptualizing variables and a framework for replication studies. We know that any high-risk group has to be heterogeneous; not all of its members will break down. Analysis of the profiles of those who do break down, especially over time, provides insight into the combination of factors affecting development. Facet design and multidimensional analysis of individual profiles have much to contribute to the high-risk field.

Finally, there are good ongoing studies and data bases that can still be improved upon or used for replication. These steps should precede the complicated and expensive course of initiating new studies while existing ones remain unfunded, underused, and unfinished.

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The Authors

At the time this work was done, Joseph Marcus, M.D., was Professor of Child Psychiatry and Director of the Unit for Research in Child Psychiatry and Development, University of Chicago, Chicago, IL. Dr. Marcus is currently Co-director of the Unit and Professor Emeritus. Sydney L. Hans, Ph.D., is Research Associate (Assistant Professor) in the same department at the University of Chicago. Shmuel Nagler, Ph.D. (deceased) was formerly Clinical Professor, Kounin Lonenfeld Chair of Special Education, Uni-
Family Care of Schizophrenia

Family Care of Schizophrenia, authored by Ian R.H. Falloon, Jeffrey L. Boyd, and Christine W. McGill, has been recently published by The Guilford Press (200 Park Avenue South, New York, NY 10003). In an ongoing search for the cause (causes) of schizophrenia, the family has often been identified as a prime candidate. Focus on the harmful effects of critical or rejecting family members and deviant communication patterns has obscured the potentially beneficial role of many families in providing support for their schizophrenic members. Though available evidence suggests that intolerance and emotional overinvolvement do heighten the risk of relapse, the authors’ thorough review of the literature reveals that only half of the families studied exhibit such attitudes.

Family Care of Schizophrenia focuses on a model developed by the authors for the broad-based community treatment of schizophrenia and other severe forms of mental illness that taps this underutilized potential. Based on the hypothesis that environmental stress is a major factor in the onset and severity of schizophrenic episodes, the model incorporates well-established behavioral techniques to enhance the coping mechanisms and problem-solving abilities of the family. The goal of the program is not merely the reduction of stress that can trigger floric episodes, but also the restoration of the patient to a level of effective social functioning that permits employment and socialization with persons outside the family. Following a thoughtful and highly readable discussion of the rationale behind their approach, the authors present a detailed description of their behavioral family model, buttressed by illustrative transcripts from actual therapy sessions. Central to their strategy is the development of problem-solving skills and social supports for the patient and his or her family—including education about the illness and the effects of neuroleptics—that will enable them to cope not just with potentially threatening behavioral disturbances and other traumatic life events, but also with the stressors of daily life.

As the authors persuasively demonstrate, families can, with proper guidance, be taught to modulate the level of intrafamilial stress, regardless of whether it derives from family tensions or external life events. Their careful exposition of the family care model, coupled with case studies and results from a controlled outcome study, reveal the family to be an important resource in the community management of mental illness. A major contribution to the treatment of schizophrenia, this unique synthesis of systems theory and behavioral techniques will be of interest to psychiatrists, who are familiar with the limitations of present treatment strategies, as well as to family and behavior therapists concerned with the problems posed by major mental illness.