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Review Article

Prevalence Studies in Schizophrenia

E. FULLER TORREY

Over 70 prevalence studies of schizophrenia published since 1948 are reviewed. Despite problems of method, the studies suggest that there may be significant differences in prevalence among different populations and that prevalence may change over time. Further research is needed on how much differences in diagnosis or the course of schizophrenia contribute to the variable prevalence rates. The paper suggests the following as areas for additional enquiry: a possible north-south gradient, special populations (e.g. American Hutterites, northern Swedes, western Irish, castes in India) and ongoing case registers in areas of suspected high and low prevalence.

Warm climates are not those which produce the greatest amount of insanity, but rather temperate climates, subject to great atmospheric vicissitudes, and especially those whose temperature is alternately cold and humid, damp and warm. Jean E. Esquirol (1845)

Geographical comparisons of the prevalence of schizophrenia have been of interest to mental health specialists for well over a century. When Emil Kraepelin voyaged to Singapore and Java in 1904 he specifically looked for cases of dementia praecox, and concluded that "in all civilized nations" the disease "comes under observation in approximately the same forms and everywhere accounts for the greatest number of the permanent inhabitants of institutions" (Kraepelin, 1919).

In recent years there has been a resurgence of interest in prevalence as epidemiological studies have multiplied. No longer can the field be characterised, as it was in 1963, as composed of "a small amount of inadequate research combined with a large amount of adequate criticism" (Mishler & Scotch, 1963). Since 1948 over 70 prevalence studies of schizophrenia have been published in which many used sophisticated techniques equivalent to epidemiological studies in other areas of medicine.

The interpretation of these studies, however, has varied widely. Jablensky & Sartorius (1975) reviewed 23 prevalence studies with an almost ten-fold difference from the lowest to the highest rate and concluded that "with few exceptions . . . the data on the prevalence of schizophrenia appear to be very similar in different cultures." More recently, in summarising the World Health Organisation (WHO) study of the incidence of schizophrenia in which a two-fold difference was found using a narrow definition and an almost three-fold difference using a broad definition, Sartorius *et al* (1986) concluded that "the results provide strong support to the notion that schizophrenic illness occurs with comparable frequency in different populations." Similarly Leff (1981) reviewed 11 prevalence studies of schizophrenia with an almost five-fold difference and concluded that "we can state on the basis of the studies reviewed that there is no evidence suggesting that schizophrenia is much more frequent in one part of the world than in another." On the other hand, Torrey (1980) reviewed a large number of studies and concluded that "the difference is greater than ten-fold and cannot be ignored," while Eaton (1985) also noted "roughly a ten-fold variation in the rates" and asserted that the differences were highly significant.

One reason for the differing interpretations of the data is problems of method inherent in prevalence studies of schizophrenia. Differences in diagnostic standards have varied widely around the world and certainly account for some of the different rates. Differing life expectancies will also affect rates, as will the age distribution of the population (e.g. large numbers of young children will lower the rate). For this reason some researchers have calculated the schizophrenia prevalence rate for a given age cohort (e.g. 18–65) or applied an age correction factor (e.g. the Weinberg abridged method). Another factor to be considered is the course of the illness; there is evidence from several studies that schizophrenia has a more benign course in developing countries which would produce lower prevalence rates.

Incidence studies of schizophrenia have the advantage of counting cases at their inception so the rates are not as affected by course and outcome; their big disadvantage, however, is that a significant subgroup of persons develop schizophrenia insidiously over months or years and it is virtually impossible to date the onset. Some studies of incidence have defined

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it as when the person was first referred for psychiatric care but this measure is affected by cultural factors and the availability of care. For these reasons incidence studies have been less used than prevalence studies and will not be included in this review. As Cooper (1978) summarised: "Reported incidence rates for schizophrenia tend to vary more widely than reported prevalence rates, and on the whole are probably less reliable."

It should be noted that all major diseases in which both genetic and non-genetic factors are thought to be important have significant prevalence differences. Heart disease varies approximately six-fold (Thom *et al*, 1985), rheumatoid arthritis ten-fold (Utsinger *et al*, 1985), type I diabetes 30-fold (Marble *et al*, 1975) and multiple sclerosis at least 50-fold (Kurtzke, 1975). In all these diseases there have been problems of method of narrow versus broad diagnostic definitions and differing mortality rates, similar to problems faced with schizophrenia. In addition, all current aetiological hypotheses of schizophrenia (genetic, diathesis-stress, biochemical, nutritional, infectious, psychosocial) would logically predict significant differences in the prevalence of the disease. If schizophrenia has no such differences it would be a unique disease and that fact alone would be one of its most significant aspects. In looking at the prevalence studies of schizophrenia it would be surprising if differences were not found.

Range of prevalence

Table I summarises schizophrenia prevalence studies with approximately 1000 or more subjects which have been published (or summarised) in English since 1948. According to Dr Assen Jablensky of WHO several additional studies have been published in the Russian literature (pers. comm.) The studies are arranged from the lowest prevalence to the highest. Prevalence rates are given per total population but the rates are not necessarily comparable because of the problems with method previously noted. In some studies prevalence rates were calculated only for age-corrected cohorts but, since different cohorts were used in different studies, these rates are also not comparable. Countries with large numbers of young children have a greater difference between the prevalence rate per total population and age-corrected rate.

The prevalence period used in the studies varies from cases symptomatic at the time of the survey (point prevalence) to cases which have occurred at any time during the person's life (lifetime prevalence). Cases of schizophrenia in which the person has recovered will be excluded from the shorter prevalence periods, while the longer periods must rely on recall of past clinical states. Case finding is done by using key informants to identify suspected cases who are then interviewed, doing house-to-house surveys (census method), or utilising ongoing case registers. For schizophrenia there is evidence that using key informants in rural areas produces results very similar to those obtained by house-to-house surveys (Nielsen & Nielsen, 1977).

The range of prevalence from the lowest reported rate (0.3 per 1000 among the ultraconservative agrarian Amish sect in the USA) to the highest reported rate (17.0 per 1000 in a restudy of an isolated population in northern Sweden) is over 50-fold. The Amish findings must be qualified, however; only four cases of schizophrenia were diagnosed among 12 500 Amish but 22 cases diagnosed with bipolar disorder had initially been called schizophrenia on hospital records. One can argue, therefore, that some of the bipolar patients would have been diagnosed with schizphrenia by other investigators and the schizophrenia rate is artificially low.

The three studies with the next lowest prevalence rates – in Ghana, among Taiwanese Aborigines, and among the Hutterites in the USA – cannot be as easily dismissed. Rin & Lin's (1962) study of the Aborigines, for example, was cited by Mishler & Scotch (1963) as having the best methods for case finding of any study done to that time. Leff (1981) criticised the study because cases of 'malarial psychosis' were not counted as schizophrenia, but in fact acute psychosis secondary to malaria is relatively common in tropical countries and should not be confused with schizophrenia. Among the 10 cases of schizophrenia diagnosed by Rin & Lin two had lasted less than 3 months and another four had recovered in less than 2 years. Despite a life expectancy of only 40–45 years among this population (which would reduce the number of older schizophrenics), the disease appears to have been genuinely uncommon in this group at the time of the study.

High prevalence was reported in Book's two studies of northern Sweden done 25 years apart (Book, 1953; Book *et al*, 1978), Vaisanen's study of communities in both northern and southern Finland (1975), and the study by Torrey *et al* (1984) of an area in western Ireland. It should be noted that both Book and Torrey *et al* selected areas for study which were reputed to have a high prevalence rate for psychosis, but this was not true for the Finnish study. The comparatively high schizophrenia prevalence rates found by Vaisanen *et al* (1975) were confirmed by a restudy of the same communities 5 years later in

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TABLE I
Prevalence studies of schizophrenia

Country	*First author*	*Year published*	*Type of study*[1]	*Total population*	*Prevalence period*	*Schizophrenia Prevalence/1000* *Total population*	*Age corrected*[2]
USA: Amish	Egeland	1983	R, K	12 500	5 years	0.3	0.5
Ghana	Sikanarty	1984	U, K	45 195	point	0.6	1.1 (15+)
Italy	Zimmerman-Tansella	1985	U, CR	74 852	1 year	?	1.3 (14+)
Taiwan: Aborigines	Rin	1962	R, C	11 442	lifetime	0.9	1.5 (15+)
USA: Hutterites	Eaton	1955	R, K	8 542	lifetime	1.1	2.1 (15+)
Argentina	Bonhour (in Sauna)	1966 1969	U, R, C	4 442	?	1.1	?
Scotland	Wing	1967	U, CR	185 000	1 year	?	2.5 (15+)
Scotland	Robertson (in Eaton)	1981 1985	U, CR	477 700	point	1.4	?
Iran	Bash	1974	U, C	928	point	?	2.2 (7+)
Canada	Roy	1970	R, K	28 096	lifetime	1.6	2.4 (15+)
Canada	Murphy	1964	R, K	18 470	point	?	2.4 (15+)
Ireland (Dublin)	Walsh (pers. comm.)	1986	U, CR	234 300	point	1.7	2.5 (15+)
India	Thacore	1975	U, C	2 696	1 year	1.9	?
Yugoslavia	Kulcar	1971	R, C	36 326	3 months	?	2.9 (20–64)
Botswana	Ben-Tovim	1986	R, K	2 526	1 year	2.0	4.4 (15+)
Italy	DeSalvia (pers. comm.)	1986	U, CR	92 104	1 year	2.0	2.6 (15+)
England (London)	Wing	1976	U, CR	154 900	point	2.0	?
Taiwan	Lin	1969	U, R, C	29 184	lifetime	2.1	?
Japan	Kato	1969	U, C	5 207	point	2.1	5.0 (W[2])
England	Gibbons (in Eaton)	1980 1985	?	?	1 year	2.1	?
Taiwan	Lin	1953	U, R, C	19 931	lifetime	2.2	5.9 (W)
Japan	Kato	1969	U, C	2 712	point	2.2	4.9 (W)
India	Nandi	1980	R, C	4 053	point	2.2	?
India	Dube	1970	R, C	28 468	lifetime	2.3	?
Japan	Kato (1954 Study)	1969	U, R, C	23 993	1 year	2.3	?
Japan	Kato (1963 Study)	1969	U, R, C	44 092	1 year	2.3	?
India	Sethi	1974	U, C	4 481	point	2.5	3.4
Germany	Hafner	1980	U, CR	308 975	point	2.5	?
Germany	Dilling	1984	R, C	1 536	point	?	3.9 (16+)
USSR	Krasik (in Cooper)	1965 1978	R, ?	?	?	2.6	?
Denmark	Nielson	1976	R, C	6 013	point	2.7	3.5 (15+)
Bulgaria	Temkov (in Jablensky)	1975 1986	U, CR	140 758	point	2.8	?
England (Salford)	Wing	1976	U, CR	130 900	point	2.8	?
England (Salford)	Freeman	1986	U, CR	91 700 (15+)	1 year	?	6.8 (15+)
Yugoslavia	Crocetti	1971	U, C	4 282	3 months	?	4.2 (20–64)
India	Nandi	1975	R, C	1 060	point	2.8	5.0
USSR	Krasik (in Cooper)	1965 1978	U, ?	?	?	3.1	?
Sweden	Stromgren	1948	R, K	45 930	lifetime	3.3	4.7 (W)
England	Wing	1967	U, CR	175 304	1 year	3.4	4.4 (15+)
USA: New Haven	Hollingshead	1958	U, K	238 831	6 months	3.6	?

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TABLE I *(continued)*

Country	*First author*	*Year published*	*Type of study*[1]	*Total population*	*Prevalence period*	*Schizophrenia Prevalence/1000 Total population*	*Schizophrenia Prevalence/1000 Age corrected*[2]
USSR	Zharikov	1968	U, CR	400 000	point	3.6	5.1 (16+)
Sri Lanka	Wijesinghe	1978	U, C	7 653	6 months	3.7	5.5 (15+)
Sri Lanka	Jayasundera	1969	R, C	4 718	?	3.8[3]	?
Korea	Yoo	1961	R, C	?	lifetime	3.8	9.6 (W)
USSR	Rotstein (in Jablensky)	1977 1986	U, R C	?	?	3.8	?
Sweden: Stockholm	Halldin	1984	U, C	2 009	1 year	?	6.0 (18–65)
USA: St Louis	Myers	1984	U, C	3 004	6 months	?	6.0 (18+)
USA: rural	Blazer	1985	R, C	1 936	6 months	?	6.0 (18+)
Japan: Hachijo Island	Kato	1969 (1940 Survey)	K	8 318	point	3.9	9.1 (W)
USA: Rochester	Babigian	1985 (1970 Survey)	U, CR	712 000	1 year	4.1	?
Scotland	Mayer-Gross	1948	R, K	56 231	lifetime	4.2	?
India	Elnagar	1971	R, C	1 363	lifetime	4.3	?
Australia: Aborigines	Jones	1973	R, K	1 800	lifetime	4.4	?
Australia: Aborigines	Eastwell	1975	R, K	3 400	lifetime	4.4	8.7 (17+)
Sweden	Hagnell	1966	R, C	3 310	lifetime	4.5	5.1 (11+)
Sweden	Sjogren	1948	K, R	8 736	45 years	4.6	8.3 (W)
USA: Baltimore	Wing	1967	U, CR	950 000	1 year	?	7.0
Japan: Hachijo Island	Kato	1969 (1961 Survey)	K	12 027	point	4.7	?
India	Carstairs	1976	R, C	1 233	lifetime	?	7.2 (15+)
Ireland: 3 counties 1982 data	Walsh (pers. comm.)	1986	R, CR	165 223	point	4.9	7.1 (15+)
Yugoslavia	Crocetti	1971	U, C	4 282	3 months	?	7.3 (20–64)
Yugoslavia	Kulcar	1971	R, C	15 756	3 months	?	7.4 (20–64)
USA: Rochester	Babigian	1985 (1975 Survey)	U, CR	702 000	1 year	5.1	?
Norway	Bremer	1951	R, C	1 325	lifetime	5.3	6.5 (11+)
India	Nandi	1979	R, C	3 718	point	5.6	?
Ireland: 3 counties 1973 data	Walsh	1980	R, CR	149 422	point	5.6	8.1 (15+)
Canada: Indians	Roy	1970	R, K	4 723	lifetime	5.7	11.0 (15+)
Norway	Fugelli	1975	R, C	1 726	2 years	5.8	6.9 (10+)
Ireland: Co. Roscommon 1982 data	Walsh (pers. comm.)	1986	R, CR	45 324	point	5.9	8.1 (15+)
Sweden	Larsson	1954	R, K	13 085	45 years	6.3	?
Sweden	Essen-Moller	1956	R, C	2 550	lifetime	6.7	8.1 (15–45)
USA: Baltimore	Myers	1984	U, C	3 481	6 months	?	10.0 (18+)
USA: New Haven	Myers	1984	U, C	3 058	6 months	?	11.0 (18+)
USA: Durham	Blazer	1985	U, C	1 862	6 months	?	11.0 (18+)
Ireland: Co. Roscommon 1973 data	Walsh	1980	R, CR	45 426	point	7.1	9.8 (15+)
Finland	Vaisanen	1975	U, R, C	991	point	?	15.1 (15–64)
Sweden (suspected high prevalence area)	Book	1953	R, K	8 981	point	9.4	23.9 (15–45)

continued

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TABLE I *(continued)*

Country	*First author*	*Year published*	*Type of study*[1]	*Total population*	*Prevalence period*	*Total population*	*Schizophrenia Prevalence/1000 Age corrected*[2]
Ireland (suspected high prevalence area)	Torrey	1984	R, K	2 848	6 months	12.6	17.4 (15+)
Sweden (restudy of high prevalence area)	Book	1978	R, K	5 748	point	17.0	?

R: Rural; U: Urban; K: Key; CR: Case register; C: Census

1. Type of census is characterised as either the key informant type (key) in which official and hospital records are examined, key persons are asked to name all mentally ill persons, and all suspected cases are then interviewed; or the census type (census) in which a house-to-house survey is conducted in addition to the above. For schizophrenia there is evidence that the key method over a long prevalence period identifies all cases of schizophrenia in the community and thus is equal to rates obtained by the census method (Nielsen & Nielsen, 1977). However, the key method for a point prevalence would presumably not detect all cases extant and thus would not be directly comparable to rates obtained by the census method.

2. Age-corrected schizophrenia rates are calculated by number of cases per population in the susceptible age group. Since these differ the rates in this column are not strictly comparable one to another. Many of them are calculated using the Weinberg abridged method (indicated by W) which is a measure of the expectancy of developing schizophrenia if a person lives through the 16–40 age-susceptible group. It is computed by the number of schizophrenic patients divided by (a) the total number of people who have reached age 40 plus (b) one-half the population in the 16–40 group; this product is multiplied by 100. W figures are comparable with one another in the chart (see Lin, 1953).

3. The Sri Lanka rate of 3.8 is based on the findings of the first two studies which the researchers claimed were considerably more reliable than the last two studies. If all four studies are used the rate becomes 3.2 per 1000.

which the number of persons found with psychoses was 50% higher than the original study (Lehtinen & Vaisanen, 1981); unfortunately the authors do not provide a diagnostic breakdown of the psychoses so the restudy is not included in Table I.

There are other suggestions that schizophrenia prevalence rates in northern Scandinavia are high. Bremer (1951) reported a rate of 5.3 per 1000 for a northern Norwegian village; the village was re-studied 30 years later and the number of persons with 'functional psychosis' (no diagnostic breakdown given) had increased (Bjarnar *et al*, 1975). Fugelli (1975) surveyed two northern Norwegian islands and found 10 cases of schizophrenia among 1726 residents (5.8 per 1000); in addition he diagnosed another 15 cases of 'organic and senile psychosis' and 17 cases of 'other psychosis' yielding a prevalence of all psychoses of 24.3 per 1000. Anderson (1975) studied another area of northern Norway and found a prevalence rate for all psychoses (no diagnostic breakdown given) of 24 per 1000 for the Norwegian inhabitants and 54 per 1000 for the Lapps.

The area in western Ireland in which Torrey *et al* (1984) found a schizophrenia prevalence rate of 12.6 per 1000 (included 21 with DSM-III schizophrenia, 11 with schizoaffective disorder, and four with atypical psychosis) has not yet been restudied. The authors reported widespread belief among mental health professionals in the western counties that some areas have much more schizophrenia than others. The prevalence rate of the area studied in County Roscommon is more than twice the 5.9 per 1000 rate found by case register for the county as a whole and more than seven times the rate found for the St Loman's case register in Dublin for 1982 (Walsh, pers. comm., 1986). Emigration from western Ireland has been high for over a century but the authors claim this would account for only a small portion of the high prevalence observed. Schizophrenia has also been noted to be common among Irish immigrants to the USA so the high Irish rate cannot be explained simply by saying that the healthier individuals left and the pre-schizophrenic individuals remained at home.

High and low prevalence pockets

A further perusal of schizophrenia prevalence studies, worldwide, suggests an uneven distribution between some population groups which are geographically contiguous. The Amish and Hutterite prevalence rates in the USA, for example, are less than 25% of the rates reported for rural (North Carolina) or urban (New Haven, Rochester, Baltimore, Durham, St Louis) areas in recent studies. Differences in the prevalence of schizophrenia in the USA are also suggested by studies of hospitalisation rates although it must be recognised that these are determined by availability of beds and other factors in addition to true prevalence. A 1903 study of

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hospital admission rates for schizophrenia in the USA noted that "the greatest proportion of insanity is in the northeast . . . If from this center of greatest prevalence of insanity we draw a line in any direction — west, south, or southwest — we see that no matter which way we go we find a steady decrease until we strike the Pacific slope" (White, 1903). First admission figures for schizophrenia in various states for subsequent years have confirmed White's conclusion (Torrey, 1980).

As previously noted the Taiwanese Aborigines have a schizophrenia rate less than half that of the Taiwanese Chinese, the northern Swedes studied by Book have a rate twice that of southern Swedes, and the western Irish studied by Torrey *et al* have a rate twice that of their neighbours a few kilometres away. The most intensive study of intrapopulation differences, however, was the research done in Yugoslavia by Kulcar *et al* (1971). It had long been rumoured that the Istrian peninsula had an unusually large number of people with psychosis, and this was subjected to sophisticated study over 10 years. It was found that both schizophrenia and bipolar disorder were higher in the study areas compared to other parts of Croatia; the schizophrenia prevalence rate (for people ages 20–64) was 7.4 per 1000 in villages and 7.3 per 1000 in an urban area on the Istrian peninsula compared with 2.9 per 1000 (villages) and 4.2 per 1000 (urban) elsewhere in Croatia.

The existence of high and low prevalence pockets has been observed elsewhere. Researchers in Japan did two studies of Hachijo Island and reported the prevalence of schizophrenia to be 3.9 and 4.7 per 1000; surveys done elsewhere in Japan at the time consistently found a prevalence rate of 2.1–2.3 per 1000 (Kato, 1969). Murphy & Vega (1982) found that "first admissions for schizophrenia in Northern Ireland are significantly higher for the Roman Catholics than for the rest of the population." Murphy (1968) also reported that Catholics in Canada had significantly higher hospitalisation rates for schizophrenia compared with non-Catholics. In a study in Singapore, Murphy (1968) reported that Indian (mostly Tamil-speaking) students at the University of Singapore had twice as high a schizophrenic prevalence rate as the Malay students; Chinese students had an intermediate rate. Differential prevalence rates for schizophrenia have also been observed in the Soviet Union with its many ethnic groups; it was recently reported, for example, that schizophrenia is significantly less common among Uzbeks in the Samarkand region compared with Russians in the Moscow region (Yursinova, 1982).

India is another country which has provided intriguing findings on the prevalence of schizophrenia. In a series of studies in villages in West Bengal, Nandi and his colleagues (1975, 1979, 1980) found the prevalence rate for schizophrenia to vary from 2.2 to 5.6 per 1000. The highest schizophrenia rates were found among Indians of the highest castes. This is the ninth group of researchers over the past 50 years to find that schizophrenia occurs more commonly in India in individuals of higher castes (Dhunjibhoy, 1930; Shaw, 1930; Rao, 1966; Dube, 1970; Elnager *et al*, 1971; Dube & Kumar, 1972; Saxena *et al*, 1972; Kapur, 1975; Carstairs & Kapur, 1976; Varma *et al*, 1980). This observation contrasts with claims in the USA and Western Europe that schizophrenia occurs more commonly in lower socio-economic groups. At least a partial explanation for the latter is 'downward drift' of individuals prone to schizophrenia; it is difficult to imagine how 'upward drift' could account for the Indian findings however.

Reports that there are large areas of the world in which schizophrenia is uncommon must be viewed with caution since many such reports are based on impressions only. Where schizophrenia is in excess it can be counted, but where there is a deficit it can always be said that the cases were missed or died off. In sub-Saharan African countries there have been such reports over many years. The surveys by Giel & Van Luijk (1969*a*,*b*) in Ethiopia and Ahmed's work in the Sudan (1979) (0.4 per 1000) are two more recent examples of such impressions. The best study methodologically from Africa was that of Ben-Tovim & Cushine (1986) of rural Botswana; omitting the patient with an onset at age 60 they reported a prevalence rate of 2.0 (total population) or 4.4 (15+) per 1000 which are higher rates than previous African studies.

The South Pacific is the other area of the world from which there have been reports of schizophrenia being uncommon. Torrey *et al* (1984) studied hospitalisation records for psychiatric disorders in Papua New Guinea and concluded that there was a 20-fold difference between some highland districts (very low prevalence) and some coastal districts (comparatively higher prevalence). Zigas & Rodrigue (Dohan *et al*, 1983) also had the impression that schizophrenia was rare in some highland areas. Murphy (1984), however, stated that "I myself could find only a two- to three-fold difference when I conducted a key-informant village survey in various highland and coastal districts.'

Elsewhere in Melanasia, in the Solomon Islands Clark (Dohan *et al*, 1983) found no schizophrenia among 3000 Kwaio adults living in remote villages but a prevalence rate of 2.2 per 1000 among 32 000 adults in the coastal region. In Polynesia, Murphy &

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Taumoepeau (1980) reported a low prevalence of schizophrenia (and also organic and affective psychosis) on Tonga. Dale (1981) did an extensive survey of Micronesian islands and reported a point prevalence for schizophrenia of 1.5 per 1000 (age 15 and over). Among the various islands, however, there was an east-to-west gradient with rates of 0.8 per 1000 in the Marshall Islands to 9.7 per 1000 on Yap. Three decades earlier a survey had found no individuals with schizophrenia on Yap (Dohan *et al*, 1983).

Given the lack of methodological rigour in most of these surveys it is not possible to draw any firm conclusions. The impression remains, however, that there are some areas in the world where schizophrenia is uncommon. These areas are tropical, and when compared with the higher schizophrenia prevalence rates reported for western Ireland and northern Scandinavia there is the suggestion of a possible north–south gradient in the disease's distribution similar to the gradient reported for heart disease (Thom *et al*, 1985) and multiple sclerosis (Kurtzke, 1975).

Changes in prevalence over time

Research on prevalence rates of schizophrenia is complicated by the fact that the rates may change over time. Suggestions that the prevalence of schizophrenia may have increased sharply in the nineteenth century have elicited much controversy (Torrey, 1980; Hare, 1983). In Books studies of northern Sweden the schizophrenia prevalence rate increased from 9.4 to 17.0 per 1000 over 25 years, while in Finland the prevalence of schizophrenia apparently increased less dramatically over 5 years (Lehtinen & Vaisanen, 1981). In the USA there are also suggestions that the schizophrenia rate may have increased in recent years; 1984 studies in Baltimore and New Haven using a narrow definition of schizophrenia report schizophrenia prevalence rates (Myers *et al*, 1984) which appears to be twice as high as earlier studies which used a broader definition in Baltimore (Lemkau *et al*, 1942, 1943) and New Haven (Hollingshead & Redlich, 1958).

Schizophrenia prevalence rates may also decrease. The rural areas in southern Sweden studied by Essen-Moller (1956) was restudied 10 years later by Hagnell (1966) who found a substantial decrease in the number of individuals with schizophrenia. Shepherd (1957) claimed that England's Buckinghamshire County experienced a major decrease in first admissions for schizophrenia between 1931–1933 and 1945–1947. In Scotland, Eagles & Whalley (1985) claimed that schizophrenia had decreased in that country between 1969 and 1978. It is also interesting to speculate whether the difference in Scotland between Mayer-Gross' 1948 study (4.2 per 1000) and the 1981 Aberdeen case register (1.4 per 1000) is a result of a decrease in schizophrenia or because the two studies covered different geographical regions (southern and northeastern regions respectively). In Ireland, data from the three county case register for 1973 (Walsh *et al*, 1980) compared with 1982 (Walsh, pers. comm., 1986) suggests that a decrease in schizophrenia prevalence may be taking place in that country as well. Finally, a recent New Zealand study suggests that schizophrenia may also be decreasing there (Joyce, 1987). Some of these apparent changes may of course also be due to changing diagnostic practices as in recent decreases in first admissions for schizophrenia in Denmark (Munk-Jorgensen, 1986; Munk-Jorgensen & Jorgensen, 1986).

There are also examples of schizophrenia prevalence rates remaining relatively constant over time. Odegard (1971) reported that in Norway between 1926 and 1965 the number of individuals in hospital with 'functional psychoses' increased very little, while case registers in Denmark and Iceland also showed no substantial change (Hafner & Heiden, 1986). Dilling & Weyerer (1984) studied villages in Southern Germany and found an age-corected schizophrenia prevalence rate of 3.9 per 1000. Brugger had carried out two research studies in the same region 40 years earlier and found virtually identical age-corrected rates (3.8 and 3.9 per 1000) (Torrey, 1980). In both sets of studies the institutionalised schizophrenics were not included.

Perhaps the most intriguing report of a changing schizophrenia prevalence rate came from studies in Northern Ghana. From 1934 to 1937 Fortes, trained in both psychology and anthropology, studied Tallensi villages there; among approximately 5000 people he found only one who was psychotic, a 22-year-old man who had become ill in adolescence. In 1963 Fortes returned to the village accompanied by his wife, Dr Mayer, a psychiatrist. In the same population where 27 years earlier there had been a single psychotic individual there were now 17; of these, 13 were diagnosed with schizophrenia and one each with manic-depressive psychosis, acute reactive psychosis, postpartum psychosis, and involuntional depression. Fortes & Mayer (1969) noted that Tallensi elders were themselves alarmed over the rise in psychosis; organic factors (such as trypanosomiasis) or immigration were rejected as being causal factors. Fortes was also certain that he had not missed the cases in his earlier study: "What was quite startling . . . is that several of these cases occurred in families which were specially well known

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to me in 1934–1937 . . . These were the families of my best friends and informants, some of whom are still living. Had such cases occurred among them in 1934–1937 I could not have missed them" (Fortes & Mayer, 1969).

Prognosis and seasonality

As mentioned previously, the course and prognosis of schizophrenia will affect prevalence rates if they differ among different groups. If, for example, a much higher percentage of patients fully recover in country A versus country B, then the prevalence rate in the country A will be lower even if the incidence rates in the two countries are equal.

There is evidence that prognosis and outcome do vary considerably, with schizophrenic patients in developing countries having a higher percentage of very good outcomes. Murphy & Raman (1971) brought attention to this fact in their study of Mauritius in which, 12 years after hospital admission, 59% of individuals with schizophrenia were completely recovered; a comparison with British figures showed that, 5 years after admission, only 34% of individuals with schizophrenia had completely recovered. Waxler (1979) did a similar 5-year follow-up in Sri Lanka and found that 40% of the patients had recovered completely. The most definitive study of this problem to date was the multi-nation WHO study of schizophrenia. At 2-year follow-up in this study the percentage of patients with a 'very favourable' outcome ranged from 57% (Nigeria) and 49% (India) to 24% (England), 23% (USA), 21% (Columbia), 14% (Czechoslovakia), 9% (USSR) and 6% (Denmark). In all of these studies it is important to note that the percentage of schizophrenic patients having a 'very unfavourable' outcome is relatively comparable; the difference is that more patients in developing countries recover completely while more patients in developed countries have intermediate outcomes.

Seasonality of schizophrenic births is another interesting aspect of the disease which may have a bearing on prevalence differences. It has now been shown in every northern hemisphere country which has been studied with an adequate number of subjects that a disproportionate number of individuals, who later in life develop schizophrenia, were born in the late winter and early spring months. The studies to date include England and Wales, Ireland, Denmark, Norway, Sweden, the USA, Japan, and the Phillipines and are extensively reviewed in several recent publications (Bradbury & Miller, 1985; Torrey & Kaufmann, 1986; Boyd *et al*, 1986). The excess schizophrenic births vary between 7 and 20% in these studies and the phenomenon is not necessarily constant within a single country (e.g. northern Sweden shows more seasonality than southern Sweden, the northern states in the USA more than the southern states). Nor is the seasonality fixed over time with evidence from Japan, England and Wales, and the USA suggesting shifts. Although the number of countries studied is still too few to make firm generalisations, there does not appear to be a relationship between the percentage of excess schizophrenic births and the countries with higher or lower prevalence rates for schizophrenia. In view of the firmly established seasonality of schizophrenic births, however, it would be surprising to find that the prevalence of schizophrenia did not vary around the world since seasons do vary from region to region.

Discussion

Despite methodological limitations, prevalence studies of schizophrenia published since 1948 suggest that there may be significant differences among population groups. Although the magnitude of these differences is debatable, I believe that a ten-fold range of prevalence for schizophrenia is supported by the data; this would be approximately comparable to the prevalence range reported for rheumatoid arthritis.

Since all hypotheses regarding the aetiology of schizophrenia would logically predict prevalence differences, it is not surprising that advocates of these hypotheses have utilised prevalence data to support their positions. Book (1953, 1978) explained his findings in northern Sweden by genetic mechanisms of inbreeding among the isolated population. Dohan *et al* (1983) claimed that the distribution of schizophrenia best fit nutritional theories of neuroactive peptides from grain glutens. Torrey (1980) put forth neuroviruses as the most logical explanation for the prevalence differences, and Murphy (1975) invoked psychosocial mechanisms such as the mother–son relationship in Ireland and the stress of acculturation in Ghana (Murphy, 1972) to explain the findings in those countries. The fact is that the studies on the geographical distribution of schizophrenia done to date do not point in any single aetiological direction.

The prevalence studies of schizophrenia do suggest important questions which need to be pursued. What portion of the lower rates reported from developing countries can be accounted for by the more benign course of schizophrenia in those countries? Is there a north–south gradient as has been shown for heart disease and multiple sclerosis? How much of the prevalence differences or changes over time are due

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to diagnostic differences? Groups such as the American Hutterites, northern Swedes, western Irish, and castes in India should be studied in detail with the collection of genetic, biochemical, nutritional, virological, immunological, and psychosocial data. Migrants from suspected high prevalence or low prevalence areas need to be followed to see whether their prevalence rate changes in their new home, similar to the work done in multiple sclerosis. Data on the seasonality of schizophrenic births should be collected in many more countries to ascertain its possible relationship to the prevalence of the disease. Ongoing case registers should be set up in areas thought to have a very high or very low prevalence.

There is one important advantage in studying the prevalence of schizophrenia—it does not require sophisticated and expensive laboratory equipment. We have grown accustomed in the waning years of the twentieth century to equating research with labora-tories. This is unfortunate, for some of the potentially most promising research on schizophrenia can be pursued with a diagnostic manual, pocket computer, and clinical acumen. There are methodological problems to be certain, but they are not any more formidable than those in laboratory research. As tragic a disease as schizophrenia is, it is also one of the greatest intellectual challenges of contemporary medicine.

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E. Fuller Torrey, MD, *Twin Studies Unit, William A. White Division, Saint Elizabeth's Hospital, Washington DC 20032, USA*

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