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A Prospective Study of First-Incidence Depression
The Lundby Study, 1957–72

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The present study is based on the so-called 1957 Lundby cohort, a geographically defined normal Swedish population of 2612 individuals who were evaluated for mental disorders in 1957 and 1972. The annual age-standardised first incidence of depression, with or without other psychiatric symptoms, all degrees of impairment included, was found to be 4.3 per 1000 person years in men and 7.6 per 1000 person years in women. Up until 70 years of age, the cumulative probability of suffering a first episode of depression was 27% in men and 45% in women.

Most epidemiological investigations on the occurrence of depression in the general population are prevalence studies, while incidence studies are scarce (Boyd & Weissman, 1981; Murphy *et al*, 1988). The main reason for this is probably that most community samples are not large enough to yield, within a reasonable period of time, enough new cases to enable calculations of incidence.

The present study is based on a Swedish normal population of 2612 individuals who on a certain date in 1957 constituted the total parish register of the inhabitants of a small, mainly rural area (Lundby) of Sweden. The population has been subjected to repeated evaluations by psychiatrists. First-incidence rates of depression during the following 15 years, 1957–72, are given.

Method

The investigation was performed within the framework of the so-called Lundby study, which was initiated in 1947 by Essen-Möller *et al* (1956). The population dealt with here differs from the original 1947 Lundby cohort, while methods for case finding, evaluation, collection of data, etc., have remained similar throughout the project. Before describing the present population, a short presentation of the historical background of the Lundby study is given.

The Lundby study

The study is based on a geographically defined Swedish population of 3563 persons who have been subjected to personal evaluations by trained psychiatrists on three occasions: in 1947, 1957, and 1972. Additional data were obtained from relatives, key informants, hospital records, and various official registers.

The project started in 1947, when Essen-Möller and collaborators made a point-prevalence study of all the 2550 inhabitants registered on a certain date in the Lundby parish register (Essen-Möller *et al*, 1956). In 1957 Hagnell made a follow-up study of the original population, irrespective of domicile, and also examined the 1013 newcomers in the Lundby area (Hagnell, 1966). In 1972 a second follow-up of the total population was performed, irrespective of domicile (Hagnell, 1986). Since in Sweden everybody must appear on a local register, and not more than one, this method of selecting samples gives unambiguously defined cohorts.

The three field examinations were performed in a similar way: the persons were visited, mostly in their homes, by a psychiatrist who carried out an interview focusing on mental health, adding a description of the personality and the environment. The interview was semistructured in the sense that the interviewer had to fill in a form for each proband on which a number of items were to be checked. Except for this limitation, the history taking was free. The only demands on the examiner were to use his skill and experience as a psychiatrist as fully as possible, and to record and describe his observations as completely as possible on the field examination form. The completed forms were then used as raw data, together with all other available outside information, in the final, global evaluation of 'caseness', diagnoses, etc., for later coding and scoring.

The present population

The 1957 Lundby cohort consists of all 2612 persons who were in the Lundby parish register on 1 July 1957; it can thus be considered as an unselected normal population. The age and sex distribution of the cohort is given in Table I. More than 98% were personally examined in 1957.

During the 15-year interval between 1957 and 1972, 706 persons moved out of the area, but almost all probands were revisited in 1972 and examined again irrespective of domicile. In only 0.6% of the population was the information not reliable enough for a psychiatric evaluation. (For a more comprehensive description of this 1957 cohort, see Hagnell *et al* (1986).)

Diagnostic criteria

The diagnostic criteria for depression have remained similar throughout the study. It would have been possible, at the

TABLE I
Survey of the 1957 Lundby cohort (n = 2612)

Age in 1957 (years)	*Men*	*Women*	*Total*
0– 9	169	171	340
10–19	216	209	425
20–29	170	149	319
30–39	170	150	320
40–49	193	189	382
50–59	201	172	373
60–69	99	123	222
70–79	70	82	152
80+	47	32	79
Totals	1335	1277	2612

1972 field examination, to use more modern diagnostic systems and to apply the standardised diagnostic instruments which were then available, such as the Mental Status Schedule or the Present State Examination. However, we chose to maintain the criteria adopted in the previous two studies in order to be able to make comparisons over time.

The main symptoms found in persons diagnosed as suffering from depression were the following:

> "Lowered mood, depressive feelings, tendency to guilt feelings, gloomy outlook, reduced activity, lack of initiative, reduced self-esteem, lowered enjoyment of life and feeling of low vitality, anxiety, and fear. Has more difficulty than usual, and is often unable to carry out his daily responsibilities. Sometimes retardation is present. The subject is often worse in the morning and better towards the evening. Often he has sleep disturbances and wakes up in the early morning. Loss of appetite and weight." (Hagnell, 1966)

Persons who in addition to depression as the most prominent symptom also had other coexisting psychiatric symptoms, such as anxiety, were included.

When comparing the Lundby criteria with other modern diagnostic systems, it can be said that most of the persons who were diagnosed as having depression in Lundby had a unipolar depression, and most of them corresponded broadly to the category major depressive disorder according to DSM-III (American Psychiatric Association, 1980).

Degree of impairment

The degree of impairment was rated as severe, medium, or mild, in accordance with the previous Lundby study (Hagnell, 1966). It should be emphasised that the 'mild' group does not include borderline cases; rather, even mildly impaired subjects had symptoms so obvious that the evaluating psychiatrist considered the depression to be definitely pathological and of clinical significance, requiring therapeutic intervention. For a shorter or longer period of time the subjects showed a reduced capacity to function, for many of them leading to a generally reduced activity of at least 50%. Severe cases, on the other hand, showed a total inability to work and function, and either depended on daily help or were completely taken care of periodically or permanently as a consequence of their depressive disorder.

A sample of illustrative case histories of probands with depression of different degrees of impairment is available on request.

Statistical methods

The first step in our statistical procedure was to determine, for each person involved, a period of risk. In the absence of any episode of depression before 1 July 1957, the risk period starts on that date; however, if such a previous episode has occurred, no risk period exists at all. Then the period, if any, lasts until 1 July 1972, death, or onset of depression, whichever occurs first. Note that the start of an episode once and for all terminates the risk period (as we wanted to study the incidence of *first* episodes of 'depression'). The risk period is then divided into segments, a new segment beginning when the person enters a new ten-year age group. Finally the results are aggregated over the entire cohort, i.e. for every age group the lengths of all risk-period segments in that age group are added together. In the same way the number of first episodes of depression is counted for each age group. During both these aggregation processes the two sexes are treated separately.

For each sex and each ten-year age group the sex- and age-specific incidence rate of first episodes of depression is estimated by the ratio $\mu = C/L$, where C is the number of first episodes and L is the aggregate period of risk, both relating to the sex and age group under consideration. The standard error of such an estimate is obtained by dividing the estimate μ by $\sqrt{C}$; thus

$$\text{s.e.}(\mu) = \mu \div \sqrt{C}$$

One way of summarising a set of age-specific incidence rates is to compute an overall incidence rate through standardisation. We have done this using direct standardisation, where the result is simply a weighted average of the age-specific rates, the weights being given by the age structure of a reference population. For our reference population we chose the Lundby cohort of 1 July 1947, in order to achieve comparability with other results from the Lundby study; note that it is only the *age* structure of the reference population that matters.

Another summary measure of age-specific incidence rates is the lifetime risk of developing the disease. As a first step towards computing that risk, one starts by computing, for each ten-year age interval, the probability p of contracting the disease during that interval; the equation is:

$$p = 1 - e^{-10\mu}$$

Strictly speaking, this probability is a conditional one: it refers to a person who has not experienced the disease before entering the age interval and who does not die,

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without having had the disease, before the end of that interval. The standard error of p is:

$$\text{s.e.}(p) = 10\ (1-p)\ \text{SE}(\mu)$$

Given probabilities p_1, p_2, . . . referring to single age groups, one computes cumulative probabilities P_1, P_2, . . . such that:

$$P_j = 1-(1-p_1)\ (1-p_2)\ \ldots\ (1-p_j)$$

Where P_j is the probability of having the disease before the end of the jth ten-year age interval (strictly speaking, conditional on not dying before that age without having had the disease). The standard error of P_j is:

$$\text{s.e.}(P_j) = 10\ (1-P_j)\ \sqrt{(\text{s.e.})^2(\mu_1)+(\text{s.e.})^2(\mu_2)+\ \ldots\ +(\text{s.e.})^2(\mu_j)}$$

Now, the lifetime risk is defined as P_j for some fairly large value of j; if we choose $j=8$ we obtain the risk of contracting the disease before the age of 80. Here, two points should be noted: (a) the probability is a conditional one, referring to persons who do not die, without having ever had the disease, before the age of 80; (b) the probability does not refer to an actually existing population – rather, it is a theoretical construct describing what would happen if the age-specific incidence rates observed in the cohort under study were conserved for a long time.

Results

Out of the total of 2612 persons in the 1957 Lundby cohort, 124 were diagnosed as having depression on the key date in 1957 or as having had at least one episode of depression; as already mentioned, these persons do not enter into our computations. Of the remainder, 205 had their first episode of depression during the following 15 years.

Table II gives the first incidence and risk of contracting depression with different degrees of impairment with or without other coexisting psychiatric symptoms in the 1957 Lundby cohort over 1957–72.

When all degrees of impairment are included (Table II (c)), 77 men and 128 women had their first episode of depression during the 15 years. The age-standardised annual incidence rate in this group was 4.3 per 1000 person years in men and 7.6 per 1000 person years in women; the difference between the sexes was statistically significant ($P<0.001$). In both sexes the majority fell ill between 20 and 60 years of age, with a peak in the age groups 40–49 for men and 20–29 for women. Among children under ten years of age and among persons aged 80 years and over no new cases were registered.

The cumulative probability of contracting any type of depression up to 70 years of age was 26.9% in men and 45.2% in women. The female dominance was statistically significant ($P<0.001$). Few of those diagnosed with depression were severely impaired (eight men, nine women) (Table II (a)). The findings are further illustrated by Figs 1 and 2.

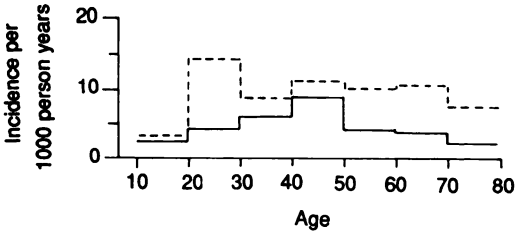

FIG. 1 Annual incidence, by age, of first episodes of any degree of depression with or without other coexisting psychiatric symptoms based on data from the Lundby 1957 cohort during the period 1957–72 ($n=2612$) (—— men; ---women).

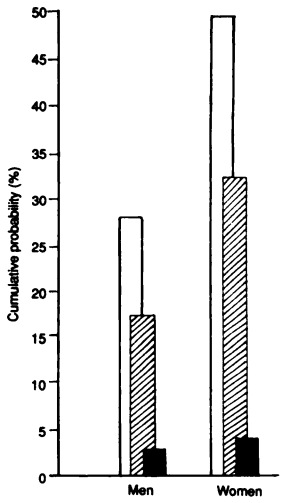

FIG. 2 Cumulative probability of suffering from depression with or without other coexisting psychiatric symptoms before the age of 80 based on data from the Lundby 1957 cohort during the period 1957–72 ($n=2612$) (degree of impairment: ■ severe; ▨ severe + medium; □ severe + medium + mild).

Discussion

In the present study we estimated the annual age-standardised first incidence of depression, all degrees of impairment included, to be 4.3 per 1000 person years in men and 7.6 per 1000 person years in women.

No first episodes of depression were recorded among children under ten years of age. Recent research has shown that depressive disorders can arise in childhood (e.g. Angold, 1988). In the present study we probably underestimated the occurrence of depression in childhood and early adolescence. The examining doctors had no training in child psychiatry. Most of

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TABLE II

First incidence and risk of developing depression with or without other coexisting psychiatric symptoms based on data from the Lundby 1957 cohort during the period 1957–72 (n = 2612)

Age interval	*Observation years of risk*	*No. of cases*	*Rate per year*	*Probability of disease during age interval*	*Cumulative probability of disease*
(a) Degree of impairment: severe					
Men					
0– 9	814.4	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
10–19	2682.0	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
20–29	2889.0	1	0.0003 (0.0003)	0.003 (0.003)	0.003 (0.003)
30–39	2488.0	3	0.0012 (0.0007)	0.012 (0.007)	0.015 (0.008)
40–49	2579.6	1	0.0004 (0.0004)	0.004 (0.004)	0.019 (0.009)
50–59	2922.5	3	0.0010 (0.0006)	0.010 (0.006)	0.029 (0.010)
60–69	2127.3	0	0.0000 (0.0000)	0.000 (0.000)	0.029 (0.010)
70–79	1108.0	0	0.0000 (0.0000)	0.000 (0.000)	0.029 (0.010)
80+	539.3	0	0.0000 (0.0000)	–	–
Total	18150.1	8		–	–
Age-standardised total			0.0004 (0.0001)		
Women					
0– 9	761.5	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
10–19	2651.5	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
20–29	2756.9	2	0.0007 (0.0005)	0.007 (0.005)	0.007 (0.005)
30–39	2263.5	1	0.0004 (0.0004)	0.004 (0.004)	0.012 (0.007)
40–49	2280.1	1	0.0004 (0.0004)	0.004 (0.004)	0.016 (0.008)
50–59	2550.3	0	0.0000 (0.0000)	0.000 (0.000)	0.016 (0.008)
60–69	2174.8	4	0.0018 (0.0009)	0.018 (0.009)	0.034 (0.012)
70–79	1340.7	1	0.0007 (0.0007)	0.007 (0.007)	0.041 (0.014)
80+	604.1	0	0.0000 (0.0000)	–	–
Total	17383.4	9		–	–
Age-standardised total			0.0004 (0.0001)		
(b) Degree of impairment: severe + medium					
Men					
0– 9	808.1	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
10–19	2633.1	3	0.0011 (0.0007)	0.011 (0.007)	0.011 (0.007)
20–29	2816.3	10	0.0036 (0.0011)	0.035 (0.011)	0.046 (0.012)
30–39	2393.0	7	0.0029 (0.0011)	0.029 (0.011)	0.073 (0.016)
40–49	2473.6	10	0.0040 (0.0013)	0.040 (0.012)	0.110 (0.019)
50–59	2733.5	11	0.0040 (0.0012)	0.039 (0.012)	0.145 (0.021)
60–69	1988.1	3	0.0015 (0.0009)	0.015 (0.009)	0.158 (0.022)
70–79	1008.0	2	0.0020 (0.0014)	0.020 (0.014)	0.174 (0.024)
80+	505.3	0	0.0000 (0.0000)	–	–
Total	17359.0	46		–	–
Age-standardised total			0.0023 (0.0004)		
Women					
0– 9	758.4	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
10–19	2602.0	3	0.0012 (0.0007)	0.011 (0.007)	0.011 (0.007)
20–29	2595.7	19	0.0073 (0.0017)	0.071 (0.016)	0.081 (0.017)
30–39	2008.7	10	0.0050 (0.0016)	0.049 (0.015)	0.126 (0.021)
40–49	1928.8	16	0.0083 (0.0021)	0.080 (0.019)	0.195 (0.025)
50–59	2155.2	14	0.0065 (0.0017)	0.063 (0.016)	0.246 (0.027)
60–69	1917.6	11	0.0057 (0.0017)	0.056 (0.016)	0.288 (0.029)
70–79	1153.1	6	0.0052 (0.0021)	0.051 (0.020)	0.324 (0.031)
80+	538.0	0	0.0000 (0.0000)	–	–
Total	15657.5	79		–	–
Age-standardised total			0.0044 (0.0005)		

(Cont.)

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TABLE II *(cont.)*

(c) Degree of impairment: severe + medium + mild					
Men					
0- 9	807.5	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
10–19	2617.4	6	0.0023 (0.0009)	0.023 (0.009)	0.023 (0.009)
20–29	2786.1	13	0.0047 (0.0013)	0.046 (0.012)	0.067 (0.015)
30–39	2306.5	15	0.0065 (0.0017)	0.063 (0.016)	0.126 (0.020)
40–49	2309.2	22	0.0095 (0.0020)	0.091 (0.018)	0.205 (0.024)
50–59	2620.2	11	0.0042 (0.0013)	0.041 (0.012)	0.238 (0.025)
60–69	1949.8	8	0.0041 (0.0015)	0.040 (0.014)	0.269 (0.027)
70–79	981.8	2	0.0020 (0.0014)	0.020 (0.014)	0.283 (0.028)
80+	482.6	0	0.0000 (0.0000)	-	-
Total	16861.1	77		-	-
Age-standardised total			0.0043 (0.0005)		
Women					
0- 9	757.2	0	0.0000 (0.0000)	0.000 (0.000)	0.000 (0.000)
10–19	2579.4	8	0.0031 (0.0011)	0.031 (0.011)	0.031 (0.011)
20–29	2457.7	37	0.0151 (0.0025)	0.140 (0.021)	0.166 (0.023)
30–39	1795.2	16	0.0089 (0.0022)	0.085 (0.020)	0.237 (0.027)
40–49	1733.7	20	0.0115 (0.0026)	0.109 (0.023)	0.320 (0.030)
50–59	1903.5	20	0.0105 (0.0023)	0.100 (0.021)	0.388 (0.030)
60–69	1734.6	19	0.0110 (0.0025)	0.104 (0.023)	0.452 (0.030)
70–79	1060.5	8	0.0075 (0.0027)	0.073 (0.025)	0.491 (0.031)
80+	482.0	0	0.0000 (0.0000)	-	-
Total	14503.8	128		-	-
Age-standardised total			0.0076 (0.0007)		

Values in parentheses are standard errors.

the deviations found in the 0–15-year age group were classified under the broad heading of child neurosis. The comparably few new cases (ten altogether) found among persons 70 years and over may also be an underestimate, mirroring the difficult differential diagnosis between depression and normal ageing, as well as between depression and the early stages of dementia. The finding that an onset of depression is relatively rare in old age is, on the other hand, in agreement with most other similar epidemiological studies.

From the NIMH Epidemiologic Catchment Area (ECA) Program, Eaton *et al* (1989) reported one-year first incidences of several DSM–III categories of mental disorder including major depressive disorder. When four of the ECA catchment areas were pooled together, the one-year first incidence of major depressive disorder was found to be 11.0 per 1000 person years in men and 19.8 per 1000 person years in women; it should be noted that Eaton *et al* considered incidence only in people who were at least 18 years old at the first interview.

From the Stirling County study, Canada, Murphy *et al* (1988) presented first incidences of depression and anxiety. For depression they found the age-standardised annual first incidence to be 2.1 per 1000 person years in men and 2.5 per 1000 person years in women.

The incidences arrived at in our investigation are thus lower for both sexes than those reported by the US team and higher than those reported by the Canadian team. The female dominance was statistically significant in the ECA study as well as ours.

In our study, severe first-time episodes of depression were rare.

As emphasised by Murphy *et al* (1988) and other workers in this field, psychiatric epidemiological studies need to be viewed in the context of the different times and places of investigation as well as of the differences in methods and definitions. In the following we do not present definite explanations, but present some aspects of the discrepancies found.

The population studied, the time period covered, and the recall of the probands

This study and the Canadian study show many similarities concerning these three background characteristics. The Stirling County area and the Lundby area are both rural, undergoing modernisation and urbanisation. This study covers the period

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1957–72; the Stirling County study 1952–68. The field examinations were performed 15–18 years apart in our study and 16–18 years apart in the Stirling County investigation. Proband recall ought thus to be similar in the two studies. The ECA study, on the other hand, was based on urban samples. The study started in 1980, and the time that passed from the first to the second interview was about 380 days.

It is well known that mental illness is more common among persons living in urban areas. During recent years there have been some indications that depression is increasing in modern society (Klerman, 1978; Schwab *et al*, 1979; Hagnell *et al*, 1982). The considerably higher incidence of depression found in the US study compared with the Lundby and Canadian studies might at least partly be due to differences concerning time and place, as well as differences concerning the recall of the probands involved.

The interview

In the Canadian and US studies the interviews were performed by lay persons trained for the specific questionnaires used. The Lundby field examinations were carried out by psychiatrists. As far as we are aware, psychiatric general population surveys of comparable size, in which psychiatrists personally interview and evaluate the probands, are uncommon. A similar clinical approach was used by Kay *et al* (1964, 1970) in the Newcastle upon Tyne survey and more recently in the Upper Bavarian field study (Dilling & Weyerer, 1980; Meller *et al*, 1986; Fichter *et al*, 1988), and in a follow-up of 70-year-old people in Gothenburg (Svanborg, 1977; Nilsson, 1984).

A fundamental part of the psychiatric interviewing is the observation of behaviour and the effort to uncover normal and abnormal attitudes and emotions. It is not only what is said that is of importance, but also how it is said, how the person reacts, and a multitude of other non-verbal ingredients in the interview.

The use of a psychiatrist as interviewer must have influenced the findings arrived at in this study. However, it is difficult to say to what extent the professional status of the interviewer increased or decreased the number of cases counted. Given an attentive listener, most people are eager to talk about themselves. The listener being a physician probably helped to achieve the high participation rate that characterises this study (98%). The clinical background of the evaluating physicians probably made them more prone than laymen to critically analyse the psychiatric histories given by the probands. On the other hand, physicians may in some cases run into the trap of 'medicalisation' and 'psychiatrisation'.

The definition of a case of depression

Our criteria for depression seem to have many similarities with the computerised symptom patterns applied for diagnosing depression by Murphy *et al* in the Canadian study. The ECA group used DSM–III, and the Diagnostic Interview Schedule (DIS; Robins *et al*, 1981, 1985). These diagnostic tools were not available for the Lundby team in 1972. However, we feel fairly certain that most of the persons who were judged to have depression in the Lundby study would have received a diagnosis of major depressive disorder had they been subjected to strict, structured diagnostic procedures according to DIS or DSM–III.

The definition of depression used in this study is mainly based on the global, clinical impression of a psychiatrist, and may seem rather subjective, unsophisticated, and broad compared with the precise diagnostic techniques that are now available. The attempt to construct strict, comparable diagnostic criteria for mental disorders has had a tremendous impact on modern psychiatry and has brought about an increased interest in psychiatric epidemiology all over the world. However, many problems still remain. Standardised interviews may, for example, in the hands of less careful researchers, result in what Barrett (1986) calls "pseudo-comparability of diagnosis", and thus give a false sense of exactness in diagnosing. Our opinion is that 'soft-data studies' of the kind presented here are still of importance.

Conclusion

The first-incidence rates for depression presented here are lower than those reported from the ECA Program and higher than those presented from the Stirling County study. The occurrence of depression in this population was also studied in terms of cumulative probabilities. Among those who lived until 70 years of age more than a quarter of the men and nearly half of the women had experienced, at least once, depression of such severity that the evaluating psychiatrist considered the disorder to be of clinical significance. The results are of course representative of only one particular cohort at one particular time.

One fundamental requirement when combating mass diseases like mental disorders is to find out their occurrence in the ordinary, unselected population.

The prospective, long-term design of the Lundby study makes it suitable not only for calculations of the incidence of mental disorders, but also for analysing factors that might be of aetiological or prognostic importance.

The present findings indicate that 'normal' people run a high risk of developing a depressive disorder. In on-going studies, persons with depression in the Lundby study are being investigated for, for example, premorbid personality traits and familial distribution of depression.

Acknowledgements

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