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**First- incidence Depression in the Lundby Study. A comparison of the two  
time periods 1947-1972 and 1972-1997**

**Cecilia Mattisson<sup>1</sup>, Mats Bogren<sup>1</sup>, Per Nettelblatt<sup>1</sup>, Povl Munk-Jørgensen<sup>2</sup>, Dinesh  
Bhugra<sup>3</sup>**

**<sup>1</sup> Department of Clinical Neuroscience  
Division of Psychiatry, the Lundby Study**

**Lund University Hospital, St Lars  
SE-221 85 Lund  
Sweden**

**<sup>2</sup> Unit for Psychiatric research  
Aalborg Psychiatric hospital  
Mölleparkvej 10, Postboks 210  
DK-9100 Aalborg  
Aarhus University Hospital  
Denmark**

**<sup>3</sup> Section of Cultural Psychiatry  
PO 25 HSRD  
David Goldberg Centre  
Institute of Psychiatry**

**De Crespigny Park**

**London**

**SE 5 8 AF**

**United Kingdom**

**Telephone +46 46 17 43 10**

**Telefax +46 46 17 46 47**

**E-mail: [cecilia.mattisson@psykiatr.lu.se](mailto:cecilia.mattisson@psykiatr.lu.se)**

## Abstract

**Background:** The Lundby Study is a prospective, longitudinal study on a total population consisting of 3563 probands. The first field investigation was done in 1947 and the last in 1997. This study compares incidence rates of depression over the two time periods 1947-1972 and 1972-1997.

**Method: The Lundby Study started in 1947 with** the aim of studying mental health and the distribution of personality traits in an unselected population. Follow-ups were carried out in 1957 and in 1972. In 1997 the surviving probands (N=1797) were interviewed by psychiatrists with a semi-structured interview. Best-estimate consensus diagnoses were used and ICD-10 and DSM-IV diagnoses were added. Further, 1030 probands who had died during the last follow-up period 1972-97 were investigated.

**Results:** Women had higher incidence rates than men in both periods. Stable incidence rates of depression were found for men but the incidence rates for women were moderately lower in the last period, 1972-1997.

**Limitations:** The recall period is of considerable length, probably introducing recall bias. The interrater-reliability over 50 years is fairly acceptable concerning depression.

**Conclusion: For men** the incidence rates in the Lundby Cohort were stable over time, but a decrease was reported for women. This finding suggests that the trend of increasing rates of depression in the Lundby cohort has terminated.

**Key words:** The Lundby Study; Incidence study; Prospective study; Depression; Psychiatric Epidemiology.

## Introduction

The Lundby Study is a prospective, longitudinal study that started in 1947 and is, along with the Stirling County Study (Murphy et al., 2004), an internationally well known study extending over a long follow-up period. The follow-up period is 50 years for the Lundby Study whereas it is 40 years for the Stirling County Study. The Lundby Study was initiated by Essen-Möller (Essen-Möller, 1956) in 1947 and the last field investigation was carried out 1997-2000 (Nettelbladt et al., 2004).

In a classic paper based upon the 1947 cohort an increase in the incidence of depressive disorders with mild and moderate degree of impairment was reported for both sexes, when the 10-year period 1947-1957 was compared with the 15-year period 1957-1972 (Hagnell et al., 1982). Interestingly, the reverse was found for depression with severe degree of impairment, which decreased for both women and men, over this time period.

Based upon data from the 1947 Lundby cohort the age-standardised annual incidence of depression, all degrees of impairment, included was found to be 1.4 per 1000 person years for men and 4.1 for women during the 1947-1957. For the 15 year period 1957-1972 the annual incidence for men was 3.7 and 7.7 for women. Data from the 1957 cohort showed that the age-standardised annual incidence for depression, all degrees of impairment included, was 4.3 per 1000 person years in men and 7.6 per 1000 person years in women for the period 1957-1972 (Rorsman et al., 1990).

These rates can be compared with the findings from the Stirling County Study from Canada (Murphy et al., 2000) which showed that the rates for men and women were in fact the same and that the overall annual incidence of depression was 3.8 per 1000 person years for the period 1952-1992. They reported that the average annual incidence of depression remained

rather stable over time. In 1996, the Finnish UKKI Study (Lehtinen et al., 1996) reported from a sample followed for 16 years, that the incidence of neurotic depression was 2.0 per 1000 person years in men and 2.7 per 1000 person years in women. In the UKKI Study also stability in the incidence of neurotic conditions over time (including depressions) was found.

The Epidemiologic Catchment Area Study (ECA) from the United States of America (Eaton et al., 1989) reported an overall first incidence for DSM-III major depressive disorder for both sexes of 15.9 per 1000 person years for all ages. Interestingly, in 1997 a follow-up 12 years after the initial data were collected an estimated incidence of 3.0 per 1000 per year for DSM-IV major depression was observed in Baltimore (Eaton et al., 1997). A more recent example of a prospective study of the first incidence of mental disorders is the NEMESIS Study in the Netherlands (Bijl et al., 2002). The observation period was one year. For DSM-III-R major depression the incidence rate for men was 17.2 and for women 39.0 per 1000 person-years at risk, which were higher incidence rates than in the ECA Study and markedly higher than in the Stirling County Study (Murphy et al., 2000) as well as the UKKI Study (Lehtinen et al., 1996).

We set out to compare the first incidence rates in the Lundby Study in the two time periods 1947-1972 and 1972-1997. The aim was to ascertain whether first incidence rates of depression were stable over these time periods, to determine the gender differences in the rates and to establish whether these gender differences remain stable.

## **Material**

The present study is based on 3563 probands of two partly overlapping cohorts from the Lundby Study. The Lundby Study started in 1947 when Essen-Möller (Essen-Möller, 1956) and collaborators carried out a prevalence study of the 2550 inhabitants registered on the

cross-sectional day of July 1, 1947, in the Lundby area in the south of Sweden. The study was from the beginning based on a geographically defined population (N=2550) which constituted the 1947 cohort.

In 1957, a follow-up of the surviving probands (N=2297) was carried out. Also 1013 newcomers to the area were included in the 1957 cohort (Hagnell, 1966). These newcomers included all those who were born in the area and also those who had moved into the area. During the same time period 1947-1957, 698 had moved out from the area and 253 had died. The 1957 cohort (N=2612) was geographically defined and represented those who were registered in the Lundby area on the cross-sectional day July 1 1957. Subjects that had moved out from the Lundby area, were not included in the 1957 cohort, but followed up irrespective of domicile as part of the follow up of the original 1947 cohort. After 1957 no new subjects were added to the study. In 1972, all subjects were traced and investigated again irrespective of their area of domicile (Hagnell et al., 1975). For those who had died, during this period information was obtained through relatives, key-informants, case notes and registers.

In 1997, 50 years after the initial field investigation a third follow-up was carried out (Nettelbladt et al., 2004). The population on the cross sectional day July 1, 1997 consisted of 1797 probands, 851 men and 946 women, aged 40-96 years. The interview data from this sample were collected between 1997-2000. During the time period 1972-1997, 1030 subjects had died and information about them was collected as in earlier field investigations through relatives, key-informants, case notes and registers. Although most subjects had moved from the Lundby area it was possible to trace a majority of the subjects. Since the start of the Lundby study, the subjects that had moved out from the Lundby area had been followed up. The Lundby cohort consists of the subjects who were registered in the area on July 1, 1947 or July 1, 1957.

## Subjects

The Lundby area of the 1940s was a rural area that since then has undergone considerable changes. Most people of working age commute nowadays to working places in the nearby cities and 50% of the subjects have moved out from the Lundby area.

On the cross-sectional day 1 of July 1997 the survivors of the total population (N=3563) were 1797 (50% ), aged 50-96 years (the 1947 cohort) and 40-96 years (the 1957 cohort). 1766 were deceased. Of the 1797 living subjects 87% (N= 1559) were respondents. Of the 238 probands who did not participate in the last follow-up 130 refused, a further 55 had died before an interview could be completed and 53 were untraceable.

Information from key-informants was collected for 23 % of the living subjects (N=1797) and for 64% (N=1030) of the deceased. Case-notes were assessed for 24 % of the living subjects and for 49 % of the deceased. Of the 1030 probands who had died ,sufficient information for an evaluation was obtained for 1018. For the whole population , dead and living (N=2827) in the period 1972-1997, the attrition rate was 5 % for the men and 7% for the women.

*Insert table 1 about here*

## Procedure

The interviews in 1947, 1957 and 1972 were similar. The fieldworkers used a card on which identification data were already entered. The examiner was free to follow interesting psychiatric diagnostic threads.

The methods used in the last follow-up 1997 were similar compared to the previous field investigations in most aspects. All fieldworkers were psychiatrists and trained at the same



clinic. An introductory letter had been sent to the proband and an appointment was scheduled by telephone which was not the case in the former field investigations. Because of long distance or sometimes reluctance to meet an interviewer at home, 128 interviews were accomplished by telephone. Hagnell and Öjesjö who accomplished the fieldwork in 1972 were supervisors for the new interviewers which guaranteed continuity of the method.

Learning from previous experience additional questions were added to the interview schedule, these covered the subjects physical and mental health in the previous 25 years. Life events, occupational problems and stress in the family were explored. The interview also included questions about substance abuse and dependence, including alcohol. The social networks were explored by asking questions about relationships and social support.

A free description of the psychiatrist's findings was done after the interview. After the interview a preliminary diagnosis was suggested by the fieldworker – psychiatrist.

Information on the 1030 deceased probands was collected from multiple sources such as the Cause of Death Register (Cause of Death Register, 2004) the Patient Register in Sweden (Patient Register, 2004) consisting of information about all in-patient care 1972-1997 and the Dalby-Tierp Register (Dalby-Tierp Register, 2004). These sources were also used to supplement interview data. A more comprehensive description of the material and method is given elsewhere (Nettelbladt et al., 2004).

## **Diagnostic criteria**

The Lundby Study started before the DSM system (American Psychiatric Association, 1994) was established and before structured diagnostic instruments were available. The diagnostic criteria for Depression used in the Lundby Study have remained same over the years. These include: “Lowered mood, depressive feelings, tendency to guilt feelings, gloomy outlook,

reduced activity, lack of initiative, reduced self-esteem, lowered enjoyment of life and a 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).

There is also a diagnosis of Depression +. In these instances there is a clear depressive disorder with lowered mood although other symptoms such as anxiety, obsessive symptom or other symptoms could also be prominent. Even if there are coexisting symptoms the depressive symptoms are primary and predominant. Depression and Depression +, are combined together in our calculations. Adjustment disorders with predominant depressive mood and major depressions with psychotic symptoms were also included in the calculations.

Following the previous conventions (Hagnell, 1966) the degree of impairment for every episode was rated as severe, medium, or mild (Leighton et al., 1963). For the follow-up in 1997 the three degrees of impairment; severe, medium and mild had been roughly approximated to GAF-scores; mild degree of impairment corresponds to GAF 70-61, medium degree of impairment corresponds to GAF 60-51 and severe to GAF 50-1. DSM-IV diagnoses (American Psychiatric Association, 1994) and ICD-10 (The ICD-10 Diagnostic criteria for research, 1993) diagnoses were also used in the last field investigation 1997-2000. According to Eaton (Eaton et al., 1997) the Lundby diagnosis Depression of medium and severe degree of impairment, roughly corresponds to major depression in DSM-IV. We have restricted our analysis to Depression of medium and severe degree of impairment.

## The assessment

The Lundby diagnostic system is a simplified classificatory system based on symptoms and adapted to fieldwork. It has been used since 1957. In order to compare the interrater-reliability between the fieldworkers from 1957, 1972 and 1997 Cohen's kappa was calculated. 200 probands were diagnosed blindly (by M.B. and C.M.) from a random sample from the Lundby cohort for the period 1947-1972. Cohen's kappa value was 0.6 for Depression which indicates substantial agreement (Landis and Koch, 1977).

*Insert table 2 about here*

The final evaluations were made after collecting case notes, data from key-informants and registers. We had access to the Cause of Death Register (Cause of Death Register, 2004) and in due instances autopsy records were ordered. Of special importance was the Patient Register (Patient Register, 2004) containing information about all in-patient care, 1972-1997. All hits were followed up with collections of available records. Case notes, both psychiatric (from hospitals and outpatient clinics) and non-psychiatric case notes, were collected. A consensus diagnosis was reached and DSM-IV diagnoses, ICD-10 diagnoses and the Lundby simplified diagnostic system were used.

## Exclusion criteria

Living and deceased probands with only mild depressions were not counted as cases. Cases with Depression which had had a previous episode of Tiredness with depressive symptoms or Anxiety with depressive symptoms were not counted either as cases in order to ensure that cases with Depression, were true first incident cases.

## **Statistical analysis**

Calculations of the first incidence rates were based upon individuals who by the start of follow-up had been free from the outcome under study. The risk period starts at baseline and ends either if the subject becomes a case, at death or at the end of the study period. Cases of dementia, schizophrenia and other psychoses were censored from the calculations after fallen ill in their disease. Incidence rates were calculated for each gender separately, and were computed for the three age intervals 15-39, 40-69 and 70-99 during the two time periods 1947-72 and 1972-97. For the comparison of average annual incidence over time standardisation was done.

Age and sex-specific probabilities of contracting depression were calculated as well as the cumulative probabilities. The standardised incidence rates were compared by calculating 95% confidence intervals (Clayton and Hills, 1993).

## **Results**

### ***Attrition***

The field investigations in 1947, 1957 and 1972 achieved a very low attrition rate around 1-2 %. In the 1997 follow-up the attrition rate for the living population was 13 %. Attrition rate for those who had died were 1.2 %.

### ***Incidence rates***

*Insert table 3 about here*

For men, 15-39 years, nearly the same first incidence rates of depression for the period 1947-1972 and the period 1972-1997 were observed. There was a moderate decrease for men aged 40-69 in the period 1972-1997, but for over 70s there was an increase in incidence rates.

*Insert table 4 about here*

For women, 15-39 years, first incidence rates showed a slight decrease from the first time period 1947-1972 to the next time period 1972-1997. In those aged 40-69 there was a moderate decrease between the two periods. There was a slight increase in the incidence among the women in the age interval 70-99 in the period 1972-1997.

### ***Cumulative probabilities (Table 3 and 4)***

In 1947-1972 the cumulative probability for developing a depression for men was 22.8 % and for women 35.7 %, calculated up to 99 years. The corresponding figures for the period 1972-1997 for men were 22.5% and for women 30.7 %.

### ***Gender distribution (Table 3 and 4)***

The women had significantly higher incidence rates compared with men in both periods.

### ***Average annual incidence (Table 3 and 4)***

The average annual incidence rate of depression was for men 3.3 per 1000 age standardised person years and 2.8 per 1000 age standardised person years for the latter period. For women the corresponding figures were 5.5 per 1000 person years and 4.1 per 1000 person years in the latter period. The observed decrease in women was statistically significant. The overall average annual rates of depression for the population at risk was for the period 1947-1972 4.4 per 1000 person years compared to 3.5 in the period 1972-1997.

## Discussion

There are several methodological difficulties and limitations inherent in incidence studies. It is difficult to compare different studies since they are never identical. The Lundby Study has since the beginning in 1947 relied on multiple sources as case-notes, registers and key-informants enhancing the quality of data. In the Lundby Study we had access to fewer registers such as the Social Insurance Register in the period of 1972-1997 and this lack of information may have influenced our results.

On the other hand, the strength of the Lundby Study is that the interviewers had been experienced clinicians in all investigations. Again, a disadvantage is the long recall period up to 25 years, even though we had access to other sources of information. The long recall period may have yielded lower incidence rates from 1972-1997 because of recall bias. Presumably most mild cases are lost due to forgetfulness, and cases of severe and medium impairment are probably more often remembered and registered.

It has been suggested that the incidence rates of depression were increasing after World War II (Klerman and Weissman, 1989), which is partially borne out by our data. According to the global burden of disease study (Murray and Lopez, 1996) unipolar major depression was the fourth leading cause of disability adjusted life years in 1990 and was suggested to rise to the second in 2020 due to demographic changes in the worldwide population.

The present data suggest that the trend with increasing rates of incidence seems to level off for subjects in the aged 15-39 and 40-69. On the other hand, we found an increase in the incidence rates in the oldest age groups (age interval 70-99) suggesting differences in trends of incidence rates. We found that rates of depression are fairly stable for men, but falling for women. These findings are partly in line with what has been reported from the Stirling

County Study (Murphy et al., 2000). In the Stirling County Study the incidence rates of depression among women compared with the ones of men were higher for both time periods. In 1952 -1970 the total average annual incidence for women was 5.0 per 1000 person years compared with 3.8 for men. The corresponding results for the time period, 1970-1992 were 3.8 for women and 3.5 for men. The difference in incidence rates between the genders for both time periods was not statistically significant as it is in our study.

Some of the differences may be explained by differences in methods of data collection and diagnostic assessment. The highly structured DPAX interview was administered by trained laymen in the Stirling County Study, while a semi structured interview was used by psychiatrists in the Lundby Study.

In comparison with the UKKI Study from Finland (Lehtinen et al., 1996) we report higher figures, but again our methods concerning case finding were not identical since we had tried to detect new cases between the follow-ups, which is a difference between the studies and probably explains the lower figures in the UKKI study. Our results show a higher incidence of depression, but the samples also differ concerning age intervals. In the Lundby Study, the elderly up to 99 years old were included and this was not the case in the Finnish study. The length of the follow-up is clearly important as pointed out by Lehtinen (Lehtinen et al., 1996); the longer the follow-up period is, probably more new cases are lost. In our study access to other sources of information such as psychiatric case-notes, registers and key-informants strengthens our findings to some extent.

We report much lower incidence rates than the NEMESIS study (Bijl et al., 2002), which reports the first 12 months incidence of DSM-III-R disorders and thus has a short period of follow-up. In the ECA Baltimore follow-up (Eaton, 1997) with a median time of 12.6 years

between baseline and follow-up of an estimated incidence of 3.0 per 1000 per year was reported which is similar to our results of an overall estimated incidence of 3.4 per 1000 per year in the period 1972-1997.

The declining cumulative probability for women may have several possible explanations. One reason could be the long recall period and that some episodes of depression may have been forgotten especially if these were short-lived, not serious enough or did not require treatment. Another possible explanation maybe that the health of women had improved due to a better socio economical status for women since 1972. The possibility that the diagnosis of depression has changed compared to the earlier models is unlikely in this case, since we have used same diagnostic categories and symptom sets as the earlier investigations.

In the Lundby Study we have higher incidence rates for women than in men in all age intervals, but the differences are not as prominent as reported by some authors (Klerman and Weissman., 1989). The differences between the genders were less pronounced in the time period 1972-97.

A major strength of our study is that attrition rates in the investigations 1947, 1957 and 1972 were very low. The number of drop-outs in the investigation 1997-2000 were also fairly acceptable.

The fieldworkers of 1957 and 1972 probably achieved more comprehensive information of the population studied and they also had access to more well-informed key informants. These background factors and methodological difficulties may have contributed to our observations of lower first incidence rates for the time period 1972-1997 compared with the time period 1947-1972.



With this background in mind and the above described limitations our results must be cautiously interpreted and the figures must be regarded as low estimates. Earlier field investigations, in the Lundby Study had pointed out a rise in the incidence of depression after World War II (Hagnell et al., 1982). This trend now seems to have terminated in the Lundby Study.

## **Conclusion**

Lower annual age standardised incidence rates for women and fairly stable ones for men are seen when we compare the two time periods 1947-1972 with 1972-1997 indicate that gender differences continue to play a role. A rise in the incidence rates for the elderly for both genders was detected. In spite of the methodological problems in the data collection we are fairly confident that our findings indicate changing patterns of first incidence of depression in this sample.

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**Table 1**

The distribution of the Lundby population 1947-1997  
at the four field investigations.

	Men	Women	Total	Age
1947	1312	1238	2550	0-80+
1957	1696	1614	3310	0-80+
1972	1425	1402	2827	15-80+
1997	851	946	1797	40-80+

**Table 2**

Inter- rater reliability between research teams before and after 1972.

		Field team 1957-1972			
		No diagnosis	Depression	Other diagnosis	Total
Field team 1997	No diagnosis	139	1	5	145
	Depression	1	6	6	13
	Other diagnosis	19	1	22	42
	Total	159	8	33	200

**Table 3**

The incidence and risk of contracting Depression for the first time in the Lundby population 1947-72 and 1972-97 for **men** per 1000 person years.

<b>1947-72</b>					
Age interval	1 <sup>st</sup> inc cases	Obs years	Inc rate	95% Conf interval	Cumulative prob %
15-39	39	13660.9	2.9	2.0-3.8	6.9
40-69	53	13511.3	3.9	2.9-5.0	17.2
70-99	6	2583.1	2.3	0.5-4.2	22.8
Age-stand.Tot.	98	29755.3	3.3	2.6-4.0	
<b>1972-97</b>					
15-39	15	5317.8	2.8	1.4-4.2	6.8
40-69	35	14070.9	2.5	1.7-3.3	13.5
70-99	14	3839.8	3.6	1.7-5.6	22.5
Age- stand.Tot.	64	23228.5	2.8	2.1-3.5	

**Table 4**

The incidence and risk of contracting Depression for the first time in the Lundby population 1947-72 and 1972-97 for **women** per 1000 person years.

<b>1947-72</b>					
Age interval	1 <sup>st</sup> inc cases	Obs years	Inc rate	95 % Conf interval	Cumulative prob %
15-39	60	12543.9	4.8	3.6-6.0	11.3
40-69	75	11896.9	6.3	4.9-7.7	26.6
70-99	12	2712.2	4.4	1.9-6.9	35.7
Age- stand.Tot.	147	27153.0	5.5	4.6-6.4	
<b>1972-97</b>					
15-39	21	5169.9	4.1	2.3-5.8	9.7
40-69	49	12436.5	3.9	2.8-5.0	19.7
70-99	22	4476.3	4.9	2.9-7.0	30.7
Age- stand.Tot.	92	22082.7	4.1	3.7-5.0	