

BRIEF COMMUNICATION

Parental separation at birth and depression in adulthood: a long-term follow-up of the Finnish Christmas Seal Home Children

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ABSTRACT

Background. Early separation of a child from the mother has been considered a risk factor for later depression. We investigated the association between very early separation and depression in adulthood in a unique dataset.

Method. The index cohort consisted of 3020 subjects born in 1945–1965 in Finland, isolated from their family due to tuberculosis in the family and placed in special nurseries, immediately after birth, for an average time of 7 months. Those subjects alive at 1 January, 1971 were identified. For every index subject two reference subjects were chosen, the matching criteria being sex, year of birth and place of birth. Data on depression were obtained from the Finnish Hospital Discharge Register by the end of year 1998.

Results. In males, 4.2% of the index subjects and 2.6% (Adjusted Rate Ratio RR 1.7, 95% CI 1.3–2.3) of the reference subjects had been treated in hospital due to a depressive episode. In females the respective figures were 3.9% for index subjects and 3.6% (RR 1.1, 95% CI 0.8–1.5) for reference subjects.

Conclusions. The index subjects had an elevated risk for hospital treated depression in adulthood. One explanation may be that the very early temporal separation from the mother at birth may have unfavourable effects on later psychological development. On the other hand, separation from the parents at birth was not found to be strongly associated with severe adulthood depression.

INTRODUCTION

Adverse experiences in childhood have been found to raise the risk for depression in adult life (Brown & Harris, 1993). Several have focused on the effects of childhood separation. The results of these studies have been somewhat variable. Some studies have shown that childhood separation is a risk for later depression (Sethi, 1964; Bowlby, 1978; Brown & Harris, 1978; Lloyd, 1980; Kennard & Birtchnell, 1982; Roy, 1985; O'Neil *et al.* 1987), while others have

reported an unclear connection between childhood separation and depression in adulthood (Abrahams & Whitlock, 1969; Hällström, 1986; Zahner & Murphy, 1989; Kendler *et al.* 1992, 2002). Harris *et al.* (1986) and Rutter (1989) have emphasized that the significant factor may not be the separation itself, but rather its consequences. The consequences depend on the quality of separation: the age of the child, permanency of separation and whether separation was due to parental divorce, parental death or other reasons.

We studied the association of very early separation from the caregiver and later development

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of depression in a unique dataset. The subjects were separated from their families at birth to remove them from the risk of tuberculosis during their first year of life.

METHOD

In 1936 the Finnish Anti-Tuberculosis Association founded the first institution, *Joulumerkkikoti*, the 'Christmas Seal Home', into which were gathered the children born into families with tuberculosis. The institutions were funded by selling special Christmas seals or stamps for Christmas cards, this method of funding was also used in the campaign against tuberculosis in other Nordic countries and the United States (Doyle, 1989). The newborns were first isolated and then given BCG vaccination to reduce the risk for tuberculosis (Anttolainen, 1972). Usually, the newborn entered the Christmas Seal Home within the first 24 hours of life. This was done with maternal consent and became an accepted aspect of public health policy and practice. Care in the Christmas Seal Homes was provided by specialized doctors and nurses according to prevailing standards. During the isolation all infants were given milk from other mothers. Efforts were made to keep in contact with the children's families, e.g. by mail, and to maintain the link between children and their families. An attempt was made to ensure that every child would have his/her own nurse as a maternal substitute, even though each nursery nurse had more than one infant to care for (Tamminen, 1982). This policy employed for children born into families with tuberculosis was effective in reducing early mortality and morbidity of tuberculosis (Anttolainen, 1972).

The average separation time was 218 days. For those born between 1945 and 1954 the length of stay in nurseries was longer (in average 242 days) than for those born between 1955 and 1965 (206 days). Until 1953, mortality in the nurseries was noticeably high, but after that the mortality was even lower than the infant mortality in the general population in Finland (Anttolainen, 1972). After the separation period, 93% of the children were returned to their homes.

The index cohort consisted of 3020 subjects (1617 males and 1403 females) born from 1945 to 1965 and isolated in the nurseries, and who

were alive on 1 January 1971. For every identified index subject two matched reference subjects were randomly chosen from the Population Register matched for sex, year of birth and municipality at birth. Six of the reference subjects had, however, died and 40 had emigrated from Finland before 1 January 1971. In addition, 24 index subjects were accidentally assigned by the Population Register Centre to be reference subjects. After these exclusions 70 (2.3%) index subjects had only one comparator. Altogether we obtained 5970 reference subjects (3197 males and 2773 females). The study is described in more detail by Mäki *et al.* (2003).

A 28-year follow-up for the cumulative incidence of depression began on 1 January 1971 and ended on 31 December 1998. The subjects between ages 6–26 were followed up until ages 33–53. It was decided that 1 January 1971 was to be the starting date of the follow-up, because from that year onwards the data in the computerized files were considered to be reliable. The Population Register Centre provided the information on date of death and emigration from Finland. The discharge date of the first hospitalization due to depressive episode was obtained from the Finnish Hospital Discharge Register (FHDR). All Finnish citizens have virtually free access to in-patient and out-patient health care. The FHDR contains all diagnoses, admission and discharge dates for in-patient stays at public and private facilities.

During the 28-year follow-up period, three different diagnostic classification systems were used on the FHDR, namely ICD-8 until the end of 1986, ICD-9 for the years 1987–1995 and ICD-10 from 1 January 1996. Depression included ICD codes 2960, 2968, 3004 (ICD-8), codes 2961, 2968, 3004 (ICD-9) or codes F32–F34 (ICD-10). Psychotic level depressive episodes were those with codes 2960, 2968 (ICD-8), 2961E (ICD-9) or F323, F333 (ICD-10).

Individual follow-up was stopped at the date of death, emigration, the date of first admission due to depressive disorder, or on 31 December 1998, whichever came first. Descriptive Kaplan–Meier analyses were performed for the index group and the reference group. We also stratified the groups by sex and by birth cohort to those born in 1945–1954 and those born 1955–1965, respectively. The statistical analyses of the relative morbidity rate for depression

Table 1. Cumulative incidence (%) of psychotic and non-psychotic hospital treated depressive episodes (from 1 January 1971 up to 31 December 1998 after controlling for onset of illness, emigration date and date of death) in the index and reference cohorts, and the estimated rate ratio (RR with 95% confidence interval, CI) between the two groups overall, by gender and by two birth cohorts born 1945–1954 and 1955–1965, respectively

Birth cohort	Males			Females			All		
	Cohort		RR (95% CI)*	Cohort		RR (95% CI)*	Cohort		RR (95% CI)*
	Index (N=1617)	Reference (N=3197)		Index (N=1403)	Reference (N=2773)		Index (N=3020)	Reference (N=5970)	
1945–1954									
Psychotic depression	0.8	0.2	3.52 (0.84–14.8)	0.4	0.7	0.57 (0.14–2.37)	0.6	0.4	1.28 (0.51–3.21)
Non-psychotic depression	3.6	2.8	1.45 (0.88–2.39)	3.5	3.6	0.95 (0.57–1.59)	3.6	3.2	1.17 (0.88–2.39)
All depressive episodes	4.4	3.0	1.61 (1.01–2.56)	3.9	4.3	0.89 (0.55–1.44)	4.1	3.6	1.18 (0.85–1.65)
1955–1965									
Psychotic depression	0.5	0.4	1.39 (0.50–3.88)	1.0	0.4	2.15 (0.80–5.80)	0.7	0.4	1.76 (0.86–3.58)
Non-psychotic depression	3.5	2.0	1.78 (1.16–2.68)	2.9	2.8	1.06 (0.65–1.72)	3.2	2.4	1.41 (1.18–2.68)
All depressive episodes	4.0	2.4	1.71 (1.17–2.51)	3.9	3.2	1.22 (0.79–1.87)	4.0	2.8	1.46 (1.10–1.94)
Both cohorts									
Psychotic depression	0.6	0.3	1.90 (0.84–4.29)	0.8	0.5	1.34 (0.62–2.92)	0.7	0.4	1.57 (0.90–2.75)
Non-psychotic depression	3.6	2.3	1.65 (1.20–2.26)	3.1	3.1	1.01 (0.71–1.43)	3.4	2.7	1.29 (1.02–1.63)
All depressive episodes	4.2	2.6	1.67 (1.25–2.25)	3.9	3.6	1.06 (0.77–1.46)	4.0	3.1	1.34 (1.08–1.66)

* Rate ratio (RR) adjusted for sex, age and place of birth by the Mantel–Haenszel method.

between the index and reference groups were performed using the summary Mantel–Haenszel estimator of the incidence rate ratio (RR), together with the approximate 95% confidence interval (obtained from the standard error of the logarithm of RR), in which the age, sex and municipality-matched sets formed the strata over which the estimator was calculated. The possible modification of the relative rate by gender was tested by an appropriate Wald statistic for homogeneity (Rothman & Greenland, 1998).

RESULTS

During the follow-up, 117 subjects of the index group and 184 of the reference group had been treated in hospital due to a depressive episode; the cumulative 28-years incidences were 4.0% and 3.1%, respectively (Table 1). The incidences were quite similar in the two birth cohorts.

There were 21 cases of psychotic depressions in the index cohort and 24 cases in the reference cohort. Most of the subjects with depression had had a non-psychotic depressive episode. The index subjects were observed to have a higher incidence of depression than the reference subjects in males (RR 1.67, 95% CI 1.25–2.25) but not in females (RR 1.06, 95% CI 0.77–1.46; $P=0.04$ against homogeneity of gender specific rate ratios). These results were dominated by very similar figures for non-psychotic depression only. Overall the rate ratios appeared higher for psychotic depression than for non-psychotic depression, but the numbers of cases of the former were too small for precise estimation of the effects confined to this subtype of depression.

DISCUSSION

The main result of the study was that the cumulative incidence of hospital-treated depression

was somewhat higher in subjects isolated from their parents temporarily at birth due to tuberculosis in the family (the Christmas Seal Home Children) as compared to a matched reference group. This pattern was obtained for both psychotic and non-psychotic depressive episodes in both sexes, but appeared clearer in males.

Every index subject had a separation experience in his/her first year of life, which lasted for approximately the first 7 months of life. As far as the authors know this is the first epidemiological study dealing with temporary separation at birth and depression in adulthood. The length of stay in the nurseries did not explain the elevated morbidity to depression as the isolation time was longer in the older birth cohort born 1945–1954, but the risk ratios were greater in the younger cohort of 1955–1965 than in the older birth cohort.

The follow-up time was long, up to the ages of 33–53 years, and covered 28 years. The cumulative incidences of hospital treated depression were 3–4%, which represents may be the most severe quarter of all depressive episodes in the subjects (Smith & Weissman, 1992; Lehtinen & Joukamaa, 1994). For this reason the authors are unsure whether the results of the study may be generalized to depressions that do not require hospitalization. However, there is no strong reason to suppose that subjects with non-hospitalized and hospitalized depressive episode should differ systematically as to whether or not they were separated as children. In this study no gender differences were found in the cumulative incidences of depression. This is in contrast to most other studies where depressive episodes have been found to be more common in females than males (Piccinelli & Wilkinson, 2000). Possibly, this is due to the fact that only the most severe, hospital-treated depressive episodes were included in the present study.

The risk ratios in the present study were generally lower than in most studies with positive relation between childhood separation and adult depression (Sethi, 1964; Bowlby, 1978; Brown & Harris, 1978; Lloyd, 1980; Kennard & Birtchnell, 1982; Roy, 1985; O'Neil *et al.* 1987; Rodgers, 1994; Rodgers *et al.* 1997). In the other studies the separation did not occur as early as in our study and the separation was in most studies permanent and occurred up to adolescence. Possibly the permanency of the

separation explains the bigger effect sizes in the previous studies, as the consequences of the separation might be the explanatory factor (Rutter, 1989).

Some researchers have stated that women are more sensitive to the influence of childhood separation than men (McLeod, 1991; Rodgers, 1994). In the present study the difference between the index and the reference cohorts in the incidence of depression was somewhat more prominent in males than in females. Our finding is in contrast with earlier studies on depression. The finding is also in contrast with another Finnish study, in which adverse childhood experiences were more highly predisposing factors to depression in women than in men (Veijola *et al.* 1998).

This study was strictly a register study. The results depend on the validity of FHDR data. The accuracy of transfer between hospital case records and the FHDR has been shown to be good (Poikolainen, 1983; Keskimäki & Aro, 1991) and the specificity of FHDR in detecting schizophrenia cases has been shown to be very good (Isohanni *et al.* 1997). On the other hand, no data are available on the accuracy of the FHDR specifically for depression.

We were not able to match the reference subjects for childhood socio-economic status (SES). However, when we compared the childhood SES of the index subjects with the SES of the general working population in 1960, there were no major differences (Veijola *et al.* 2003). We do not know how much of an increase in poverty there was due to the tuberculosis in the families of the index subjects. As low social class of parents has been shown to be linked with development of depression in adolescence (Goodman & Huang, 2002), the result shown in this study may have been partly caused by this effect.

Three out of four mothers of the index subjects had tuberculosis during pregnancy. From the data available to us, we were not able to identify the particular index children whose mothers were ill. Maternal tuberculosis has been found to be a risk factor for pregnancy (Figueroa-Damian & Arredondo-Garcia, 1998). In the index group 5% of the infants had a birth weight lower than <2500 g, which at that time may have been a somewhat higher percentage than that found in the general population (Anttolainen, 1972). Thompson *et al.* (2001)

have found that low birth weight is associated with risk of depressive disorder in late life.

It is not known how many of subjects in either group had separation experiences later. In two Finnish studies, childhood separations (mainly parental death and parental divorce) from parents were rather common (Aro & Palosaari, 1992; Veijola *et al.* 1998), about one-fifth to one-quarter of the population studied. However, we can presume that very early separation did not happen systematically in the reference series.

The Christmas Seal Home Children represent a remarkable natural experiment in terms of maternal deprivation. The early separation from the mother may have disturbed the mother-child relationship. This may have led to various effects on the development of the child. Spitz (1965) claimed that infants separated early (6 to 8 months) from their mothers for 3 months or more were at risk for anaclitic depression and even death. Bowlby (1981) described formation of the attachment between the mother and the infant. He found that early separation from the mother led to disturbed attachment between the child and mother. Subjects with interrupted attachment had a high risk of developing various psychiatric disorders, especially depression. On the other hand, a biological explanation for our finding may also exist. Brain neuropeptides have been found to be decreased in rats' brains in a situation with early life maternal deprivation. Neuropeptides have been found to be involved also in the pathophysiology of depression in humans (Jimenez-Vasquez *et al.* 2001).

The strengths of our study included matched reference group, a long follow-up period, and the information of emigrations and death dates being obtained from reliable authorities. The separation occurred specifically just after the birth. There are some limitations as well: the cohort group of index subjects was relatively small. We were not able to match the index group and the reference group for SES. Neither did we have information on the childhood life conditions of the individuals. The data did not include information on who had tuberculosis in the family, of the birth weights, obstetric complications, or the isolation time at the individual level. It is difficult to estimate in which way these limitations may have affected the results of the study.

Previously, with the same subjects, we have reported (Veijola *et al.* 2003) a slightly excess

mortality associated with very early separation. The excess mortality was mainly due to unnatural deaths (suicides and accidents). The finding presented in this paper is in line with that finding as depression and unnatural deaths are linked (Isometsä *et al.* 1995).

So, it is unclear by which mechanism the index subjects were slightly more vulnerable to depression than reference subjects. Whatever the mechanism, the separation procedure was successful in preventing tuberculosis but it may have had unfavourable effects on the later psychological development of some of the children. On the other hand, temporary separation from the parents at birth was not found to be strongly associated with severe adulthood depression. If we had been able to take into account childhood SES the association now found might have been even less visible. In general, a solitary traumatic early experience does not usually totally disturb one's life, but the consequences of such trauma and permanency of the negative consequences are important (Rutter, 1989). The care in the Christmas Seal Homes did not radically harm the later psychological life of the infants.

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REFERENCES

- Abrahams, J. & Whitlock, F. (1969). Childhood experiences and depression. *British Journal of Psychiatry* **115**, 883–888.
- Anttolainen, I. (1972). Late prognosis of children born into tuberculous households. The effect of isolation and simultaneous BCG-vaccination. *Acta Paediatrica Scandinavica* (suppl. 230), 1–49.
- Aro, H. M. & Palosaari, U. K. (1992). Parental divorce, adolescence, and transition to young adulthood: a follow-up study. *American Journal of Orthopsychiatry* **62**, 421–429.
- Bowlby, J. (1978). *Attachment and Loss, Vol. 2, Separation*. (First published 1973.) Reprinted in Penguin Books, Hazell Watson & Viney: Aylesbury, Bucks.
- Bowlby, J. (1981). *Attachment and Loss, Vol. 3, Loss: Sadness and Depression*. (First published 1980.) Published in Penguin Books, Hazell Watson & Viney: Aylesbury, Bucks.
- Brown, G. W. & Harris, T. O. (1978). *Social Origins of Depression: A Study of Psychiatric Disorders in Women*. Free Press: New York.
- Brown, G. W. & Harris, T. O. (1993). Aetiology of anxiety and depressive disorders in an inner-city population. 1. Early adversities. *Psychological Medicine* **23**, 143–154.
- Doyle, K. (1989). 'Stamping' out tuberculosis: the story of Christmas Seals. *American History Illustrated* **24**, 66–68.
- Figuroa-Damian, R. & Arredondo-Garcia, J. L. (1998). Pregnancy and tuberculosis: influence of treatment on perinatal outcome. *American Journal of Perinatology* **15**, 303–306.

- Goodman, E. & Huang, B. (2002). Socioeconomic status, depressive symptoms, and adolescent substance use. *Archives of Pediatrics & Adolescent Medicine* **156**, 448–453.
- Harris, T., Brown, G. W. & Bifulco, A. (1986). Loss of parent in childhood and adult psychiatric disorder: the role of lack of adequate parental care. *Psychological Medicine* **16**, 641–659.
- Hällström, T. (1986). Social origins of major depression: the role of provoking agents and vulnerability factors. *Acta Psychiatrica Scandinavica* **73**, 383–389.
- Isohanni, M., Mäkikyrö, T., Moring, J., Räsänen, P., Hakko, H., Partanen, U., Koironen, M. & Jones, P. (1997). A comparison of clinical and research DSM-III-R diagnoses of schizophrenia in a Finnish national birth cohort. Clinical and research diagnoses of schizophrenia. *Social Psychiatry and Psychiatric Epidemiology* **32**, 303–308.
- Isometsä, E., Henriksson, M., Marttunen, M., Heikkinen, M., Hillevi, A., Kuoppasalmi, K. & Lonnqvist, J. (1995). Mental disorders in young and middle aged men who commit suicide. *British Medical Journal* **310**, 1366–1367.
- Jimenez-Vasquez, P. A., Mathe, A. A., Thomas, J. D., Riley, E. P. & Ehlers, C. L. (2001). Early maternal separation alters neuropeptide Y concentrations in selected brain regions in adult rats. *Brain Research & Developmental Brain Research* **131**, 149–152.
- Kendler, K. S., Neale, M. C., Kessler, R. C., Heath, A. C. & Eaves, L. J. (1992). Childhood Parental loss and adult psychopathology in woman. A twin study perspective. *Archives of General Psychiatry* **49**, 109–116.
- Kendler, K. S., Sheth, K., Gardner, C. O. & Prescott, C. A. (2002). Childhood parental loss and risk for first-onset of major depression and alcohol dependence: the time-decay of risk and sex differences. *Psychological Medicine* **32**, 1187–1194.
- Kennard, J. & Birchnell, J. (1982). The mental health of early mother-separated women. *Acta Psychiatrica Scandinavica* **65**, 388–402.
- Keskimäki, I. & Aro, S. (1991). The accuracy of data on diagnoses, procedures and accidents in the Finnish Hospital Discharge Register. *International Journal of Health Science* **2**, 15–21.
- Lehtinen, V. & Joukamaa, M. (1994). Epidemiology of depression: prevalence, risk factors and treatment situation. *Acta Psychiatrica Scandinavica* (suppl. 377), 7–10.
- Lloyd, C. (1980). Life events and depressive disorder reviewed: events as predisposing factors. *Archives of General Psychiatry* **37**, 529–535.
- McLeod, J. D. (1991). Childhood parental loss and adult depression. *Journal of Health and Social Behavior* **32**, 205–220.
- Mäki, P., Veijola, J., Joukamaa, M., Läärä, E., Hakko, H., Jones, P. & Isohanni, M. (2003). Maternal separation at birth and schizophrenia – a long-term follow-up of the Finnish Christmas Seal Home Children. *Schizophrenia Research* **60**, 13–19.
- O'Neil, M. K., Lancee, W. C. & Freeman, S. J. J. (1987). Loss and depression: a controversial link. *Journal of Nervous and Mental Disorders* **175**, 354–357.
- Piccinelli, M. & Wilkinson, G. (2000). Gender differences in depression. Critical review. *British Journal of Psychiatry* **177**, 486–492.
- Poikolainen, K. (1983). Accuracy of hospital discharge data: five alcohol-related diseases. *Drug and Alcohol Dependence* **12**, 315–322.
- Rodgers, B. (1994). Pathways between parental divorce and adult depression. *Journal of Child Psychology and Psychiatry* **35**, 1289–1308.
- Rodgers, B., Power, C. & Hope, S. (1997). Parental divorce and adult psychological distress: evidence from a national birth cohort: a research note. *Journal of Child Psychology & Allied Disciplines* **38**, 867–872.
- Rothman, K. J. & Greenland, S. (1998). *Modern Epidemiology*, 2nd edn. Lippincott-Raven: Philadelphia, PA.
- Roy, A. (1985). Early parental separation and adult depression. *Archives of General Psychiatry* **42**, 987–991.
- Rutter, M. (1989). Pathways from childhood to adult life. *Journal of Child Psychology and Psychiatry* **30**, 23–51.
- Sethi, B. B. (1964). Relationship of separation to depression. *Archives of General Psychiatry* **10**, 486–496.
- Smith, A. L. & Weissman, M. M. (1992). Epidemiology. In *Handbook of Affective Disorders*, 2nd edn (ed. E. S. Paykel), pp. 111–129. Churchill Livingstone: Edinburgh.
- Spitz, R. (1965). *The First Year of Life*. International Universities Press, Inc.: New York.
- Tamminen, A. (1982). *Joulumerkkikotimme 1936–1973*. (In Finnish.) The Christmas Seal Homes in Finland 1936–1973. Tuberkuloosin vastustamisyhdistys: Helsinki.
- Thompson, C., Syddall, H., Rodin, I., Osmond, C. & Barker, D. J. (2001). Birth weight and the risk of depressive disorder in late life. *British Journal of Psychiatry* **179**, 450–455.
- Veijola, J., Puukka, P., Lehtinen, V., Moring, J., Lindholm, T. & Väisänen, E. (1998). Sex differences in the association between childhood experiences and adult depression. *Psychological Medicine* **28**, 21–27.
- Veijola, J., Mäki, P., Joukamaa, M., Läärä, E., Hakko, H., Nieminen, M. & Isohanni, M. (2003). Adulthood mortality of infants isolated at birth due to tuberculosis in the family. *Scandinavian Journal of Public Health* **31**, 69–72.
- Zahner, G. & Murphy, J. (1989). Loss in childhood: anxiety in adulthood. *Comprehensive Psychiatry* **30**, 553–563.