

# Mental health problems and psychopathology in infancy and early childhood

## An epidemiological study

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The significance of the first years of living in the determination of mental health later in life has been discussed since the pioneering work of Anna Freud (1936, 1973), Rene Spitz (1951) and John Bowlby (1951). In these works from the early start of child psychiatry, the understanding of children's mental illness was primarily based on hermeneutic interpretations of the consequences of deprivation of maternal care (Rutter 1979).

Along with the development of child and adolescent psychiatry, the concept of mental illness in children has reflected shifting focus on either primary biological aetiology or psycho-dynamic and socio-cultural risk mechanisms (Neve & Turner 2002). Since the influential Isle of Wight Study in the 1970's however, the different and until then diverging concepts of aetiology have been united in a bio-psycho-social understanding of psychiatric diseases in children (Rutter 1989, Costello et al 2005). Besides, the concept of *developmental psychopathology* has been applied to the understanding of how nature-nuture interacts over time and how mental health symptoms evolve at different developmental stages (Rutter 2000, Costello et al 2006).

Epidemiological research has demonstrated the significance of childhood psychopathology by the finding of an overall prevalence of psychiatric disorders in school aged children and adolescents of 16-18 %, and a high risk of continuity of mental health problems from school age to adolescence and adulthood (Verhulst et al 1992, Roberts et al 1998, Costello et al 2005, Maugham & Kim-Cohen 2005).

In the clinical field of child psychiatry, still younger children are referred to treatment and increasing evidence from the latest decades point to the significance of early symptoms of disorders previously not diagnosed until school age (Egger & Angold 2006).

However, epidemiological studies of preschool aged children are few, and even more limited when it comes to children below the age of four years (Carter et al 2004, Egger & Angold 2006).

The literature on clinical aspects of mental illness in the first years of life is sparse, and most handbooks on child and adolescent psychiatry only mention psychopathological symptoms in children 0-3 years of age in relation to disorders of attachment and behavioural problems, and with comments on early symptoms of autistic disorders and attention-deficit-hyperactivity disorders ADHD.

From the current stage of knowledge, it is obvious to search for research data on the early presentation of symptoms, risk factors and course of mental illness in order to get answers to how and possibly why mental illness develop.

### EPIDEMIOLOGICAL STUDIES OF MENTAL HEALTH PROBLEMS AND PSYCHOPATHOLOGY IN CHILDREN AGED 0-3 YEARS – A REVIEW OF THE LITERATURE

The literature from the period 1967-2007, was searched in the database Medline (PubMed) with the search terms: infant, infancy, toddler, preschool, child, mental health, psychiatry, psychopathology, behaviour problems, disorders, illness, disease, disturbances, diagnoses, epidemiology, prevalence, risk factors, predictors, precursors, longitudinal, birth cohorts.

Only studies investigating aspects of psychopathology in children below the age of 4 years were included. Additional search from the reference lists of identified literature was performed.

Overall, epidemiological studies of mental health problems and psychopathology, which have included children 0-3 years of age, fall in the following three categories:

1. Studies of clinical populations
2. Cross-sectional studies of non-clinically referred populations
3. Longitudinal studies of selected and unselected cohorts

#### STUDIES OF CLINICAL POPULATIONS OF CHILDREN 0-3 YEARS

Overall, thirteen studies of mental health problems and psychopathology in clinical populations have been published from 1987 through 2007 from USA, Canada, Austria, Portugal, France and Denmark (Table 1).

A considerable diversity was seen across the studies: a) the age of the children ranged from infancy to 72 months, and results regarding the age group 0-3 years could not be isolated in all

Table 1. Studies of mental health problems in clinical populations including children aged 0-3 years (published 1987-2007) – distribution on diagnostic groups.

Study	N	Age (months)	Diagnostic classification	Primary Syndrome Diagnosis (%)										Relationship disorders (DC 0-3: Axis II) (%)
				Developmental disorder (%)	ADHD (%)	Behaviour disorder (%)	Emotional disorder (a) (%)	Feeding and eating disorder (%)	Sleep disorder (%)	Attachment disorder (%)	Regulatory disorder (%)	Adjustment disorder (b) (%)	No psych. Diagnosis (%)	
Lee et al (1987)	129	12-72	DSM-III	7.8	7.8	8.5	1.6	-	-	-	-	27.1	-	7.8
Hooks et al (1988)	193	Infancy-60	DSM-III	8.8	0.1	2.0	4.7	-	-	0.1	-	10.9	15.0	5.7
Dunitz et al (1996)	82	0-24	DSM-IV/DC: 0-3	-	-	-	9.8	43.9	9.8	15.9	-	9.8	-	-
Minde & Tidmarsh (1997)	57	15-48	DSM-IV/DC: 0-3	5.3	-	-	8.4	-	-	-	36.8	10.4	21.0	52.6
Luby & Morgan (1997)	116	9-70	DSM-III-R	37.0	30.2	11.2	11.2	-	-	-	-	9.5	26.60	-
Thomas&Clark (1998)	64	12-47	DSM-IV/DC: 0-3	-	20.3	21.8	21.8	-	-	-	-	46.9	-	-
Skovgaard et al (2001)	529	0-47	ICD-10	11.0	0.8	8.1	4.2	2.5	0.2	10.8	-	30.4	25.0	-
Elberling & Skovgaard (2002)	114	0-47	DC: 0-3	24.6	-	-	18.4	8.8	-	8.8	12.3	6.1	21.9	50.0
Guédéney et al (2003)	85	0-37	DC: 0-3	12.9	-	-	20.0	1.2	7.1	11.8	11.8	4.7	23.5	72.6
Keren et al (2003)	414	0-42	DC: 0-3	-	-	1.4	6.5	11.8	10.0	1.9	5.1	8.2	55.2	52.0
Cordeiro et al (2003)	343	0-48	DC: 0-3	18.7	-	-	26.2 (d)	2.9	1.8	-	6.4	5.5	23.3	63.9
Maldonado-Durán et al (2003)	167	0-36	DC: 0-3	9.5	-	-	6.5	4.1	2.9	1.1	42.0	11.3	9.5	37.2
Frankel et al (2004)	177	0-58	DSM-IV/DC 03 (c)	3.4	4.0	6.8	4.5	1.7	0.6	9.6	7.9	11.3	5.7	7.3

- (a) Inclusive mixed disorder of emotional expressiveness, anxiety disorders and mood disorders.  
 (b) Inclusive post traumatic stress disorder.  
 (c) Only DSM diagnosis here.  
 (d) Inclusive reactive attachment disorder.

studies, b) background populations varied with respect to routes of referral, the proportion of high risk families, e.g with mentally ill parents and intake from deprived areas. Furthermore, c) a broad range of diagnostic methods had been applied: retrospective file review, consensus clinical diagnoses and diagnostic classification based on standardized measures.

Seven studies have investigated DSM diagnoses (Lee 1987, Hooks 1988, Dunitz 1996, Minde & Tidmarsh 1997, Luby & Morgan 1997, Thomas & Clark 1998, Frankel et al 2004) and nine studies have classified mental health problems according to Diagnostic Classification Zero-to Three, DC: 0-3 (Dunitz 1996, Minde & Tidmarsh 1997, Thomas & Clark 1998, Elberling et al 2002, Cordeiro 2003, Guédéney 2003, Keren et al 2003, Maldonado-Durán et al 2003, Frankel et al 2004). In four of these studies, the DSM and DC: 0-3 diagnoses were investigated simultaneously (Dunitz 1996, Minde & Tidmarsh 1997, Thomas & Clark 1998, Frankel et al 2004). ICD diagnoses have only been investigated in one study: a nation wide register study of 0-3 year old children referred to child psychiatric departments in Denmark (Skovgaard et al 2001).

The methodological diversity of the clinical studies reviewed, does not allow any systematic comparison of diagnostic distribution in referred children. However, it is noteworthy that in several studies, a high proportion of the children were not diagnosed with a mental health diagnosis at all, and the most commonly used diagnosis across several studies was a condition of non-specific manifestations: adjustment disorder (Table 1).

#### STUDIES OF NON-REFERRED CHILDREN/COMMUNITY OR GENERAL POPULATION BASED STUDIES

Table 2 shows an overview of prevalence studies of mental health problems and psychopathology in community or general population samples.

In 9 of the 12 studies (published 1975-2006), the definition of cases was based on parent-reported child behaviour in questionnaires or checklists e.g the Behaviour Screening Questionnaire BSQ developed by Richman and Graham (Richmann et al 1971, 1975) and from the late 1980's the Achenbach Child Behaviour Check List CBCL (Achenbach 1987, 2000). The rates of prevalence of deviant behaviour or behavioural and emotional syndromes range from 7.3 % (Richmann et al 1975) to 12-16 % (Briggs-Gowan et al 2001). In two studies, child mental health diagnoses were studied in a two stage design of children aged 2-3 years (Lavigne et al 1996) or 2-5 years (Egger and Angold 2006) with the use of behavioural screening at stage one and diagnostic assessment at stage two.

Three studies have investigated DSM diagnoses (Earls 1980, Lavigne et al 1996, Egger and Angold 2006) and one study ICD diagnoses (Weyerer 1988). However, among these, the study by Lavigne et al is the only which report explicitly on diagnoses in children down to the age of 2-3 years (Lavigne et al 1996). In this study a sample of 2.262 children aged 2-3 years were recruited from primary care paediatric clinics in Chicago, US, and studied in a two stage design, with CBCL screening at first stage and at stage two: in-depth assessment by, among others, developmental tests and play obser-

Table 2. Community/ general population studies of prevalence of mental health problems and psychopathology including children aged 0-3 years (published 1975-2007).

Study	Population	N	Age	Method	Informants	Case-definition	Area of psychopathology	Prevalence %
Richmann, Stevenson & Graham (1975, 1982)	General population (UK)	Two stage 1. 705 2. 212	3	BSQ	Parent	Behaviour Screening Questionnaire Scale	Behavioural problems	7.3
Earls & Richmann (1980)	General population (London/UK)	58	3	BSQ	Parent	Behaviour Screening Questionnaire Scale	Behavioural, social and psychosomatic problems	15.5
Earls (1980)	Rural community (US)	100	3	BSQ	Mother	Behaviour Screening Questionnaire Scale Clinical consensus/DSM III criteria	Deviant behaviour DSM III diagnoses	16.5
Earls (1980)	Rural community (US)	85	3	BSQ	Father	Behaviour Screening Questionnaire Scale	Deviant behaviour	8.3 (score=10)
Weyerer et al (1988)	General population (Germany)	358 *	3-14	Standardized psychiatric examination	Mother Child	ICD 9 Rutter's multiaxial scheme	ICD 9	18.4
Larson, Pless, Miettinen, (1988)	Birth cohort (Canada)	756	3	CBCL	Parent	Child Behaviour Checklist Deviant Score (CBCL)	CBCL Syndrome	11.1
Koot & Verhulst (1991)	General population (Netherlands)	421	2-3	CBCL	Parent	Child Behaviour Checklist Syndrome Score (CBCL)	Behaviour Syndrome	7.8
Stallard (1993)	Community health clinic (UK)	1.170	3	BCL	Parent	Behaviour Checklist Score (BCS)	Behaviour items	10.0
Lavigne (1996)	Community/ paediatric sample (US)	Two stage 1. 2.262 2. 256	2-3	Two stage 1. CBCL 2. CBCL, BSID, play obs.	Parent	DSM III-R	DSM III disorders	13.6/ 7.1 ** (2 years) 26.5/ 14.0 ** (3 years)
Sourander (2001)	Community /Finland	374	3	CBCL	Parent	Child Behaviour Checklist Score (CBCL)	Behaviour Syndrome	7.9
Briggs-Gowan et al (2001)	Community sample (US)	1.280	2	ITSEA CBCL/2-3	Parent	Child Behaviour Checklist Score (CBCL)	Emotional and behavioural symptoms	12-16
Egger & Angold (2006)	Community sample (US)	Two stage 1. 1.037 2. 307	2-5	Two stage 1. CBCL 2. PAPA	Parent	DSM IV	DSM IV disorders	16.2

(\* data concerning children <5 years of age is not specified, \*\* all / severe)

BSQ (Behaviour Screening Questionnaire), BCL (Behaviour Checklist), BSID (Bayley's Scales of Infant development), CBCL (Child Behaviour Checklist), ITSEA (Infant Toddler Social and Emotional assessment), PAPA (Preschool Age Psychiatric Assessment), DSM (Diagnostic and Statistical Manual of Mental disorders), ICD (International Classification of Diseases)

vation. Diagnostic classification was done by psychologists as “best estimate diagnosis” according to DSM III-R and a global rating of impairment by C-GAS. The prevalence of having a child psychiatric diagnosis including all areas except general and pervasive developmental disorders was 13.6 % in 2 year old children and 26.5 % in 3 year olds. If only severe cases were included, the prevalence in the same age groups was respectively 7.1 and 14.0 % (Lavigne et al 1996, 1998).

Egger & Angold investigated 1.073 children aged 2-5 years with CBCL screening at stage one, and at stage two, a total of 307 children were assessed with the structured Preschool Age Psychiatric Assessment (PAPA) which includes DSM-IV criteria relevant for axis I diagnoses in young children and not including general and pervasive developmental disorders (Egger & Angold 2006). The overall prevalence rate of severe to moderate psychopathology except for general and pervasive developmental disorders was 16.2 %. Separate data for age groups within the age span were not informed (Egger & Angold 2004, Egger & Angold 2006).

#### LONGITUDINAL STUDIES- BIRTH COHORTS

Longitudinal research has demonstrated a continuity of several aspects of mental health problems from childhood to adult age and hereby contributed to the current understanding of developmental psychopathology (Rutter, Kim Cohen & Maugham 2006).

However, when the literature is restricted to studies of un-selected populations which includes data from the first three years of living, only two studies which are addressing the longitudinal per-

spective of developmental psychopathology remain: The Dunedin Study (Silva 1990) and the ALSPAC Study (Golding et al 2001).

The Dunedin Multidisciplinary Health and Development Study, DMHS collected data from a birth cohort of 1037 children born at the same hospital in Dunedin, New Zealand in 1972-1973. The overall aim was to study health, development and behaviour of children and adolescents and to identify correlates of normal and abnormal development (Silva 1990, Mc Gee et al 1995). The Dunedin study has demonstrated associations between psycho-motor development and early child temperament measured at child age three years on one side and later psychopathology on the other (Caspi et al 1995), but no mental health variables were recorded from this study before the age of three year (Caspi et al 1996).

The Avon Longitudinal Study of Parents and Children, ALSPAC, has collected data on 10.000 children, born in 1991-1992 in the county of Avon, UK in a comprehensive study of child health and development. Within the study, detailed data from questionnaires to parents, medical records and biological samples were collected from pregnancy and onward. Information on child health was obtained from questionnaires to parents send out the first month after birth and then two times a year. Clinical assessment of a randomly selected sample of 1000 children included assessment of cognitive function at child age 4 and 18 months, and assessment of language development at child age 25 months. Parenting was assessed at child age 12 months (Golding et al 2001). However, no data on child psychopathology in the first three years of life have been reported from this study.

## LONGITUDINAL STUDIES OF POPULATIONS SAMPLED ACCORDING TO RISK

The Manheim Study of Children at Risk seems to be the only study published where systematic data on infant-toddler mental health have been collected in the first years of living (Laucht et al 1993). The study population of 362 children born in the Rhine-Neckar Region, Germany, in 1986-1988 were sampled at birth according to high, moderate or low respectively biological risks (e.g pregnancy and birth complications) and psycho-social risks (family background). Parents were interviewed by the Manheim Parent Interview MEI, a standardized interview developed from the Rutter Parent Questionnaire (Rutter 1989) to cover diagnostic criteria of relevance in early childhood (Esser et al 1989). Parent-child interaction was assessed at 3 months and the children were individually assessed at 3 and 24 months regarding cognitive and general psycho-motor function using the Bayley's scale of Infant Development (Laucht et al 1993).

The first outcome assessed at age 3 months demonstrated significant and different impact of biological and psycho-social risk factors on child mental health (Laucht et al 1993). At 24 months, the biological risk factors described at birth seemed to have decreased in influence, whereas the importance of psycho-social risks had become more prominent (Laucht et al 1997, 2000).

*Conclusion:* Epidemiological studies of psychopathology in children below the age of four years are few and no studies have published data on prevalence and risk mechanisms regarding the whole spectre of mental illness in the first years of life in unselected populations.

## AIMS OF THE THESIS

The principal objective was to start the longitudinal study of developmental psychopathology from birth to adolescence/ adult life.

*The research aims were the following:*

1. To establish a general population birth cohort suitable for the investigation of mental health problems and psychopathology prospectively from birth
2. To study the presentation and prevalence of mental health diagnoses in children 1½ years of age.
3. To study risk factors and predictors of psychiatric illness from the first year of life.
4. To investigate the potentials of screening for infant mental health problems in an existing child health surveillance programme.

*The work presented in this thesis is based on the following hypotheses:*

- Infants and toddlers suffer from mental illness like older children do.
- Disorders of neurodevelopment: mental retardation, pervasive developmental disorders, PDD and attention deficit hyperactivity disorders, ADHD manifest in the first years of life.
- Risk factors and predictors of later child mental illness can be identified in the first year of life.

- General health professionals are able to screen for mental health disorders in infancy.

## METHODS

### DESIGN

#### PAPER I: THE COPENHAGEN COUNTY CHILD COHORT

##### – DESIGN OF A LONGITUDINAL STUDY OF CHILD MENTAL HEALTH

The design is a prospective birth cohort study of mental health problems.

This thesis concern the first stages of the study covering the period from birth to 18 months supplied by a register follow-up of hospital admissions for mental health problems covering the age period from birth through 36 months in the same cohort.

### *Study populations*

The study population comprises all children born of mothers with address in sixteen (out of eighteen) municipalities in the former County of Copenhagen in the period from 1st of January to 31st of December 2000.

The children were identified through midwives birth registration to the Civil Personal Registration System (CPR) and constitute the Copenhagen Child Cohort, CCC 2000 (named The Copenhagen County Child Cohort, CCCC 2000 until Copenhagen County was merged in the Capital Region in 2007).

A total of 6090 children were born in the study area which had a background population of 527.563 inhabitants per 1st of January 2000. The participating municipalities are located around the city of Copenhagen and comprise urban and to a lesser degree semi-rural areas, representing a broad spectrum of socio-economical and ethnical backgrounds.

From the CCC 2000 baseline population, 3 study populations are investigated in this thesis:

I: The whole CCC 2000 cohort at child age 0-11 months

All cohort children were described at baseline with data from Danish national registers and prospective recordings from community health nurses' home visits one to four times in the period from birth to child age 11 months.

### *Participation at baseline*

Of 6.090 children born in the study area, data from the Medical Birth Register, MFR, were available on 6.072, 99,7% of the children. For 5.624 (91%) standardised data from at least one home visit were available and data from three or more home visits were available for 5.362 children (88 %). One municipality withdrew from the study by 1st of October 2000, and in this municipality only children born before that date were entered in the cohort.

The cohort constitutes 9 % of all children born in Denmark in the year 2000. The cohort children did not differ significantly from the general population of Danish children born in the same year with regard to data recorded in the Medical Birth Register, MFR

(See Appendix 1) except for a higher proportion of parents with other ethnic background than Danish.

II: CC 1½ - A subpopulation investigated at age 1½ years

A sample of children for a thorough child psychiatric examination at the age of 18 months, was selected from a CCC 2000 sub-cohort of children from 6 municipalities (N=2155).

Only children for whom information from at least four health nurse visits were available was considered eligible for the sampling (N=1896).

*Sampling was done with the following considerations:*

- to include all cases of putative mental health problems and psychopathology as identified by the child health nurses from the municipalities
- to obtain an unbiased sample of 18 months old children from the general population, serving both as source for a control group in a nested case-control study of the health nurses screening, and for studying developmental psychopathology in the general population
- to examine no more than 400 children in depth, given resource constraints of the study
- to enable future comparisons between the sub-cohort and the rest of CCC 2000 in order to identify effects from intervention towards children identified with mental health problems at child age 1½ years.

Accordingly, from the six sub-cohort municipalities with a total of 1896 eligible children (having four home visits 0-10 months) an iterative random sampling was performed in order to obtain the desired number of approximately 200 cases and 200 controls.

Hereby a total of 411 children were selected to participate in the child psychiatric assessment at age 18 months: 205 were cases

according to health nurses conclusions of concern and 206 children of no concern served as controls.

Furthermore, from the same population, naïve to case-control status, a random sample of 306 children was formed (see Fig 1).

Exclusion: Children with severe physical disabilities and children from families, where the parents did not speak Danish were afterwards excluded from this part of the study.

Participation rate: 65 % (n=134) among health nurse cases, 79 % (n= 162) among controls, and 69 % (n=211) in the random sample study.

In accordance with one of the exclusion criteria, analyses of attrition in data from Danish National Registers (see Appendix 1), showed that non-participant children were significantly more often from families with other ethnic background than Danish, but otherwise no significant differences were found.

Comparison between the children in the six municipalities in CC 1½ study and in the remaining municipalities in CCC 2000, showed no differences with regard to putative child psychiatric risk factors (ethnicity, parent's ages, single parents, birth weight, Apgar score and peri-natal illness measured as days spend in hospital after birth).

#### *Reliability study in CC 1½*

A reliability study was performed using raw data from the child assessments of 18 children in the CC 1½ study. The children were selected (blind to the investigators) from the children investigated at 1½ years in order to represent children with different mental health problems and children with no mental health problems.

III: The CCC 2000 register follow-up study of mental health diagnoses recorded at hospitals within the first three years of life

Of the 6090 children in CCC 2000, 6065 could be followed-up in the National Register of Patients and the Psychiatric Central Register in a study of mental health diagnosis recorded at hospitals between birth and 36 months. Included as cases in this study were all children who had received at least one ICD-10 diagnosis of a mental health disorder (F-diagnoses and R 62.0: Psycho-motor retardation). A total of 87 children were included, all of whom had been recorded in the National Register of Patients. Out of these, 34 had additionally been recorded in the Psychiatric Central Register (Fig 1).

#### *Attrition from CCC 2000 in the period 1.1 2000-31.12 2003 (in the first 3 years of life)*

Based on data from the National registers, The National Birth Registry (MFR), the National Register of Patients (LPR) described in Appendix 1, the attrition from the cohort in the period from 1.1 2000-31.12 2003 was 17 children, of whom 16 died within the first few months of life and further one died between the age of 12 and 36 months.

#### *Baseline data*

##### *Data from National Registers (Appendix 1)*

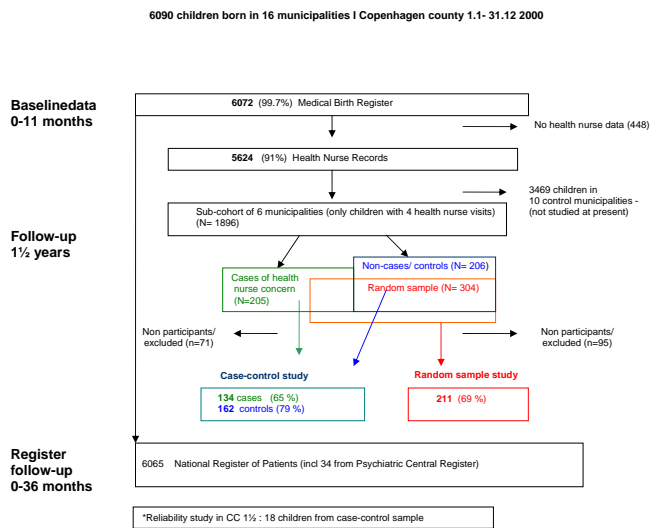
In Denmark, all citizens have a unique 10-digit ID- number, which follows them throughout life. This personal number informs birth

**Table 3 Background Characteristics of CCC 2000**  
Data derived from Medical Birth Register (Appendix 1)  
(N= 5624)

Variable (categorical)	N (%)	Distribution	n (%)
Sex	5624 (100%)	Boys Girls	2891 (51,4) 2733 (48,6)
Ethnicity (Parents born i DK)	5608 (99,7%)	None One Two	879 (15,7) 675 (12,0) 4054 (72,3)
Affluence	5624 (100%)	High Medium Low	1202 (21,4) 1919 (34,1) 2503 (44,5)
Parents living together (at the child's birth date)	5608 (99,7%)	Yes No	5192 (92,6) 416 (7,4)
Parity (Mothers total no of live-born children)	5251 (93,4%)	1 2 3 ≥4	1976 (37,6) 2247 (42,8) 735 (14,0) 293 (5,6)
Birth complications (child)	5624 (100%)	No Yes	5130 (91,2) 494 (8,8)
Serious congenital disorder	5624 (100%)	Nej Ja	5521 (98,2) 103 (1,8)
Smoking during pregnancy	5502 (98,6%)	Never Yes, but stopped Yes	4216 (76,6) 118 (2,2) 1168 (21,2)
Variable (continuous)	N (%)	Mean (SD)	(Range)
Mothers age (years)	5608 (99,7%)	30,3 (26,7-33,7)	16,5 – 46,3
Fathers age (years)	5527 (98,3%)	32,6 (28,9-36,3)	17,9 – 61,8
Birth weight (gram)	5519 (98,1%)	3500 (3150-3900)	612 – 5900
Gestational age (weeks)	5567 (99,0%)	40,0 (38,9-40,9)	25,1 – 44,1



Fig.1 Copenhagen Child Cohort CCC2000



date and sex and it is stored together with information about places of residence, nationality and the ID-number of the parents. All national Danish registers use the ID-number, which makes linkage between different registers and across time very accurate. (For details see Appendix 1). In the first stages of The CCC 2000 study presented in this thesis, data from the following registers have been included: The Civil Personal Registration System (CPR), The Medical Birth Registry (MFR), the National Register of Patients (LPR) and The Psychiatric Central Register (PCR).

#### Data collected by community health nurses

Community health nurses visiting all infant families have been an integrated part of the general child health surveillance in Denmark for more than fifty years. The health nurses are educated in paediatric child care and prevention and their key function is to promote child health by general health assessment and parent counselling (Sundhedsstyrelsen (eng. National Board of Health), 1995).

Health nurses are informed by midwives about all deliveries in the municipality and all families with a newborn child are offered free home visits during the child's first year of life. In the majority of municipalities in Denmark, families are offered a mean of three home visits, and only few families decline.

The health nurses follow overall national guidelines (Sundhedsstyrelsen, 1995), however, no standardization of the health nurse recordings has formerly been applied.

#### Standardization of community health nurse recordings – the CCC 2000 health nurse record

Prior to the study, the CCC 2000 health nurse record was developed to serve as tool for 1) a standardized collection of data obtained by the traditional routines at home visits at specific ages during the first years of life and 2) the inclusion of core areas of infant mental health as variables in the record.

By tradition, the health nurses in the municipalities entered in

the study, made on average four home visits to infant families within the first year of the child's life: at child age 0-2 weeks, 2-3 months, 4-6 months and 8-10 months. Accordingly, the health nurse record was standardized to cover these four stages.

Information of infant mental health 0-10 months recorded by health nurses (see Appendix 2)

In addition to the recordings of data on child health and development, the CCC 2000 record comprises the nurses' recordings of parents information concerning the child and the family, and recordings regarding the parent's own observations of the child.

In accordance with the health nurses' practices, each variable was recorded dichotomized as being in the normal range or not.

The home visits customary takes 30 to 60 minutes. At the end of the visit, the health nurse concludes whether the child or the family needs extra-ordinary visits from her or any particular intervention.

*Children of health nurse concern:* By tradition, Danish health nurses describe children at risk as "concern children". This concept reflects an overall worry with regard to the health and the development of the child or regarding the caregiver environment. Accordingly, the CCC 2000 health nurse record included the recording of any concern from each home visit, and the traditional differentiation of health nurse concern into areas of 1) child development, 2) mother-child relationship and 3) family functioning was used as separate variables in the CCC 2000 record (see Appendix 3).

Furthermore, it was recorded whether intervention had been suggested and carried out, e.g whether the child or the family had been offered extended health nurse support or had been referred to treatment or support in the health care system or in the municipality.

Variables obtained by health nurses at home visits (see Appendix 3)

A manual to the CCC 2000 record was prepared including guidelines on how to obtain and record the data, and a pilot study was conducted to establish the face validity of the variables in the record and to test the applicability in the daily routines at home visits.

After revision, the record was implemented in the routines at home visits of a total of 170 child health nurses from the 16 participating municipalities.

From the 1st of January to the 31st of December 2000 the record was used to collect data on all CCC 2000 children.

Overall, records from 5.624 children (91 %) who have received at least one home visit from a health nurse were used at data source.

#### MEASURES

#### PAPER II: ASSESSMENT AND CLASSIFICATION OF PSYCHOPATHOLOGY IN EPIDEMIOLOGICAL RESEARCH OF CHILDREN 0-3 YEARS OF AGE – A REVIEW OF THE LITERATURE

Based on experiences from epidemiological research in older children and increasing knowledge about methods to assess and classify mental health problems in infants and toddlers in primarily clinical settings, the following methodologically requirements to

the diagnostic classification of 0-3 year old children in an epidemiological context can be suggested:

1. *Standardized instruments* that have been validated in epidemiological research, or are validated during the research process.
2. In-dept assessment *by experienced clinicians to ensure face-validity* of case-definition (in accordance to clinically recognisable patterns of psychopathology).
3. Developmentally appropriate *assessment procedures with known psychometric properties e.g validity and reliability* for the age group in question.
4. *Investigation of several domains of mental development.*
5. Inclusion of the *relationship between child and parents* in the assessment and classification.
6. Classification of cases according to *clinically relevant diagnoses with appropriate diagnostic criteria and categories for age.*
7. Inclusion of *multi-axial classification* of individual child psychopathology as well as relational aspects.
8. Inclusion of *information from different sources*: E.g psychometric measures, parent's questionnaires, clinical observations.
9. Use of methods that *optimise cooperation of parents and children*, e.g methods that are not too time consuming and not stressing the child and the parents.

From a review of the literature on methods to assess and classify psychopathology in children aged 0-3 in epidemiological research (Paper II) the following main categories of measures were identified:

a) tests of child development, b) measures based on parent's information: interviews, questionnaires and rating scales, c) assessment measures of parent-child relationship, e) diagnostic classification schemes, and f) instruments to identify specific diagnostic categories.

It could be concluded from the review, that methodological progresses seen in the last decades, make it possible to assess and identify cases of psychopathology in children 0-3 years of age with psychometric properties corresponding to what has been seen in epidemiological research of older children two or three decades ago (Skovgaard et al 2004).

In accordance with the reviewed literature, the methodological requirements to an epidemiological study of 0-3 year old children can be met by a combination of established research instruments, e.g. Child Behaviour Check List, CBCL, (Achenbach & Rescorla 2000) and standardized and clinical methods of in-depth assessment of child mental health functioning, known from both clinical practise and research: developmental tests, such as the Bayley's Scales of Infant Development BSID (Bayley 1993) and relationship assessment as the Parent-Child Early Relational Assessment, PC-ERA (Clark 1985, Clark 1999).

Regarding diagnostic assessment of children 0-3 years, it was concluded, that the challenges of case-identification and diagnostic classification, at an age where the developmental changes are so rapid and the dependency of the relations to parents so pervasive, can be met by the inclusion of Diagnostic Classification Zero-to Three, DC: 0-3 (Zero to Three 1994). DC: 0-3 is an age specific classi-

fication scheme that complements customary classification by ICD-10 (WHO 1992) and DSM- IV (APA 1980) with developmentally appropriate diagnostic categories and diagnostic guidelines, and the possibility to classify disordered parent-child relations in a multi-axial framework (Zero to Three 1994).

### ***Child assessment at age 1½ years (see paper V)***

#### **Procedure**

The mental health functioning and symptoms of psychopathology at child age 1½ years were assessed by experienced child psychiatrists and child psychologists by the following: 1) assessment of child development and psychopathology by standardised tests and clinical measures, 2) parent interview with standardized questions combined with open-ended and semi-structured questions and 3) clinical observations and videotape recordings of the child in interaction with the attending parent in semi-structured activities during play and feeding/ eating, and 4) observation of spontaneous behaviour and free play of the child, including in relation to a foreigner (the investigator).

The child assessment lasted two-hours. At the end of the session, the parents were given a feed back regarding the development and mental health of the child, with regard to strengths as well as possible difficulties. Parents were informed that they would be contacted if the further analyses of the assessments disclosed areas of concern and any need of intervention regarding child mental health.

### ***Diagnostic assessment (see papers II and V)***

The measures of diagnostic assessment at 18 months (See Appendix 4) were selected according the conclusions of the literature review and included:

#### **1. The CC 1½ parent interview**

A semi-structured parent interview was developed to include the following: The Child Behaviour Check List CBCL1 ½-5 (Achenbach & Rescorla 2000), Checklist for Autism in Toddlers CHAT (Baird et al, 2000) and The Infant Toddler Symptom Check List ITSC (De Gangi et al 1995).

The interview was complemented with items from the Manheim Eltern Interview MEI (Esser et al 1989, Laucht et al 1993) and with thirteen adverse temperament characteristics elaborated from The Temperament Scales of Thomas and Chess (Thomas et al 1963). Questions dealing with the physical and mental health and development of the child and the psycho-social background of the family were also applied.

#### **2. Child assessment**

The psycho-motor and cognitive development and functioning of the children were assessed by the Bayley's Scales of Infant Development BSID II (Bayley 1993).

#### **3. The parent-child relationship assessment**

The relation between parent and child was examined by the Parent-

Child Early Relationship Assessment *PC ERA* (Clark 1985, Clark 1999) and rated regarding impact by the Parent-Infant Relationship Global Assessment Scale: PIR-GAS (Zero to Three 1994, Aoki et al 2002).

#### 4. Classification of mental health problems and psychopathology in ICD-10 and DC: 0-3

Psychopathology was classified through a standardized diagnostic process where mental health problems and psychiatric phenomena were identified and rated after clinical observations and videotape recordings. The diagnostic process included a categorisation of developmental problems by the subscales of BSID II, categorisation of mental health problems according to the subscale score of CBCL/ ½-5 and according to specific questions from the parent interview, e.g regarding attachment behaviour and traumatic stress reactions.

Evaluation of impact was included in the overall assessment, and classification was done according to the research diagnostic criteria of ICD-10 (World Health Organization 1992, World Health Organization 1993) and diagnostic guidelines in the DC 0-3 (Zero to Three 1994).

The DC: 0-3 diagnoses of regulatory disorders were diagnosed according to the ITSC and with the inclusion of clinical cut-off scores (DeGangi et al 1995, 2000). Relationship disturbances were classified according to guidelines in DC: 0-3 and PIR-GAS cut-off score below 40 (Zero to Three 1994).

No forced choice between diagnoses was done, and one child could thus be given more than one diagnosis of a psychiatric syndrome at axis one, both in ICD-10 and DC: 0-3. In case of diagnostic uncertainty, the videotape recordings of the child were blindly assessed by the investigators and afterwards discussed in the study team in order to reach consensus diagnoses.

#### ***The psychometric properties of case-identification at 1½ year***

##### Validity

Validity of diagnostic assessment was optimized by standardized measures whenever possible and by employment of experienced clinicians as investigators.

The face validity and applicability of assessment procedures and diagnostic instruments was tested in a pilot study of six children from an infant psychiatric clinic and six not-referred children from the general population.

##### RELIABILITY

#### PAPER III: THE RELIABILITY OF THE ICD-10 AND THE DC: 0-3 IN AN EPIDEMIOLOGICAL SAMPLE OF CHILDREN 1½ YEARS OF AGE

The inter-rater reliability and test-retest reliability in the diagnostic classification according to ICD-10 and DC: 0-3 was investigated in 18 children as a part of the CC 1½ study. The raw material from the child assessment inclusive videotape recordings, were re-diagnosed 3-12 months after the initial assessment by the three child psychiatrists, who made the initial diagnostic assessment in the study. The investigators were naïve with regard to diagnostic conclusions at the primary assessment.

#### ***Main findings***

The inter-rater and test-retest agreement among investigators in the identification of children with disorders, e.g the differentiation between children with a mental health diagnosis, and children with no diagnosis, was 96 %. In the differentiation between parent-child relationship with DC: 0-3 relationship disturbances and healthy relationships, the agreement was 100% and kappa= 1, with regard to both inter-rater and test-retest reliability. In the classification of psychopathology at Axis I, the kappa values of inter-rater reliability and test-retest reliability were respectively 0.66 and 0.57 with ICD 10, and 0.72 and 0.74 respectively, with DC: 0-3.

In conclusion, reliability of case-identification and parent-child relationship disturbances was high. Diagnostic classification of mental health problems was good and classification by DC: 0-3 resulted in improved test-retest reliability compared to ICD-10.

#### ***Clustering of mental health diagnoses at child age 1½ years***

Child psychiatric outcome was measured as ICD-10 and DC: 0-3 diagnoses. Analyses of associations were done for ICD-10 diagnoses, and those DC: 0-3 diagnoses, which are not directly comparable to ICD-10 diagnoses: Multisystem developmental disorders MSDD, regulatory disorders and relationship disorders.

The ICD-10 diagnoses were clustered in two major groups in order to get a sufficient number for the analyses of associations. The one group included the neurodevelopment disorders from the ICD-10 section F 80-F89 (disorders of psychological development), R 62.0 (psycho-motor retardation), and F 90 (hyperactivity/ attention deficit disorders). The ICD-10 diagnoses F 80-F 89 (disorders of psychological development) include F 80.1 (expressive language disorder), F 82.9 (specific developmental disorder of motor function), and the category F 88.0-F88.9 (other disorders of psychological development). The latter category covers specified disorders of psychological developmental, which do not fulfil the diagnostic criteria of the other subcategories in F 80-F84 (WHO 1992).

The other main group clustered for analysis contained all other ICD-10 F-diagnoses given in the study. These included the following: F 92 (mixed disorders of conduct and emotions), F 93 (emotional disorders), F94.1 (reactive attachment disorder), F 98.2 (feeding disorder), F 51 (sleeping disorder), and F 43 (adjustment disorder).

#### ***Definition of risks***

Biological and psycho-social risk factors recorded at parent interview at child age 1½ years were clustered according to the Manheim Risk Index into groups of high, moderate and no risk (see Appendix 5).

#### ***Statistics***

The majority of data are presented as descriptive statistics. Univariate analyses were performed using the likelihood ratio Chi-square test and Fisher's exact test, if cell count was less than 5. Multivariate analyses (cross sectional data) were done by logistic regression with child mental health disorder as dependent variable and biological and psychosocial risks as independent variable.

Odds ratios (OR), 95 % confidence interval (CI) and P-values



(two-sided) were calculated for basic and multivariate analyses. Kappa statistics was used to assess reliability.

The potential of screening for mental illness was evaluated as sensitivity, specificity, predictive value of positive test (PV pos), and predictive value of negative test (PV neg) (Altman1991).

## RESULTS

### MENTAL HEALTH PROBLEMS IN INFANCY

#### PAPER IV: MARKERS OF MENTAL HEALTH PROBLEMS BASED ON PUBLIC HEALTH NURSES' ASSESSMENTS OF 0-1-YEAR-OLD CHILDREN: THE COPENHAGEN COUNTY CHILD COHORT 2000

Based on data from child health nurses' assessments and recordings at home visits at child age 0-2 weeks, 2-4 months, 4-6 months and 8-10 months, variables were created with regard to core aspect of child development and parent-child relationship (Appendix 3).

#### **Main findings**

In Table 4, the distribution of problems in different areas of health and development was reconstructed in the age periods: 0-2 months, 2-6 months and 6-10 months.

Problems of feeding and eating were the most frequent problems recorded by health nurses and across the first 10 months of living, and 30 % of these children exhibit feeding/ eating problems at one or more health nurse visit. Health nurses reported problems regarding the overall development of the child at least once between birth and 10 months in 13 % of the children, and abnormal development of verbal and non-verbal communication was reported in 11.7 % of the children. In 4 % of the children, the health nurse reported that the parents had an experience of deviant contact with the child.

Problems in the interaction between mother and child were reported for 10 % of the children, and these problems and other problems in the relationship between parents and child, such as deviant handling and deviant expectations to the child, were most frequent at 2-6 months.

#### **Discussion**

No other general population studies have published data on

developmental and relational aspects of mental health in infancy and direct comparisons with other studies are thus not possible. But with regard to the high frequency, 30 %, of problems of feeding and eating found in the present study, the results corresponds to results from other studies of children at corresponding age (Benoit 2000), inclusive a general population study of Swedish children (Lindberg et al 1991).

### THE PREVALENCE AND ASSOCIATES OF PSYCHOPATHOLOGY AT 1½ YEARS

#### PAPER V: THE PREVALENCE OF MENTAL HEALTH PROBLEMS IN CHILDREN 1½ YEARS OF AGE – THE COPENHAGEN CHILD COHORT 2000

The prevalence and associates of mental health problems, measured as ICD-10 and DC: 0-3 diagnoses, were investigated in a random sample study of 211 children at age 1½ years (see Fig 1).

Co-morbidity was studied with regard to primary child (axis I) diagnoses in ICD-10 and DC: 0-3 and parent-child relationship disturbances (axis II) in DC: 0-3.

Data on biological and psychosocial risks were obtained from parents at the interview in relation to the diagnostic assessment of the child. Putative child psychiatric risk factors were analysed according to the Manheim Risk Index of no, moderate and high biological and psycho-social risk (Se Appendix 5).

#### **Main findings**

The prevalence of axis I diagnoses of a primary child psychiatric syndrome was 16 % (CI 11.9-22.1) with ICD-10 and 18 % (CI 13.5-24.4) with DC: 0-3 (Table 5). Most frequent *child diagnosis* was the DC: 0-3 diagnoses of regulatory disorders, which were diagnosed in 7.1 % (CI 4.0-11.5). Parent child-relationship disturbances were the most frequent diagnoses of all, found in 8.5 % (CI 5.1-13.2).

When including ICD-10 axis II diagnoses (specific developmental disorders) and axis III diagnoses (mental and psycho-motor retardation) the overall prevalence of children with one or more ICD-10 diagnoses was 18 % (CI 13.4-23.6).

ICD-10 neurodevelopment disorders, including general and specific developmental disorders and attention deficit hyperactivity dis-

**Table 4: Problems of health and development at child age 0-10 months recorded by child health nurses (N=5624)**

Area of infant health and functions Variables	0-2 months		2-6 months		6-10 months		0-10 months	
	Recorded n (%)	Problems %	Recorded n (%)	Problems %	Recorded n (%)	Problems %	Recorded n (%)	Problems %
Feeding/ eating	5521 (98.2)	13.2	4812 (85.6)	10.0	5050 (89.8)	15.9	5622 (99.9)	30.0
Sleep	5393 (95.9)	4.4	4749 (84.4)	12.9	4927 (87.6)	9.8	5611 (99.8)	20.0
Defecation	5524 (98.2)	3.3	4825 (85.8)	9.7	5050 (89.8)	7.5	5623 (99.9)	16.0
Infant language	5524 (98.2)	2.0	4825 (85.8)	7.0	5050 (89.8)	5.7	5623 (99.9)	11.7
Tactile reactions	5226 (92.9)	0.5	4675 (83.1)	1.8	4833 (85.9)	0.3	5598 (99.5)	2.1
Gross-motor functions	5265 (93.6)	1.9	4747 (84.4)	10.4	4968 (88.3)	6.0	5614 (99.8)	14.1
General development	5524 (98.2)	3.4	4825 (85.8)	7.2	5050 (89.8)	7.1	5623 (99.9)	13.0
Parents perception of contact with the child	5524 (98.2)	2.7	4825 (85.8)	1.2	5050 (89.8)	0.6	5623 (99.9)	4.0
Parents way of speaking about the child	5524 (98.2)	1.0	4825 (85.8)	2.2	5050 (89.8)	1.7	5623 (99.9)	3.7
Parents handling and care	5524 (98.2)	1.9	4825 (85.8)	2.5	5050 (89.8)	1.5	5623 (99.9)	4.2
Mother-child relation	5411 (96.2)	3.7	5166 (91.9)	7.0	5337 (94.9)	6.1	5604 (99.6)	10.1

**Table 5 Prevalence of mental health diagnoses at 1½ years (ICD 10 and DC: 0-3)**  
(N = 211)

ICD 10 diagnoses				DC 0-3 diagnoses			
Axis I	n	%	CI 95 %	Axis I	n	%	CI 95%
Disorders of psychological development (F 88-89, R 62)	6	2.8	1.1-6.1	Multisystem Developmental Disorders MSDD (700)	7	3.3	1.3-6.7
Hyperactivity/ Attention deficit disorders (F 90)	5	2.4	0.8-5.4	Regulatory disorders (400)	15	7.1	4.0-11.5
Disorders of behaviour and emotions (F 92-93)	9	4.3	2.0-5.4	Disorders of affect (200)	6	2.8	1.1-6.1
Reactive attachment disorder (F 94)	2	0.9	0.1-3.4	Reactive attachment disorder (206)	1	0.5	0.0- 2.6
Eating disorder (F 98.2)	6	2.8	1.1 – 6.1	Eating disorder (600)	5	2.4	0.8-5.4
Sleeping disorder (F 51)	3	1.4	0.3-4.1	Sleeping disorder (500)	3	1.4	0.3- 4.1
Adjustment disorder (F 43)	2	0.9	0.1- 3.4	Adjustment disorder (300)	2	0.9	0.1-3.4
One or more ICD 10 axis 1 diagnoses	34	16	11.9- 22.1	One or more DC:0-3 axis 1 diagnoses	39	18	13.5-24.4
<i>Axis I, II and III diagnoses</i>				<i>Axis 2</i>			
One or more ICD 10 mental health diagnosis	37	18	13.4- 23. 6	Relationship disorders (902-905)	18	8.5	5.1-13.2

**Table 6**

**Co- morbidity between relationship disturbances and child mental health disorder in a random sample of 211 children at the age of 18 months**

(Odds Ratio 95 % CI)

Child diagnoses (ICD 10/DC 0-3)	N	Relationship disturbance (DC 0-3)		OR (95 % CI)
		No 193/ 211	Yes 18/ 211	
Developmental disorders ICD 10: F 88-89	6	5	1	2.2 (0.2-20.0)
Hyperactivity/Attention Deficit Disorder ICD 10: F 90	5	2	3	19.1 (13.0-123.3)*
Disorders of conduct and emotions ICD 10: F 92-93	9	4	5	14.5 (3.7-56.4)*
Reactive attachment disorder ICD 10: F 94	2	0	2	-
Disorders of eating and sleeping ICD 10: F 51, F 98.2	9	8	1	1.3 (0.2-11.5)
Regulatory Disorders DC 0-3: 400	15	10	5	6.3 (1.9-21.1)*
All ICD 10 child mental health diagnoses	36	25	11	10.6 (3.8-29.8)*

velopmental disorder (F84), whereas 3.3 % (CI 1.3-6.7) were diagnosed in DC: 0-3 with a multi system developmental disorder, MSDD. ICD-10 emotional and behavioural disorders were diagnosed in 4.3 % (CI 2.0-5.4) and eating disorders in 2.8 % (CI 1.1-2.8).

Significant comorbidity was found between DC: 0-3 parent-child relationship disorder and child mental health disorders, OR 10.6 (CI 3.8-29.8). In particular ICD-10 emotional and behavioural disorders and ADHD and the DC: 0-3 diagnosis of a regulatory disorder were associated with relationship disorders (Table 6).

Associations of risk at child age 1½ years (Table 7)

*Biological risk* were associated with an increased risk of a mental health disorder, but only significant with regard to neurodevelopmental diagnoses, OR 4.9 (CI 1.4-16.9). A non-significant lower risk of relationship disturbances with high biological risk was seen.

*Psychosocial risk* were significantly associated with a mental health disorder in the child, OR 3.1 (CI 1.2-8.1) and with a parent-child relationship disorder OR 5.0 (CI 1.6-16.0).

The strongest risk associations were found between relationship disorders and child mental health disorders in the area of emotional, behavioural, eating and sleeping disorders, and this association persisted when the confounding effect of both biological and psycho-social risks were corrected for, OR 11.6 (3.8-370.5).

### Discussion

*The prevalence of mental health disorders at child age 1½ years.* The most frequent single child diagnosis was the DC: 0-3 diagnosis of

order, ADHD, were diagnosed in a total of 7 % (CI 3.6-10.8) of the children, of whom ADHD were diagnosed in 2.4 % (CI 0.8-5.4). No children fulfilled the criteria of an ICD-10 diagnosis of a pervasive de-

**Table 7****Risk associations**

Associations of biological and psycho-social risks (Appendix 5) with mental health disorder and relationship disturbances in a random sample of 211 children at the age of 1½ year. Logistic regression

		Child Mental Health Disorder (ICD 10 diagnose, N=37)				Relationship disturbances (DC 0-3, axis 2 N= 18)			
		Yes	No	%	OR CI (95 %)	Yes	No	%	OR CI (95 %)
Sex (female)	(N=101/211)	15	95	13.6	1.6 (0.8-3.4)	10	91	9.9	1.2 (0.4-3.6)
<b>Biological Risk (MRI- A)</b>									
Low	(N= 151)	20	131	13.2	-	12	139	7.9	-
Moderate	(N= 34)	10	24	29.4	1.9 (0.7-3.8)	4	30	11.8	1.1 (0.3-3.8)
High	(N= 26)	7	19	26.9	1.6 (0.6-4.7)	3	24	7.7	0.4 (0.1-2.2)
<b>Psycho-social Risk (MRI- B)</b>									
Low	(N= 113)	12	101	10.6	-	7	106	6.2	-
Moderate	(N= 56)	12	44	21.4	1.9 (0.8-4.6)	2	54	3.6	0.1 (0.1-2.8)
High	(N= 42)	13	29	31.0	<b>3.1(1.2-8.1)*</b>	9	33	21.4	<b>5.0 (1.6-16.0)*</b>

\*  $p < 0.05$

regulatory disorder, found in 7.1% of general population children. Regulatory disorder is a diagnostic concept from DC: 0-3, defined by disturbances in the regulation of neurophysiological and emotional-behavioural reactions, which at one end reflect maturity-based and transient deviances in an otherwise normal development and at the other end, more persistent neuro-regulatory disturbances (Zero to Three, 1994, Barton & Robins 2000, DeGangi et al 2000). The latter has been suggested to be an early manifestation of attention deficit and hyperactivity disorder, ADHD (Barton & Robins 2000). In the present study, children diagnosed with regulatory disorder with DC: 0-3, show a spectrum of diagnoses in ICD-10, ranging from no diagnoses in one third, to ADHD in another third, which concurs with these considerations.

DC: 0-3 relationship disorders were the most frequent mental health problem of all, diagnosed in 8.5 % of parent-child pairs. Furthermore, relationship disorders were significantly associated with a mental health disorder in the child, in particular ADHD, reactive attachment disorders and emotional and behavioural disorders.

For comparison, no other general population studies of children at this age have investigated prevalence and co-morbidity of mental health diagnoses. A comparison of the diagnostic distribution and prevalence of single diagnoses found in the present study, with the results from other studies at the same age, is thus not possible. However, studies of parent-reported behavioural and social-emotional problems in non-selected populations below the age of three years (Table 2) have demonstrated rates of prevalence ranging from 7% to 24 %, with the majority falling between 10% and 15 %

(Richmann et al, 1975; Earls, 1980; Larsson, Pless & Miettinen, 1988; Koot & Verhulst 1991; Stallard et al 1993, Sourander, 2001; Briggs-Gowan & Carter, 2001; Egger & Angold 2006). In a study of psychiatric diagnoses in children from a paediatric population, Lavigne et al found an overall prevalence of best estimate DSM-III R diagnoses of 7.1-13.6 % in children aged 2 years. Children with general or pervasive developmental disorders were not included in this study, and furthermore, the participation rate was low, 45 %. Accordingly, direct comparison with the present general population study is not possible.

However, studies of children aged 5 years or more, have found a mean general population prevalence of mental disorder at 16 % (Roberts et al 1998, Costello et al 2005), which corresponds to the prevalence we have found in the 1½ year old children. Additionally, studies of older children have shown an overall distribution of diagnostic categories which are comparable to the results from the present study, with emotional, - behavioural- and adjustment disorders being the most common, and neurodevelopment disorders, including attention deficit hyperactivity disorders, affecting a minor proportion of disordered children (Rutter 1989; Fombonne 2002, Costello et al 2005, 2006).

*Associations of risk at child age 1½ years:* The significant associations between biological risks and neurodevelopment disorders, and between psycho-social risks and disorders of emotions and behaviour found in the present study, correspond to results from studies of older children (Rutter et al 1989, 2005, Costello et al 2005, 2006). Furthermore, the findings of significant associations between psycho-social adversities, relationship disorders and child mental

health disorders in the present study of general population children, are in line with empirical data from clinical populations of infants of psycho-socially disadvantaged parents, e.g parents with mental illness, alcohol/ drug abuse, low education etc (Zeanah et al 1997 a, 1997 b, 2000, Seifer et al 2000).

INFANCY PREDICTORS OF PSYCHOPATHOLOGY  
PAPER VI: PREDICTORS (0-10 MONTHS) OF PSYCHOPATHOLOGY  
AT AGE 1½ YEARS- A GENERAL POPULATION STUDY IN THE  
COPENHAGEN CHILD COHORT 2000

Predictors of child mental disorder were investigated in prospective data recorded by child health nurses from birth to ten months and with the outcome at 1½ years in the CC 1½ random sample study of 211 children from the general population (see Fig 1). The predictor variables (see Appendix 3) were grouped in the following cardinal domains of infant mental health: neurodevelopment, cognitive functions, language, social interaction/ communication, regulation of physical functions, emotional functioning and parent-child relations, and further divided into early (0-6 months) and late (8-10 months) problems.

**Main findings**

Impairments in neuro-cognitive functioning, deviant language development, disturbances in the child's contact and communication and parent-child relationship problems were all significant infancy predictors of a child mental disorder at 1½ years (Table 8).

*Predictors of neuro-developmental disorders* (Table 9): Impaired social interaction and communication recorded already in the first

six months of the child's life, predicted all the neurodevelopment disorders investigated, inclusive attention deficit hyperactivity disorders, ADHD. Delays in cognitive functioning and language impairment predicted all neurodevelopment disorders but ADHD. The latter however, was predicted by the parent's perception of deviant contact with the child recorded in the first ten months of living.

Predictors of other child mental disorders: No single infancy predictor was found regarding the clustered group of emotional-, behavioural-, eating and sleeping disorders. Among the separate diagnoses, however, eating disorder at 1½ years was significantly predicted by eating problems recorded at 8-10 months, OR 6.1 (CI 1.2-31.7).

*Relationship disorders*: No single child factor recorded from birth to ten months seems to predict a relationship disturbance at 1½ year, but several parent related factors did: Unwanted pregnancy and the parent's negative expectations of the child and deviant handling and reactions to the child recorded in the first months of the child's life, were significant predictors of a relationship disturbance at 1½ year (Table 10).

**Discussion**

Prospective data recorded by health nurses between birth and child age 11 months showed significant predictors of neurodevelopment disorders at child age 1½ years. These infancy predictors of neurodevelopment disorders correspond to childhood predictors of neuropsychiatric disorders, that have been demonstrated in longitudinal studies of adolescents and adults (Mc Gee et al 1995, Isohanni et al 2004, Rutter et al 2006), e.g predictors of schizophrenia found in the Dunedin study (Cannon et al 2002).

**Table 8**  
**Infancy predictors of psychopathology**

Associations of health nurse recorded mental health problems (0 - 10 months) with ICD 10 psychiatric disorders at 1½ years in a random sample of 210\* children.  
(Odds ratio 95% CI)

Area of abnormal development or function	Neurodevelopmental disorders (R 62, F 80-89, F90)			Emotional-, behavioural-, eating and sleeping disorders (F 92, F93, F 94, F 98.2, F 51, F 43)				Any mental health disorder**		
	No (n=196)	Yes (n=14)	OR CI 95%	No (n=187)	Yes (n=23)	OR	CI 95%	No (n=174)	Yes (n=36)	OR CI 95%
<b>Neuro-developmental problems</b>										
Deviant language development (28/ 210)	22	6	<b>5.9 (1.9-18.7)</b>	24	4	1.4	(0.5-4.6)	18	10	<b>3.3 (1.4-8.0)</b>
Neuro-cognitive functions (incl language) (50/210)	41	9	<b>6.8 (2.2- 21.4)</b>	45	5	0.9	(0.3-2.5)	36	14	<b>2.4 (1.1- 5.2)</b>
One or more developmental problems (70/ 210)	61	9	<b>4.0 (1.3- 12.4)</b>	63	7	0.9	(0.3- 2.2)	54	16	1.8 (0.9-3.7)
<b>Feeding/ eating problems (61/ 210)</b>	55	6	1.9 (0.6- 5.8)	52	9	0.7	(0.3- 1.8)	47	14	1.7 (0.8-3.6)
<b>Sleeping problems (35/210)</b>	33	2	8.8 (0.2- 3.9)	28	7	2.5	(0.9- 6.6)	26	9	1.9 (0.8- 4.5)
<b>Emotional state/ regulation (17/ 208)</b>	15	2	2.0 (0.4- 9.7)	15	2	1.1	(0.2- 5.1)	13	4	1.5 (0.5- 5.0)
<b>Disturbances in child's contact and communication (48/ 210)</b>	41	7	<b>3.8 (1.3- 11.4)</b>	41	7	1.6	(0.6 4.0)	34	14	<b>2.6 (1.2- 5.6)</b>
<b>Relationship problems Disturbances in parents relations to the child (34/ 210)</b>	30	4	2.2 (0.7- 7.5)	28	6	2.0	(0.7- 5.5)	24	10	<b>2.4 (1.0- 5.6)</b>

(\* One child of 211 children in random sample was excluded because of missing data)  
\*\* One child had a diagnosis both of the two main groups

**Table 9**

**Infancy predictors of neuro-developmental disorders**

Associations of health nurse recorded problems (0-10 months) and neuro-psychiatric disorders at child age 1½ years (ICD 10 and DC 0-3 diagnoses) in a random sample of 210\* children (Odds Ratio OR CI 95 %)

<b>Mental health problems</b>	<b>Psycho-motor retardation</b> (ICD 10 R 62.0)	<b>Disorders of Psychological Development</b> (ICD 10 F 88-89)	<b>Attention Deficit Hyperactivity Disorders</b> (ICD 10 F 90)	<b>Multi-system Developmental Disorders</b> (DC 0-3:701-703)
Assessed at age (months) n/N (%)	N= 3 OR CI 95%	N= 6 OR CI 95%	N=5 OR CI 95%	N=7 OR CI 95%
<b>Delay in cognitive functioning</b> (0-6 months) 27/209 (12.9)	<b>1.1 (1.0-1.3)</b>	<b>7.5 (1.4-39.1)</b>	1.7 (0.2-15.9)	<b>10.4 (2.2-49.3)</b>
<b>Language delay/ impairment</b> (0-10months) 28/ 210 (13.3)	<b>13.9 (1.2-159.0)</b>	<b>7.2 (1.3-37.4)</b>	1.7 (0.2-15.3)	<b>5.3 (1.1-25.3)</b>
<b>Impaired social interaction and communication</b> (0-6 months) 14/210 (6.7)	<b>32.5 (2.8-384.3)</b>	<b>8.0 (1.3-48.2)</b>	<b>10.7 (1.6-70.4)</b>	<b>6.4 (1.1-36.3)</b>
<b>Deviant contact perceived by parents</b> (0-10 months) 6/ 210 (2.9)	0.97 (0.95-0.99)	7.8 (0.8-81.3)	<b>33.5 (4.3-258.8)</b>	6.6 (0.7-65.5)

(\* One child of 211 children in random sample was excluded because of missing data)

Taken together, the present study confirms the significance of pre- and perinatal risks in the pathogenesis of neurodevelopment disorders and points to the existence of global predictors of neuro psychiatric disturbances that can be identified as early as in the first year of living.

Predictors of a parent-child relationship disorder at child age 1½ year could be tracked back to the first months of the child’s life and manifest disturbances in the parent’s relations to the child recorded by health nurses between birth and 10 months significantly predicted a mental disorder at child age 1½ years.

Studies of children older than 6-7 years of age, have demonstrated different influences on mental health whether exposed to biological or psycho-social risks (Rutter 1989, Friedman et al 2002, Rutter et al 2003, 2005, Costello et el 2005, 2006, Rutter et al 2006).

For comparison with the present study of 1½ year old children, only the Manheim Study of Risk Children have investigated *both* biological *and* psychosocial risks simultaneously and prospectively from infancy (Laucht et al 1997) and furthermore, with measures comparable to those used in the present study.

The Manheim Study investigated children in respectively high, moderate and low/ no risk regarding biological as well as psycho-social risk factors, and found significant and different impact of biological risk and psycho-social risk on respectively psycho-motor development and psycho-social functioning at age 3 months (Laucht et al 1993).

A decrease in influence of biological risk recorded at birth was seen at follow up at child age 24 months, whereas the importance of psycho-social risks had become more prominent (Laucht et al 1997,

**Table 10**

**Risk factors of parent-child relationship disorder**

Associations of child and family variables recorded from birth to 10 months and a relationship disorder diagnosed at child age 18 months in a random sample of 210 children\* (Odds Ratio CI 95 %)

<b>Risk factor</b>	<b>(Prenatal / 0-10 months)</b> N (%)	<b>Relationship disorder</b> (DC: 0-3 902-905)		
		No (n=192)	Yes (n=18)	OR CI 95%
<b>Child variable</b>				
Female sex	101 (48.1)	91/101	10.8	1.4 (0.5-3.7)
Birth complications	73 (34.8)	71	2	3.8 (0.9-16.5)
Congenital disorder/ malformations	4 (1.9)	4	0	-
Neuro-developmental delay	50 (23.8)	44	6	1.6 (0.6- 4.7)
Feeding/ eating problems	60 (28.5)	54	6	0.8 (0.3- 2.2)
Sleeping problems	35 (16.7)	33	2	0.6 (0.1- 2.8)
Emotional state/ regulation	17 (8.1)	14	3	2.5 (0.7- 9.7)
<b>Parental factors</b>				
Low / lacking education	20 (9.5)	15	5	<b>3.6 (1.5- 9.2)</b>
Mental illness in parents	18 (8.6)	16	2	1.3 (0.2-3.5)
Parental conflicts	38 (18.1)	30	8	<b>3.6 (1.5 8.5)</b>
Lack of social network	14 (6.7)	9	5	<b>5.4 (2.3-12.9)</b>
<b>Relationship variables</b>				
Unwanted pregnancy	8 (3.8)	5	3	<b>5.0 (1.8-13.9)</b>
Parental perception of deviant contact with the child	6 (2.9)	3	3	<b>12.6 (2.3- 67.9)</b>
Deviant expectations, handling or reactions to the child (0-1 month)	14 (6.6)	10	4	<b>5.1 (1.4- 18.5)</b>

(\* One child of 211 children in random sample was excluded because of missing data)

2000). These findings are in accordance with the results from the present study of 1½ years old children.



**Table 11**

**Associations of health nurse’s concern stratified on periods in infancy and mental health disturbances at child age 18 months in a general population sample of 296 children from CCC 2000**

(ICD 10: Neuro-developmental disorder (F 80-89, F 90 and R 62) and Emotional-, behavioural-, eating and sleeping disorder (F 43, F 51, F 92-93, F 94.1 and F 98.2) and DC: 0-3 relationship diagnoses 902-905)

Area of concern	Age period	Neuro-developmental disorder (N=25)		Emotional-, behavioural-, eating and sleeping disorder (N=35)		Relationship disorders (N=25)		Any disorder (N=57)	
		OR	CI 95 %	OR	CI 95 %	OR	CI 95 %	OR	CI 95 %
<i>Child development</i>	0 - 6 months	2.0	(0.8-5.19)	1.5	(0.6-3.5)	0.6	(0.2-2.2)	1.6	(0.8-3.1)
	8- 10 months	<b>3.8</b>	<b>(1.5-9.5)</b>	0.9	(0.3-2.6)	<b>0.9</b>	<b>(0.8-0.9)</b>	<b>2.2</b>	<b>(1.0-4.7)</b>
	Any period	<b>2.8</b>	<b>(1.2-6.5)</b>	1.3	(0.6-2.8)	0.4	(0.1-1.2)	1.8	(1.0-3.4)
<i>Mother-child relationship</i>	0- 6 months	1.1	(0.3-3.7)	<b>2.7</b>	<b>(1.1-6.5)</b>	1.1	(0.3-3.7)	2.3	(1.0-4.9)
	8-10 months	3.5	(0.9-13.6)	1.3	(0.3-6.5)	1.9	(0.4-9.1)	2.7	(0.9-8.7)
	Any period	1.6	(0.6-4.6)	<b>2.5</b>	<b>(1.1-5.8)</b>	1.2	(0.4-3.7)	<b>2.6</b>	<b>(1.2-5.3)</b>
<i>Family relations</i>	0-6 months	1.3	(0.5-3.6)	2.7	(0.5-3.1)	0.9	(0.3-2.9)	1.3	(0.6-2.6)
	8-10 months	1.6	(0.4-5.8)	1.3	(0.3-6.5)	1.9	(0.6-5.9)	1.6	(0.6-3.9)
	Any period	1.6	(0.6-4.0)	1.4	(0.6-3.3)	1.6	(0.6-4.0)	1.5	(0.8-3.0)
<i>Any concern</i>	0-6 months	1.1	(0.5-2.7)	1.4	(0.7-2.8)	1.1	(0.5-2.7)	1.2	(0.7-2.2)
	8-10 months	<b>2.6</b>	<b>(1.1- 6.1)</b>	0.9	(0.4-2.1)	0.8	(0.3-2.2)	1.7	(0.9-3.2)
	Any period	<b>2.3</b>	<b>(1.0-5.3)</b>	1.3	(0.7-2.7)	1.1	(0.5-2.5)	1.7	(0.9-3.1)

The present CCC 2000 results point to the importance of parent-child relationship problems in the risk mechanisms of emotional, behavioural and eating and sleeping disorders, both when recorded between birth and 10 months and when diagnosed as parent-child relationship disorder at 1½ years.

For comparison, the Manheim Study found significant associations between relationship problems recorded at three months and symptoms of social-emotional withdrawal at 4½ and 8 years of age (Gerhold et al 2002).

**MENTAL HEALTH SCREENING IN INFANCY**

PAPER VII: CAN A GENERAL HEALTH SURVEILLANCE BETWEEN BIRTH AND 10 MONTHS IDENTIFY CHILDREN WITH MENTAL DISORDER AT 1½ YEAR? – A CASE-CONTROL STUDY NESTED IN COHORT CCC 2000  
A global concept of concern, concluded at home visits regarding child development, parent-child relations or family functions, was used as “screening-measure”, and the potential of screening for mental health problems in infancy was investigated in 296 children in a case-control study nested in a sub-cohort of CCC 2000 (Fig 1) and with child mental disorder or parent-child relationship disorder at 1½ year as the outcome.

Children of any health nurse concern were the cases and children of no-concern were the controls in the study.

**Main findings**

Community health nurses concern about the development of the

child recorded between birth and ten months was significantly associated with the child having a neuro-developmental disorder at 1½ year (Table 11).

Concern about mother-child relationship was associated with the child having a disorder of emotional-, behavioural, eating and sleeping disturbance and this association was seen already in the first 6 months of the child’s life OR 2.7 (CI 1.1-6.5).

A tendency towards inverse associations between concern of child development (0-10 months) and relationship disturbances at 1½ year was found: concern of child development at child age 8-10 months was thus associated with a significantly 10 % lower risk of a mother-child relationship disturbance at 1½ year.

The predictive value of health nurse concern with regard to the child having a mental disorder at age 1½ years (PV pos: true positive/ true positive +false positive) was highest when concern was concluded regarding mother-child relations, PV pos 34.2 % (CI 20.6-50.7) and child development, PV pos, 26.6 % (CI 17.6-37.9). The highest sensitivity (true positive/ true positive + false negative) was seen with health nurses’ overall conclusion regarding concern or no-concern within the whole period 0-10 months, 56.1 % (CI 42.4-69.0). Across all areas of concern, but in particular regarding mother-child relations and family function, the predictive value of a negative test was high, more than 80 %, which indicate that the majority of children concluded of no-concern at age 0-10 months, were truly identified as not in risk of a mental disorder at age 1½ year.

## Discussion

Health nurses' conclusions of concern respective no-concern between birth and ten months were predictive of mental health outcome at child age 1½ years in more than half of the children. Bearing in mind, that the screening measure investigated was a global concept of risk or concern, and the health nurses have no formalized training in infant mental health assessment, it is noteworthy, that nearly a fourth of children with a mental health disorder at 1½ years were identified. The predictive value depended on the age of the child and the area of concern, and the strongest association was seen, when concern about child development was concluded at 8-10 months, being associated with a more than three fold increase in risk regarding a neurodevelopment disorder at 1½ years.

In their customary routines Danish health nurses perform a standardized test of hearing, attention and communication, the BOEL test, at child age 8-10 months. Another study in CC 1½ has investigated the predictive value of abnormal reactions at the BOEL test and compared to health nurses' global assessment of child development with neurodevelopment disorders as outcome (Jacobsen et al 2007). The results point to the improvement in predictive validity of a mental health screening, when a standardized measure as the BOEL test is applied.

To the author's knowledge, no other studies have been published which investigate the screening potential in the general infant population and with regard to the whole spectrum of mental illness in such young children. Studies of screening for autism spectrum disorders, ASD (Baird et al 2000, Dietz et al 2006) have shown, that even when a specific screening tool as Checklist for Autism in Toddlers, CHAT, is applied at child age 18 months, the sensitivity and the predictive validity of a positive test, PV pos, is relatively low, whereas specificity and predictive value of negative test, PV neg, is high (Baird et al 2000, 2001, Chairman et al 2005).

Taken together, the present study of unspecific "screens" and the studies of CHAT both illustrate the problems of low predictive value of a positive test, when screening a general population for relatively rare disorders in preschool age, as relatively many children are being screened as false positive (Costello et al 2005).

## A REGISTER STUDY OF THE INCIDENCE OF MENTAL HEALTH DISORDERS IN 0-3 YEAR OLD CHILDREN (UNPUBLISHED DATA)

For this overview, a register study was carried out on CCC 2000 children diagnosed at hospitals within their first three years of life.

For all cohort children, their unique identification was searched within the National Register of Patients (LPR) and the Psychiatric Central Register (PCR). For details see *Appendix 1*.

The age of the child was calculated from the birthday and the first day of treatment at hospitals. The incidence of mental health disorders was calculated as first time diagnosis of a disorder of mental health in the population for each year.

## Main findings

During their first three years of life a total of 87 children from the

CCC 2000 were recorded in the registers (LPR and PCR) with 118 first time diagnosis of an ICD-10 mental health F-diagnosis or the diagnosis R 62.0 of psycho-motor retardation. Of these, 64 had a first time mental health F-diagnosis corresponding to an overall incidence of 10.7/ 1000 (Table 12).

Diagnoses of mental retardation and psycho-motor retardation were the most frequent of all, accounting for more than half of all first time diagnoses between birth and 36 months. The majority of children with mental retardation and psycho-motor retardation were diagnosed in the first year of life at paediatric departments/ hospitals. Also eating disorder was most often diagnosed at paediatric departments during the first year of life, with an incidence of 1.5/ 1000. Attachment disorders were also most frequently diagnosed in the first year of life, whereas 3 of 4 children with pervasive development disorders, including autistic disorders, were diagnosed in their third year of life.

The distribution on gender shows a higher rate of boys compared to girls regarding developmental disorders and behavioural-emotional disorders, whereas girls were more frequently diagnosed with eating -, attachment- and adjustment disorders.

## Discussion

The overall incidence of a child mental disorder diagnosed at hospital from birth to 36 months and including all F-diagnoses and R 62.0 was 1.9 %, while the general population prevalence of the corresponding diagnoses was 18 % (CI 13.4-23.6) at child age 18 months. A comparison with regard to the diagnostic areas, show a higher proportion of neurodevelopment disorders compared to emotional and behavioural disorders in children treated at hospitals, probably due to early referral to paediatric departments of children with developmental delay and co-morbid physical illness. As children with severe physical illness or handicaps, e.g profoundly retarded children, were not included in the general population study, the overall prevalence of neurodevelopment disorders at child age 1½ years was underestimated.

For all diagnostic categories investigated, a pattern of considerable higher prevalence in the general population was seen at child age 1½ years, when comparing to the incidence of disorders diagnosed at hospitals in the first 3 years of life. Thus, ADHD was diagnosed at hospital in 0.03 %, whereas the general population prevalence of the disorder was 2.4 %. Eating disorders were diagnosed at hospital in 0.15 % in the first three years of life, whereas 2.8 % of the children in the general population met the criteria of an eating disorder at 1½ years, e.g within the same period of age.

Discrepancies between the prevalence of disorders in the general population and the incidence of children exceeding the threshold to referral to hospital services, are well known from epidemiological studies of older children (Costello et al 2005), and currently discussed in the context of reluctance to diagnose mental illness in children and the inappropriate resources to assessment and treatment.

With regard to infants and very young children as investigated in the present study, a relatively low incidence could also be explained by limitations in knowledge about infant and toddler psychopathology in the primary health services.

**Table12****Incidence of mental health diagnoses in children aged 0-3 years in CCC 2000 (N=6090)**

Frequency of children (N=87) diagnosed with a first time mental health diagnosis in their first 3 years of life- Based on register data (LPR and PCR) recorded from paediatric and child psychiatric departments 2000-2004 and stratified on age and gender

<b>ICD-10- mental health diagnoses</b> (F- diagnoses and R 62.0)	<b>1. year</b> (N= 6090) n / 1000	<b>2. year</b> (N=6074) n / 1000	<b>3. year</b> (N=6073) n / 1000	<b>0-3. year</b> (N=6073) n / 1000	<b>Ratio</b> <b>boys: girls</b>
Mental Retardation (F70-F 77, F78-F 79)	4 (0.66)	4 (0.66)	5 (0.82)	13 (2.15)	1.2
Psycho-motor retardation (R 62)	32 (5.25)	14 (2.31)	6 (0.99)	52 (8.56)	1.4
Specific developmental disorders (F80-83)	-	3 (0.49)	4 (0.66)	7 (1.31)	1.3
Pervasive Developmental disorders (F84)	1 (0.16)	-	3 (0.49)	4 (0.66)	1
Hyperactivity Disorders (F90)	1 (0.16)	1 (0.16)	-	2 (0.33)	1
Disorders of conduct and emotions (F91, 92, F 93)	1 (0.16)	2 (0.33)	2 (0.33)	5 (0.82)	1.5
Attachment disorders (F94.1-F94.9)	7 (1.15)	-	1 (0.16)	8 (1.31)	0.1
Eating disorders (F98.2-F50)	13 (2.15)	2 (0.33)	-	15 (1.48)	0.7
Sleeping disorders (F51)	1 (0.16)	1 (0.16)	2 (0.33)	4 (0.66)	1
Adjustment disorders (F43)	2 (0.33)	2 (0.33)	2 (0.33)	6 (0.99)	no boys
Other F-diagnoses (F 18)	1 (0.16)	-	1 (0.16)	2 (0.33)	1
<b>All F-diagnoses</b>	<b>31 (5.1)</b>	<b>15 (2.47)</b>	<b>18 (3.03)</b>	<b>64 (10.7)</b>	0.7
<b>All diagnoses</b>	<b>63 (10.4)</b>	<b>29 (4.7)</b>	<b>26 (4.28)</b>	<b>118 (19.4)</b>	0.9

**GENERAL DISCUSSION**

A general population birth cohort was established to study psychopathology prospectively from birth in order to fill in the gap in knowledge regarding core epidemiological aspects of mental illness in early life.

**THE HYPOTHESES INVESTIGATED IN THE STUDY WERE:****1) INFANTS AND TODDLERS SUFFER FROM MENTAL ILLNESS LIKE OLDER CHILDREN DO**

Psychiatric phenomenology regarding 0-3 year old children was investigated in a general population prevalence study of 1½ years old children, and supplied with a register study of first time diagnoses in children referred to hospital, and diagnosed with a mental health disorder at age 0-3 years. Based on in-depth child psychiatric assessment by experienced clinicians using standardized measures

and clinical assessments, it was shown that mental health disorders according to the diagnostic categories in ICD-10 and DC: 0-3, can be detected in the general population of children as young as 1½ years. The frequency and distribution of diagnostic categories correspond in several aspects to what has been found in studies of older children (Roberts et al 1998, Costello et al 2005).

Among children diagnosed at hospital, the whole spectrum of ICD-10 mental health diagnoses were represented, with general developmental disorders and eating disorders as the most frequent. An age and gender specific pattern was seen, with pervasive developmental disorders diagnosed more frequent the older the age, and eating disorders and attachment disorder more frequently diagnosed in the youngest children. The gender distribution known from studies of older children was seen already in children 0-3 years of age, with neuro-developmental disorders diagnosed more frequent in boys and eating disorders more frequent in girls (Rutter et al 2003).

Together these findings point to a far earlier emergence of manifest psychopathology than has been described hitherto.

## 2) DISORDERS OF NEURODEVELOPMENT: MENTAL RETARDATION, PERVASIVE DEVELOPMENTAL DISORDERS PDD AND ADHD MANIFEST IN THE FIRST YEARS OF LIFE

Disorders of neurodevelopment were identified in 7 % of the children from the general population at child age 1½ years. Of these, ADHD was found in 2.8 %, whereas no children were diagnosed with an autism-spectrum disorder at age 1½ years. Among referred children aged 0-3 years, ADHD showed an incidence of 0.03%. The overall incidence of PDD was 0.1 %, with incidence increasing with age.

Neurodevelopmental disorders were associated with biological risk factors similar to what has been found in studies of older children (Costello et al 2006). Significant early predictors of deviant neurodevelopment were identified between birth and 10 months by community health nurses.

Among referred children, the increased risk regarding neurodevelopmental disorders in boys, known from studies of older children, was seen already at child age 0-3 years.

Together these findings point to the validity of neurodevelopmental disorders in early age.

## 3) RISK FACTORS AND PREDICTORS OF CHILD MENTAL ILLNESS CAN BE DETECTED IN THE FIRST YEAR OF LIFE

Risks factors were investigated on cross sectional data obtained from parents at the time of the diagnostic child assessment at age 18 months and predictors were studied on prospective data, collected by health nurses from birth to 10 months.

The study results concurs with results from epidemiological studies of older children regarding different pathway of risks, with biological risks associated with neurodevelopment disorders and psycho-social risk with emotional-, behavioural-, eating, sleeping and adjustment disorders (Rutter 1989, Rutter 2005, Costello et al 2006).

The early influences of these risks are demonstrated by the findings that predictors can be identified in the first 6 months of life.

### ***The role of relationship disturbances in the early risk mechanisms***

Parent-child relationship problems identified by health nurses in the first ten months of life were associated with a more than two fold increase in risk of a child disorder at age 1½ years, and children with a parent-child relationship disorder had a ten fold increased risk of a co-morbid mental disorder, in particular reactive attachment disorder, disorders of behaviour and emotions and attention deficit hyperactivity disorder, ADHD. Risk factors of relationship disturbances at child age 1½ were manifest before the birth of the child, e.g parent's low education and unwanted pregnancy. These findings are in accordance to the literature and to clinical experiences regarding the key role of the parent-child relations in infant and toddler psychopathology (Zeanah et al 1997 a, b).

No child risk factors at age 0-10 months were associated with increased risk of parent-child relationship disturbances at age 1½

years. On the contrary, a tendency of inverse association was found in children with biological risk and showing developmental impairment at age 8-10 months, as these children had a 10 % reduced risk of relationship disturbances at child age 1½ year.

ADHD was found associated with both predictors of neurodevelopment disorders (e.g deviances in social interaction and communication and parents perception of deviant contact between birth and ten months) and with relationship disorders at age 1½ years.

The study results point to the early manifestation of ADHD as regulatory disorders, a DC: 0-3 diagnostic concept of maturity based neuro-regulatory disturbances (Zero to Three 1994) and furthermore, the results suggest a pathway of further risk exposition in these children early in life, due to disturbances in parent-child relationship. These results are in accordance with the results from the Bloomington Longitudinal Study of prospectively recorded early precursors of children's self-regulatory competence (Olson et al 2002) and in accordance with the results from the Manheim Study of Children at Risk (Laucht et al 2000). The latter found significant associations between difficulties in the child's temperament and regulatory problems at 3 months on the one side, and ADHD symptoms at 2 years of age at the other side (Laucht et al 1993, 1994). However, when controlling for family adversity, this association vanished (Becker et al 2004).

Using ADHD as a model to understand the role of the parent-child relation in developmental psychopathology, a two directional influence on the pathogenesis can be considered: the negative influences on the relationship, given a regulatory disturbed hyperactive child in one direction, and the aggravation of constitutional hyperkinetic symptoms, given a disturbed parent-child relation, e.g based on an unwanted pregnancy and parents negative expectations to the child and lack of resources to regulate and support the child.

Taken together, the findings from the study support the experiences from clinical settings regarding the parent-child relationship as the potential key mediator of psycho-social risks, as well as a key resilient factor with regard to the early promotion of child mental health (Zeanah 2000).

### ***The role of gender and age in the risk mechanisms***

Studies of school aged children and adolescents have shown remarkable differences in psychiatric morbidity according to sex and age, most pronounced in clinical populations, but the same tendencies have been found in general population studies. In school aged children, neurodevelopmental and externalising disorders, e.g behavioural disorders, have been found most prevalent in boys, whereas internalising disorders, in particular emotional disorders have been found more prevalent in girls. Before puberty, boys exceed girls with regard to the prevalence of overall psychiatric illness, whereas the pattern changes after puberty, and girls exceed boys, partly due to increase in emotional/ affective disorders (anxiety disorders and depressive disorders) and eating disorders (Rutter et al 2003).

In the present general population study of children aged 1½ years, no significant differences in gender distribution were seen.

However, among children referred to hospital within age 0-3 years, the same pattern of gender distribution as described in older children was seen, with boys more frequently diagnosed with a neurodevelopment disorder and girls more often with eating disorders. In the age period investigated, 0-3 years, differences according to age were seen regarding eating disorders and attachment disorders being predominantly diagnosed in the first year of life, and pervasive developmental disorders diagnosed more frequent, the older the child. The same tendency was seen in another study of children aged 0-3 years, referred from the same geographic area, but diagnosed in the period 1996-1998 (Elberling et al 2002). Taken together, these findings suggest that gender and age specific differences in the manifestations and identification of psychopathology, known from studies of older children, are seen already in very early childhood.

### ***The role of early feeding and eating problems***

Nearly one third of all general population children were reported to have *feeding problems* between birth and ten months, which corresponds to results from other general population studies (Lindberg et al 1991, Reilly et al 1999).

Studies of *eating disorders* in 0-3 year old children have been restricted to small clinical samples, and no other studies have published data on prevalence at this young age. We found a general population prevalence of eating disorders of 2.8 % in children aged 1½ years and an incidence of eating disorders diagnosed at hospitals in the same study population of 0.15 % in children aged 0-23 months.

The findings suggest differences in severity of the most common infant problem, problems of feeding and eating: From developmentally normal variations in establishing feeding in the first ten months at one end, across manifest symptoms of feeding and eating problems with increasing impact on weight to, at the other end: manifest eating disorder, exceeding the threshold to referral to treatment at hospital, and possibly due to weight faltering/ failure to thrive. The data on children diagnosed with an eating disorder at hospital show, that these were most often referred in the first year of life, indicating the early manifestation of severe feeding and eating problems.

A study of failure to thrive in CCC 2000 children with the definition of FTT as the slowest growing 5 % of the infant population (Olsen et al 2006) showed significant associations between health nurse's report of feeding problems and contemporary FTT. FTT with onset within the first two months of life was associated with pre- and perinatal adversities (preterm birth, low birth weight) and developmental impairment reported after birth, whereas FTT with onset after 3 months seemed to be associated to no other risk factors but feeding problems (Olsen et al 2007).

In the present study of infancy predictors, feeding problems recorded by health nurses at child age 8-10 months was the only significant predictor of eating disorders at age 1½ years.

Taken together, the findings from the CCC 2000 studies point to different psychopathological mechanisms in the development of eating disorders in infancy, and at least two, in principle different, risk

mechanisms can be suggested: One characterized by pre-/ perinatal adversities, weight faltering/ failure to thrive FTT within the first two months of life, in children with early signs of neurodevelopment impairment and, probably early oral-motor conditioned feeding problems as discussed by Reilly et al (Reilly et al 1999). In the other type, the pathway from feeding problems within the normal range, to the development of an eating disorder with weight faltering, could be suggested to be the result of a compromised parent-child interaction, developing over time in an otherwise healthy child. The latter suggested type corresponds to the subtypes of feeding behaviour disorders characterized by parent-child relationship problems proposed by Chatoor (Chatoor et al 2004).

Overall, the suggested hypotheses of different routes of risk mechanisms in early feeding problems are in accordance with clinical experiences and the literature on feeding and eating disorders in infants and toddlers (Benoit 2000, Chatoor et al 2004), and also in accordance with the proposed classification of feeding and eating disorders in DC: 0-3 R (Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood, Revised 0-3, DC: 0-3 R 2005).

### **4) GENERAL HEALTH PROFESSIONALS ARE ABLE TO SCREEN FOR MENTAL HEALTH DISORDERS IN INFANCY**

The possibilities of mental health screening were investigated in the general child health surveillance with the traditional measure of risk among Danish health nurses, "concern" as the "screening instrument".

The results show, that within their ordinary routines, child health nurses manage to perform an unspecific mental health screening which is demonstrated by the identification of a fourth of those children diagnosed with a mental health disorder at age 1½ years. Even though no specific screening instrument was applied, and the health nurses were not specifically trained in child mental health screening, they were able to identify children diagnosed with *neurodevelopment disorders* at age 1½ years, by the recognition of developmental impairment e.g in the area of language or communication, already in the first 10 months of life. However, the predictive validity of positive test was low, which point to the need of developing more specific and standardized measures to ensure the validity of screening for neurodevelopment disorders in infancy.

Considerations of infant mental health screening in a public health system have to include considerations regarding intervention. Disorders of neurodevelopment (e.g pervasive developmental disorders, attention deficit hyperactivity disorders and psychomotor retardation) are all characterized by persistent problems and a high risk of complicating mental and social disabilities. Intervention towards these disorders, e.g by parent counselling and psycho-education, have the potential benefit of reducing the risk of exceeding mental health problems, by reducing inappropriate demand on the child and facilitation of the general development.

Early intervention as described has potentially long lasting perspectives regarding prevention of the emotional and behavioural complications of these disorders (Offord & Bennet 2002).



### **Screening and intervention towards children in risk of parent-child relationship disorders**

The results from the present study point to parent-child relationship disturbances as the core mediator of psycho-social risks, which can be identified before the birth of the child (e.g. unwanted pregnancy) or in the first months after birth (e.g. negative expectation towards the child, negative handling and reaction to the child). Accordingly, the results both point to the need of developing screening instruments to the valid identification of parents-child relationship problems, as well as the need to develop and test strategies of intervention directed towards the parent-child relationship, e.g. concerning pregnant women and infant-mothers of psycho-social risk as described in the European Early Promotion Project EEPP (Puura et al 2005).

### **STRENGTHS AND LIMITATIONS**

The research presented is based on a general population study of mental health and psychopathology in a developmental perspective, starting with birth.

The main strengths of the research concern: 1) the prospective collection of data relevant to infant mental health 2) in a comprehensive study population, 3) in-depth assessment of psychiatric phenomenology at child age 1½ years, 4) the investigation of developmental psychopathology in the first years of life in a cohort from the general population and furthermore, 4) the investigation of mental health screening in the existing child health surveillance programme.

Data from the Danish National registers ensured a) a high coverage of data, e.g. on child physical and mental health and putative risk factors in the families, b) a broad description of core epidemiological data including socio-demographic variables and c) option for analyses of non-participants on several relevant parameters from registers.

The study profits by an established and well accepted general child health surveillance programme by health nurses as source of information on development, health and psycho-social environment, ensuring a high participation at baseline (91%) and low cost data generation. The health nurses' perform their functions at home visits, thus data collection was done in the natural setting of children and parent. Information on child health consisted of both observations and assessments by child health nurses and the parent's structured information of the nurses.

These strengths also imply one of the limitations in the study: The unknown psychometric properties of the same data collection, even though optimizing the validity was aimed through the creation of standardized record.

Identification of psychiatric conditions in children aged 1½ years is controversial as the concept of mental illness at this age is still debated, and the validity of diagnostic categories not as well established as in older age groups (Emde et al 1993, Zeanah et al 1997, American Academy of Child and Adolescent Psychiatry 1997). However, as pointed out by Egger & Angold: the present situation in epidemiological research on psychopathology in preschool aged children can be compared to the situation thirty years ago, where epidemiological research in older children's mental illness opened the

way for the understanding and conceptualizing of mental health problems and psychopathology in school aged children, at a time where the psychometric qualities of the diagnostic classification were questioned (Egger & Angold 2006). In accordance with this, Egger & Angold point to the need of a dual approach where the applicability of current diagnostic criteria for identifying disorders in very young children is tested while exploring the validity and clinical utility of developmentally specific criteria/ or diagnostic algorithms.

In the child psychiatric assessments at child age 1½ years, we have followed this approach: to search for a case-definition with the optimal psychometric properties given "the state of art", while ensuring that the measures of psychopathology made it possible to generalize findings to clinical settings (Verhulst 1995, 2002, Fombonne 2002). Accordingly, the whole diagnostic spectrum of psychopathology was investigated, both with regard to ICD-10 diagnoses and the infant-toddler specific classification, DC: 0-3. Validity was optimized by the use of standardized measures, research diagnostic criteria and criteria of impact available. Additionally, face validity was optimized by the use of experienced child psychologists and child psychiatric specialists as investigators.

A high reliability of the identification of children with mental health disorders was demonstrated by 96 % inter-rater agreement in the differentiation between children with or without psychopathology, and 100 % agreement in the diagnostic classification of parent-child relationships with disturbances. The reliability of the diagnostic classification of child mental health disorder present kappa values of 0.6 (ICD -10) and 0.7 (DC:0-3), corresponding to results from studies of clinical samples regarding DC: 0-3 diagnoses (Guedeney et al 2003, Emde & Weise 2003, Frankel et al 2004) and DSM-IV diagnoses (Frankel et al 2004). Furthermore, when comparing the reliability of the separate diagnostic categories found in the present study to studies of older aged children in clinical settings, corresponding figures of reliability is seen (Skovgaard et al 1988, Taylor & Rutter 2003, Egger et al 2006).

The methodological strength of a thorough child psychiatric investigation also implies a limitation, given the relatively small sample size possible to investigate. The statistical power of associations is limited and for some analyses condensation of group has been necessary.

### **MAIN CONCLUSIONS**

The research presented in this thesis demonstrates that very young children, 0-3 years of age, may suffer from the same kind of mental health disorders as older children do. The risk factors seem to be similar to findings from studies of older children, with seemingly specific psychopathological pathways of biological and psycho-social risks. Furthermore, the results point to the key role of parent-child relationship disturbances in early childhood as mediator of psycho-social adversities.

Prospective data from the first year of living with the outcome regarding mental disorder at 1½ years, suggest a pattern of pan-developmental predictors of neuropsychiatric disorders similar to what has been described in studies with outcome in adult age.

A general child health surveillance programme offers a frame to screen for mental health problems in the first year of living, conditioned the development of appropriate psychometric screening measures and education of the involved health professionals.

Data on children treated for psychiatric conditions in the health care system indicates that only a minor group of the children, which might potentially profit from it, are identified and treated.

### **PERSPECTIVES**

The results from the study contribute to the understanding of developmental psychopathology early in life and point to the possibilities of early identification of parent- child relationship disorder and mental health disorders in the child.

The results suggest, that intervention should be done at a far earlier stage in the child's life than has been effectuated until now, and underscore the importance of developing and assessing specific and focused strategies directed towards children in biological risks and parents in psycho-social risks, optimally effectuated already in pregnancy and early infancy.

The implications for the health care system concern the necessity of an increased focus at infants and toddlers mental health, regarding psychiatric symptoms. Due to their role in the child health surveillance, both community health nurses and the general practitioners should be educated in the identification of early symptoms of mental health disturbances in infants and toddlers, and trained in small scale strategies of intervention.

Finally, the results point to the demand for an extension in child psychiatric services to include the youngest children and hereby ensure the early assessment and treatment of infants and toddlers with manifest mental health disorder. The perspectives of early diagnosis followed by appropriate parent counselling and specific treatment imply a reduced risk of progressions and complications of mental illness in childhood.

Overall, identification of risk factors, predictors and manifest mental disorder in the first years of life have the perspectives of reducing the burden of mental health disorder, at the level of the individual child and the family, as well as at the society level.

### **SUGGESTIONS FOR FUTURE RESEARCH**

Follow-up studies of the whole CCC 2000 cohort are needed to investigate the longitudinal course of mental health problems and developmental psychopathology.

Standardized instruments of mental health screening in infancy should be developed and tested regarding psychometric properties. Furthermore, strategies of specific intervention in the general child health surveillance should be investigated, e.g by controlled studies of systematic intervention based on parent counselling, psycho-education and short-term psychotherapy conducted by health professionals, e.g. child health nurses.

## SUMMARY

The thesis includes seven published papers and an overview concerning the epidemiological aspects of mental health problems and psychopathology in children aged 0-3 years.

The research behind the thesis focuses at psychopathology in the first years of life. The aim has been to investigate phenomenology, prevalence, risk factors and predictors, in order to contribute to the knowledge about early developmental psychopathology, and improve the scientific foundation for identification and treatment of mental illness of infants and toddlers, and optimize the foundation for prevention of psychiatric illness in early life.

The Copenhagen Child Cohort CCC 2000 was established with inclusion of 6090 children born in year 2000. The cohort was described at baseline with data from Danish National registers and prospective data on mental health and development collected by health nurses at home visits.

At 1½ years of age a subpopulation was thoroughly investigated regarding child psychiatric illness, in a random sample prevalence study and a case-control study nested in cohort, with cases being children of health nurse concern in the first ten months of living.

Mental health disorders were identified in 18 % of 1½ year old children from the general population. The prevalence and distribution of main diagnostic categories correspond to results from studies of older children. Disorders of neurodevelopment (mental retardation, disorders of psychological development and ADHD) were associated with pre- and perinatal biological risks and predictors were deviant language development and impaired communication, recorded by health nurses in the first ten months of life. The findings correspond to results from studies of older children and adolescents and point to an earlier emergence of neurodevelopmental psychopathology than has been described hitherto.

Risk factors of emotional, behavioural and eating and sleeping disorders were psycho-social adversities in parents, and parent-child relationship disturbances seem to be the key mediator in the risk mechanisms. Risk factors of relationship disorders at child age 1½ years can be identified before the birth of the child, and predictors can be identified by health nurses from birth to 10 months.

In the general child health surveillance between birth and ten months, community health nurses are able to identify risk factors and predictors of child mental disorders at 1½ years, and by a global and unspecific screen, health nurses identify one fourth of children diagnosed with a mental disorders at age 1½ year.

The incidence of mental health disorders including mental retardation diagnosed at hospital in the first three years of life was 2 %. Sex differences known from studies of older children were demonstrated in children referred to hospitals, with neurodevelopment disorders more often diagnosed in boys, and eating disorders more frequent in girls.

Conclusions: For the first time it is shown in a general population study, that children as young as 1½ years may suffer from mental illness as older children do. Risk factors and predictors of mental illness can be identified in the first ten months of life, and the association of risks found in studies of older children seem to operate al-

ready from birth. The results point to the potentials of mental health screening and intervention in the existing child health surveillance.

Perspectives: The current longitudinal study of CCC 2000 in pre-school and school age will expand the present findings and further elucidate the significance of the first years of life regarding child mental health. Future research in this area should include the study of measures to screen and intervene towards mental health problems in infancy within the general child health surveillance.

## DANSK RESUMÉ

Afhandlingen omfatter 7 artikler og en sammenfattende oversigt vedrørende epidemiologiske aspekter ved psykiske helbredsproblemer og psykopatologi hos 0-3 årige børn.

Forskningen bag afhandlingen fokuserer på psykopatologi i de første leveår med udgangspunkt i data indsamlet prospektivt fra fødslen. Formålet har været at udforske fænomenologi, forekomst, risikofaktorer og prædiktorer, for herved at bidrage med viden til forståelsen af tidlige psykopatologiske mekanismer, og øge det videnskabelige grundlag for diagnostik og behandling af spæde og småbørn, og grundlaget for forebyggelse af psykisk sygdom.

Studiepopulation er en uselekteret fødselskohorte, *Copenhagen Child Cohort CCC 2000*, CCC 2000, bestående af 6090 børn født i 2000. Ved baseline blev kohorten beskrevet ud fra nationale registre og data vedrørende psykisk helbred og potentielle risikofaktorer de første 10 måneder efter fødslen, indsamlet prospektivt ved sundhedsplejerskernes hjemmebesøg.

Ved 1½ års alderen er gennemført dybtgående studier indenfor kohorten med henblik på at identificere psykopatologi hos små børn fra normalpopulationen og fastlægge hyppighed af psykisk sygdom og prædiktorer herfor. Desuden er potentialet for psykisk helbreds-screening i barnets første leveår undersøgt med udgangspunkt i sundhedsplejerskernes undersøgelser ved hjemmebesøg i den eksisterende småbørnsprofylakse. Studiet er suppleret med ikke-tidligere publicerede data fra en registerundersøgelse af psykiatriske diagnoser hos hospitalsbehandlede 0-3 årige i CCC 2000 kohorten.

Ved 1½ års undersøgelsen kunne psykopatologiske tilstande svarende til ICD-10 diagnoser identificeres hos 18 %, og med en diagnostisk fordeling, der svarer til resultater fra undersøgelser af ældre børn. Neuro-udviklingsforstyrrelser (mental retardering, psykiske udviklingsforstyrrelser og forstyrrelser af opmærksomhed og aktivitet, ADHD) fandtes associeret med biologiske risici påvist i tiden omkring fødslen. Afvigende kognitiv udvikling og afvigende kommunikative færdigheder var prædiktorer for neuro-udviklingsforstyrrelser, som allerede kunne påvises ved sundhedsplejerskernes undersøgelser i de første 10 levemåneder. De påviste risikofaktorer og prædiktorer svarer til fund fra undersøgelser af ældre børn og unge og peger på en tidligere manifestation af psykopatologien ved neuro-psykiatriske lidelser end hidtil påvist.

Risikofaktorer for følelsesmæssige og adfærdsmæssige forstyrrelser og forstyrrelser af spisning og søvn var psyko-sociale belastninger hos forældrene, hvilket er i overensstemmelse med fund fra undersøgelser af ældre børn. Desuden viste undersøgelsen af de 1½ årige børn, at forstyrrelser i forældre-barn relationen har en central rolle i risikomekanismerne, og at psyko-sociale prædiktorer for forældre-barn relationsforstyrrelser kan identificeres af sundhedsplejerskerne allerede i tiden omkring barnets fødsel.

Inden for den eksisterende småbørnsprofylakse kan sundhedsplejerskerne, uden specifikke screeningsinstrumenter, identificere hvert fjerde barn, som diagnosticeres med en psykisk forstyrrelse ved 1½ år.

Hos hospitalsbehandlede 0-3 årige i kohorten var hyppigheden af førstegangs diagnoser for psykisk sygdomme incl mental retarde-

ring, 2 %. Kønsforskelle, som er kendt fra undersøgelser af ældre børn, fandtes også hos 0-3 årige diagnosticeret på hospital, med overvægt af drenge med neuro-udviklingsforstyrrelser og overvægt af piger med spiseforstyrrelser.

Konklusion: For første gang viser en populationsbaseret undersøgelse, at børn ned til 1½ år kan rammes af psykiske sygdomme som ældre børn. Risikofaktorer og prædiktorer for psykisk sygdom kan identificeres i de første ti levemåneder, og risikomekanismer som er beskrevet ved undersøgelser af ældre børn, ser ud til at udøve deres virkning fra den tidligste barnealder.

Undersøgelsens resultater peger på screeningsmuligheder i den eksisterende småbørnsprofylakse.

Perspektiver: Igangværende og planlagte follow-up studier i CCC 2000 vil bidrage yderligere til at belyse risikomekanismer og prædiktorer ved psykisk sygdom i den tidlige barnealder. Valide metoder til psykisk helbreds-screening og effektive interventionsstrategier i barnets første leveår bør udvikles og afprøves systematisk, både mht. sundhedsplejersker og praktiserende læger. Desuden bør sundheds-væsenets muligheder for tidlig diagnostik og behandling af 0-3 årige med psykiske vanskeligheder udbygges.

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**Appendix 1**  
**Danish National Registers**

<b>National Registers in Denmark</b>	Area of information
<i>The Civil Personal Registration System (CPR)</i>	All citizens in Denmark have a unique 10-digit ID- number, which follows them throughout life. This personal CPR ID-number is stored together with information about age, sex, places of living, nationality and the CPRID-number of the parents
<i>The Medical Birth Register (MBR)</i>	All children born in DK. Parents ethnicity, marriage, mothers and fathers place of birth Pregnancy and delivery, place of birth, birth complications, Gestational age, birth weight, length at birth, Apgar - score. No days treated at hospital after birth
<i>National Register of Patients (LPR)</i>	Admissions to somatic hospitals in DK including diagnoses and treatments
<i>The Psychiatric Central Register (PCR)</i>	Admissions to psychiatric departments in DK including diagnoses and treatments.
<i>The National Social Register (IDA):</i>	School, education, vocational training, and earnings as well as present and past occupation.
<i>The National Register of Medicinal Products</i>	Prescribed medicine

Appendix 2

Information recorded by health nurses at home visits (CCC 2000)

Area	Variables	Measure
Psycho-social conditions	Educational level of parents Occupational status of parents Housing conditions Marital / civil status Ethnicity* Number of siblings Parent's smoking and drinking Parental supervision and care ←	Parent interview (1-5 weeks after birth)       at each visit
Pregnancy and birth	Complications in pregnancy* Gestational age* Birth complications* Weight and length at birth* Congenital deformities Peri -natal problems	Parent interview (1-5 weeks after birth)
History	Psychomotor development Sensory functions Inter current physical illness / hospitalisation** Patterns of urination and defecation Nutrition Regulation of sleep and eating Parents perception of the child (communication/ temperament)	Parent interview (At each visit)
Assessment of infant health and development	Weight and length Developmental milestone: - psycho- motor development - language/ communication (appropriate for age) Social and emotional state	Clinical observation/ examination by health nurse (At each visit)
Conclusions / intervention	Child development Mother-infant relationship Family relations  Advices Referrals	(At each visit)

\* Information also obtained from Medical Birth Register (MFR)

\*\* Information also obtained from The National Register of Patients (LPR)

**Appendix 3 Variables of infant mental health 0-10 months recorded by community health nurses in CCC 2000**

<i>Domain</i>	<i>Function</i>	<i>Examples of variables (age at assessment/months)</i>
Neuro development	Reflexes Gross motor development Fine motor development Oral- motor development Activity, interest Capacity of attention and focusing Perception (visual, hearing, tactile)	Suckling-, searching- (0-1), grasping- (0-6), moro -reflexes (0-6) Rolls from ventral to dorsal position (4-10) , sits alone (8-10) Tweezers grasp (8-10) Examines objects by putting into the mouth, bites and chews (4-10) Observes an object and reaches for it (4-10), curious and examining (8-10) Concentrates at the following of objects (visual and hearing) (8-10), listens to conversation (4-10) Enjoys being touched and handled (0-6)
Language development	Receptive Expressive (non-verbal, verbal)	Reacts at mothers mimics and voice (0-10) Babbling (2-6), dialogue babbling (3-10)
Social interaction/ communication	Social reactivity Joint emotional involvement Interactive intentions and reciprocity Differentiated communication	Reacts at mothers mimics and voice (0-10), listens to conversation (4-10), Dialogue babbling (3-10), contact smile (8-10) Touches mothers face (4-6), reaches the hands to be taken up (8-10), waves (8-10) Pats-a cake (8-10)
Regulation of physical functions	Sleep  Feeding, eating Digestion	Sleep problems (0-10)  Problems with feeding (0-10) Regurgitation (0-10), vomiting (0-10)
Emotional state/ Affective expression	Joy Discomfort, unhappiness	Smiles (2-3), chuckles (2-3), laughter (4-6), contact smile (8-10) Differentiated crying (2-3)
Mother-infant relation	Sensitivity, responding, regulation Affective involvement Mother's presentation of the child Physical interaction, touching Mutuality, reciprocity	Mother's taking care of physical and emotional demand of the child (0-10) Love and warmth in mother's spoken of the child (0-10) Mother's positive expectations of the child (0-10) Adequate and positive handling of the child (0-10) The quality of the contact between mother and child (0-10)

## Appendix 4

### Measures of Diagnostic Assessment at 18 months

<i>1. Parent interview</i>	Child Behaviour Check List CBCL /1½-5 Infant toddler Symptom Check List ITSCCL Checklist of Autism in Toddlers CHAT Manheim Eltern Interview MEI
<i>2. Child assessment</i>	Bayley Scales of Infant Development BSID II Checklist of Autism in Toddlers CHAT Clinical observations /videotape recordings of child behaviour
<i>3. Relationship assessment</i>	Parent Child Early Relationship Assessment (PC-ERA) Parent Infant Relation Global Assessment Scale PIR-GAS
<i>4. Diagnostic classification</i>	
<i>ICD 10:</i>	<ol style="list-style-type: none"><li>I. Psychiatric Syndrome</li><li>II. Specific Developmental disorders</li><li>III. Intellectual Level</li><li>IV. Physical Illness</li><li>IV. Psycho-social Disadvantages.</li></ol>
<i>DC 0-3:</i>	<ol style="list-style-type: none"><li>1. Primary Mental Health Diagnosis</li><li>2. Relationship disturbances</li><li>3. ICD 10 (DSM IV) Diagnoses</li><li>4. Psycho-social Stressors</li><li>5. Functional Emotional Level</li></ol>



## Appendix 5

### Definition of Risks (Manheim Risk Index)

#### A. Estimation of biological risks

- 
1. Birth Weight 2500-4200
  2. Gestational age GA: 38-42 weeks
  3. No information of signs of asphyxia (Apgar 10/ 5 min)
  4. No surgical delivery (Except elective)
  
  5. Toxaemia of pregnancy (oedema, proteinuria and hypertension)
  6. Pre-term birth, GA < 37 weeks
  7. Preterm labour: Tocolytic treatment or cerclage
  
  8. Very low birth weight BW < 1500 g
  9. Clear case of asphyxia (Apgar < 5/ 5 min) and special treatment at intensive neonatal unit for > 7 days
  10. Neonatal complications: Seizures, respiratory therapy (mechanical ventilation) or sepsis
- 

#### Groups of biological risk

Non-risk: all of items 1-4 and none of 5-10

Moderate-risk: one out of items 5-7 and none of 8-10

High-risk: one out of items 8-10

#### B. Estimation of psycho- social risk

- 
- |                                                   |                                                                                                                    |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 1. Parents low educational level                  | Parent without completed school education or without skilled job training                                          |
| 2. Overcrowding                                   | More than 1.0 person/room                                                                                          |
| 3. Parental psychiatric disorder                  | Moderate or severe disorder (diagnosed at hospital)                                                                |
| 4. Parental broken home or history of delinquency | Institutional care of parents or more than two changes of care takers in parents childhood or parental delinquency |
| 5. Marital discord                                | Low quality of partnership in two out of three areas (harmony, communication, emotional warmth)                    |
| 6. Teenage parents                                |                                                                                                                    |
| 7. One -parent family                             | at the time of child birth                                                                                         |
| 8. Unwanted pregnancy                             | Abortion was seriously considered                                                                                  |
| 9. Poor social integration and support of parents | Lack of friends and lack of help in child care                                                                     |
| 10. Severe chronic difficulties                   | Affecting a parent more than 1 year                                                                                |
| 11. Poor coping skills in parent                  | Inadequate coping with stressful events of the last year                                                           |
- 

#### Groups of psycho-social risk

Non-risk: no item fulfilled

Moderate-risk: one or two fulfilled

High-risk: more than two fulfilled

(for details see Laucht, Esser & Schmidt, 1997).