



Cohort Profile

Cohort Profile: The Tracking Opportunities and Problems Study (TOPP)–study of Norwegian children and their parents followed from infancy to early adulthood

Wendy Nilsen,^{1,2*} Anne Kjeldsen,³ Evalill Bølstad Karevold,⁴ Anni Skipstein,³ Maren Sand Helland,³ Kristin Gustavson,^{1,4} Frøydis Enstad,³ Silje Baardstu,⁴ Espen Røysamb,^{3,4} Tilmann von Soest⁴ and Kristin S. Mathiesen³

¹Department of Mental Disorders, Mental and Physical Health, Norwegian Institute of Public Health, Oslo, Norway, ²Work Research Institute, Oslo and Akershus University College of Applied Sciences, Oslo, Norway, ³Department of Child Development, Norwegian Institute of Public Health, Oslo, Norway and ⁴Department of Psychology, University of Oslo, Norway

*Corresponding author. Work Research Institute (AFI), Oslo and Akershus University College of Applied Sciences, Postbox 4 St Olavs plass, NO-0130 Oslo, Norway. E-mail: wendy.nilsen@afi.hioa.no

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Why was the cohort set up?

Findings on prevalence and consequences of childhood problem behaviour put preventive efforts on the political agenda in Western countries in the late 1980s. However, at this time, there was limited knowledge about identification and persistence of problem behaviours among children as young as 1–2 years of age. Few studies had addressed both positive and negative influences on children's behaviours simultaneously, using factors from several ecological levels (e.g. individual, family and neighbourhood). This dearth of empirical evidence limited the possibility to identify problem behaviours present already in infancy, that would remain problematic later in childhood. Furthermore, identifying factors associated with stability and change from this early age onwards, which could be used for informing preventive efforts, was absent.

Against this backdrop, K.S.M. designed the Norwegian Tracking Opportunities and Problems study (TOPP) in 1993, with funding from the Research Council of Norway.

The project was originally set up to provide knowledge about precursors, developmental pathways and predictors of good adaptation and mental health problems among preschool children and their parents. A number of the theoretical perspectives and scales was adopted from the Australian Temperament Project.¹ The study gradually expanded, and has now followed children and their parents across 18 years of data collection.

Overall, the main goals of the TOPP study have been to extend our knowledge of why:

- children from infancy and through adolescence develop symptoms of emotional distress and norm-breaking behaviour, or on the other hand develop good mental health and good social skills;
- mothers develop symptoms of psychological distress, sick leave, burnout and illness, or good coping styles and well-being; and
- parents experience relationship breakups or develop strong partnerships.

Who is in the cohort?

All families from 19 health care areas in Eastern Norway, who attended a child public health programme (i.e. 18 months vaccination programme) during 1993 were invited to participate (t1).² Baseline characteristics of the families are described in Table 1. Health clinic data showed that non-responding mothers did not differ from responding mothers in maternal age, education, employment status or marital status.³ Most often the mothers, and occasionally the fathers, accompany their child to this programme several times during the first 5 years of the child's life. The only inclusion criterion for participation in TOPP was Norwegian language abilities. Of the 1081 invited families, 913 mothers (84%) participated with data about 921 children (including twins/triplets). At t2 and t3, an additional 24 and 10 families, respectively had moved to the area and were invited to join the study.⁴

How often have they been followed up?

The families completed questionnaires eight times from when the children were 18 months (t1) to when they were 19 years old (t8) (see Table 2). Mothers participated from

t1 to t8. Due to the additional participation of children from t5 and fathers from t6, the total participation numbers from t5 to t8 range from $n = 1106$ to $n = 1335$. The public health clinics administered the data collection at the three first waves, and the remaining collections were obtained through mail correspondence. Families who moved between waves were found using a nationwide administrative registry run by the Norwegian Tax Administration.

A major methodological challenge in longitudinal studies is attrition (see Table 2). The dropout from $n = 913$ to $n = 524$ mothers over 18 years implies an annual average attrition rate of 2.5% of the initial sample. In the TOPP study, only low maternal educational level predicted maternal dropout from t1 to t5⁵ and to t7,⁶ whereas factors such as child temperament, family structure and financial status, chronic stressors, parents' relationship quality and mothers' age, temperament, working status, social support or symptoms of anxiety and depression, did not affect attrition levels. We found no differences in correlations between mental health and 15 other baseline variables (t1) among those who stayed until t7 versus those who dropped out.⁶ Low maternal education level and male gender predicted adolescent attrition from t1 to t7 and t8.^{7,8} The slight increase in response rate at t5 and t8 is probably due to additional resources granted at these particular time points to enhance tracing procedures.

Table 1. Characteristics of participating families at baseline

Maternal age (years), mean (SD)	30 (4.7)
Maternal education (%)	
Basic schooling (≤ 9 years)	9.5 %
Basic schooling + (10–11 years)	27.6 %
Finished high school (13 years)	25.4 %
Higher education (≥ 14 years)	37.6 %
Maternal work status (%)	
No paid work	37.0 %
Part-time paid work	32.0 %
Full-time paid work	31.0 %
Maternal relationship status (%)	
Married/cohabitor	91.2 %
Single	8.8 %
Maternal mother tongue (%)	
Norwegian	93.6 %
Other than Norwegian	6.4 %
Family economy	
We manage well/very well	53.4 %
We manage	40.7 %
We manage poorly/very poorly	5.9 %
Pariety (%)	
1 child	48.2 %
2 children	37.2 %
3–10 children	14.6 %
Offspring infant gender (%)	
Girl	51.1 %
Boy	48.9 %

What has been measured?

The data consist of multi-informant responses from mothers, fathers and children on a broad selection of individual, family and contextual risk and protective factors from 15 comprehensive questionnaires across eight waves. The majority of instruments are validated, reliable and widely used. When needed, we tailored some of the instruments to fit the age group or the Norwegian context. Measures at each time point are presented in Tables 3 and 4.

What has it found? Key findings and publications

So far, the TOPP data have fostered more than 30 international articles, 11 PhD dissertations and a number of book chapters and reports [<http://www.fhi.no/studier/topp-stien/publikasjonsliste>]. We present key findings below.

Findings from the early childhood years

The TOPP study has enabled a thorough examination of developmental pathways to problem behaviours across childhood and adolescence. The study was among the first to apply valid instruments to identify precursors of children's

Table 2. Sample sizes, the age of the child at each wave and the year of data collection (from 1993 to 2011)

Data waves	T1: 18 months Year	T2: age 2.5 1993	T3: age 4.5 1994	T4: age 8.5 2000	T5: age 12.5 2004	T6: age 14.5 2006	T7: age 16.5 2008	T8: age 19 2011
N mothers (s)	913	777	727	506	587	474	421	524
% mothers	84%	85%	80%	55%	64%	52%	46%	57%
N fathers (s)*						367	310	370
% fathers						40%	34%	41%
N children/adolescents (p)	939	804	760	535	611	481	425	524
% children/adolescents	87%	86%	81%	57%	65%	51%	45%	57%
N adolescents (s)	—	—	—	—	566	458	375	441
% adolescents					60%	49%	40%	47%

Notes: s = self-report, p = parent report.

Response rate-% at t1 is calculated on the basis of families invited at t1 (1081 families).

All the following response rates for mothers (t2-t8) are calculated on the basis of mothers participating at t1 (913 mothers).

All response rates for children/adolescents at t2-t8 are calculated on the basis of parental report (including twins) at t1 (n=939).

*A small number of fathers (>23) also responded at t1-t5.

Table 3. Measurement of individual factors in the TOPP study

Type of information	Early Childhood 18 months–age 4.5	Middle Childhood age 8.5	Early Adolescence age 12.5	Middle-Late Adolescence age 14.5–age 19
Mental health and well-being				
Internalizing symptoms	CmM	CmM	CmAM	CmACfMF
Externalizing behaviour	Cm	Cm	CmA	CmACf
Activity / hyperactivity	Cm	Cm	CmA	CmA
Eating problems /dieting	Cm		CmA	CmMAF
Body image			A	A
Positive mental health				MAF
Somatic health/physical development				
Physical health	CmM	CmM	CmMA	CmMAF
Puberty			A	A
Physical exercise			A	A
Pain			Cm	CmA
Personality and skills				
Language development	Cm	Cm		
School related outcomes		Cm	CmA	CmA
Social development	Cm	Cm		A
Coping	M	M	MA	MA
Social skills		Cm	CmA	CmA
Personality				MA
Temperament	CmM	CmM	CmMA	CmMAF
Health and risky behaviours				
Alcohol use and problems			A	CmMAF
Household alcohol problems	M	M	M	
Sexual risky behavior				A
Bullying others			A	CmA
Use of health care services	CmM	CmM	CmA	CmA

Note: Cm = mother report on child, M=mother report on self, A=Adolescent report on self, Cf=father report on child, F=father report on self.

later problem behaviours from child age 18 months.⁹ Our early findings showed that a substantial number of children with definitive problem behaviours at 18 months had sustained problems throughout the preschool age, with one-

third of the children having definitive problems at age 2.5 years and one-fourth having problems also at age 4.5 years.¹⁰ Risk factors present at 18 months were found to have persistent links to later child problems over and above

Table 4. Measurement of family and contextual factors (neighbourhood, friends, school, work and stressors) in the TOPP-study

Type of information	Early Childhood 18 months–age 4.5	Middle Childhood age 8.5	Early Adolescence age 12.5	Middle-Late Adolescence age 14.5–age 19
Family				
Family structure	M	M	MA	MAF
Marital status/history	M	M	M	MF
Interparental relationship	M	M	M	MF
Partner social support	M	M	M	MF
Interparental collaboration		M	M	MF
Child-related strains	M	M	M	MF
Parent-child relationship			MA	MAF
Parenting		M	MA	MAF
Family social support	M	M	M	MF
Neighbourhood				
Neighbourhood quality	M	M	M	
Sense of belonging	M	M	MA	MAF
Relationship to neighbours	M	M	M	
Friends				
Friendships	M	M	MA	MF
Social support from friends	M	M	MA	MAF
School and work				
Social support from teachers			A	A
Adaptation to school		M		
Grades/School attainment			MAF	MAF
School absence				A
Employment/Work hours	M	M	M	MAF
Sick leave				MAF
Burnout				MF
Job control/demands/support				MF
Stressors				
Negative life events	M	M	MA	MAF
Chronic strains	M	M	MA	MAF
Victimisation (physical/sexual abuse)				MAF
Victimisation (bullied)			A	A
Socio-economic indicators				
Education level	M	M	M	MAF
Financial situation	M	M	M	MAF

Note: M=Self-reports from mothers; A= Self-reports from adolescents, F= Self-reports from fathers.

changes in risk factors,¹⁰ and predicted a high stable trajectory of externalizing problems from 18 months to 14.5 years.¹¹ Moreover, problem behaviours at 18 months predicted adolescent symptoms of depression and anxiety at ages 12.5, 14.5 and 16.5 years, with paths going through maternal psychological distress.^{5,8}

A number of TOPP articles have also demonstrated that child temperamental factors (i.e. emotionality, shyness, sociability, activity) measured from as early as 18 months onwards are prospectively associated with a multitude of outcomes. Temperament has predicted picky eating at age 4.5 years,¹² eating problems at age 16.5,¹³ social skills at ages 8.5 and 12.5,^{14,15} resilient processes at age 8.5¹⁴ and internalizing and externalizing problems in childhood

and adolescence.^{5,9,11,15–17} In addition, moderate stability in shyness from 18 months to early adolescence (age 12.5) has been reported.¹⁵ Results from person-oriented methods using the TOPP material add to this body of evidence, with Janson and Mathiesen¹⁸ reporting selective patterns of relationships between temperament profiles and externalizing and internalizing problems across ages (18 months to 8.5 years). Also, Kjeldsen *et al.*^{7,11} identified five trajectory patterns of externalizing problems starting from 18 months to mid-adolescence, wherein high stable trajectories were found to predict internalizing and reduced well-being in late adolescence/young adulthood (age 19).

The TOPP data have also enabled researchers to investigate the longitudinal interplay between child

characteristics and contextual factors. For instance, maternal distress was found to account for the impact of family discord on child behaviour in infancy as well as accounting for the association between problem behaviours at 5 18 months and mothers' lack of social support and child-care challenges.³ Maternal distress at 18 months has also emerged as a predictor of adolescents' internalizing problems over and above later maternal distress.^{5,8} In addition, family and temperamental factors present in childhood 10 have been found to explain nearly 40% of the variation in children's symptoms of anxiety and depression in adolescence.⁵ Later findings showed that family stress assessed at 18 months differentiated the adverse (e.g. stable high) from the remaining four trajectory classes of externalizing problems in children from infancy to mid-adolescence.¹¹ Problems with behavioural and emotional regulation in 15 preschool and middle childhood have also been found to predict low prosocial personality in adolescence, but primarily when parents used negative and punitive practices 20 towards their children.¹⁹ Furthermore, in a multiple mediation model, Nilsen *et al.*²⁰ reported that friend social support, but not parent or teacher support, mediated the longitudinal link between social competence and adolescent depressive symptoms for girls. Together, these 25 findings underscore the importance of focusing on tendencies and precursors in early childhood, as well as interaction effects between children and their environment.

Findings on parental mental health and parental relationships

30 The TOPP study has collected considerable information on both mothers' and fathers' mental health and well-being throughout eight and three waves, respectively. Early findings showed that psychological distress among mothers of 18-month-old children was mainly related to socioeconomic indicators (low education), social support (from partner, family and friends) and child-related daily stressors (e.g. child care problems).^{2,4} Nærde, Tambs and Mathiesen²¹ showed that changes in child-related stressors predicted changes in maternal distress across the preschool 35 period (18 months to age 4.5 years). Corresponding predictive factors were identified in subsequent studies of maternal psychological distress measured over several time points. Latent profile and logistic regression analyses indicated that mothers in chronic high symptom groups were 40 more likely to have low age, low education and less paid work, were less likely to be married/cohabiting and had lower levels of social support compared with mothers in lower symptom groups.²² Furthermore, the strongest predictor of high symptoms of maternal distress was negative 45 emotionality.^{22,23} Later findings have indicated that 50

adverse maternal distress trajectories during childhood (18 months to age 14.5 years) prospectively predicted burnout and work-family conflict in mothers²⁴ and internalizing problems in their adolescent offspring 4 years later.²⁵

55 Researchers using the TOPP data have also examined the longitudinal interplay between psychological distress, well-being, relationship quality and dissolution (i.e. divorce and cohabitation break-up) among mothers and fathers. Relationship dissolution was predicted by relational, individual and environmental factors.²⁶ More specifically, frequent criticism from partner and socio-demographic variables predicted early dissolution (before children were 8.5 years old), whereas child-related stressors and maternal temperamental sociability uniquely predicted long-term dissolution (i.e. when children were between ages 8.5 and 19). Low emotional support from partner and low education predicted both early and long-term dissolution. Findings from TOPP have also identified two-way associations between relationship quality and 60 mental health, with high relationship quality predicting decreased psychological distress and increased well-being over time and vice versa.^{27,28} Moreover, high relationship quality at t1 has been found to predict well-being in intact couples 15 years later.²⁷

65 70 Several findings using the TOPP study address methodological issues specifically. Findings include evidence of good psychometric properties in instruments such as the EAS temperament survey for pre-schoolers³ and adults.²⁹ Results also indicate interpretable and highly replicable 75 classifications of temperament profiles for children from 18 months to age 8.5 years¹⁸ and high robustness of bivariate associations despite the level of attrition.⁶

80 85 We have summarized some of the findings briefly in this section; a full list of TOPP publications is available at [https://www.fhi.no/en/studies/tracking-opportunities-and-problems-in-childhood-and-adolescence-topp-study/publications-topp-study/]. A peer-reviewed book integrating 20 years of research using the TOPP data is in progress and is planned to be published in 2017.

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What are the main strengths and weaknesses?

The strengths of the TOPP study include: (i) frequent data assessment with psychometrically valid measures starting already when the children were infants; (ii) high response rate at t1 (87%) in a community-based representative sample of Norwegian families; (iii) data collection spanning over 18 years through eight data waves from infancy (18 months) to young adulthood (age 19 years); (iv) inclusion of a wide range of individual, familial and contextual

factors; and (v) use of multi-informant data from three family members from t5-t6 and onwards.

Another strength, which is a particular advantage of conducting long-term longitudinal studies in the Nordic countries, is the availability of nationwide administrative registers, providing reliable information about participants' place of living. The use of such registers facilitates tracking participating families when they have moved during the study course. The availability of nationwide registers provides exciting possibilities to link individual survey data to time series data from registers in the areas of work, education, welfare benefits, health and use of health care services,^{30,31} which we are planning to do with the TOPP data.

Some caution is needed when interpreting some of the findings. First, mothers were the main informants about their children's development at the first four assessments (t1, t2, t3 and t4), which could entail single informant bias. However, findings generally support the validity of maternal reports of concrete child behaviours.³² Second, despite high validity, some instruments show modest reliability as measured by Cronbach's alpha.^{8,11,19,20} Yet, modest alphas can be expected in scales with few items and with measures concerning young children. Still, the estimates are satisfactory when measured by alternate reliability measures (average inter-item correlations and alphas based on polychoric correlations).^{7,11} Measurement errors have been mitigated in several of the publications, using structural equation models which allow partitioning of error variance from true score variance.^{5,11,17,22,23}

In general, tracking development from infancy to late adolescence involves both methodological and conceptual challenges. More specifically, it can be difficult to differentiate between transient (age-normative) adjustment problems and more severe (enduring) behaviour problems. In light of this, the TOPP study has been particularly attentive to the notion that use of age-appropriate measurement instruments at different ages is necessary in order to capture the essence of various developing phenomena.^{9,33} Thus, the instruments included at each time point in the TOPP study have been carefully selected based on the awareness that developmental research requires strong theories, advanced longitudinal methods, high quality prospective data, and knowledge about normative as well as deviant child development.

Although information from the first three data waves contributes to prevalence estimations, the decreasing response rates over time might threaten the generalizability of the findings. Nevertheless, the other properties of the TOPP study make the data set well suited to identify precursors, pathways and consequences of children's developing personalities, symptoms, skills and events that have relatively high rates in the population. Although the slight

over-representation of participants with higher levels of education may suggest that the findings are somewhat more uncertain in terms of people with low socioeconomic status, TOPP has fostered the possibility of studying the development of emerging difficulties as well as healthy adjustment in 'regular, well-functioning' families. This is particularly important given the high proportion of individuals with substantial mental health problems who never are in contact with mental health care services.³⁴

Changes in response rates during the course of our study provide indications of general factors influencing response rates and attrition in longitudinal studies. For example, response rates fell considerably between waves 3 and 4, when surveys went from being distributed by health care personnel at the clinics to being sent by mail. Face-to-face contact with the participants provided the possibility to provide practical help when completing the questionnaire and emphasised the importance of the study, thereby ensuring rather high response rates. The somewhat higher response rates at waves 5 and 8, compared with previous postal waves, may be because funding was available to contact the non-responding participants by phone. Appropriate research funding and strategies for increased facilitation of face-to-face or other personal contact with participants can increase participants' loyalty to the study and decrease dropout. We, in line with other longitudinal studies,³⁵ thus regard appropriate resources and an active strategy for communication with the participants as particularly important for reducing dropout rates.

Can I get hold of the data? Where can I find out more?

Researchers who are interested in future collaborations using the TOPP data should contact the research group at [topp-studien@fhi.no]. The study is set up as a limited access resource in which external researchers can access the data when we have available resources to facilitate and administer collaboration, rather than an open access resource. We encourage interested researchers to send a brief proposal to the group. The TOPP study has a website with updated contact information: [<https://www.fhi.no/en/studies/tracking-opportunities-and-problems-in-childhood-and-adolescence-topp-study/>].

TOPP profile in a nutshell

- TOPP is a prospective multi-informant community-based study investigating precursors, pathways and predictors of healthy/unhealthy development in children from infancy to adulthood, and their parents.

- Through a child public health clinic programme, 18-month-old children ($n = 939$) and their mothers were recruited in 1993 in 19 health care areas in Eastern Norway.
- Follow-up includes eight mother-reported questionnaires (18 months to age 19 years), four child-reported questionnaires (age 12.5 to 19) and three father-reported questionnaires (age 14.5 to 19). The t8 sample is 1335 individuals.
- The data set comprises self-reports and multi-informant reports on mothers, children and fathers on a variety of individual, familial, social, work and other contextual factors.
- TOPP is a limited access resource based on available researcher and administration resources; contact [topp-studien@fhi.no] for collaboration suggestions.

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