



~ Research Connections ~

ISTS Mid-Congress Conference



June 29, 2005

USC Campus

Grace Ford Salvatori Building



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*The International Society for Twin Studies (ISTS)
is an international, nonpolitical, nonprofit,
multidisciplinary scientific organization.
Its purpose is to further research and public education
in all fields related to twins and twin studies,
for the mutual benefit of twins
and their families and of scientific research in general.
The Society was founded in Rome in 1974.
<http://www.ists.qimr.edu.au/>*



Greetings

From the ISTS President

Jaakko Kaprio

On behalf of the International Society for Twin Studies, I would like to welcome all delegates to ISTS Mid-Congress Conference here on the beautiful campus of the University of Southern California. The ISTS has had the tradition of holding International Congresses, the main scientific event of the Society, every three years ever since ISTS was founded in 1974. The 11th International Congress was held in 2004 in Odense, Denmark. With more and more active researchers involved in research related to multiples and the pace of scientific research becoming greater, the Board of the Society discussed in Odense various possibilities to offer the members of the society and other interested in twin research and in the welfare of multiples to meet more often. One option was to shorten the time interval between International Congresses to two years, which is an issue to be discussed in the Society. The Board decided to organize a shorter, one-day Mid-Congress Conference focused on a smaller number of themes. Having the meeting precede the Behavior Genetics Association meeting in Hollywood made it feasible to have it in 2005.

Mary Adcock as COMBO chair kindly took on the task to organize the meeting, and has worked closely with Dr. Margaret Gatz and other scientists in the LA area to create an exciting program in an excellent venue. I would like to thank all those involved for their dedication and hard work. I would also like to thank all those who have submitted abstracts of a high scientific quality. These will be published later this year in our journal, *Twin Research and Human Genetics*. Finally, I would like to thank all the delegates, who have come from all over the world for a stimulating meeting. I look forward to meeting old friends and new acquaintances, and hearing about the latest scientific developments.

From the Conference Chair

Mary Adcock

Welcome to the ISTS Mid-Congress Conference, “Research Connections”. Thank you for taking the time to be with us today.

There are a number of volunteers who helped in putting together this Mid-Congress Conference. I thank every one of them for their hard work and dedication. I would especially like to thank USC for their support of this conference, in particular Dr. Margaret Gatz and Barbara Yuen who served as the essential LA Connection. Thanks also to:


- the Program Committee for their input and direction,
- the ISTS board for their support and guidance, and
- our keynote speaker, Leena Peltonen, and GenomeUTwin for their additions to today’s program.

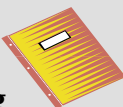
Both USC and GenomeUTwin also assisted with financial support for this day.

It has been my honor to serve as chair of the ISTS Mid-Congress Conference. I hope by day’s end, you will say that this conference provided “research connections” that enlightened or led you to new questions, which, in turn, helped you in moving forward with your work.

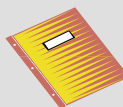


Conference Schedule At A Glance

8:00 a.m. — 9:00 a.m.	Registration and Continental Breakfast 	Atrium
8:00 a.m. — 9:00 a.m.	Poster Set-Up	Room 101
9:00 a.m.— 10:00 a.m.	Two concurrent sessions	

1 Twin Family and Twin Relations
 Room 104
 Jaakko Kaprio: Chair 

- **Risk factors affecting smoking initiation and persistence in California twins**
Ann Hamilton
- **Post-Partum depression in mothers of multiples**
J. Susan Griffith
- **Changing Challenges — Life isn't always fair**
Joyce Keating

2 Learning and Health Issues
 Room 107
 Jennifer Harris: Chair 

- **Having a co-twin with ADHD**
David Hay
- **Learning needs of multiple birth children and the response of the educational system**
Mary Adcock
- **Early life risk factors associated with Asthma in twins**
Wendy Cozen

10:00 a.m. — 10:15 a.m.	Break	Atrium
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10:15 a.m. — 12:15 p.m.	GenomEUTwin Symposium	Room 106
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- **Overview of GenomEUTwin**
Leena Peltonen
- **Height**
Jaakko Kaprio
- **BMI**
Jennifer Harris

- **Stroke, longevity**
Kaare Christensen
- **CVDRF - lipids, smoking**
Dorret Boomsma
- **Migraine**
Nick Martin
- **Discussion about collaboration with other twin registries**



12:15 a.m. — 1:00 p.m.

Lunch



Atrium

12:45 p.m. — 1:30 p.m.

Time to view posters, books, handout materials

Room 101



POSTER Presentations

Comparability of twins and singletons

- 1** **A twin-sibling study of adolescent wellness**
Meike Bartels
- 2** **The association between regular exercise and negative affect in twins, siblings and other family members: A study from the Netherlands Twin Registry**
Marleen H.M. deMoor
- 3** **A comparison of height of five-year-old twins and singletons**
G.F. Estourgie-van Burk
- 4** **Personality and self-concepts in twins and singletons in South Korea**
Yoon-Mi Hur
- 5** **Are there differences in brain morphometry between twins and singletons?**
Sarah Ordaz

Health Prognosis & Twin Birth

- 6** **Development of behavioral and emotional problems: Do twins born after IVF differ from other twins?**
Dorret I. Boomsma
- 7** **Genetic and environmental influences on exercise participation: A comparative study of twin cohorts in six countries**
Janine H. Stubbe
- 8** **Is there an association between caesarean section and a risk for Asthma in twins?**
Toos C.E.M. van Beijsterveldt



POSTER Presentations, continued

Learning and Education Issues

- 9** Linguistic features of Japanese twins at 3 or 4 years of age
Yoko Kobayashi
- 10** Parenting stress and language development in twins
Reiko Nishihara
- 11** Working memory in 12-year-old twins and their siblings
Tinca Polderman
- 12** Classroom separation of twins during primary school
Marieke van Leeuwen

Obstetric issues and current findings from twin studies

- 13** Congenital cardiac malformation in twins:
A Danish nationwide population-based register study
Anne-Maria Herskind

Pediatric Aspects of Twinning

- 14** Heritability of testosterone levels in 12-year-old twins
Rosa A. Hoekstra

Twin Registers & Methodology

- 15** What to do with non-normal data: Classical test theory versus
item response theory in estimating variance components
Stephanie Van den Berg

1:30 p.m. — 2:15 p.m.	Keynote Presentation Leena Peltonen Genome-wide view to human diseases and the special value of twin studies in the post-genome era <i>Professor Peltonen is among leading molecular geneticists worldwide and is one of the pioneers in the use of genetically isolated populations in the genetics-based identification of disease genes.</i>	Room 106
2:15 p.m. — 2:30 p.m.	Break	Atrium

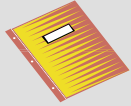
2:30 p.m. — 4:30 p.m.

Two concurrent sessions

1 Twin Studies in Symptoms, Treatments of Disease Or Disorders/ Twin Registers & Methodology

Room 104

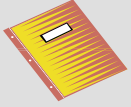
Nick Martin: Chair

- **Monozygotic female twins discordant for transsexualism: A pair of case reports**
Nancy Segal 
- **Structural MRI of monozygotic twins discordant for the risk for anxiety and depression**
EJC deGeus
- **Activities associated with sun exposure in childhood modifies risk of Multiple Sclerosis among monozygotic twins**
Talat Islam
- **Opportunities for exposure to infection and risk of young adult Hodgkin Lymphoma twins**
Wendy Cozen
- **A novel method for linkage in 294 twin pairs replicates a QTL for eye colour on 15q**
D Posthuma

2 Obstetric Issues/ Language Development & Memory

Room 107

Tom Mack: Chair

- **Hospital protocol after a multiple birth child has died**
Joyce Keating
- **Post-partum depression in Higher Order Multiples: Increased incidence and obstacles to diagnosis**
Kelly Ross 
- **Reading proficiency and multiple birth children**
Mary Adcock
- **Component cognitive processes of working memory in middle-aged twins**
William Kremen
- **Tokyo twin cohort project**
Juko Ando

ISTS Mid-Congress Conference Program Committee

Isaac Blickstein

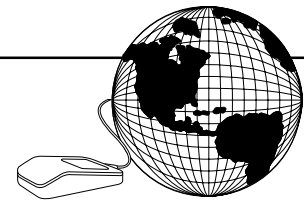
Ann Hamilton

Tom Mack

John Mascazine

Karen Thorpe

Name cited below each study refers to the author who submitted the work for presentation. Refer to the abstract section, page 10, for a complete listing of the authors associated with each presentation.





Keynote Speaker

Leena Peltonen, M.D., Ph.D., professor

Department of Molecular Medicine and Medical Genetics,

National Public Health Institute and University of Helsinki, Finland

Professor Leena Peltonen is among leading molecular geneticists worldwide. She is one of the pioneers in the use of genetically isolated populations in the genetics-based identification of disease genes. Using study samples from Finland her research group has characterized the genetic background of numerous monogenic diseases and more recently identified tentative allelic variants in dyslipidemias and neuropsychiatric diseases. She has also been pivotal in numerous international research efforts and scientific networks. She is the current president of



HUGO and has served as the member of the UNESCO Bioethics Committee and in the Board of Directors of the American Society of Human Genetics. She currently leads the Nordic Center of Excellence of Disease Genetics as well as a European Community research program, GenomEUTwin aiming at characterization of genetic and life style risks of common diseases. Dr. Peltonen has received several international science awards, she has produced 390 original publications and 58 review articles and supervised 54 Ph.D. theses.



GenomEUTwin

GenomEUTwin is one of the largest integrated projects within EU. The project currently involves eight countries, Sweden, Finland, Denmark, Norway, Holland, Italy, England, and Australia. Together, the national twin registries of these countries contain more than 620,000 twin pairs.

GenomEUTwin involves efficient collaboration of twin researchers, genetic epidemiologists, molecular geneticists and mathematicians. The goal is to identify critical genetic and life-style risk factors for common diseases using European strengths in genetics, epidemiology and biocomputing. European populations and epidemiological cohorts are of special significance in the current era of genomic research aiming to characterize the background of common human diseases. This project will apply and develop new molecular and statistical strategies to analyze unique European twin and other population cohorts to define and characterise the genetic, environmental and lifestyle components in the background of health problems like obesity, migraine, coronary heart disease and stroke, representing major health care problems worldwide.



This project is supported by the European Commission under the programme “Quality of Life and Management of the Living Resources” of 5th Framework Programme.

GenomEUTwin contacts

Co-ordinator

Prof. Leena Peltonen, National Public Health Institute; Helsinki Biomedicum, Finland

Scientific secretary of the steering board

Dr. Markus Perola, National Public Health Institute; Helsinki Biomedicum, Finland

info@genomeutwin.org



Abstracts

Listed in alphabetical order according to presenting author.

**Learning needs of multiple birth children
and the response of the educational system**

9:00-10:00, Rm. 107

Mary Adcock, Rebecca Moskwinski

National Organization of Mothers of Twins Clubs, Inc., USA

The combination of research with educational best practices can result in a positive change in the educational environment for multiple birth children. The National Organization of Mothers of Twins Clubs, Inc., drew from both of these arenas along with anecdotal data gathered from parents of multiples and educators in order to develop a set of guidelines for the education of multiple birth children. This presentation will review those guidelines and present information as to their implementation in schools throughout the United States of America. Data from NOMOTC's most recent studies with educators and parents on this topic will also be included.

Reading proficiency and multiple birth children

2:30-4:30, Rm. 107

Mary Adcock, Rebecca Moskwinski

National Organization of Mothers of Twins Clubs, Inc., USA

The National Organization of Mothers of Twins Clubs, Inc. recently completed research focused on the reading proficiency of multiple birth children. The research tool was a 24-question survey, to be completed by parents of multiples. The survey aimed to determine differences and similarities in the reading proficiency of multiple birth children. Specific attention was given to determining the impact of premature birth on later development in literacy. Classroom placement and information on family support in terms of literacy were examined as factors.

Responses were provided by nearly 300 parents of twins and/or higher order multiples from throughout the United States. Results in some cases mirrored the results of recent research in reading proficiency for the overall population. However, results also showed an above the norm percentage of multiples reading at or above grade level, including those born prematurely, and a significant amount of at home literacy support provided by parents of multiples.

Tokyo Twin Cohort Project (ToTCoP):

2:30-4:30, Rm. 107

Outline of a population-based study of twin children in Japan

Juko Ando (1), Koichi Nonaka (2), Noriko Kato (3), Syuichi Ooki (4), Ryoko Nakajima (1)

(1) *Keio University, Tokyo, Japan*

(2) *Wako University, Tokyo, Japan*

(3) *National Institute of Public Health, Saitama, Japan*

(4) *Ishikawa Prefectural Nursing University, Ishikawa, Japan*

A new project of twin study in childhood, Tokyo Twin Cohort Project (ToTCoP), started in December 2004 in the Tokyo area. The ToTCoP is a part of the national program "Brain Science and Education" conducted by the Japan Science and Technology Agency (JST). This project aims to establish a population-based twin registry for the first time in Japan in the Tokyo Metropolitan area and then to conduct a five-year longitudinal study of twins' growth and development. A cross-sectional study for twin children of a wider range of age (2-15 years) is also planned this summer. The estimated number of newborn twin pairs in this target area is about 3,000 per year. The disclosed information on the resident registration is used to construct the registry through transcribing the data of individuals who share the same address and date of birth, since it is impossible to use a personal identification number for the purpose of research in Japan. A pilot study was conducted for selected regions (about 20% of target areas) in April, 2005, in which entry sheets were sent to 309 families rearing twins with 9-14 months of age. The response rate was

about 40%. Subsequent survey, which contains detailed questions as to obstetrical findings, growth and development of twins, parenting attitude of parents, and so on, is to be conducted for those families that have returned entry sheets. Preliminary findings of the pilot study, which contains the information of zygosity classification, birth weight, feeding method, sleeping patterns and others, will be reported.

A twin-sibling study of adolescent wellness

Poster Presentation

Meike Bartels (1), James J. Hudziak (2) and Dorret I. Boomsma (1)

(1) *Department of Biological Psychology, Vrije Universiteit, Amsterdam, the Netherlands*

(2) *Departments of Psychiatry and Medicine (Division of Human Genetics), Center for Children, Youth and Families, University of Vermont, College of Medicine, Burlington, VT, USA*

Adolescence is a developmental period marked by rapid changes in behavior, cognition, health, and risk taking behavior. Despite the perception that the majority of adolescents suffer from one or more emotional behavioral problems during the years between childhood and adulthood, most adolescents live healthy and happy lives. On this poster we will present the first results of our Twin-Sibling study of Adolescent Wellness. In order to study adolescent wellness (comprising psychological and physiological well-being) self-report data using the Dutch Health Behavior Questionnaire (DHBQ) are collected in a pilot sample. This self-report instrument contains direct measures of wellness, such as life satisfaction and happiness. Twin-sibling comparisons of wellness in Dutch adolescents will be presented. In this pilot study it has been found that twins are not more or less happy or satisfied with their life as their non-twin siblings. On a scale from 0 to 10, twin rated their lives as being 6.67, while their non-twin siblings value their lives as being 6.52.

Development of behavioral and emotional problems:

Poster Presentation

Do twins born after IVF differ from other twins?

Dorret I. Boomsma, Meike Bartels, Toos van Beijsterveldt

Department of Biological Psychology, Vrije Universiteit, Amsterdam, The Netherlands

Since 1987 the Netherlands Twin Register recruits newborn twins shortly after birth. The development of these twins is followed in longitudinal survey studies. Approximately every 2 years parents complete mailed questionnaires which track growth, motor, behavioral and emotional development of the children. From age 7 years onwards, surveys are also sent to the teachers of the twins. In the past years, we see a substantial increase in the number of twins who were born after IVF: in 1990 less than 6% of twin pairs were born after IVF, in 2001 this was almost 20%. In this presentation we will compare the development of IVF twins to matched control twins. We look at growth, the age at which the twins reach specific milestones and at the prevalence of Internalizing and Externalizing problems.

Early life risk factors associated with asthma in twins

9:00-10:00, Rm. 107

W Cozen, J Zadnick, MG Cockburn, AS Hamilton, TM Mack

Department of Preventive Medicine, Keck School of Medicine, University of Southern California, USA

The hygiene hypothesis suggests that protection from the usual childhood viruses in childhood produces an immune system susceptible to asthma and other diseases. In a large cohort of native California twins, we assessed early childhood risk factors for asthma by comparing 366 asthma-concordant (case pairs) to 8,033 pairs in which neither twin developed asthma (control pairs). Asthma was assessed by self-report. Smokers were excluded from the analysis. Analysis was performed using unconditional logistic regression (SAS version 8.1), adjusted for age, race/ethnicity, parental education level and parental smoking and stratified by zygosity and gender. The effect of birth order (i.e. of the twin pair relative to other siblings) was stronger than that of sibship size. Twins were more



likely to report asthma in both members of the pair if they were born first compared to those born fourth or later. These effects were strongest for male-male pairs, especially in dizygotic twins (odds ratio [OR] for asthma concordance in twins who were born first vs. born fourth or later = 13.8, $p=0.013$, test of trend for birth order = 0.0006). When birth order and sibship size were combined, twins of each zygosity/gender group who were only children consistently had higher risks than twins who were last born in large families. Twins who moved to separate rooms relatively late were somewhat protected against asthma, although trends were not statistically significant. These results demonstrate that even among twin pairs, growing up in relative isolation from other children may increase asthma risk.

**Opportunities for exposure to infection
and risk of young adult Hodgkin lymphoma in twins**

2:30-4:30, Rm. 104

W Cozen, P Zhao, AS Hamilton, MG Cockburn, J Zadnick, MT Salam, TM Mack

Department of Preventive Medicine, Keck School of Medicine, University of Southern California, USA

Risk factors for Hodgkin lymphoma diagnosed before age 50 (young adult Hodgkin lymphoma, YAHL) include lack of close siblings (either no siblings or first or last born with a large interval between the closest sibling's birth), high socioeconomic status of parents, and single family residence. These risk factors suggest that relative social isolation and protection from exposure to common childhood infections lead to increased susceptibility. We conducted a case-control study in twins discordant for Hodgkin lymphoma to test the hypothesis that the twin with more opportunities for exposure to infections as a child would have lower risk. Detailed questionnaires were mailed out to 366 twin pairs with YAHL registered in the volunteer International Twin Registry. We received 120 questionnaires from one member (single respondents) and 104 questionnaires from both members (double respondents) of YAHL-discordant pairs (61% overall pairwise response rate). Statistical analysis was performed using conditional logistic regression (SAS, Version 8.1). Analyses for single and double respondents were combined if responses were similar. The twin who sucked a pacifier, thumb or fingers more was at a lower risk for YAHL (OR = 0.66, 95% CI = 0.39-1.11), as was the twin who put things into their mouth more (OR = 0.40, 95% CI = 0.21-0.78), or had more contact with pets (OR = 0.81, 95% CI = 0.48-1.36). The twin who kissed people more often at any age was at a lower risk, although this was not statistically significant. More exposure to infections as a young child appears to be protective against YAHL.

**Structural MRI of monozygotic twins discordant
for the risk for anxiety and depression**

2:30-4:30, Rm. 104

E.J.C. de Geus (1), S.P.A. Wolfensberger (2), D. van 't Ent (1), K. Baas (1), M.D. Janssen (1), M. Van Belzen (3), F. Gosso (3,1), W.J.G. Hoogendijk (2), D.I. Boomsma (1), D.J. Veltman (2)

(1) *Dept Biological Psychology, Vrije Universiteit (VU), Amsterdam, The Netherlands*

(2) *Dept Psychiatry & Clinical PET Centre, VU University medical center, Amsterdam, The Netherlands*

(3) *Dept Clinical and Human Genetics, VU University medical center, Amsterdam, The Netherlands*

Current biological psychiatric models assume that the environmental risk factors for anxiety and depression converge on the same neurobiological pathways as the genetic risk factors. To test this assumption, we compared the intrapair differences in brain volume in extremely discordant monozygotic (MZ) twin pairs (N=9) to the differences between groups of concordant twin pairs, in which both members were either at very high (N=7) or very low risk (N=15) for anxiety and depression. MZ twins are genetically identical, so that discordance in their risk for anxiety and depression must arise from differential exposure to environmental influences. The differences between extreme low and high scoring MZ concordant pairs are more likely to reflect differences in genetic vulnerability. Differences in brain anatomy were assessed by optimized voxel-based morphometry (VBM) on high resolution T1 weighted MR images obtained from a 1.5 T Sonata system. In MZ discordant pairs, we observed a volume reduction in the right hippocampal area in subjects at high risk for anxiety and depression. A group comparison of high risk

subjects from concordant versus those of discordant pairs confirmed right hippocampal volume reduction to be selective to the high risk subjects from the discordant pairs. Our results suggest that the smaller hippocampal volume is specific to the environmentally driven etiology of anxiety and depression. Future MRI studies on anxiety and depression should avoid admixture of subjects who are at risk due to genetic factors with those at risk due to environmental factors.

The association between regular exercise and negative affect in twins, siblings and other family members: a study from the Netherlands Twin Registry Poster Presentation

Marleen H. M. de Moor, A. Leo Beem, Janine H. Stubbe, Dorret I. Boomsma, Eco J. C. de Geus
Department of Biological Psychology, Vrije Universiteit, Amsterdam, The Netherlands

Population studies that investigated the relationship between regular exercise and negative affect (i.e., anxiety, depression and neuroticism) are scarce. In fact, these studies entirely focussed on the relation between exercise and depression. Moreover, they often used measures of exercise that were based on a single question.

The aim of the present study was to examine the association between regular exercise and negative affect in a large population-based sample as a function of gender and age. Our sample comprised subjects who participated in the study on health-related behavior from the Netherlands Twin Registry and consisted of adolescent and adult twins, their siblings, parents and spouses (N=19,462). Measures of regular exercise (type, frequency and duration), anxiety, depression and neuroticism were obtained by means of questionnaires.

The overall prevalence of regular exercise in our sample was 51.4 percent. The prevalence of exercise showed a strong decline with age. No gender differences in prevalence of exercise were found. Twins and siblings did not differ in prevalence of exercise, except for age 35-40 and 55-60 years where twins exercised more often than siblings. Regular exercisers were on average less anxious, depressed and neurotic than non-exercisers. Although these differences were modest in size, they appeared to be very consistent across gender and age.

To determine causality of these associations, a longitudinal study of negative affect and exercise habits in genetically related subjects may provide unique opportunities.

A comparison of height of five-year old twins and singletons Poster Presentation

G.F. Estourgie-van Burk (1), M. Bartels (2), C.E.M. van Beijsterveldt (2), H.A. Delemarre-van de Waal (1), D.I. Boomsma (2)

(1) *Department of Paediatric Endocrinology, Vrije Universiteit Medisch Centrum, Amsterdam, the Netherlands*

(2) *Department of Biological Psychology, Vrije Universiteit, Amsterdam, the Netherlands*

During the first 2.5 years of life differences in body size between Dutch twins and general population infants decrease but do not disappear despite correcting for gestational age. Some studies have shown that these differences disappear during childhood, but in other studies differences remain until at least the age of 18 years. We studied height in a large group of 5-year old twin pairs in relation to the Dutch reference growth charts in order to investigate the persistence of twin-singleton differences. Maternal report on height of 5-year old twins and information on parental height were available from 5905 twins (2910 boys, 2995 girls) of the Netherlands Twin Register (NTR). Standard deviation scores (SDS) for height and target height were calculated with the Dutch reference growth charts for the general population from 1997. Between 4.5 and 5.5 years of age, Dutch female twins are as tall as singletons, while male twins are significantly shorter than singletons (SDS -0.17; $P < 0.01$). For both boys and girls the mean height SDS is 0.6 SDS below the mean target height ($P < 0.01$). At age 5, Dutch twin girls show a complete catch-up in height compared to singletons. Dutch twin boys catch up in body height, but are still significantly shorter at age 5. As for height, twins grow fairly well compared to singletons. However, they grow below their target height, due to the above average height of the parents (reflected in above average target height for the children) of these twins.

Post-Partum Depression in mothers of multiples

9:00-10:00, Rm. 104

J. Susan Griffith, Rebecca Moskwinski, Mary Adcock

National Organization of Mothers of Twins Clubs, Inc., USA

Post-Partum Depression is a serious problem that often goes unrecognized or is dismissed cavalierly by medical personnel and/or patients' families. This condition can range from mere "baby blues" to a suicidal or homicidal depression and even to psychosis. The National Organization of Mothers of Twins Clubs, Inc. (USA) conducted a survey of mothers of twins and higher-order multiples for the occurrence of Post-Partum Depression. A total of 758 mothers of twins and higher-order multiples completed NOMOTC's survey, with the rate of Post-Partum Depression being just over one-third of mothers (37%). Only 10% of this same group of mothers of multiples reported having had similar symptoms during a singleton pregnancy.

NOMOTC's rate of Post-Partum Depression will be compared to rates in three other studies: MOST (Mothers of Supertwins, a support group for higher-order multiple birth families in the United States), TAMBA (Twins & Multiple Births Association, a multiple birth support group in Great Britain), and a singleton study done in the United States.

Risk factors affecting smoking initiation and persistence in California twins

9:00-10:00, Rm. 104

Ann S. Hamilton (1), Christina N. Lessov (2), Myles G. Cockburn (1), Jennifer Unger (1), Thomas Mack (1)

(1) *USC Keck School of Medicine, Los Angeles, CA*

(2) *SRI International, Menlo Park, CA*

Objective: To determine the relative effects of genetic vs. environmental influences on smoking initiation (SI) and smoking persistence (SP) as well as risk factors affecting these behaviors.

Methods: Analyses were based on 33,881 twin pairs (22,810 dizygotic (DZ) pairs and 11,071 monozygotic (MZ) pairs) from the California Twin Program. Analyses were stratified by zygosity, gender, closeness between twins, and birth cohort. Standard epidemiologic and genetic analyses were conducted. Adjusted odd ratios for SI and SP were determined using multiple logistic regression models. Tetrachoric twin pair correlations were computed, and structured models were constructed to estimate the variance due to additive genetic factors, shared environment and individual environment.

Results: The strongest risk factor for SI was the co-twin's smoking status, with adjusted odds ratios of 9.7 (95% C.L. 8.8-10.6) among MZ twins and 5.7 (95% C.L. 5.2-6.2) among DZ like-sex twins if the co-twin also smoked. The co-twin's continued smoking also was a significant risk factor for SP (Adjusted OR=3.2 (95% C.L. 2.8-3.7) for MZ twins and 2.2 (95% C.L. 1.9-2.5) for like-sex DZ twins. While the MZ and DZ twin pair tetrachoric correlations were higher for SI than SP, the MZ/DZ correlation ratios were higher for SP indicating a larger genetic effect for SP and relatively greater effect of shared environment for SI; however differences by gender were seen for both phenotypes. Genetic factors were relatively more important for males than females for SI, whereas the reverse was true for SP. From the best fitting model for SI the proportion of variance due to additive genetic effects, shared environment, and individual environment was 31.6% (24.2-39.1), 47.5% (41.1-53.7), and 20.9% (18.8-23.1) for females, and 71.2% (66.7-75.4), 12.0% (8.7-15.7), and 16.7% (15.0-18.7) for males. For SP the corresponding values were 54.1% (49.0-59.0), 0%, and 45.9% (45.9-59.0) for females, and 33.1% (22.1-45.2), 18.3% (8.5-27.3), and 48.6% (43.6-53.7) for males. Modification by cohort and closeness was seen.

Conclusions: While both genetic and environmental factors affect smoking behaviors, the gender differences seen in the relative contribution of genetic and environmental influences on SI and SP indicate that different approaches need to be developed for smoking cessation efforts aimed at males and females. Interventions may be possible that could modify a genetic propensity to smoke or continue to smoke.

Having a cotwin with ADHD

9:00-10:00, Rm. 107

David Hay, Megan McDougall, Kellie Bennett

School of Psychology, Curtin University of Technology, Perth, Western Australia

Attention Deficit Hyperactivity Disorder (ADHD) is a common childhood disorder and may be more common in twins. Our data on MZ twins discordant for ADHD indicate it is associated with birth complications, especially breathing difficulties. This paper focuses on the longterm psychosocial consequences for the twin who does not have ADHD, using two waves of data from the Australian Twin ADHD Project (ATAP). In one wave, parental report data on 1550 twin pairs aged 8-16 plus their siblings were used to examine the rate of behavioural problems in DZ pairs discordant for ADHD, how the effects on the non-ADHD twin depended on whether or not they were of the same gender and whether the effects were greater for the non-affected twin than any non-twin siblings. One key issue was that of comorbidity and whether the ADHD twin had additional problems besides ADHD which may confound the family dynamics. The second study explored why some twins may cope better than others with their cotwin's ADHD, using self-report from the next wave of ATAP when the twins were aged 12 or more. Stimulant medication may help siblings as much as it does the ADHD child. Some of the protective factors for the non-ADHD twin are identified, but one uncontrollable influence is that of the media presentation of ADHD as a family-stigmatising disorder. More needs to be done to attend to the cotwin who does not have ADHD and to appreciate the effects on them and their peers.

Congenital cardiac malformations in twins:

Poster Presentation

A Danish nationwide population-based register study

Anne-Maria Herskind, Inge Petersen, Axel Skytthe, Kaare Christensen

The Danish Twin Registry and Center for the Prevention of Congenital Malformations, University of Southern Denmark, Odense C, Denmark

The risk of congenital heart defect has in several studies been found to be higher in twin pregnancies than in singleton pregnancies, but the concordance rate has been found to be low even in monozygotic twins. However, most previous studies have been small and highly selected.

We linked the population-based Danish Twin Registry with the National Patient Register to obtain information on all hospitalizations for Danish twins born 1977 to 2001. A total of 1136 twin pairs (624 with known zygosity) in which at least one of the twins had a congenital cardiac malformation were identified. The proband concordance rate for any heart defect was 37% in MZ twins and 27% in DZ twins corresponding to a heritability of 43% (95% CI 26%-59%) and a common environment factor of 42% (29%-54%). Among the 188 concordant pairs, 84% (157 pairs) had the same diagnosis on an ICD-8 3-digit level. The study suggests a high occurrence of a similar congenital heart defect in co-twins to twins with congenital heart defects.

Heritability of testosterone levels in 12-year old twins

Poster Presentation

Rosa A. Hoekstra, Meike Bartels, Dorret I. Boomsma

Department of Biological Psychology, Vrije Universiteit, Amsterdam, the Netherlands

The sex hormone testosterone is reported to be linked to several behavioral problems, such as aggression and antisocial behavior. However, the underlying factors influencing the testosterone-behavioral link are ill understood. Relatively little research has focused on the etiology of individual differences in testosterone levels in the normal population and data in children in this field are lacking. The aim of this study was to estimate genetic and environmental influences on variation in testosterone levels in 12-year old children. Midday salivary testosterone samples were collected on two consecutive days in a sample of 183 unselected twin pairs. A significant contribution of genetic effects to the variance in testosterone levels was found. Heritability was approximately 68% in both boys and girls. The remaining proportion of the variance could be explained by non-shared environmental influences.

Data on opposite sex twin pairs showed no evidence that different genes influence variation in testosterone levels in boys and girls, suggesting that sex differences in genetic expression take place in later phases of puberty.

Personality and self-concepts in twins and singletons in South Korea

Poster Presentation

Yoon-Mi Hur (1), Youngsoon Yoon (2)

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(2) *Department of Education, Hansung University, Seoul, South Korea*

The present study compared South Korean twin children to their age- and gender-matched singletons in personality traits and self-concept. Three hundred and forty-five pairs of twins (197 MZ, 94 SSDZ, & 54 OSDZ) and 761 singletons aged between 8 and 12 years completed six cluster scales of Piers-Harris Children's Self-Concept Scales. A subsample of these twins and singletons also completed a short-form of Multidimensional Personality Questionnaire. Mx (Neale, 1999) was used to examine mean differences between twins and singletons. Whereas personality traits were not significantly different between twins and singletons, self-concepts were significantly higher for twins than for singletons. These results support recent findings from adult twin studies that demonstrated no significant differences in personality traits between twins and singletons (Johnson et al., 2002). We speculate that twins have higher self-concepts than singletons because they are generally more popular than nontwins among elementary school children.

Activities associated with sun exposure in childhood modifies risk of Multiple Sclerosis among monozygotic twin

2:30-4:30, Rm. 104

Talat Islam, J Gauderman, W Cozen, T Mack

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Objective: We intended to investigate the association between sun exposure and multiple sclerosis (MS) risk, among MZ twins.

Subject: The International Twin registry has information on 1294 twin pairs, with at least one case of MS, who were identified through newspaper advertisement during 1980-1992. Disease and exposure discordant MZ (n=195) twin pairs were detected from this registry for this analysis.

Exposure: Each twin was asked about their sun exposure in childhood and prior to developing MS. The data were comparative (comparison of exposure within pairs) in nature.

Analysis: Data was analyzed using conditional logistic model and the point estimates were expressed as odds ratio.

Result: Among the MZ twins, we found that childhood sun exposure was a strong protective factor against MS. Twin members who spent more time outdoors in two or more seasons were 59% (p-value 0.05) less likely to develop MS compared to their co-twins. Similarly twins who spent more time outdoors during whether 'hot' or 'cold' days were also less likely to have MS (OR: 0.47, 95% CI: 0.21-1.00). Similar reduction in MS risk was noted for those who performed activities directly related to sun exposure e.g. sun tanning or going to the beach (OR: 0.48 95% CI: 0.25-0.91). Twins participating more in team sports compared to their co-twin also appeared to be protected from MS (OR: 0.50, 95% CI: 0.22-1.11), with marginal significance

Conclusion: After adjusting for genetic susceptibility sun exposure appears to be a strong protective factor against MS.

Changing challenges - Life isn't always fair

9:00-10:00, Rm. 104

Joyce Keating

Australian Multiple Birth Association (AMBA)

Twins - just like having two closely spaced children...or so the community assumes. Too often we, as parents of

multiple birth children, hear this comment. But does the uniqueness of twins, triplets, quadruplets stop once they go to school? What support can multiple birth parents receive when their journey through parenting multiples include:

- adolescents
- twins facing separation when one accepts a scholarship to study overseas the other remaining at home
- one decides to take recreational drugs and the other doesn't
- finding appropriate high schools for twins who are scholastically different or when one has a disability
- the "hormone years" with multiples (especially different sex sets)
- families with two sets of adolescent multiples
- the dating scene
- when one or more of the multiples has died
- hormones run amok -- when they develop at differing rates
- curfew
- one is at school and the other(s) work
- anger management

In 2003 a number of multiple birth parents in Australia were dissatisfied with the lack of focus, in their local multiple birth groups, with parenting "older multiples." Rather than lose their expertise and to provide for other parents coming through the ranks a support group, affiliated with the Australian Multiple Birth Association, was formed. We offer support, networking and dissemination of information and work attempt to help other multiple birth groups to keep and harness the expertise of their "parents of older multiples."

Hospital protocol after a multiple birth child has died

2:30-4:30, Rm. 107

Joyce Keating

Australian Multiple Birth Association (AMBA)

Currently most children hospitalised will, after treatment, be discharged into their families care. Armed with a "discharge plan" and with time most of these children and their families will become independent of medical care. Yet as we all know in some cases, it doesn't matter how much medical intervention takes place, or how many well trained and caring staff these children come in contact with, some will still die.

What is done for these families? In the case of multiple birth loss the grief experienced is often compounded by the variety of "types" of loss.

- where all of the multiples die
- length of time the survivors remain in hospital
- when the death occurs after TTTS
- when a number of children from the set die at intervals
- where the pregnancy continues after the death of one or more
- where one or more survive
- if the death occurred after fetal reduction
- when the children are older and one dies

Too often a discharge plan is only implemented when the child survives. The Multiple Birth Association Bereavement Support Group, which is affiliated with the Australian Multiple Birth Association, is working on a paper which it hopes will be the basis for hospitals within Australia to set up discharge protocols for families after one or more of their multiple birth children dies in hospital.

Linguistic Features of Japanese Twins at 3 or 4 Years of Age Evaluated by Illinois Test of Psycholinguistic Abilities

Poster Presentation

Yoko Kobayashi, Kazuo Hayakawa, Rituko Hattori, Mikiko Ito, Kenji Kato, Chisato Hayashi, Hiroshi Mikami
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In general, twins have retardation of language development early in childhood compared with the singletons. The purpose of this study was to clarify the overall linguistic features of twins. We mainly performed a Japanese version

of the ITPA (Illinois Test of Psycholinguistic Abilities) in 48 pairs of twins at home between 3 and 4 years of age (n=48). The results showed that the mean PLA (psycholinguistic ages) of twins was 40.3 · 5.2 months, which was five months behind the mean chronological age (45.3 · 5.6 months). The overall linguistic features of twins was in a normal range (mean scale score: 33.0 · 2.4 points) compared with those of singletons (normal mean scale score of the ITPA: 36.0 · 6.0 points). In addition, among the sub-tests of ITPA, only “auditory reception” of psycholinguistic abilities was within the region of language disorder (mean scale score: 24.9 · 5.1 points). Our results in which current Twin-Talk pairs performed better on the auditory reception scale are in conflict with previous reports that have suggested that current Twin-Talk pairs experience greater delays in acquisition of language skills. This disparity was not explained by differences in the neuroanatomical development with increasing age between the two groups. Interestingly, there were no other differences in neuroanatomical factors in subscale scores, or in total score between the current Twin-Talk and no current Twin-Talk groups. These findings suggest that retardation of “auditory reception” ability characterizes the overall linguistic features of twin language development.

Component cognitive processes of working memory in middle-aged twins 2:30-4:30, Rm. 107

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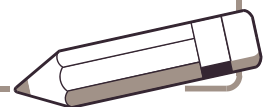
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Working memory, the ability to maintain and manipulate information held briefly in memory, is an executive function that is important in cognitive aging. Few twin studies include tests that are used to disentangle maintenance (storage) from manipulation (executive) components. We addressed this issue in 679 middle-aged male twin pairs (mean age=47.9 years). Storage was assessed by digit span forward (DSPF), which requires subjects to simply maintain numbers in short-term memory. Storage plus executive ability was assessed by a digit transformation (DT) task in which subjects heard digits and had to mentally add 3 or 4 to each digit. Bivariate genetic analysis indicated that the phenotypic correlation between the two measures was due entirely to genetic influences. The genetic correlation was 1.0 based on the best-fitting model, indicating complete overlap of genetic factors influencing the measures. Genetic influences contributed about one-quarter of the variance in DSPF and nearly 60% of the variance in DT. Shared environmental influences contributed about one-quarter, and unique environmental influences contributed about one-half of the variance in DSPF. Unique environmental influences contributed about 40% of the variance in DT, but all of this was specific to DT. The common genetic factor could reflect storage ability (the component cognitive process common to both tests), but this would suggest that only unique environmental factors influence executive ability. The common factor could also indicate that genes influencing executive ability are the same genes that influence storage ability. The authors discuss how component cognitive processes may map onto genetic influences.

Take Note:



Parenting stress and language development in twins

Poster Presentation

Reiko Nishihara (1), Ritsuko Hattori (2), Yoko Kobayashi (1), Kazuo Hayakawa (1)

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Objective: There is increased child abuse in families with twins in Japan. It is reported that the maltreatment causes a delay in language development in children. In this study, we examined the relationship between parenting stress in twins' mothers and language development in twins.

Methods: Questionnaires were mailed to 218 mothers of twins and 358 mothers of singletons aged 0 to 2. Of them, 110 mothers of twins (56.1%) and 96 mothers of singletons (26.8%) returned the questionnaires. Three pairs of twins were excluded for premature birth. The core questionnaires included biological characteristics (twin's age, sex, gestational age, birth weight, and birth height), family environments (maternal age and household members), parenting stress by Child Rearing Support

Questionnaire, and infant motor and mental development by Tsumori-Inage infant developmental scale.

Results: The mean score of parenting stress score in mothers of twins was significantly higher than those of singletons ($p < .05$). Only in twins aged 2, the score was significantly correlated with language developmental score.

Conclusion: Significant relationship in parenting stress score with linguistic development in two-year-old twins suggests that parenting stress influences on child development in twins.

Are there differences in brain morphometry between twins and singletons?

Poster Presentation

Sarah J. Ordaz, Michael A. Rosenthal, Greg L. Wallace, Liv S. Clasen, Rhoshel Lenroot, Jay N. Giedd

Child Psychiatry Branch, National Institute of Mental Health, National Institutes of Health, Bethesda, MD, USA

Twin studies are important for assessing genetic and environmental influences on variation in phenotypic traits such as brain morphometry. However, a potential limitation to these studies is that brain morphometric data collected from twins may not be comparable to that collected from singletons because of differences in prenatal, perinatal, and family environments. A previous study found no significant difference in brain volumes between adult twins and singletons in total brain volume, gray matter, white matter, and lateral ventricles, but finer subdivisions of the brain were not investigated (Hulshoff Pol et al., 2002). To determine whether there are volumetric differences in the brain between child and adolescent twins and singletons, 130 twins (one randomly selected per pair) and 130 age- and sex-matched singletons were scanned using magnetic resonance imaging. Total cerebral volume, gray and white matter volumes, and lobar gray and white matter volumes were not significantly different between twins and singletons. There were no significant differences between groups for subcortical regions. Hulshoff Pol et al. (2002) found differences in brain volumes between first-born and second-born twins which may be due to different prenatal and perinatal conditions, but this finding was not replicated. Brain volumes in twins did not differ based on zygosity. Birth weight correlated strongly with total cerebral volume, but did not differentiate twins and singletons. These findings suggest that brain morphometry during childhood and adolescence does not differ between twins and singletons.

Working memory in 12-year-old twins and their siblings

Poster Presentation

Tinca J.C. Polderman (1), J.F. Stins, D. Posthuma (1), F.C. Verhulst (2), D.I. Boomsma (1)

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Working Memory (WM) is conceptualised as a limited capacity system for information processing. It is an important aspect of cognition, and is often impaired in cognitive disorders. In the current study we investigated to what extent genetic or environmental factors explain individual differences in WM. Specifically, we looked at the

sources of individual differences in two subcomponents of WM: speed (WMS) and capacity (WMC). WMS and WMC were assessed in a sample of 12-year-old twin pairs (N=177) and their additional siblings (N=53). WMS was assessed with a reaction time (RT) task with three increasing memory load conditions. WMC was measured with three subtests of the Wechsler Intelligence Scale for Children Revised (WISC-R): Arithmetic, Digit Span Forward and Digit Span Backward.

In the RT task, there was an increase in RT with increasing memory load. Also, correlations between WMS and WMC increased with increasing complexity of the two subcomponents. For both WMS and WMC, correlations for monozygotic twin pairs were generally higher than the correlations for dizygotic twin pairs and for twin-sib pairs. This suggests a genetic contribution to individual differences in the performance on WMS and WMC tasks.

A novel method for linkage in 294 twin pairs replicates a QTL for eye colour on 15q

2:30-4:30, Rm. 104

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Since 1991 the Dutch Twin Registry has sent out biannual questionnaires to twins and their family members. All questionnaires included a question regarding the similarity in eye colour for twins to determine zygosity status. This question was answered by the mother (4 occasions), the father (1 occasion), or the twins themselves (6 occasions). For 4748 twin pairs the similarity for eye colour was available on a three point scale (“not at all alike” – “somewhat alike” – “completely alike”). The probability that twins were alike for eye colour was calculated from the response pattern on all questionnaires and all respondents. Based on DNA or questionnaire data, 2167 were MZ twins, 2520 were DZ twins, and for 61 twin pairs zygosity was ambiguous. Of the MZ twins, 96.3% were alike for eye colour (probability ≥ 0.75), whereas of the DZ twins 25.2% were “completely alike” and 34.5% were “not at all alike” (probability < 0.25). For 294 DZ twin pairs genome wide marker information was available. We regressed the average amount of IBD sharing on the probability that the twins were completely alike for eye colour. Using similarity in a pair as opposed to having determined actual eye colour in individuals, we found a peak LOD-score of 2.85 at 15q, overlapping with the region implicated recently for eye colour.

Supported by NWO-Spinoza; National Supercomputing Facilities; Human Frontiers Science Program (rg0154/1998-B); GenomeEUtwin (EU QLG2-CT-2002-01254).

Postpartum depression in higher order multiples:

2:30-4:30, Rm. 107

Increased incidence and obstacles to diagnosis

Kelly Ross, Lauretta Shokler, Maureen A. Doolan Boyle

Mothers of Supertwins (MOST)

To study postpartum depression (PPD) in mothers of higher order multiples (triplets, quadruplets and above) in order to determine if a greater incidence of PPD occurs in this population and if the presentation and symptoms experienced differed from the description of PPD in current medical literature.

Methods: We conducted a survey assessment where members of Mothers of Supertwins were mailed a survey and asked to answer a set of questions. Data pertaining to sociodemographic status, medical, gynecologic, and obstetric history, pregnancy, perinatal and neonatal events were collected as well as symptom-specific data pertaining to PPD.

Results: In comparison to current medical literature on PPD, the incidence of PPD is greater in mothers of higher order multiples (HOM), the onset is often delayed and the diagnosis is complicated. Maternal age, financial stress, and number of infants were strong risk factors for PPD. No association was found between zygosity and gender of children, or the mother’s work status and postpartum depressive symptoms. Nearly half (48%) of those reporting “thoughts of hurting themselves/others” or “thoughts of death or suicide” never sought professional help.

Conclusion: Mothers of HOM have a greater risk of experiencing postpartum depression. Despite meeting many

of the documented risk factors for PPD, under diagnosis in PPD in mothers of HOM remains a problem. The consequences of untreated PPD can be devastating and the increased infant number amplifies this possible outcome. Inquiry about symptoms on the part of the health care provider appears to increase the likelihood of diagnosis. Investigation into ways to enhance self-diagnosis and increase provider screening for PPD is warranted.

MZ Female Twins Discordant for Transsexualism: A Pair of Case Reports

2:30-4:30, Rm.104

Nancy L. Segal

California State University, Psychology Department, Fullerton, CA, USA

Monozygotic female twin pairs discordant for transsexualism are rare. Data available from only two published case reports, an unpublished conference presentation and the non-scientific literature include 12 such pairs: 3 concordant and 9 discordant. Two additional twin pairs came to the attention of this investigator during the last two years. Interviews with both the twins and several of their family members eliminated unusual social life history and medical life factors as playing a causal role in the twins' gender identity differences. In both pairs, these gender identity differences were observed in very early childhood, consistent with, but not proof of, co-twin differences in prenatal hormonal effects. Gathering data on additional MZ female twin pairs discordant for transsexualism can enhance biological and psychological understanding of this behavior. Findings from these two new twin pairs, as well as findings from extant studies of female-to-male transsexuals, suggest new directions for future research.

**Genetic and environmental influences on exercise participation:
A comparative study of twin cohorts in six countries**

Poster Presentation

Janine H. Stubbe (1), Dorret I. Boomsma (1), Jennifer R. Harris (2), Jaakko Kaprio (5), Richard J. Rose (7), Urho Kujala (8), Nicolas G. Martin (3), Belinda K. Cornes (3), Nancy L. Pedersen (4), Kirsten O. Kyvik (6), Axel Skytthe (6), & Eco J.C. de Geus (1)

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Twin studies have shown that a major component of variation in exercise participation is due to genetic differences. The aim of this study was to compare the prevalence and to assess the relative contribution of genetic and environmental influences on the variation in exercise participation across six countries participating in the GenomEUtwin. Self-reported data from Australia, Denmark, Finland, Norway, the Netherlands and Sweden were used. Preliminary results of 3,378 complete twin pairs aged 21 to 30 years from the Dutch, Norwegian and Finnish cohorts showed that there was no geographical variation in participation rates for males. The percentage of females exercising was significant lower in Finland compared to the Norwegian and Dutch sample. Importantly, model fitting results showed that genetic effects play an important role in explaining individual differences in exercise participation. Broad heritability estimates of exercise participation ranged from 58% to 73% for males and from 57% to 62% for females. Shared environmental effects were of no importance in this age group. These results encourage the use of pooling across countries when searching for genes influencing exercise participation. *This work originated from the GenomEUtwin project which is supported by the European Union Contract No. QLG2-CT-2002-01254.*

Is there an association between caesarean section and a risk for asthma in twins? Poster Presentation

Toos C.E.M. van Beijsterveldt, Dorret I. Boomsma

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The purpose of this study is to examine the association between caesarean section and the presence of asthma in 5-year-old twins. Information about birth delivery, birth weight, gestational age, smoking and drinking behavior of the mother before and during pregnancy was acquired from a questionnaire filled in by the mother shortly after birth of the twin. When the twins were 5 years, the mother was asked about doctor-diagnosed asthma and allergy. Complete data was available for about 8000 twins. The prevalence of asthma was compared between twins born by means of vaginal delivery and by means caesarean delivery separately for smoking and non-smoking mothers. Preliminary data analysis revealed that children of smoking mothers and born by means of caesarean section had an increased risk for developing asthma.

What to do with non-normal data: Classical test theory versus item response theory in estimating variance components Poster Presentation

S.M. Van den Berg (1), C.A.W. Glas (2), D.I. Boomsma (1)

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Many datasets that consist of sum scores show marked non-normality in their distributions, which may be due to many causes. These data are usually analysed under the assumption that these sum scores have normal distributions. Transformation does not necessarily get rid of the errors in inference. The approach that we prefer is to include explicit measurement models into the genetic modeling. Rather than modeling sumscores that are known to be non-normal using normal models, which is necessarily wrong, we advocate an approach where one models the raw data themselves, modeling the underlying trait as normally distributed and partitioning the variance of the underlying trait into genetic and non-genetic components. We illustrate the approach using data on attention problems in adulthood and discuss several advantages and disadvantages of our approach.

Classroom separation of twins during primary school Poster Presentation

M. van Leeuwen, S.M. van den Berg, C.E.M. van Beijsterveldt, D.I. Boomsma

Department of Biological Psychology, Vrije Universiteit Amsterdam, The Netherlands

We studied short and long-term effects of classroom separation in twins on behavioural problems and academic achievement. Short-term effects were studied at age 7 in twins separated at age 5 and long-term effects at age 12 in twins who had been separated or together most of the school period. Behavioral problems were rated by mothers (CBCL at ages 3, 7 and 12) and teachers (TRF at ages 7 and 12). Academic achievement was measured at age 12 using a national academic achievement test (CITO). Short-term effects were studied in 6738 (5686 for TRF) twin pairs and long-term effects in 2184 pairs (284 for TRF, 843 for CITO). At age 7, separated twins had more internalizing and externalizing problems than non-separated twins, as rated by both mothers and teachers. However, only for the maternal ratings of internalizing problems, these effects could be attributed to the separation itself, instead of to pre-existing problems (at age 3). At age 12, there were differences in problem behavior, but again these could be explained by pre-existing differences. There were no differences in academic achievement between separated and non-separated twins. The results suggest that the decision to separate twins when they enter primary school is based in part on existing behavioral problems and that in the long run, separation does not affect problem behavior or academic achievement. The results were similar for MZ and DZ twins.

* All abstracts will be published in the August issue of *Twin Research and Human Genetics*.



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