



THE SELMA STUDY

a Swedish birth cohort following more than 2,000 mother-child pairs, with focus on health risks in children due to exposure for endocrine disruptor chemicals in early life.

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BACKGROUND

Large scale bio-monitoring programs around the world have provided extensive information on human exposure for man-made chemicals and it is evident that humans are ubiquitously and increasingly exposed to many of these compounds. One group of chemicals, for which a strong concern is expressed, is compounds with suspected endocrine disrupting properties (EDCs). Hundreds of research articles during the last two decades have identified several topics for concern for such exposure. Firstly, EDCs can have effects at low doses, and evidence shows that there might be non-monotonic dose response relationships. Secondly, EDC exposure is probably more important during development in the prenatal and infancy period but the effects can be delayed. Thirdly, EDCs can be found in a large number of commonly used consumer products meaning that everyone is exposed, including pregnant women and infants. Lastly, a large number of epidemiological studies have reported a possible relationship between EDC exposure and multiple chronic illnesses such as neurodevelopmental disorders, asthma and allergy, reproduction and infertility and overweight and obesity meaning that this is related to a major public health issue.

AIM

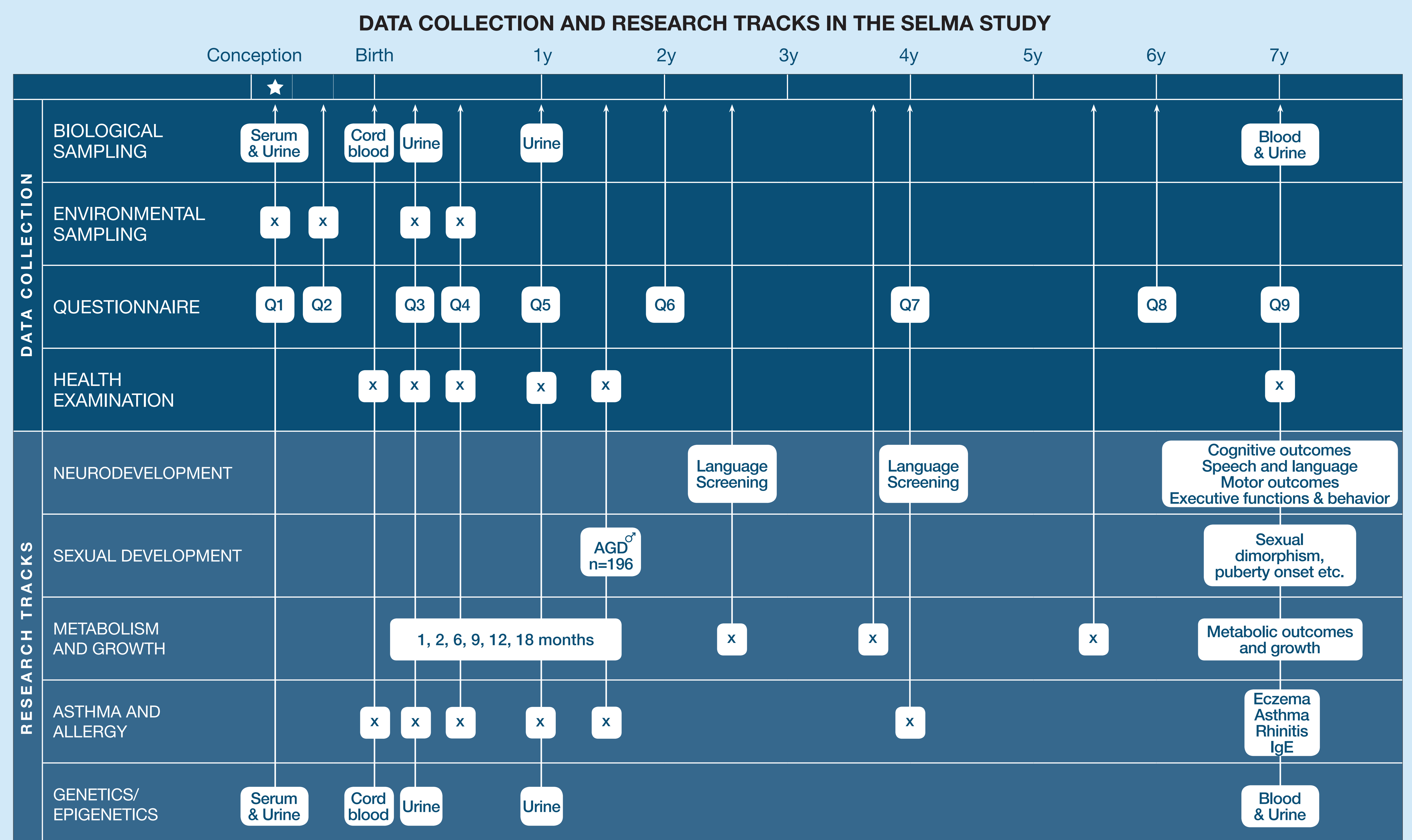
The SELMA study aims to investigate the importance of early life exposure to endocrine disrupting chemicals during the pregnancy and infancy period for the development of multiple chronic diseases/disorders in offspring children.

METHOD

The recruitment of pregnant women and the data collection and sampling procedures have been conducted in connection to the routinely performed examinations at the public Antenatal Care Centres (ACCs) and Child Health Centres (CHCs) where almost all pregnant women and infants/children attend in Sweden. Pregnant women visit an ACC around gestational week 8-10 and are then monitored continuously throughout the pregnancy period and then the child is followed at CHCs up in school age. During the period from September 2007 to March 2010 we recruited 2,582 pregnant women corresponding to a participation rate of 39%. The multiple data collection and sampling procedure during pregnancy, birth and infancy/childhood period included the items described in the figure.

Biological sampling

Biological samples have been taken from the pregnant women and the child and are kept frozen (-80°C for serum and -20°C for urine) in a bio-bank including serum and morning urine



from the pregnant women at their first visit at ACC during the 10th week of pregnancy, cord blood at delivery, and urine samples from the child at 2-4 months and at 12 months of age. Blood and urine will be collected from the child at the age of seven.

Environmental sampling

Indoor settled dust have been collected by the families themselves in all participating homes during the pregnancy and the infancy period by the use of a "pizza box" method for a period of 15 weeks and a filter sock placed on the families' vacuum cleaner. In addition, indoor air samples (passive PUF and tenax) have been taken in 165 randomly selected homes and are stored frozen for analyzing the air concentration of VOC:s and SVOC:s.

Questionnaires

Questionnaires focusing on the family's life styles, use of consumer products/articles, building characteristics, home furnishings and renovations, food habits, and health of the family and the child (incl. ISAAC asthma/allergy symptoms), etc. have been used two times during the pregnancy, three times during infancy and later on.

Health examination

The national child health promotion program is attended by virtually all children in Sweden and each child visits the CHCs about 20 times until it has reached the school age of seven years.

The practical responsibility resides mainly with nurses but there were also regular scheduled examinations by physicians at the ages 2, 6, 12 and 18 months. These data are available for the SELMA study. At age seven an extended health examination will take part.

FOUR HEALTH DOMAINS IN FOCUS

Four health domains are in focus for the study; (1) neurodevelopmental effects including cognition, speech and language, behavior, and motoric outcomes, (2) sexual development including puberty onset (Tanner), sexual dimorphism, etc., (3) metabolism including weight gain, BMI, fat composition, adiposity, etc., (4) immunological diseases including eczema, asthma, rhinitis, IgE sensitization etc.

EXPOSURE ANALYSES

Eight chemicals classes is being measured in serum and urine for the pregnant women (week 10) and the child at different ages including in total 51 compounds (see table); 21 non-persistent compounds representing four classes of pollutants: Phthalates, alkyl phenols, polycyclic aromatic hydrocarbons (PAHs) and pesticides, and 30 POPs which fall naturally into four classes: proteinophilic per- and polyfluorinated alkyl substances (PFAS), lipophilic, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), and organochlorine pesticides (OCs).

EDCs ANALYZED IN URINE AND SERUM IN THE SELMA-STUDY

Compounds	Metabolites	EXPOSURE PERIOD			
		Week 10	Birth	2 months	7 year
NON PERSISTENT COMPOUNDS					
Phthalic acid esters (phthalates)					
DEP	MEP	x			x
DBP	MBP	x			x
BBzP	MBzP	x			x
DEHP	MEHP	x			x
	MEHHP	x			x
	MECHP	x			x
	MECOP	x			x
DINP	MHNP	x			x
	MCNP	x			x
	MCOP	x			x
DINCH	MHINCH	x			x
DPHP	MCPHP	x			x
DDP	MCNP	x			x
Alkyl phenols					
Bisphenol A		x			x
Bisphenol F		x			x
Bisphenol S		x			x
Triclosan		x			x
Polycyclic aromatic hydrocarbons (PAHs)					
Fluorene	1-hydroxyfluorene	x			x
Phenanthrene	2-hydroxyphenanthrene	x			x
Pesticides					
Pyrethroid	3-Phenoxybenzoic acid	x			x
Korpyrifos	Trikoppyridinol	x			x
PERSISTENT ORGANIC COMPOUNDS (POPs)					
Proteinophilic per- and polyfluorinated alkyl substances (PFAS)					
PFNA		x			x
PFDA		x			x
PFLnDA		x			x
PFDDA		x			x
PFHDS		x			x
PFHpA		x			x
PFDA		x			x
PFOS		x			x
Lipophilic, polychlorinated biphenyls (PCBs)					
PCB 24		x			x
PCB 99		x			x
PCB 118		x			x
PCB 138		x			x
PCB 153		x			x
PCB 156		x			x
PCB 170		x			x
PCB 180		x			x
PCB 183		x			x
PCB 187		x			x
Polybrominated diphenyl ethers (PBDEs)					
BDE 47		x			x
BDE 99		x			x
BDE 153		x			x
Organochlorine pesticides (OCs)					
γ-HCH		x			x
α-HCH		x			x
β-HCH		x			x
γ-HCH		x			x
Oxychlorane		x			x
Transnonachlor		x			x
p,p'-DDT		x			x
p,p'-DDE		x			x

COLLABORATORS

The SELMA study is conducted in collaboration between Karlstad University, County Council of Värmland, SP Technical Research Institute of Sweden, and Lund University. International collaborators are Harvard School of Public Health and Mount Sinai School of Medicine, Columbia University in USA.

PUBLICATIONS

Bornehag, C.G., Moniruzzaman, S., Larsson, M., Boman Lindström, C., Hasselgren, M., Bodin, A., von Kobyletzki, L., Carlstedt, F., Lundin, F., Nånberg, E., Jönsson, B.A., Sigsgaard, T., Janson, S. The SELMA study: a birth cohort study in Sweden following more than 2,000 mother-child pairs. *Paediatric and Perinatal Epidemiology*. 2012 Sep;26(5):456-67.

