

MATERNAL SMOKING HABITS AND COGNITIVE DEVELOPMENT OF CHILDREN AT AGE FOUR YEARS IN A POPULATION- BASED BIRTH COHORT

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CREAL-IMIM

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INTRODUCTION

- ✓ **Active maternal smoking during pregnancy has been associated with a higher risk of behavioural disorders in children (Huizink, 2006).**
- ✓ **It is not clear the role of postnatal smoking in children's neurodevelopment.**
- ✓ **It is not clear the role of psychosocial factors.**

OBJECTIVE

We report the effects of pre and post-natal maternal smoking habits on four year old children's cognitive development in a general population.

We assess global cognitive outcomes, and specific neurocognitive areas to gain a better understanding of the underlying pathways relating to smoking neurotoxicity.

METHODS

- ✓ **Subjects:**

 - 482 new-borns (94% of those eligible) from the general population in Menorca island. 420 (87%) completed full assessment after four-years follow-up.**

- ✓ **Assessment instruments at age 4:**

 - The McCarthy Scales of Children's Abilities (MCSA).**

- ✓ **Parental smoking habits were assessed by interviewer-administered questionnaires each year since pregnancy.**

METHODS

✓ Procedure:

Training of two psychologists for MCSA

**Test assessment during 2001-2003
period at age of four**

**Parental general questionnaire
administration at child's birth and at same
time than test assessment**

METHODS

✓ Models were linear regressions and GAMs adjusted for:

child's gender, birth weight and height, having older siblings, duration of breastfeeding, age and school season during test administration, geographic location and psychologist, mother's education level, social class, parity, marital status and alcohol consumption during pregnancy, and father education level.

RESULTS

Consistency of maternal smoking between surveys

SMOKING THROUGH THE YEARS	SMOKING AT 4th-YEAR-SURVEY	
	N	% Total Agreement
3rd Trimester-Survey	421	83
1st-Year-Survey	424	88
2nd-Year-Survey	417	91
3rd-Year-Survey	424	92

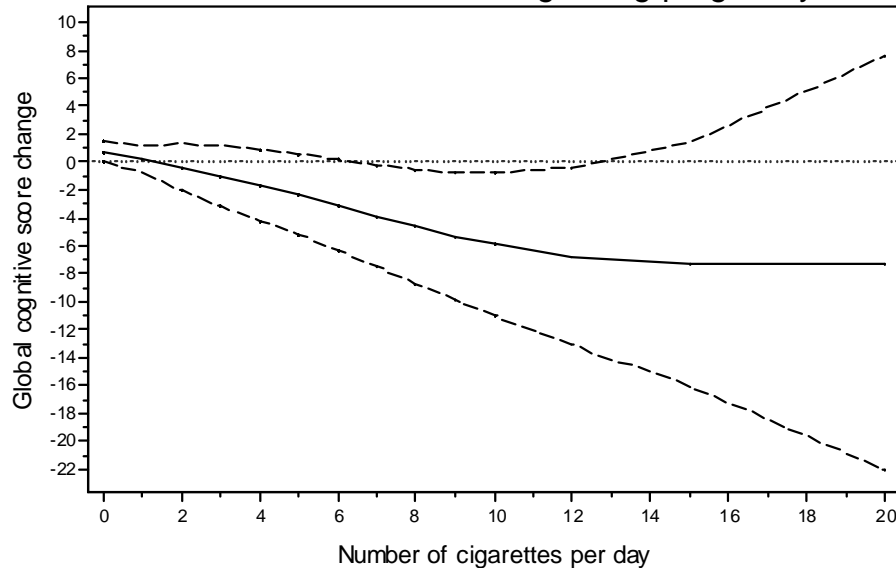
Maternal smoking by social class and educational level

COVARIATES	MATERNAL SMOKING HABITS		
	No	Yes, during pregnancy	Yes, only postnatal
Mother	N=253	N=90	N=77
Social Class (%)*			
Non-manual (65)	70	57	59
Manual (35)	30	42	40
Education level (%)*			
Secondary & High, ≥ 12 years (42)	47	36	32
Less than Secondary, < 12 years (58)	53	64	68

* *P-value* < 0.05

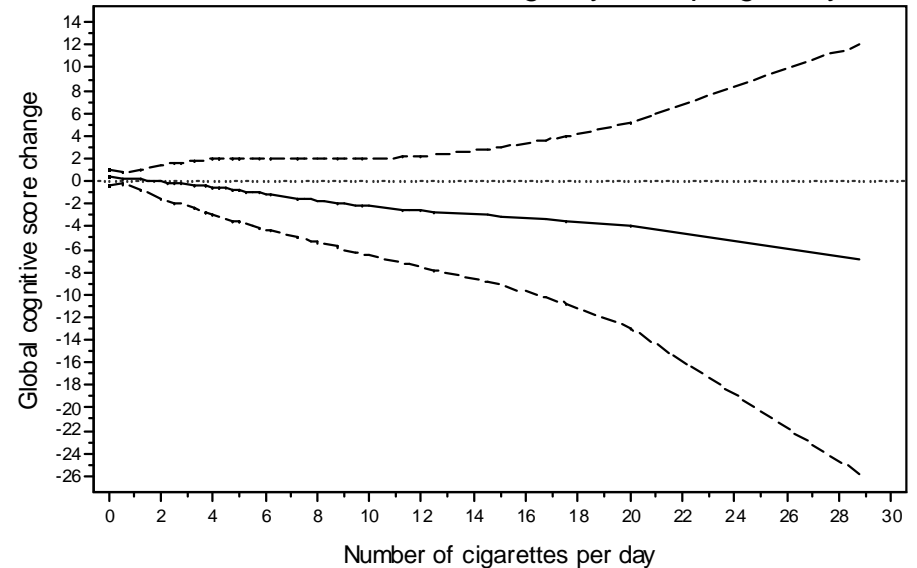
Parental smoking and children's global cognitive outcome at age 4

GAM for mothers smoking during pregnancy



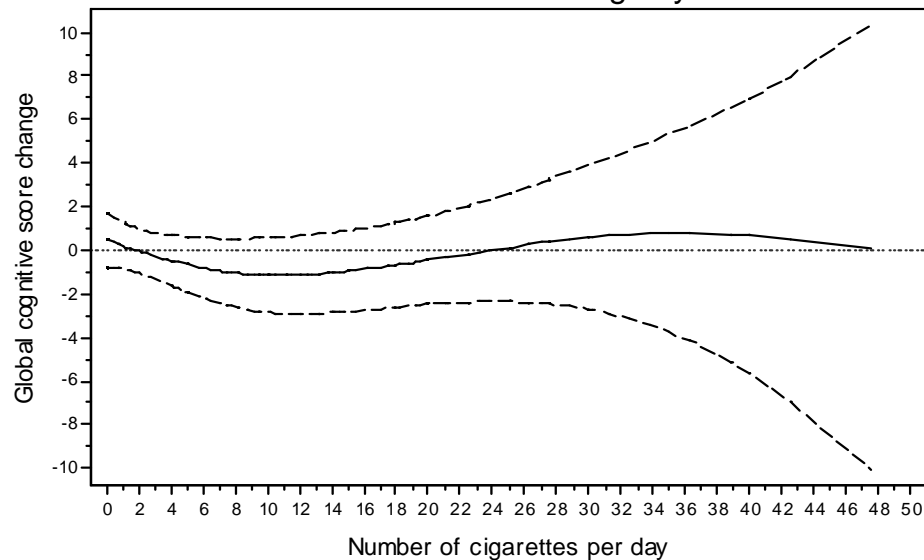
P-value for linearity (null hypothesis) of 0.33

GAM for mothers smoking only after pregnancy



P-value for linearity (null hypothesis) of 0.57

GAM for fathers smoking any time



P-value for linearity (null hypothesis) of 0.07

† Adjusted for: Home location, maternal alcohol consumption during pregnancy, child's gender, birth weight and height, breastfeeding duration, child's school season and age during test administration, psychologist, mother's social class & level of education, parity, marital status at child's age of 4 years, father's education level.

All three smoking determinants are included in the model.

Sensitivity analysis

GLOBAL COGNITIVE	SMOKING VARIABLES TREATED AS CONTINUOUS (CIG/DAY)		
	During pregnancy (mother)	Only postnatal (mother)	Father
N (420)	90	77	226
Crude	-0.75 (-1.20; -0.30) <i>p</i> -value= 0.00	-0.11 (-0.49; 0.27) <i>p</i> -value= 0.56	-0.11 (-0.24; 0.02) <i>p</i> -value= 0.10
Adjusted	-0.51 (-0.99; -0.04) <i>p</i> -value= 0.03	-0.16 (-0.55; 0.22) <i>p</i> -value= 0.40	-0.05 (-0.18; 0.08) <i>p</i> -value= 0.44
Adjusted + Mutual Adjustment	-0.60 (-1.10; -0.09) <i>p</i> -value= 0.02	-0.24 (-0.63; 0.15) <i>p</i> -value= 0.22	-0.01 (-0.14; 0.12) <i>p</i> -value= 0.96

Smoking and the sub-areas of the global cognitive outcome scores

SUB-AREAS OF THE GLOBAL COGNITIVE	PARENTAL SMOKING (CIG/DAY)		
	During pregnancy (mother)	Only postnatal (mother)	Father
Verbal	-0.59 (-1.11; -0.07) <i>p</i> -value= 0.03	-0.33 (-0.74; 0.08) <i>p</i> -value= 0.11	-0.00 (-0.14; 0.14) <i>p</i> -value= 0.96
Quantitative	-0.57 (-1.08; -0.06) <i>p</i> -value= 0.03	-0.17 (-0.57; 0.22) <i>p</i> -value= 0.39	-0.05 (-0.19; 0.08) <i>p</i> -value= 0.43
Working memory	-0.46 (-0.92; -0.01) <i>p</i> -value= 0.04	-0.16 (-0.51; 0.18) <i>p</i> -value= 0.36	0.05 (-0.07; 0.16) <i>p</i> -value= 0.45
Executive functions, frontal cortex predominance	-0.71 (-1.23; -0.20) <i>p</i> -value= 0.01	-0.31 (-0.71; 0.09) <i>p</i> -value= 0.13	0.04 (-0.10; 0.18) <i>p</i> -value= 0.57

DISCUSSION

- ✓ **Active maternal tobacco smoking was highly consistent throughout the four years of follow-up in the current study, with a small reduction in smoking consumption seen during the pregnancy period**
- ✓ **We found lower McCarthy's global cognitive scores in the four year old offspring of mothers who reported smoking daily during pregnancy, which was not seen in mothers who smoked only in the postpartum period or their partners.**

DISCUSSION

- ✓ **Some neurocognitive areas, specifically verbal, quantitative, executive and working memory scores, showed a higher negative association.**
- ✓ **Our findings respect maternal smoking behaviour are in consonance with literature (Cornelius, 2000; Weitzman, 2002).**
- ✓ **Human epidemiological and animal experimental studies support our findings related to fetus exposition to tobacco and the specificity of the areas associated (Weitzman, 2002; Huizink, 2006).**
- ✓ **Postnatal exposure association is less consistent as it is reflected in precedent studies (Linnet, 2003; Huizink, 2006).**
- ✓ **Part of biological plausibility could be explained by the effect differences between maternal (pregnancy) and paternal smoking (any time) on offspring's cognitive development.**

LIMITATIONS

✓ We didn't adjust for potential confounders:

IQ (parents)

Personality and mental health (parents)

Paternal-filial rearing style

✓ We didn't assess cotinine levels in blood (mothers or children)

CONCLUSIONS

- ✓ **Active maternal smoking tobacco was highly consistent throughout the years.**
- ✓ **The association was found specifically in those mothers who reported to smoke (cig./day) during pregnancy, adding consistence to be explained by biological pathways of neurotoxicity.**
- ✓ **Other factors not controlled in this study could explain part of the association, but after adjusting for important indicators of these factors, the associations were still strong.**