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Associations Between *In Utero* MeHg Exposure and Child's Weight, from Birth to 36 Months, in China and Norway

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Fish is a source of MeHg + beneficial nutrients (e.g., PUFAs); rice is also a source of MeHg without the same nutrients.

Among fish consumers, the MeHg effect is likely underestimated, due to confounding by beneficial nutrients.

MeHg and Low Birth Weight

Low birth weight is associated with a cascade of adverse health effects:

- Risk of childhood illness
- Cognitive impairment
- Potentially associated with long-term health effects (e.g., DOHaD)

MeHg efficiently crosses the placental barrier

However, in prior studies, no strong evidence between prenatal MeHg exposure and birth weight (Dack et al., IJERPH, 2021). Most studies focused on fish consumers.

Hypothesis: Adverse associations between prenatal MeHg exposure and child weight are modified by the dietary MeHg source (fish versus rice)

Guangxi Province, China: Birth Cohort Study

Daxin county, Guangxi province,
Non-contaminated region for Hg, inland

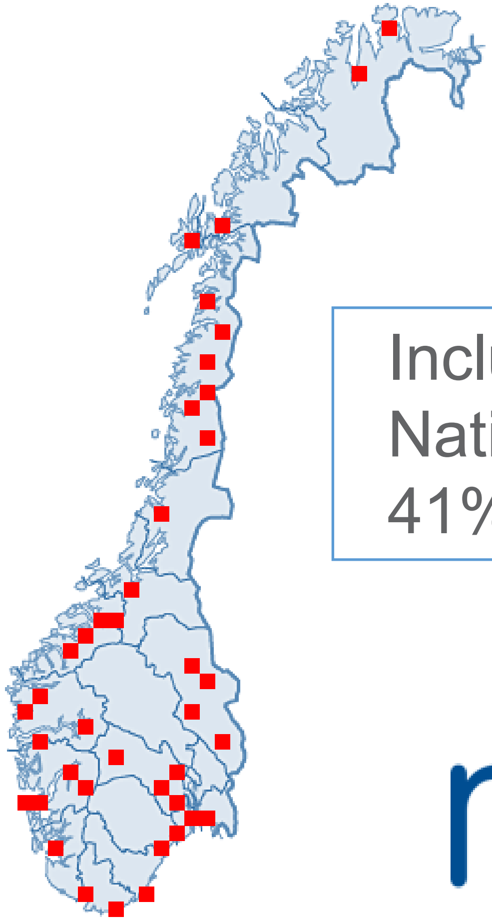
Overall aim:
To study the impacts of prenatal MeHg exposure on child development

Peripartum mothers were enrolled, 2013-2014

N=391 mother/offspring pairs

- Maternal blood THg
- Children's birth weight, 12- and 36-months
- Excluded pre-term and post-term births

The Norwegian **Mother, Father and Child** Cohort Study



Overall aim:

To prevent childhood and adult diseases by understanding early environmental and genetic factors

Inclusion 1999-2008
Nationwide from 2005
41% participation rate

moba

N=2,452 mother/offspring pairs

- Maternal blood THg
- Children's birth weight, 12- and 36-months
- Excluded pre-term and post-term births

Harmonized both data sets- and compared blood THg and rice/fish ingestion

	China N=391 Median (Range)	Norway N=2,452 Median (Range)	P-value
Maternal blood THg (µg/L)	**1.2 (0.29, 8.6)**	1.0 (0.10, 14)	<0.0001***
Rice ingestion (g/day)	**213 (0, 650)**	24 (0, 170)	<0.0001***
Fish ingestion (g/day)	0 (0, 461)	**22 (0, 199)**	<0.0001***
Shellfish ingestion (g/day)	0 (0, 143)	**4.0 (0, 79)**	<0.0001***

Harmonized both data sets- and compared maternal/child characteristics

China N=391	Norway N=2,452
Cesarean section (yes)	Maternal age (categorical)
	Maternal education (categorical)
	Maternal smoking (yes)
	Breastfeeding duration (categorical)
	Maternal pre-pregnancy BMI (kg/m^3)
	Gestational weight change (kg)
	Daily dietary intake (from FFQ) (kcal)

All variables differed between China/Norway (p<0.001***)
Only one variable did not differ: child sex (p=0.81)

Outcome variable (dependent): child's weight-for-age (z-score) (WAZ)

Weight-for-age (WAZ) is calculated using standard growth curves:

- Birth: Intergrowth-21 Newborn Birth Standards, based on a reference population of 20,484 births from 8 countries, including China (Villar et al., 2014)

- For 12m and 36m: WHO Child Growth Standards (2006), based on a reference population of 8,440 children in 6 countries, including Norway

Z-score: mean=0, SD=1

Outcome variable (dependent): child's weight-for-age (z-score) (WAZ)

	All N=2,843 Median (Range)	China N=391 Median (Range)	Norway N=2,452 Median (Range)	
WAZ (birth) (z-score)	0.625 (-3.01, 3.99)	-0.229 (-3.01, 3.49)	0.771 (-2.94, 3.99)	<0.0001***
N	**2,843**	**391**	**2,452**	
WAZ (12 months) (z-score)	0.40 (-2.92, 3.74)	-0.61 (-2.92, 2.38)	0.49 (-2.91, 3.74)	<0.0001***
N	**2580**	**310**	**2270**	
WAZ (36 months) (z-score)	0.37 -2.83, 4.08)	-0.66 (-2.8, 2.51)	0.48 (-2.83, 4.08)	<0.0001***
N	**2376**	**202**	**2174**	

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Statistics: Mixed effects model for repeated measures

Model 1:
Dependent variable: WAZ (birth, 12m and 36m)
Independent variable: $\log_2$ maternal blood THg (µg/L)

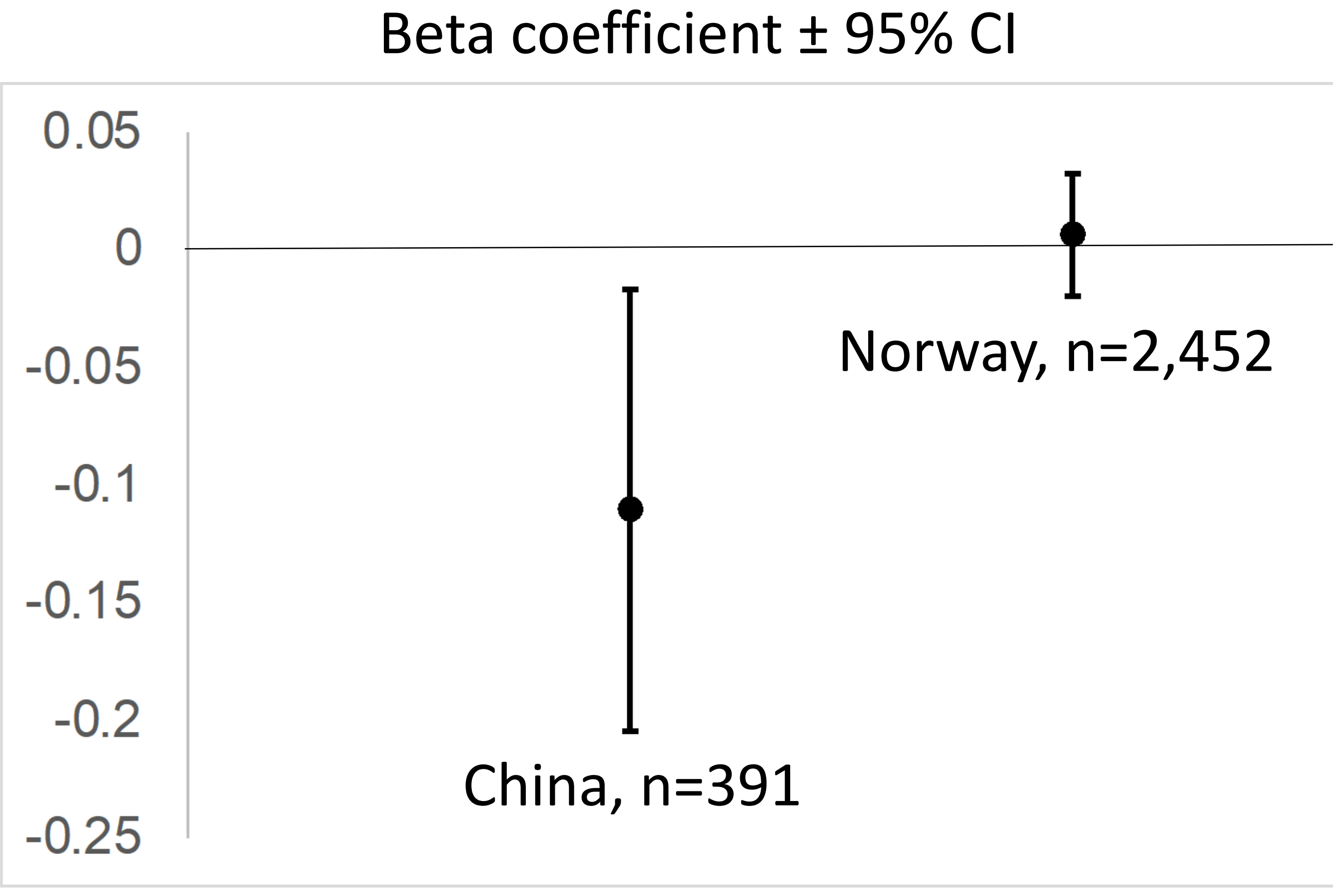
Interaction term: Log_2 Blood THg x China/Norway

Models 2 & 3: Sensitivity analyses, address attrition

Adjusted for 1)maternal pre-pregnancy BMI (kg/m^2), 2) maternal smoking (yes/no), 3) maternal age (categorical), 4) $\log_{10}$ energy (kcal), 5) C-section (yes/no), 6) breastfeeding duration (categorical), 7) child's age (birth, 12m, 36m), 8) location (Daxin/Norway), 9) gestational weight change (kg), 10) maternal education (categorical), and 11) child's age x Daxin/Norway

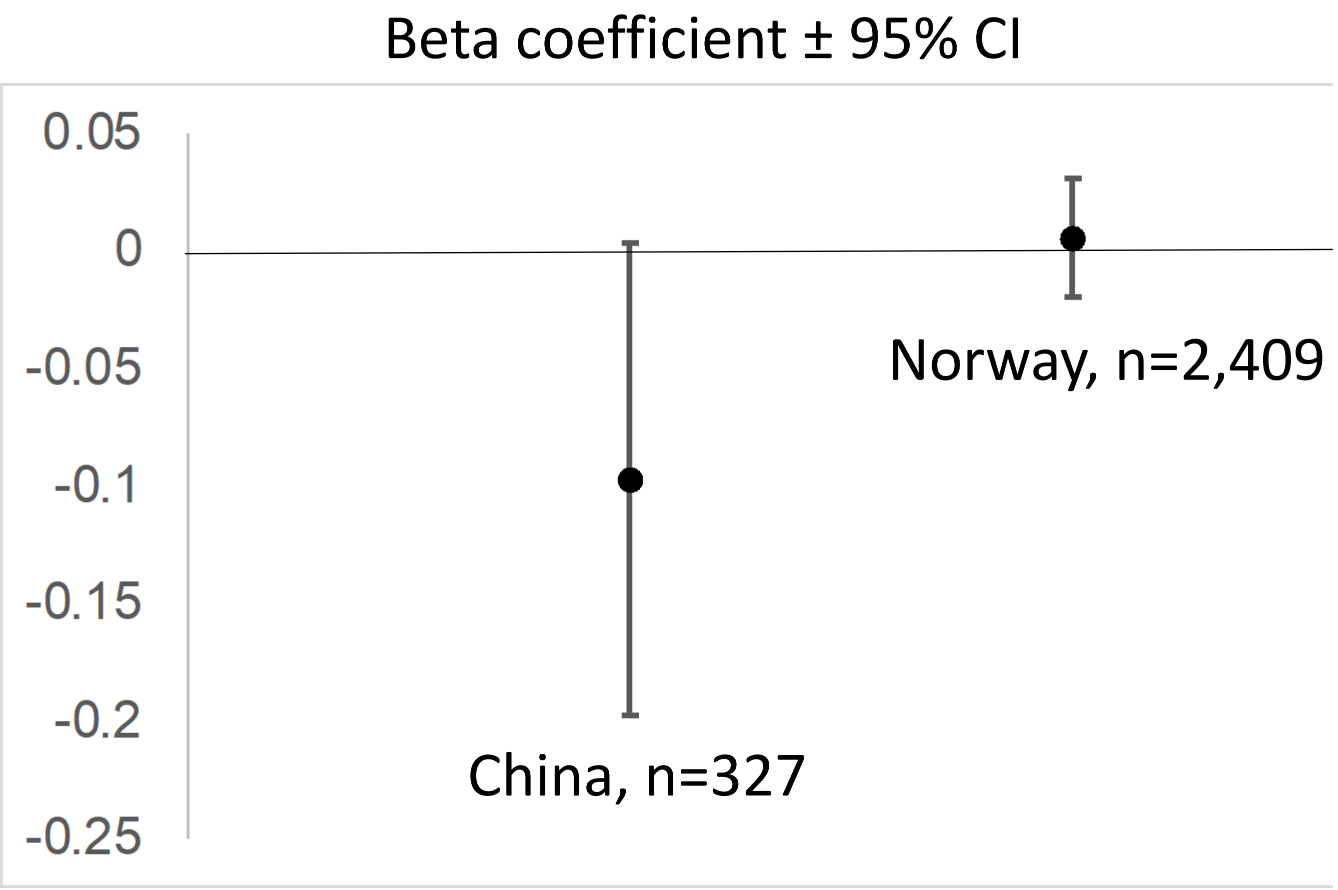
Adjusted Model 1 (all participants)

Predicted change in child's WAZ for a doubling in maternal blood THg (µg/L)



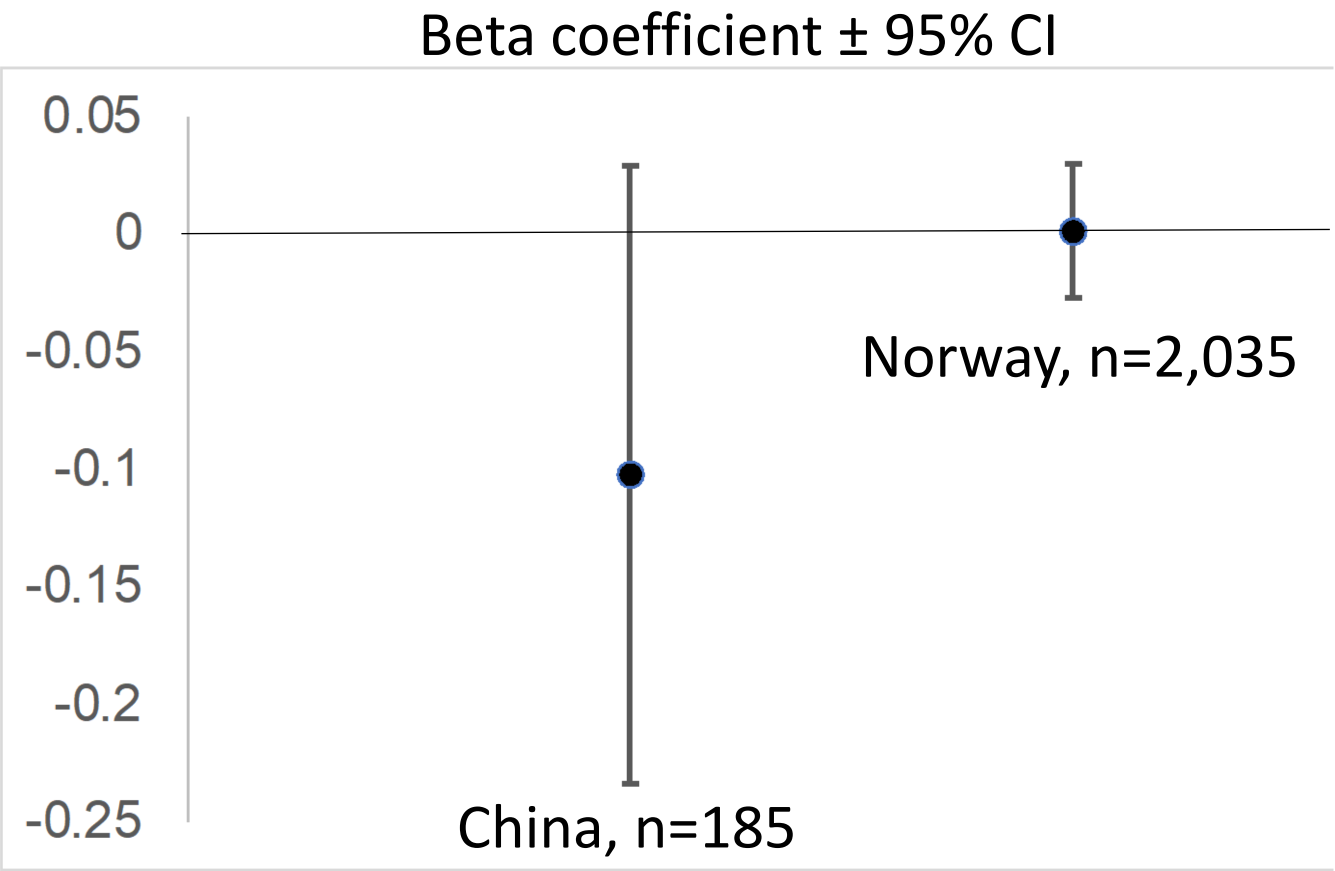
Adjusted Model 2 (returned at 12m or 36m)

Predicted change in child's WAZ for a doubling in maternal blood THg (µg/L)



Adjusted Model 3 (returned at 12m & 36m)

Predicted change in child's WAZ for a doubling in maternal blood THg (µg/L)



Conclusions

1. Prenatal MeHg exposure was adversely associated with child's WAZ, from birth to 36 months, in China- but not Norway.

2. Results suggest among rice-eaters it may be possible to ascertain MeHg's effect b/c beneficial nutrients (e.g., PUFAs) are not as prominent.

3. Results expose potentially new vulnerabilities for communities that depend on rice as a staple food.

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Thank you!!!!

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