



Maternal perchlorate levels during pregnancy and offspring cognitive development: Data from the controlled antenatal thyroid screening study

P.N. Taylor¹, O.E. Okosieme¹, S. Channon², P. Smyth³, C.M. Dayan¹,
L.E. Braverman⁴, J. Lazarus¹, E.N. Pearce⁴

1) Thyroid Research Group, Cardiff University

2) Depart. Child Psychology, St David's Hospital

3) School of Medicine, University College Dublin

4) Section of Endocrinology, Diabetes and
Nutrition, Boston University

83rd Annual Meeting of the American Thyroid Association

Saturday October 19th 2013

Email: taylorpn@cardiff.ac.uk



Disclosure

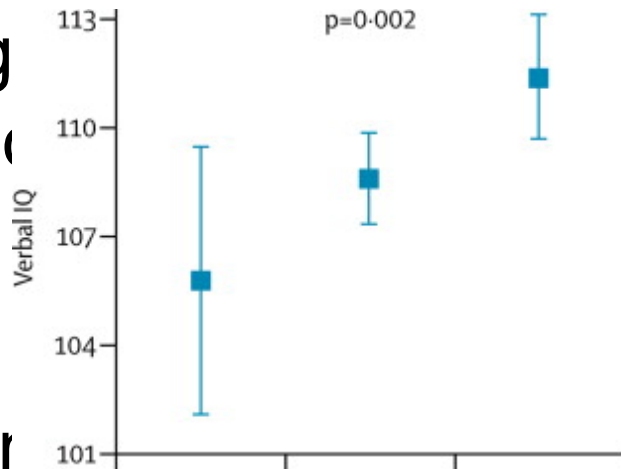
- In relation to this presentation, I declare that there are no conflicts of interest.

Learning Objectives

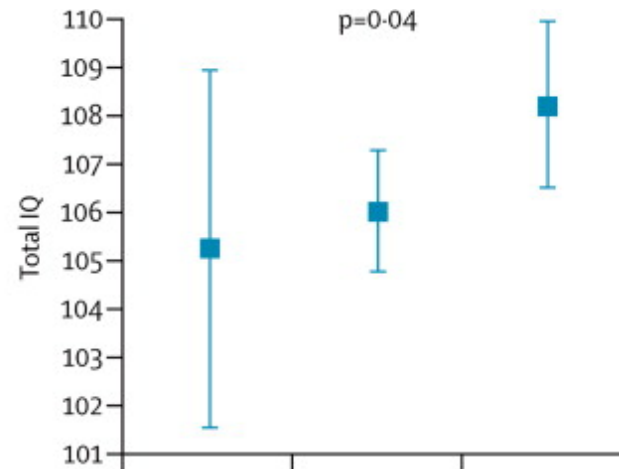
- Understand why high maternal perchlorate levels might have a negative impact on childhood cognitive development.
- Aware of the nature of our observed relationship between higher perchlorate levels and IQ.
- Understand the implications arising from the impact of maternal iodine status, thyroid function and levothyroxine treatment on the relationship between maternal perchlorate levels on childhood IQ.

Introduction

- Cognitive and

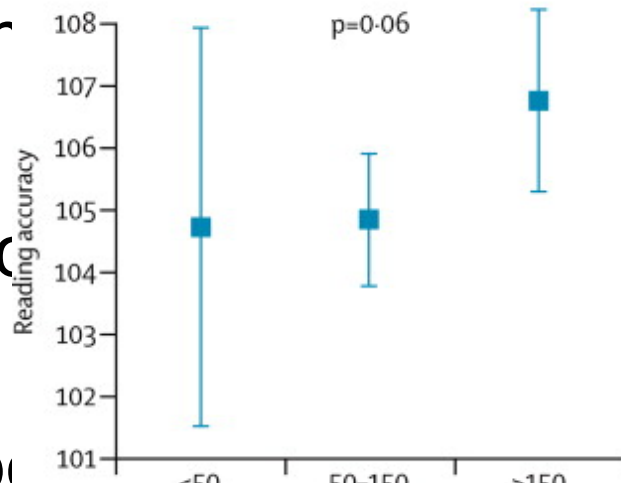


- Iodine deficiency

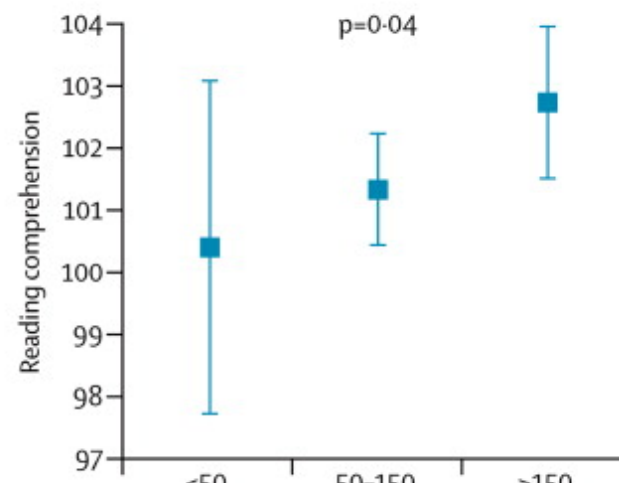


on an
fetal life

- Percentage



- Exposure



thyroid

ake.

- Exposure

levels, is

ed.

Bath et al. Lancet 2013 Jul 27;382(9889):331-7.

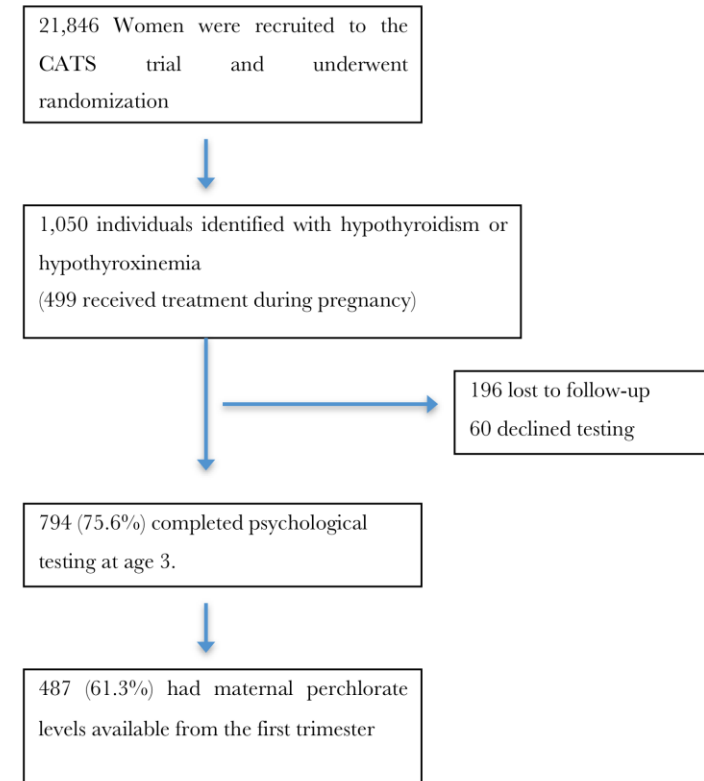
Introduction

- The fetus and developing infant may be especially vulnerable to the effects of perchlorate due to their high thyroidal iodine turnover.
- We sought to determine if higher maternal perchlorate levels were associated with sub-optimal IQ in offspring.

Study Population

- Subset of 487 mother child pairs.
- Hypothyroid/hypothyroxinemic & mild iodine deficiency (median UIC 72 $\mu\text{g/liter}$)
- Urinary perchlorate measured at recruitment (12 weeks).
- 45% subsequently treated with levothyroxine.
- Offspring IQ measured at age 3.

Figure 1 Flow chart of study participants



Methods

- Logistic regression undertaken to assess the odds of offspring IQ in the lowest 10% (IQ <80) if maternal perchlorate levels were in the highest 10% (>10.89 µg/liter). Analyses were repeated for individuals with the highest tertile of perchlorate (>4.0 µg/liter).

Model 1

Crude

Model 2

Maternal age

Maternal smoking

Recruitment centre

Received T4

Age & sex of child at IQ test

Model 3

Model 2+

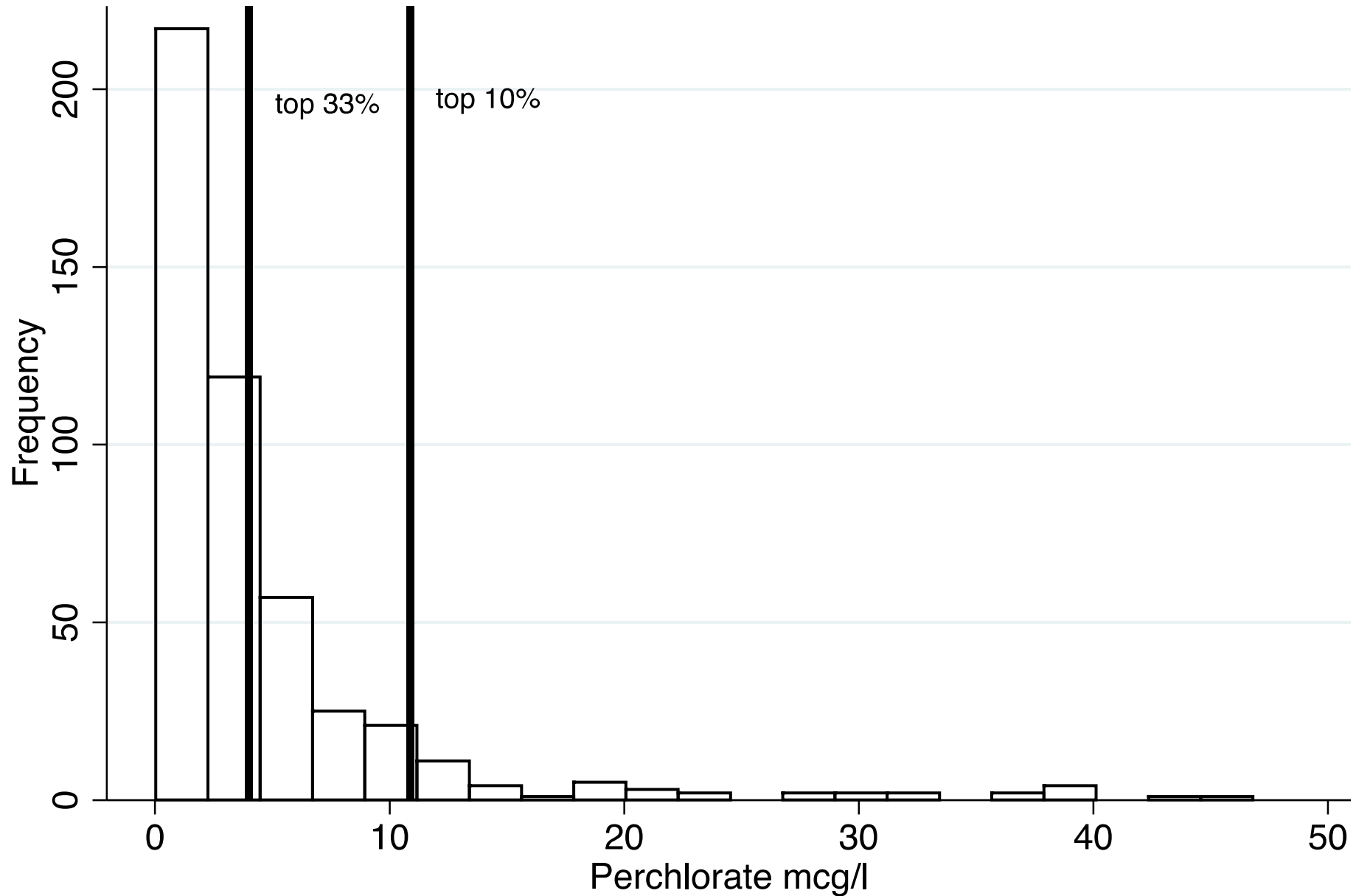
Maternal TSH

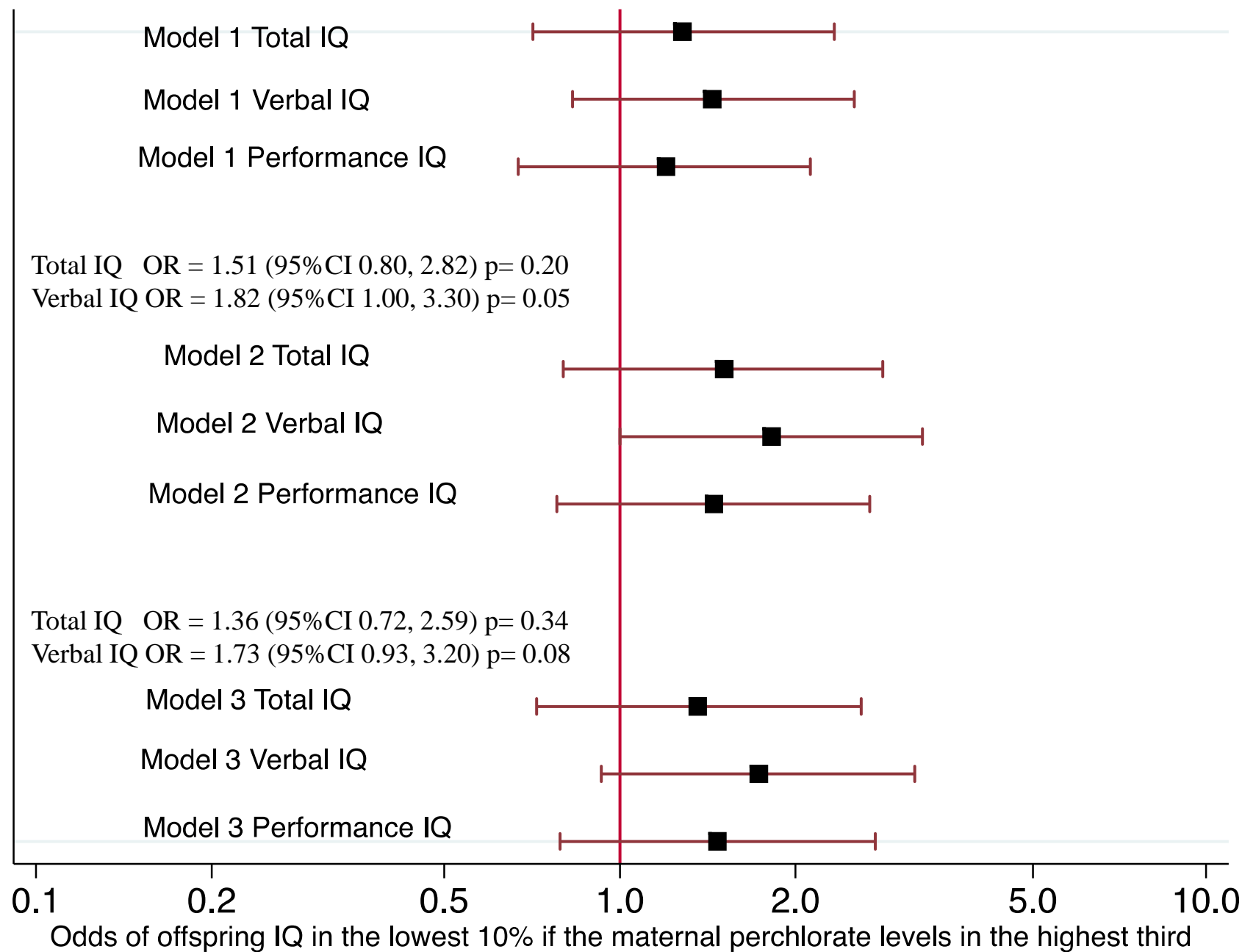
Maternal FT4

Maternal Iodine

- Generalized ordered logistic estimates were used to identify if a proportional or non-proportional odds model best.

Histogram of maternal perchlorate levels





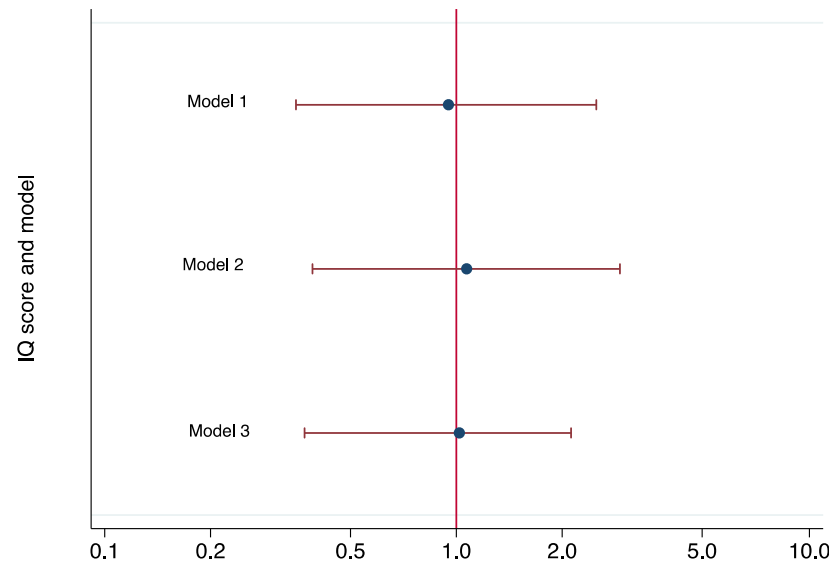
Further Analyses

- Offspring of mothers with perchlorate in the highest 10% were more likely to have IQ scores in the lowest decile.

$B = -1.80$ (95%CI -2.92, -0.68) $p=0.002$

Very strong evidence of non proportional odds $p=<0.001$.

- No evidence of an association between maternal urinary iodine : perchlorate ratio and odds of offspring IQ in the lowest 10%.



Limitations

- Observational data subject to residual confounding.
- Limited data on social class.
- Did not have neonatal or childhood thyroid function.
- Only spot samples of urinary iodine and perchlorate.

Conclusions

- First study to show higher maternal perchlorate levels were associated with lower offspring IQ using individual-level patient data.
- Negative impact of perchlorate levels more profound on verbal IQ than performance IQ. Greater impact on lower IQ.
- The lack of a protective effect of levothyroxine and lack of a substantial impact after adjusting for maternal thyroid and iodine status is intriguing.

Conclusions

- There may be a direct effect of perchlorate on the fetal thyroid gland which results in a negative impact on cognitive development.
- Alternatively maternal perchlorate exposure may be a proxy for neonatal perchlorate exposure.
- Pressing need for larger studies on the impact of perchlorate from the general pregnant population. Studies also needed to assess the impact of perchlorate levels in childhood on thyroid function and IQ.

Acknowledgements

Boston University School of Medicine

- Elizabeth Pearce
- Lewis Braverman



Cardiff University

- John Lazarus
- Colin Dayan
- Onyebuchi Okosieome
- Sue Channon
- Charlotte Russell
- Marian Ludgate
- John Gregory
- Rhian Rees



University College Dublin

- Peter Smyth



Wolfson Institute of Preventive Medicine, Barts

- Jon Bestwick
- Mohammed Jooman

